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EDITORIAL

End of the road for Rift Lake species?

November could see the ratification of a CITES proposal which could, in effect, herald the end for wild-caught African Rift Lake Cichlids and some riverine species.

According to proposals currently being considered, a species might — depending on several factors — and up being listed in Appendix I (which would result in its being banned from trade) if:

- a) the species occupies a very small area (less than 100 square kilometres); or
- b) the area of distribution is restricted (less than 500 square kilometres) and certain conditions apply.

At first sight, these limitations appear eminently sensible. No-one, after all — and that includes the whole of the aquatic trade worldwide — has any desire to drive any species into extinction. But when figures are quoted and statements are made without due consideration of some salient facts as they exist in nature, we can easily end up with a totally unrealistic and unnecessarily restrictive situation.

For instance, I recently heard the noted cichlid authority Ad Konings say that he has detected no decrease, either in quantity of individuals, or variety of

species, during some twenty years of diving in Lake Malawi, both in areas where regular collection takes place, and in those where collection is banned.

This, therefore, is a classic balanced, sustainable biotope which shows no signs of being threatened. So why consider banning the fish from such areas because they may fall within one or other of the restricted distribution criteria? Where's the logic?

If you feel as concerned at this possibility as we are, then write, seeking clarification, to: **Department of the Environment, Tollgate House, Houlton Street, Bristol, BS2 9DJ.**

Ornamental Fish Industry (UK), as well as members of Ornamental Fish International in a number of countries, have been making representations to the relevant authorities. Join them in trying to prevent a potentially disastrous and unnecessary situation from becoming written into international law.

John Dawes

KEEPING AND BREEDING:

The Panda Cichlid



As John Rundle shows, small is beautiful when it comes to dwarf cichlids such as this interesting *Apistogramma* photographs — unless otherwise indicated — by the author

An adult male in full colours.



One of my pairs hovering around their cave.



A female guarding the entrance to her flower pot. The male is visible inside.

During my years of keeping and breeding fish, dwarf cichlids have always been present somewhere in a tank in my fish house. There has always been room for such fish as Agassiz's Dwarf Cichlid (*Apistogramma agassizi*), the Cockatoo or Crested Dwarf Cichlid (*A. cacatuoides*), Borelli's Dwarf Cichlid (*A. borelli*), Golden Dwarf Acara (*Nannacara anomala*), and many others.

Then, a few years ago, I was shown an article in a German fish magazine. I could not read the text, but I could as they say, "look at the pictures". Apparently, the article was entitled the **The Panda Cichlid**, and the photographs were of a very beautiful little fish. I knew somehow I would have to obtain and breed this 'Panda Cichlid', *Apistogramma nijsseni*.

Long search

There were some *nijsseni* in this country at the time and these were filtering into the retail trade. I therefore began to let local dealers know that I would be interested if these fish became available on their lists. A couple of them told me that they were on wholesalers' lists, but were expensive.

It was not until early in 1990 that there came a time, as chairman of the Plymouth Fish Club, I had to phone my counterpart in the West Cornwall Fish Club. By chance, he is also the owner of a fish retail outlet in Cornwall. He told me that he had the Panda Cichlid in his shop and ... yes, they were a little pricey (£22 for the pair).

Many of you will know that when you are smitten by this hobby of ours, the urge to own a fish can overtake such minor details as money. So it was that I was able to obtain my first pair of *Apistogramma nijsseni*. By the time that I was able to get to the shop in Cornwall, there was only one pair of the fish left. There was little I could do but buy the pair and hope that they would be compatible and breed. Fortunately, luck was to be with me, for within five weeks, I was to have two more pairs. These were obtained from members of my own fish club.

At last, my collection was complete and I could start the breeding programme.

Scant details

To me, the initial search to obtain a certain species of fish for such a programme is all part of the hobby, so during the search, I spent the time finding out as much as I could about this fish.

There was not an abundance of information around on *nijsseni*. There were a few facts in Hans-Joachim Richter's book *The Complete Book of Dwarf Cichlids*, which

gave me a brief outline of the fish, but no in-depth breeding information.

I found out, however, that *Apistogramma nijsseni* (Kullander 1979) comes from the lower Río Ucayali, near Jenaro Herrera in Peru. It is found in small, slow-flowing waters, with a hardness (dH) under 1, and a pH value around 5.5. Males grow to 80mm (3.1in); females to 60mm (2.4in).

Determining the sex of the fish at the adult stage, or even as young adults, should not be a problem. As the photographs indicate, the male has a somewhat more robust body, compared to other *Apistogramma* males, such as Agassiz's and the Cockatoo Dwarf Cichlid. I would go as far as to say that the male Panda Cichlid is rather compressed.

The dorsal and caudal fins have strong red markings at the edges, whereas the body colour can change according to its mood.

At breeding time, the male's body colour is at its best, with blue and red hues. Another factor is that with most of the *Apistogrammas*, when looking for a pair, you can look at the front rays on the dorsal fin. In males, they would be higher than in the females, but with the *nijsseni*, this is not so apparent.

With this fish, I tend to look for the females first, as they tend to carry more distinct signs of sexual differentiation, in that they are smaller and their body shape is slightly more elongated. The main 'female' point is the centre black marking on the body. Also, as females grow older, they will start to show yellow body colour.

Recommended tank set-up

All the fish that I had acquired could be classed as young adults, and I was to follow the normal ground rules I use for keeping dwarf cichlids. They would all be placed together to allow them to choose their own compatible partners. Alternatively a dominant male can be allowed to court a couple of females and form his own harem. To allow this, though, the tank must be large enough for the fish to establish their own territories.

The area required by a pair of dwarf cichlids can be as large as 12in (30cm) in diameter. Therefore, if you have one male breeding with two females, the male would cover two areas of 12in. The females, once they have bred, will hold their own personal 12in patch at all costs. So, in theory, you would require a 24 x 12in (60 x 30cm) tank at least to hold a breeding trio. I had three pairs of fish, so I used a 36 x 15 x 12in (90 x 38 x 30cm) tank, which was just large enough to allow 12in each pair.

The tank consisted of a gravel substrate and plants, somewhat similar to your normal community tank. The only difference was in the abundance of slate caves, clay flower pots and small clay plant dishes with an entrance cut to allow the fish to enter. These established hiding places are



Juvenile Panda Cichlids. Even at this early age, the females can be distinguished by their black markings on the base of the caudal fin and the centre of the body.

a must for *nijsseni*, as it is classed as a 'cave spawner'...one that adheres its eggs to the roof or wall of such a hiding place.

The plants in the tank were Java Fern (*Microsorium pteropus*), *Cryptocoryne wendtii* and clumps of Java Moss (*Vesicularia dubyana*). You could say that the tank was well planted, and the reason for this is that, like most dwarf cichlids, *nijsseni* can be very nervous, so they need this cover to hide in if they feel threatened in any way.

The water temperature was around 78-80°F (c25.5-26.5°C); filtration was supplied by a large sponge-type filter.

This was, by the way, the only tank in the fish house that had a permanent lighting system. It consisted of two 40-watt incandescent light bulbs; ideal for this type of fish, as dwarf cichlids — because of their nervousness — will hide under strong lights.

Water conditions

As you will have gathered from the details I referred to earlier, the water from the natural biotope of this species can be said to be very soft and on the acid side. Where I live in the West County the water is soft, with a pH of around 7 to 7.2, so I breed all my dwarf cichlids using water as it comes from the tap. The readings from the *nijsseni* tank were 7.2pH and 1 dH, both of which were fine, although the pH was higher than that reported from the wild.

In the fish house at this time were other *Apistogrammas*. All those fish had young broods and all had spawned in my tapwater, so I did not see the need to change it for the Pandas. I know there will be people reading this who cannot obtain tapwater as soft as that in my area. To them I say, do not let this put you off keeping any of the dwarf cichlids, such as *nijsseni*. There are now many items on the market

for changing water chemistry, and I am sure your local dealer will be able to suggest the best options.

There will also be readers who can state that they have bred dwarf cichlids in water with a higher hardness and pH. All I can say to this is that if you wish to keep *nijsseni* in good condition, you should try to adhere to the water I have suggested and, once a week, carry out a 15% water change and clean the sponge filter.

Feeding

You will find that feeding is not difficult, as this fish will take most dry foods. I feed a standard flake and high protein food, frozen bloodworm and live whiteworm. On this diet, a good growth rate was achieved, and soon the fish were showing signs of pairing off.

The daily feeding programme would be:

- 1) Morning: dry foods
- 2) Evening: frozen bloodworm
- 3) Twice a week: live whiteworm

Breeding

It has been said that *Apistogramma nijsseni* can cause a few problems when it comes to breeding. I must say that I did have initial minor problems, but once I had established the breeding pairs, I was able to raise large broods of fry.

Of all the dwarf cichlids I have bred, I cannot think of a female that will show you so many colour variances as the female *nijsseni*. You will soon get to recognise its defence, offence and fright patterns.

One you will not fail to identify is the breeding pattern, which will be seen at its best when she is guarding her eggs or a brood of fry. The bright yellow body with the prominent black centre body marking

is the sign of a proud mother who will protect her clutch at all costs. At this point, you will see why this species is called the Panda Cichlid.

In the 36in tank which held the stock fish, one pair was spawning at regular intervals, but did not raise any young. The female would eat the eggs after a couple of days. One other pair was also spawning under a clay dish at the opposite end of the tank, but, again, no young.

The males and females of the two groups would defend their own areas of the tank, each one not moving into the other's patch. I felt this could be the reason for the females eating the eggs. So, after this had happened about six times, I decided to set up a 24x12x12in (60x30x30cm) tank with the same layout and use a one-pair-one-tank system.

Waiting game

This type of set-up was to prove more advantageous to me, as it enabled me to observe spawning and allowed me to take photographs.

I selected a pair, placed them in their new home and allowed them time to settle in and again establish a territory. I did not have to wait long before I noticed they were into their pre-spawning dance outside a 3in flower pot with a small aperture cut to serve as an entrance.

Soon after, the male and the female would both enter the pot at frequent intervals, and at one point during this, I could see eggs on the side of the pot.

Once the spawning was over, in typical *Apistogramma* fashion, the female drove the male from the site, the signal for me to remove him from the tank for his own protection. The female, meanwhile, protected the eggs and would advance to the front of the tank to warn me off at feeding time.

The eggs hatched within three days, and were moved by the female to the slate cave, where they could be clearly seen wriggling. It was on the sixth day that I was greeted with the sight of her herding the free-swimming brood in search of food.

Feeding the young fry was no problem, as they took brine shrimp nauplii and micro-worms as their first foods. After a period of 18 days, I removed the female and the young fish were left to fend for themselves. I now started changing about 25% of the water each week to remove any uneaten brine shrimp that would pollute the tank.

Growing on

When the young fish were six weeks old, I moved them to a larger tank measuring 36x12x12in (90x30x30cm). This was to be a bare tank, that is to say, it had no substrate. Filtration was to be supplied by one of my homemade filters (you could, of course, use a sponge-type filter just as

PANDA CICHLID FACTFILE

Tank Size: You can keep Pandas in a normal, average-sized community type tank with other fish of compatible size and temperament, but if you intend to breed them, they will require the space I have suggested in the text.

Temperature: A good range is 78°F (26°C) to 82°F (28°C). If kept at lower temperatures, breeding instincts seem to be impaired.

Tank Decor: Allow plenty of hiding places in whatever set-up you use. When using plant pots, do not use plastic, only clay.

Lighting: Do not use bright lights over the tank. A cover of floating plants will help to subdue the lighting.

Water: The pH can be allowed to vary slightly, but try to keep the dH (hardness) within the parameters suggested: 8 to 8pH — 1 to 6° dH.

Feeding Adults: By using the high quality dry foods on the market, you can bring most fish into breeding condition. *Apistogramma nijsseni* are no different. I found that they will take all types of dry food. Whiteworm is a bonus.

Breeding: (i) **Eggs** The number of eggs can vary according to the size of the female. I obtained egg clusters of about 50 to 60 in number. The colour of the eggs is red.

(ii) **Incubation Period** The eggs hatch after three days, but the fry will not be free-swimming for another three days. Remember, do not be too eager to view the eggs: you may cause the brooding female to eat them.

(iii) **Size of Fry** They are about 2mm in length when first seen free swimming. They will take freshly hatched brine shrimp and micro worm.

well). By now, the fish were large enough to take dry foods and this they did with relish. The size of the brood was 50 fish; further broods have also been around this size.



Good *nijsseni* breeding set-up. One of the females can be seen hovering inside the clay pot.

I was soon to have three pairs spawning in separate tanks, which allowed me to build up a large collection of *nijsseni* in a relatively short time.

I could sex the fish at about 15mm (0.6in) in length. The males would show the red edge in the caudal fin and, in the females, the centre black marking would start to show. Problems would, however start whenever I attempted to catch a pair. Every fish would lose all markings as soon as the net hit the water!

Expensive recommendation

Apistogramma nijsseni is, without doubt, one of the more expensive dwarf cichlids around, but I can recommend it to all fishkeepers.

If you keep them, just follow the water condition guidelines I have suggested and you will eliminate any breeding problems. Also remember that adult pairs need plenty of space.

Go on, spoil yourself ... buy a pair of Panda Cichlids!

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FASCINATING FISH FACTS

Fish with a trigger

Like all its relatives, this *Balistes carolinensis* has a pretty useful 'trigger' with which to defend itself.



Tropical reefs can be dangerous places for fish, especially at night when predators are on the prowl. Being able to wedge yourself safely away into a cave would therefore be most useful. This is just what the aptly named Trigger fishes do.

The first spiny ray of the dorsal fin of these fish can be locked firmly into place and can only be released when the second ray, or 'trigger' is pressed. At night, or when danger threatens, the Triggerfish simply squeezes into a small cave and raises and locks its spine, effectively wedging itself in place.

If a Triggerfish is caught unawares outside a cave, most predators, even hungry ones, will think twice before attacking it, because the raised spine, in addition to providing the fish with a useful 'wedging' tool, also makes it quite a hard meal to swallow.

BREEDING MARINES

PART FOUR

97 SPECIES AND COUNTING...

Creating a Hatchery

Colin Grist continues his in-depth review of breeding tropical marines with a look at spawning and rearing facilities.

Diagrams by the author

The greatest thrill for any fishkeeper, or anyone involved in animal husbandry of any kind, is when an unusually difficult species starts to breed in captivity. In this

respect, there are many opportunities for the marine aquarist to be thrilled, as it is still relatively rare that coral reef fishes and invertebrates breed in aquaria, although the number of species which have done so is growing all the time and their requirements are becoming much better understood.

It's not uncommon for the aquarist to observe courtship behaviour in the aquarium, particularly if any of the Anemonefish species, *Amphiprion*, are being kept, and it is not too unusual for a successful spawning to occur. But, should your fishes get this far, what do you do about it?

Well, most aquarists, unfortunately, do not have the spare time to pursue things

further, but there are many who do have some time available and, given that they are interested enough, could have an attempt at rearing the larval fishes. To undertake such a project may seem daunting to most, but, as you read on, you will discover that it does not necessarily mean you will need lots of expensive apparatus or lots of space.

First steps

The first thing anyone interested in breeding coral reef fishes will have to do is choose a species, although, in many cases, the fishes will choose themselves for you.

Then you **must** research as much information about that species as possible. It may be that, after doing your bit of research, it will become apparent that the species you have chosen is just not suitable for your purposes. If this happens, then choose another!

It is very important to learn as much as possible about the species you are going to breed, because there may be some specific features of its lifestyle that will have to be replicated in the aquarium, otherwise it may not easily be induced to mate. For instance, the species may require a specific type of habitat, or it may naturally live in groups, trios, or even harems, or it might prefer a certain kind of water movement, or it might even be cannibalistic towards its own kind, in which case a certain amount of ingenuity will have to be employed. However, it really goes without saying that the correct type of food and feeding habits are essential areas to research.

Appropriate aquaria

Now that you are armed with all the information you can lay your hands on about your chosen species, the second thing to do is establish a suitable aquarium for the parents — the largest you can accommodate and afford. Obviously, water quality is of utmost importance, and all test readings must be within the recommended parameters for optimum conditions.

Where salinity is concerned, some authorities have been able, in some cases, to induce spawning by gradually lowering it and maintaining it at a specific gravity of around 1.018.

It is fairly common practice these days to include good-quality, and properly cured, living rock in spawning tanks, as it is believed to help further condition the water, and thus induce spawning activity. Arrange the rock according to the species' needs; for example, Royal Grammas, *Gramma loreto*, require overhanging ledges for them to swim upside-down beneath, and if this habitat can be provided for them, they are more likely to mate.

Living rock — minus resident predators like this Gaudy Clown Crab — is often used in spawning tanks (see text for details).



THEY'RE MICROSCALD



Even with the commonest species, such as the clown, *Amphiprion ocellaris*, aquarium conditions must be closely matched with the fishes' natural requirements.

Lighting

Lighting is important and the 'daylight' period should be as close to that which the fishes would find in the wild. A timer is a very useful piece of equipment as, not only will it ensure the correct photoperiod each day, but it can also be adjusted so that this period fits in with the aquarists' own habits.

This is useful because reef species tend to spawn just before dawn, and let's face it, most people are still asleep at that time and unable to deal with anything the fishes might get up to.

For this technique to be effective, breeding tanks must be kept in a room where no natural daylight can get in to disrupt the cycle, especially at dawn and dusk. Although not essential to induce spawning, it will certainly improve the chances if the lighting can be on an automatic unit which will gradually brighten and fade as if to simulate dawn and dusk.

This is difficult with fluorescent tubes, but not impossible as, at least one British

company, Zentec, seem to have mastered this technology with its use in the aquarium hobby in mind. However, any form of incandescent lighting operated by one of these units will suffice, even if fluorescents are also used during the main part of the daylight period.

The light levels should also be sufficient to maintain the small invertebrate life found on the living rock, so at least two fluorescent tubes suitable for reef aquaria should be used with enhancers, or any other commonly used reef aquarium lighting, i.e. metal halide.

The hatchery

Should your fishes spawn, and let's hope they do, you will need another aquarium or some sort of suitable container ready for attempting to rear the larvae. If the fishes lay demersal eggs (attached to rocks, for example) you will either have to wait until the fry hatch and become free-swimming before transferring

them into the rearing tank, or, alternatively, move the actual rock holding the eggs into the rearing tank. Many species, such as angelfishes, drop eggs which float to the surface. In this case, they will have to be gently skimmed off and transferred to the rearing tank.

Whatever the mode of spawning, it is best that the eggs or larvae are transferred into water which is identical to that in which they were produced. The

- 1 Living rock is often used in marine breeding tanks as it tends to condition the water to a degree that can induce spawning.
- 2 Free-swimming larvae are attracted to light. Therefore, they can be easily collected from the darkened tank by shining a torch into it and then gently scooping the gathered group out with a plastic container.
- 3 Larvae rearing tanks must be operated in such a way that the larvae cannot be damaged. For example, no filtration should be used, and the sides of the tank should be darkened and in shadow so that the larvae remain in an illuminated central column of water.
- 4 A large growing-on tank must be provided, otherwise many fry will start to die due to lack of oxygen and space; whole broods could be lost if this is not dealt with.
- 5 Never expect to have a 100% success rate, because you will be disappointed.

easiest way to achieve this is to have the breeding and larvae rearing tanks interconnected. A shut-off valve must be incorporated so they can be isolated from one another when necessary, though. As you can see in one of the diagrams, the tanks have to be drilled so that tank connectors can be fitted to allow for a length of pipe to run from one to the other. A valve is fitted along this length of pipe. The water flows from the breeding tank into the rearing tank and is then returned to the breeding tank by a small water pump, or power head, with a length of flexible hose.

Handling fry

When it is time to transfer either the eggs or larvae over to the rearing tank, switch off the return pump and close the valve between the two tanks. Obviously, leave all filtration running as normal in the breeding tank.

Free-swimming larvae are easy to collect and transfer. They normally become free-swimming in the morning before it becomes light, but because they are naturally attracted to light, they can be grouped together by directing the beam from a torch onto the water surface. They can then be scooped out using a cup or some sort of plastic container. Never use a net!

The rearing tank does not require any filtration, but, if you decide to use some, it must be light and operated very slowly to avoid the larvae being sucked into gravel or canisters where they will perish. Some experienced breeders add very light aeration, the problem being that larvae can be easily damaged if they are in violent currents and are pushed into solid objects, like the side of the tank. With this in mind, it is also very important to blacken the sides of the rearing tank and provide a

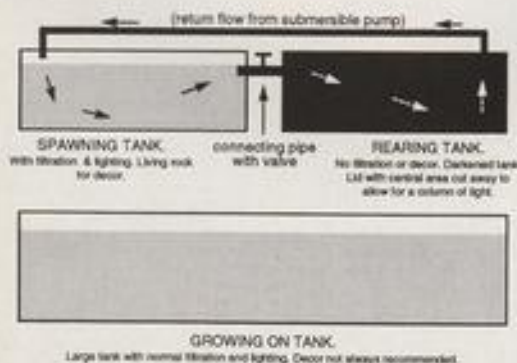


FIG. 1. BASIC SPAWNING, LARVAE REARING AND GROWING-ON SYSTEM.

cover with a hole cut out of the centre. The idea behind this is to cast a shadow down the sides of the tank; as the larvae are naturally attracted to light, they will stay swimming in the central beam.

Good lighting is very important to the larvae, as without it they will not be able to feed in the correct manner. Some researchers have found the larvae do not suffer any detrimental side-effects if subjected to light 24 hours a day. Obviously, if this technique is employed, constant feeding must be provided.

After transferring the eggs or fry over, it does not do any harm to dose the water with a mild bactericide and fungicide, like Waterlife's Myxazin, although fairly recent research has found larval fishes seem to have a pronounced resistance to bacterial and fungal infections.

The first food to try on any larval fishes are rotifers. See last month's article on

rotifer and algae culturing in *ASP*. More information about feeding will be given in forthcoming articles, where the requirements of individual species will be discussed.

Finally, a much larger tank must be provided for when the larvae reach metamorphosis. This is when the larvae trans-

form into a more recognisable fish shape and start developing colour and pattern.

The growing-on tank can be filtered by normal methods, as the fry are now much stronger, but still avoid using anything that has suction grilles large enough to allow the fry through. It is often best to omit decor, as more dominant individuals could establish territories and make life miserable for the other fry, thus inhibiting growth. At this stage, the fry can be fed on larger foods such as, brine shrimp nauplii (*Artemia*) and some proprietary foods.

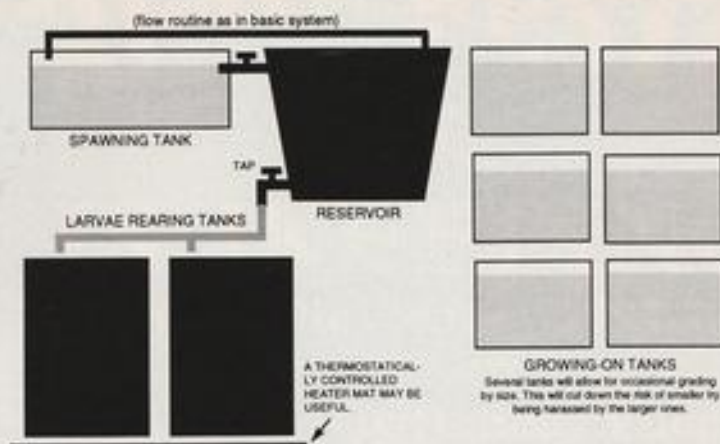


FIG. 2.

A MORE ELABORATE AND EFFICIENT SYSTEM.

In this system a large reservoir made from inert plastic (or something similar) is used to supply water to the larvae rearing tanks when required. The larvae rearing tanks should be made of inert black plastic, such as some types of dustbin. The lids have the centre cut out to allow light down a central column and to cast a shadow down the sides internally. Obviously, suitable lighting has to be included.

(TO BE CONTINUED)

**NEXT TIME:
DETAILED INFO ON SPAWNING
AND REARING ROUTINES, AND
HOW TO OBTAIN BROODSTOCK**



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Iford Diamond Jubilee

The third Annual Aquatic Conference was recently held by Iford and District Aquarists and Pondkeepers Society as part of the celebrations of the society's Diamond Jubilee.

Lectures were given throughout the day, including Philip Swindell's presentation on ponds and Mary Bailey's on Cichlids, while Mike and Gina Sandford presented a light and sound show with Brian Walsh.

Home-bred fish and exotics, such as newts, were sold from the society's own stand; additional clubs with stands included the British Cichlid Association, Thames AS, London Livebearer Group, Walthamstow AS, and FBAS. Trade stands included displays by Aquarian and Kol's Den of Dagenham.

To commemorate Iford's 60th year, Bob Esson of the FBAS presented the society with a commemorative silver cup.

On Dave Ford



Philip Swindell in full flow at the Iford conference.

SOCIETY WORLD

FBAS News

1 The Federation of British Aquatic Societies (FBAS) has announced the death of Vernon Hunt, a regular letter contributor to A&P and a well-respected FBAS judge and speaker. Vernon was also an active member of Portsmouth AS and much of his work for the FBAS, as yet unpublished, will provide valuable information of benefit for all aquarists. We at A&P join the FBAS in extending our best wishes to Vernon's family and friends.

2 Through circumstances beyond its control, the FBAS has withdrawn from this year's Town and Country Festival at Stoneleigh, Warwickshire over the August Bank Holiday weekend.

3 The Federation has announced that Dieter Vogt will be a guest speaker at this year's Supreme Festival of Fishkeeping (Pontins Holiday Chalet Hotel, Sand Bay, Weston-Super-Mare, 5-6 November). Full details of weekend tickets and booking forms are available from Colin Richards, Beechwood Cottage, Long Grove Wood Farm, 234 Chartridge Lane, Chesham, Bucks HP5 2SG. Tel: 0494 773094. Last-minute entries for the society tableau competition will be accepted if sent immediately to: Peter Furze, 9 Upton Road, Hounslow, Middlesex TW3 3HP.

YAF Judge's thanks

The Yorkshire Association of Aquarist Societies' Judges and Standards Committee would like to extend a vote of thanks to the main Yorkshire Festival



STEVE JONES

YAF '94 judges (left to right): Edward Cheetham, Roy Johnson, Derek Jones, Trevor Douglas, Paul Baker, Jim Duckett, Hugh Bowie, Kevin Webb (also judging at the event, but missing from the photo: Mick Price and Arthur Frisby).

Committee for all the hard work they put into making this year's Festival such an enjoyable event to judge.

Two guest judges also come in for well deserved praise: Roy Johnson (FNAS) and Hugh Bowie (FSAS).

New Dulwich name

East Dulwich AS has changed its name to South London (East Dulwich) Aquatic Society, in order to become more representative of their geographical area. Meetings are held on the second Thursday of every month at 8.00pm at Pasley Hall, Stopford Road, Kernington, London SE17.

To celebrate the change of name, the society's first Open Show will be held on Sunday 14 August at the above venue. Benching is from 9.00am to 12.00pm and the show is part of the Superbowl contest. For further membership or show information, contact Mr How Pang, Tel: 081 767 3330.

August

Sunday 14
Whitby & District AS — Open Show, Turnbull Football Ground, Whitby. Details: Andrew Thornton, Secretary, 29 Stathees Lane, Stathees, Cleveland, TS13 5AH
Perth Aquarium Society — Annual Open Show and auction, City Hall, Perth. Details: Tom Young, Secretary, Tel: 0738 21704.

Monday 15-Saturday 20
Portsmouth AS — Exhibition of coldwater, tropical fish, waterlilies, reptiles and amphibians, 10am-6pm (Mon-Fri), 10am-5pm (Sat), Portsmouth Community Centre, Maline Road, Buckland, Portsmouth. Details: S D Fosse, Show Manager, Tel: 0705 824160.

Sunday 21
Skelmersdale & District AS — Auction. Booking in: 10.30am-12.30pm, Skelmersdale Labour Club, Westgate, Old Skelm. Details: G Lester, Tel: 0695 25734 or J A Barlow, Tel: 0942 716191.

Saturday 27
Northern Goldfish & Pondkeepers Society — Annual Open Show Trinity United Reform Church Hall, Delamare

Road, Atrincham. Details: Paul Coyle, Show Manager, Tel: 061 748 7211 or Alan Ratcliffe, Show Secretary, Tel: 0292 420097.

Sunday 28
Dunfermline & District AS — 23rd Annual Open Show, Parkgate Community Centre, Rosyth. Benching: 10am-1pm; auction: 1pm. Details: Frank Stewart, Tel: 0506 482936 or Mrs Gill Lawlor, Tel: 0383 730179.

Fornton AS — Open Show. Benching 9am — 11.30am; Auction: 12.30pm, Wrexley Leisure Centre, Nr Warrington, Cheshire. Details: Gary Newsome, Secretary, 11 Beech Heyes Drive, Weaverham, Cheshire, CW9 3BT, Tel: 0606 853771.

September

Sunday 4
CAGB — Open Show, AcA Superbowl round, Details: A. Sykes, 63 The Vineyard, Welwyn Garden City, Herts AL8 7PY.

Tuesday 6
Gloucestershire AS, Monthly meeting — talk by Clive Norris of Reflections Aquatic Consultancy: My top 20 Fish, Bell & Gavel Pub, by the Cattle Market, St. Oswalds Road, Gloucester. Details: Andy Ramsbotham, Secretary, Tel: 0452 521609.

Sunday 11
Dunstable & District AS — Open Show, AcA Superbowl round, Queensway Hall, Dunstable, Beds. Details: M.S. EBBOT, 34 Staveley Road, Dunstable, Beds, LU5 3QQ. Tel: 0582 668406.

Saturday 17
Plymouth AS — 23rd Open Show. Benching: 9am-11.30am, University of Plymouth main hall. Details: Dennis Wilton, 685 Budstead Road, Whiteleigh, Plymouth, PL15 4DP or J Rundle, Tel: 0752 343343.

Sunday 18
North East Federation of Aquarist Societies — Annual Show, Hobart

Adkinson Youth & Community Centre, Thornes Road, Thornaby, Cleveland. Benching: 12-2pm; Judging: 2pm. Details: J. Duffell, Tel: 0642 478636.

Osley AS — Annual Open Show, raffle and auction, Prince Henry's Grammar School, Osley, West Yorkshire. Details: Simon Midcott, Show Secretary, 23 Riverside Drive, Osley, North Yorkshire, LS21 2PL, Tel: 0943 464632.

Six Towns Aquarist Association — Auction: booking 11am, starts 1.30pm, Heron Cross Sports & Social Centre, Grove Road, Heron Cross, Stoke on Trent, Staffs. Details: Alan Rothwell, Tel: 0782 317741.

Sunday 25
Cramlington AS — Open Show, Seghill Institute, Main Street, Seghill, Near Cramlington, Northumberland. Details: 0670 726603.

Darwen AS — 17th Annual Open show, Darwen Library Theatre, Darwen. Booking in: 11.30am; Judging: 1.15pm; Auction: 1.30pm. Details: Brian Walsh, 9 Marsh Terrace, Darwen, Lancs BB3 5HF. Tel: 0254 776567 or J. Gibson, 25 Thorncliffe Drive, Darwen, Lancs BB3 3QA. Tel: 0254 776960.



Sticks and waves

GOLD LINE FEEDS (UK) are launching their new PHOENIX 2000 POND STICK range, not only on a wave of enthusiasm, but also on a genuine North Sea Wave too!

Fish will appreciate, and benefit from, the food's high digestibility (thanks to a very low ash content) and from the finest Norwegian Herring meal ingredient which leads to exceptional water clarity.

Available in three pack sizes, 110gm tub, and 500gm and 850gm boxes, each Pond Stick product pack contains a £15.00 discount voucher against a North Sea Ferries continental mini-break. Better still, six lucky customers will, thanks to a Grand Draw (see food packaging for details) enjoy a free North Sea Ferries continental mini-break.

The complete Phoenix 2000 range of foods is available from all good aquatic outlets and garden centres.

Details from: **GOLD LINE FEEDS (UK)**, Pinfold Farm, Welham, Retford, Notts DN22 0SQ Tel: 0777 702131; Fax: 0777 706800.

Naturally clear water

Given the choice between the good, the bad and the smelly, there's no prizes for guessing which we'd all choose as ideal conditions for our pond water!

AQUAPLANTON is a naturally occurring mineral substance (extracted from alluvial deposits) which changes the balance of bacteria in the pond in favour of the 'good' aerobic types which remove slime and algae, while controlling the 'bad' anaerobes which cause the 'smelly' slime and odours.

WATER'S EDGE

BY DICK MILLS

The cleansing action works in three stages: particles are precipitated and fall to the bottom, allowing photosynthesis to re-establish in the now-clearer water; acidity (and the abundant algae which thrive in such conditions) are reduced immediately; aerobic bacteria flourish and the quantity of mud is reduced by increasing the digestion of organic matter. With the subsequent production of a food supply for invertebrate life below the surface.

The general increase in numbers of aerobic bacteria over anaerobic types greatly accelerates the breakdown of mud; up to six inches of mud have been cleared in six months. Water should become crystal clear within a week under normal circumstances which, in turn, will allow full aquatic plant growth to flourish.

Details from: **AQUAPLANTON**, Clavering Cote, Little London, Stowmarket, Suffolk IP14 2ES or

LAYZELL PUBLIC RELATIONS, Little Orchard, Dallinghoo, Woodbridge, Suffolk IP13 0LG. Tel: 047 337468; Fax: 047 337750.

Purifier with a whirl

Following the introduction of ultra-violet treatment of water as a purifier, new models of UV-using equipment quickly emerged.

As time has gone by, increased knowledge about the actual use of UV (and how to optimise its beneficial qualities) has also led to new designs too, and the latest **POND WATER PURIFIER** from **HOZELOCK** is a typical example.

Water is fed into the unit from the pond pump and is then sent round a spiralling flow by means of a unique turbulator device which ensures even (and longer) exposure to the UV light. A mounting foot anchors it in its

selected pondside position.

Details from: **HOZELOCK LIMITED**, Haddenham, Aylesbury, Buckinghamshire HP17 8JD. Tel: 0844 291881; Fax: 0844 290344.

Automatic feeder

Sometimes the food requirements of pondfish are neglected (particularly in summer) on the assumption that 'nature will provide'. However, now you can guarantee that they are regularly fed without you even having to move from your patio deckchair.

The **P21 POND FISH FEEDER** from **PET MATE** will provide daily meals for fish for up to 21 days, with an adjustable feed quantity and timing for all types of fish foods. Now you need not worry about overfeeding problems occurring through the best-meant efforts of your 'fish-sitter'.

Of special interest to aquarists is the new **FISH MATE BS5 BIO FILTER SYSTEM**. This small internal air-operated filter features a triple chamber construction and a wet/dry biological filtration process with Bio-cycle control, the adjustable air/water interaction. The easy-change pre-filter medium has a waterflow indicator which shows when cleaning is necessary.

Details from: **PET MATE LTD.**, Central Avenue, West Molesey, Surrey KT8 2QZ. Tel: 081 941 9818; Fax: 081 941 9886.

Well-educated fountain range

The original fountain on which the **HADDONSTONE** range of fountains is based, stood in the Cloister court of Eton College. Now, you can't get a much better pedigree than that!

The **ETON COLLEGE FOUNTAIN** has ornate pedestals supporting three decorative shell bowls topped by a naturalistic



bud. Some of the components from this design have been incorporated into two further new fountains.

The **NEAPOLITAN LARGE DOUBLE FOUNTAIN** has ornate shell bowls and pedestals supporting an entwined triple dolphin centerpiece.

The **NEAPOLITAN SMALL DOUBLE FOUNTAIN** comprises two ornate shell bowls and pedestals topped by a naturalistic bud fountain head.

Formed from reconstructed limestone, these designs are extremely durable and are available in four standard colours, or can be matched to any existing stonework at extra cost. These designs complement the existing Haddonstone range of landscape and architectural stonework — everything from balustrades to porticos, urns to statuary.

Details from: **HADDONSTONE LTD.**, The Forge House, East Haddon, Northampton NN6 8DB. Tel: 0604 770711; Fax: 0604 770027

Clearer water filter

Using ultra-violet light, together with an external filter to combat green water is common practice, but over the years, several 'problems' have arisen, notably in the 'mechanics' aspect of the process.

The new **BIOMASTER** unit from **UVAQ** has features in which these disadvantages have been 'designed out'. Typically, a low profile, common size and fixing to most filter tanks, open access chamber and spray area, safety interlock switch and weatherproof electrical system, all reflect the company's attention to detail — especially the safety aspects from the operator's standpoint.

Performance-wise, the Inlet Vortex Nozzle increases oxygenation: a large volume expansion



zone slows down incoming water flow to maximise exposure time to the UV lamp whose effectiveness has been further increased by transmission to the water of even higher levels of UV light by means of a new unbreakable plastic lamp sleeve.

The easy-to-clean integral spray system cannot block, and multiple spray points disperse water for improved biological filtration efficiency. All these factors make the Biomaster an important new product in the line-up of water purification equipment.

Details from: **UV SYSTEMS LTD., Constitution Hill, Sudbury, Suffolk CO10 6QL. Tel: 0787 376259; Fax: 0787 881452.**

Stick with it

The dangers of overfeeding cannot be stressed too often or too strongly; pondfish (often in dark, not too clear water) can be at risk more than indoor aquarium-kept species where unclean food (especially the fast-sinking type) is more easily seen.

FLOATING POND STICKS from **HIKARI** eliminate this danger by remaining on the surface, making it easy to estimate the amount of food your fish eat at any one 'serving'. The carefully balanced mix of nutrients and vitamins ensures an increase in colour and healthy activity while not clouding the water. The sticks are suitable for all ornamental pond fish, and are available in 500gm and 3Kg packs.

The new range of **HIKARI TROPICAL FOODS** show just how diverse food forms can be, with not a flake in sight: semi-floating Micro-Pellets for small fishes, Sinking Algae-Wafers and Sinking Wafers for bottom

feeders, Food Sticks for carnivorous fishes, Sinking Carnivore Pellets for large carnivorous species and Marine-A for marine fishes.

Details from: **PET PRODUCTS INTERNATIONAL LTD., Pedigree House, Gamston, Nottingham NG2 6NQ. Tel: 0602 816521; Fax: 0602 455561.**

Space-saving filter

The new in-pond **BIOLOGICAL POND FILTER** from **LOTUS** might be thought to be of Japanese origin, so modest is its size. It takes the form of a filter-media container on which the pond pump sits, drawing water through the filter before delivering clean water to either a fountain or waterfall, or simply back into the pond.

The slotted base is first fitted with its stabilising bar, lined with a matting material (supplied) and then almost filled with pea gravel; on top of this then goes a layer of Siporax (supplied). The pond pump is connected to the filter by means of a 'T' piece and you're ready to go.

Working mechanically first (detritus gets trapped first in the matting material), the unit then works biologically on two fronts: aerobic bacteria in the oxygen-rich waterflow through the pea-gravel break down ammonia into nitrite and nitrate, and then anaerobic bacteria in the oxygen depleted Siporax area convert nitrates back to free nitrogen gas. Once the pond clears, periodic washing of the filter media is all that is needed.

Details from: **LOTUS WATER GARDEN PRODUCTS LTD., Junction Street, Burnley, Lancashire BB12 0NA. Tel: 0282 420771; Fax: 0282 412719.**

Let your fish see stars

The new star-shaped pelleted foods from **OCEAN STARS** sink slowly following a period of surface floating. Several diet forms are available — **CICHLID PELLETS** and **SPIRULINA PELLETS** for tropicals, and **GOLDFISH PELLETS**.

The cichlid food includes ingredients to satisfy carnivorous and herbivorous dietary needs and is suitable for both African and South American species. The Spirulina flavour has a high level of beta-carotene

and is formulated for plant-eating fishes. The Goldfish diet contains strong natural attractants and enhances the natural pigmentation of the fish and, despite its title, can equally well be used for Koi.

All foods contain stabilised Vitamin C and are available in different pellet sizes according to your fishes' needs and appetites. For a change of flavour, and an inducement to 'finicky feeders', try your fish on **BRINE SHRIMP FLAKE**.

Details from: **OSI FOODS, TRANS EUROPE AQUATICS, Oaklands Manor, Longhill, Buxton, Derbyshire. Tel: 0298 73054; Fax: 0298 73053.**

The 'Listening' company

The application of customer feedback information into product modification is (or should be) an important factor in any manufacturer's marketing attitude, so it is encouraging to see that **KING BRITISH** have not only been listening, but also putting into practice, their customers' wishes.

Despite the obvious need for a no-frits, completely reliable, pre-set **UNO ELECTRA** heater/thermostat for the reassurance of newcomers to the hobby, experienced hobbyists — while appreciating the unit's state-of-the-art success and popularity — nevertheless required the extra facility of making their own temperature adjustments to suit their own situations.

No sooner said than done was **KB's** attitude, and the new adjustable **ELECTRA** (in four sizes, each complete with fitted plug) is now available. Keeping up the good work, look out for the **UNO POND HEATER** when those frosty nights start appearing: knowing our luck, anytime from now on!

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

Plants, heating et al

As autumn approaches, the fishkeeping season enters a double mode, with ponds still active, but indoor aquatics beginning to take over more strongly.

Recognising this, **INTERPET** maintain their spring/summer battle against green water algae and blanketweed with environment-, fish- and plant-safe products such as **GREEN AWAY** and the renowned **POND**

BALANCE respectively.

The indoor aquarium can also benefit, this time from a desirable show of green (and other colours too) thanks to the **AQUA-GARDENS** and **AQUA-GARDEN NEONS** range of plastic plants.

Where digging fishes or unsuitable water conditions preclude normal 'living' plants, these plants (available in life-like colours or startling neon hues) create a dramatic and stylish setting for fish. There are 167 variations of leaf shape and colour in four sizes, each featuring the specially-designed scooped base which prevents drifting while also allowing planting in species clumps.

Many hobbyists graciously 'allow' plastic plants with the proviso: 'you won't tell the difference, once they get a covering of algae', but should this disgusting film (which also can be chemical and mineral staining too) become a problem, then **AQUA GARDEN PLANT CLEANER** fluid is on hand. Once cleared of discolouring, then switch on your **BEAUTY LIGHT** fluorescent tube and your aquagarden will revert to its former colourful specifications.

Still with indoor aquaria, the new **THERMASURE HEATER/STATS** are both practical and safe. Tailored around three sizes — 100/200/300 watts for aquariums from 10-30 gallons — each unit has two very welcome safeguards. Excessive temperatures are automatically avoided as, in the event of thermostat malfunction, the unit switches off; when removing from the water or if accidentally exposed during water changes, the unit also 'falls safe' by switching off. A simple twist switch on the top adjusts the temperature setting and there is a visible temperature gauge (18°-33°C) on the side.

Details from: **INTERPET, Vincent Lane, Dorking, Surrey RH4 3YX. Tel: 0306 881033; Fax: 0306 885009.**



KOI TALK

by
Alan
Rogers

Illustrations
by the
author

Hungry Koi
waiting for
food in this
year's spring
sunshine.



Great news! Koi Talk is back after an unavoidable absence of a few months.

As from this month, our popular Koi section will be compiled by Alan Rogers. Alan takes over from John Cuveller who has, unfortunately, had to give up his Koi Talk and Question time slots for health reasons (see this month's Q7 for fuller details). Many of our readers already know Alan very well, but for those who don't, here's a brief profile.

Alan started his fishkeeping activities with African Cichlids and marines in 1971; his enthusiasm for Koi keeping developed in the summer of 1979. He eventually built four ponds in his garden, containing 20,000 gallons in total, and naturally — and very quickly — his fishkeeping hobby became totally Koi orientated.

He joined the British Koi Keeper's Society (BKKS) in 1981 and, in 1985, became involved in judging Koi at BKKS shows. In 1986 he became the Chairman of the current Judges' Standards Committee within the BKKS and served in that position for the next seven years.

In 1989 Alan was instrumen-

tal in formulating improved show rules and health guidelines and is still, today, a frequent speaker to the associated sections of the BKKS and other Koi clubs in England, Scotland and Wales, with talks based upon Koi development and appreciation.

Alan is currently involved with the annual judges recruitment programme and selection of trainee judges for the Koi Society, and has been a Koi Show manager on seven occasions. He is also, at present, one of the UK's most senior respected and experienced Koi Judges.

During his years of involvement with Koi, Alan has developed an international understanding with prominent Koi keepers and breeders in Japan, South Africa, West Germany, Thailand, Holland and the US; and over recent years, has visited breeders in Niigata, Nagoya, Chiba, Kyoto, Hiroshima and other major Japanese Koi producing areas.

In addition, he was founder member of his flourishing local Essex Koi Club (Crouch Valley), where he held the office of Chairman for a number of years while the club was in its early development stages.

Alan has always willingly shared his knowledge over the years by writing in British, American and Japanese journals on many aspects of Koi keeping and is a regular contributor to *Compass*, a World International Bulletin Board. His credentials are therefore impeccable, making him the ideal person to take on Koi Talk on our behalf.

We all look forward to his regular contributions and to learning from him about the fish we love. Drop Alan a line if you have any queries on Koi, or some tips to pass on... or just some interesting anecdote which you may like to tell us about.

Over to you Alan!
John Dawes (Editor)



Summer at last!

At this time of year Koi keepers are finally appreciating the warmer months of the British summer, a far cry from the late but unusually cold spring months that most regions in the UK were experiencing just a matter of a few weeks previously.

This prolonged cold snap held back pond temperatures, causing Koi growth and development to be naturally constrained. At the colder temperatures experienced in April and May of this year, unheated ponds were struggling to break through the lower 50°F (10°C) and at these ranges, the Koi's natural metabolism was not really switched on to full functioning. Overnight temperatures frequently dipped from the occasional appearance of a glimpse of spring sunshine, creating further stress to our Koi environment, although the larger and deeper ponds were probably less likely to differ quite so much as those of shallower design.

At this time, experienced and wise hobbyists would have been very conservative with food, feeding very sparingly at first until temperatures were stabilising around 52-54°F (11-12°C). Gradual increase of easily digestible food, such as wheatgerm pellets or brown bread, could then be offered in a slow but progressive manner. At 56°F (13.5°C) the fish's metabolism begins to function well, with the Koi's appetite increasing with rising temperatures.

The natural immunity system protecting the Koi against disease and parasite infection also went into enhanced activation with these welcome increases of warmer waters, and frequently, the odd raised scale and winter

wounds were healed rapidly in these higher temperature conditions.

Warm-weather problems

As the summer becomes more established in our pond environment, we are often thrown many different problems. Increased development of free-floating algae blooms, (green water), rapid growth of blanket weed and increasing ammonia and nitrite levels triggered by ever-increasing levels of food as the Koi demand more regular feeding.

1 Beware at this point of being influenced by your Koi into giving just that one handful of pellets too many... always remember that shortly after you have fed your Koi, possibly within the hour, great volumes of ammonia waste will be produced from that last feeding and your aerobic bacterial population within your filter will have to break down that waste to less harmful nitrate products. It is for this reason that "a little and often" is always the best way to feed when Koi appear to be in that ravenous mood.

2 To aid both Koi and filter bacteria growth, always be aware of oxygen levels. Koi demand huge volumes of oxygen in temperatures of 60°F (15°C), and progressive demand for more oxygen is required as temperatures climb to 70°F (21°C). Very hot days and particularly warm sultry nights can create enormous oxygen deficiencies and aeration at this time is paramount to Koi and aerobic filtration survival.





Plump and healthy Koi like these are well equipped to handle the colder weather that lies ahead.



A pergola not only helps provide some shelter during the height of summer, it also looks good too.

A REAL SUMMER TREAT

A Koi show extravaganza — staged by the British Koi Keepers Society — can be enjoyed by all Koi enthusiasts on Saturday and Sunday 13-14 August at Billing Aquadrome, Northampton. Some truly outstanding Koi will be on show, along with a great many supporting dealers displaying the very latest in Koi accessories and innovations to advance the hobby. This is a Mecca for all serious Koi keepers, and an event not to be missed. I shall be there, too, so come along and say "Hello" at Northampton at some stage during the weekend.

To support this statement, one only has to witness the vast volumes of additional oxygen levels introduced to the ponds, and even moreso to the filters, of the Japanese Koi breeders when summer temperatures start approaching.

3 During the intense heat of our high summer, Koi are often appreciative of some form of shading and, indeed, this unquestionably also aids to reduce excess algae and blanket weed growth. Over recent years, many Koi hobbyists have advocated building a permanent shaded pergola over their ponds which, apart from adding that welcome protection to the Koi, also lends a pleasing aesthetic look to the garden and surrounding landscape.

4 Particularly at this time of year, with activity in the pond in full swing, parasite epidemics can rapidly reproduce at alarming rates, so be very observant of your Koi's behaviour and swimming patterns. The last thing you need to do is disturb a good Koi growth period by upsetting water quality merely by administering chemical treatment in the pond for some reason or another. A good Koi keeper knows from observing behaviour if all is well.

5 Monitor your pH ammonia, nitrite, and water hardness levels with good-quality test kits on a regular basis, at least once a week when possible. Checking accurate oxygen readings is a little more difficult, so if in doubt, add additional air stones to the external filter bays and the pond accordingly. Happy Koi wallow in magnitudes of oxygen!

6 Remember your Koi should be prepared for winter hibernation by the end of September/October, so it is during the warm summer months that this preparation must commence. They will need to consume large amounts of food to keep them in perfect healthy condition with plenty of stored energy reserves to see them over another inevitably long British winter. Many new hobbyists believe that preparing their Koi for hibernation starts in the winter, but soon realise that only healthy Koi usually survive that unwelcome period.

There is no question that if Koi could choose their seasons, winter would be eliminated for ever, and it is to this end that, often, Koi are incorrectly referred to as a coldwater species!

Preparing Koi for winter?

Any thoughts on this subject? If you have, drop me a line so that we can share your ideas together in a later issue of Koi Talk.

AQUAPLANTON



Do you have a garden pond? Is it as clear as mud? Is it murky, muddy, slimy, smelly, choked with algae or weed and a chore to clean out?

If you have a pump, are you forever cleaning or changing the filter?

AQUAPLANTON is the simple solution

No longer need you remove the fish and drain your pond: **AQUAPLANTON** and nature will do it for you.

Available in 1lb packs for smaller ponds and 55lb bags for bigger ponds, moats or lakes.

AQUAPLANTON is an entirely natural product. When sprinkled onto water, it miraculously induces a biological digestion of organic matter. Mud and rotting algae are literally eaten away.

AQUAPLANTON is safe for fish, ducks, plants and all forms of water life. Murky waters become clear. Algae and stench disappear.

AQUAPLANTON is made under licence in the EC by P.M.K. S.A., Luxembourg.

For brochure and UK price list send the approx surface area of your pond to:

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Little London,
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Suffolk IP14 2ES
Tel: 0449 774532

Name.....

Address.....

Postcode.....

Phone.....

Pond surface..... sq ft
W.G.

Dominant male South African Mouthbrooder in full colours. His breeding success rate will be about 93%. The remaining 7% is achieved by 'sneaky little breeders'.



In Sunfishes of the genus *Lepomis*, 'sneaky' breeding is quite common.



Sneaky Little Breeders

There are born winners and born losers in every species. For the majority of organisms, the winners will be the biggest, strongest or fastest, and this is particularly true of males in their attempts at breeding.

Courtship and male dominance struggles are a familiar part of the reproductive strategies of many organisms, for example, 'rutting' in deer, 'lekking' in pearnigan and fighting in seals.

The net results of success in male dominance interactions is the opportunity to breed with as many females as possible. For the losers that do not breed, they pay the ultimate evolutionary price: they do not pass their genes on to the next generation.

For an inferior male deer, the best chance that he has of reproducing is to mate furtively with a female which 'belongs' to another male, but such a strategy is perilous, undesirable and ultimately destined to be unsuccessful.

Inferior fishes have a major advantage over terrestrial animals. Firstly, they live in water! Secondly, in most cases, the eggs are fertilised externally.

These two factors, taken together, enable some inferior fishes to overcome their inherited limitations by subterfuge. It is possible, for example, for some inferior males (of substrate spawning species) to fertilise eggs without actually making the intimate contact necessary in terrestrial animals, because their sperm is carried to the eggs in water currents.

Sneaking strategy

Even so, any male considering such action must be in the same vicinity as a spawning pair, to allow his sperm to reach the eggs before those of the actual spawning male.

Because parasitic males employ subterfuge, they are referred to as 'sneakers'. Sneakers are typically found in species in which males are territorial. The formation of territories by 'normal' males allows the necessary time-scale for the sneaker effect-

Dr David Tipping sneaks up on some unsuspecting victims of a highly original — and surprisingly successful — method of spawning 'attack'.

All photographs — unless otherwise indicated — by John Dawes

tively to parasitise another male's spawning because he knows in advance where breeding will occur, and to a large extent, when it will occur, by the presence and behaviour of a female of the same species. Some examples of species in which sneakers have been recorded are given in the accompanying list.

Misleading appearance

So how might an inferior male achieve reproductive success at the expense of a larger, probably aggressive, territorial male?

The most important feature of the sneaker male is that he doesn't look male. Territorial males usually display distinct colours or physical changes that make them look more obvious, both to other males, and to the females which they are trying to court. Any other males in breeding coloration are easily recognised and are dealt with quickly and severely.

Clearly, any small or weak male which assumed breeding coloration would both be unable to hold a territory (if there was competition) or sneak up on another male's territory. Instead, males which 'sneak-fertilise' tend to be insignificant, and often assume female coloration. For example in salmon, the sneakers are much smaller than the normal males, and do not migrate out to sea.

For males which assume female col-

oration ('female mimics') there may be other physical changes. In particular, the size of the testes may be larger (by two or three times) than in territorial males. The larger testes, particularly in smaller fish, has the added advantage that the sneaker looks even more like a female, which also appears fat, because of the development of eggs.

The larger testes of the female mimics have been shown in some species to release increased quantities of sperm, compared with territorial males. Such an adaptation is important, because it allows a greater chance of fertilising the eggs, despite a (sometimes) decreased amount of time spent with the female.

Behaviour mimics

Physical appearance alone would not guarantee that the territorial male would be fooled into allowing a female mimic into his nest or spawning site. In addition, satellite males in some species do not only mimic the appearance of females, but their behaviour as well.

In Bluegill Sunfish, for example, the female mimics are sometimes so efficient that they end up as the 'meat in the sandwich' between the spawning pair. In salmon, the sneakers are not quite so sophisticated. They wait furtively near to the depression in the substrate which will form the spawning site. When the pair spawn, they sneak in, rapidly release their sperm and race off again.

Successful alternative

However, it would be incorrect to assume that every sneaker was an inferior male. It has been suggested that in some species such an alternative breeding strategy may be just as successful as a territorial strategy.

In those species where the male guards the eggs until they hatch, it may be particularly profitable, because the sneaker is free to fertilise the eggs of another pair

while the territorial male is bringing up a brood of offspring which are only partly his.

The fact that sneakers exist at all implies that the strategy must, at least, be viable.

Genes and ratios

In some species, sneakers are probably genetically different from territorial males, while in others they are genetically similar, but forced into such a strategy by unfavourable circumstances, such as competition for territories or females.

In the Desert Pupfish, *Cyprinodon pecosensis*, the ratio of territorial males to satellite males varies with the sex ratio in the aquarium in which they are raised. In situations where there is inter-male competition, there is an increased likelihood that sneakers will be present. The implication is that in this species, males are capable of adopting either strategy, and that they assume whichever role affords them the best chance of reproductive success.

The presence of alternative strategies is an evolutionary phenomenon which necessitates involved explanations. The success rate of each strategy depends on the proportion of the total population which adopts it. For example, if you're a sneaker, you will probably breed much more successfully if you're the only one,



This is a submissive male Indian Gourami hiding from the same male as the female in the accompanying photograph. Note how similar his colours are to those of the female. This offers him some protection. 'Sneaking' males employ this same technique

Mouthbrooding species of cichlid (this is *Labotropheus trewavasae*) are potentially more likely to 'accommodate' sneaker males owing to their territorial spawning behaviour.



M.P. - C. PEGNOR

rather than if 50% of the population are sneakers. This is partly because, if there are more sneakers, there will (inevitably) be fewer territorial males to sneak up on, and partly because sneakers would be tripping over each other.

In the maternally mouthbrooding cichlid the Nigerian or South African Mouth-brooder, *Pseudocrenilabrus philander*, males progress through the various forms of reproductive behaviour seen in the species. The smallest males mimic females and adopt a sneaking strategy, but because the process of egg deposition and uptake by the female is so fast, the estimated rate of fertilisation is about 2%.

Older males adopt a semi-territorial strategy, and have some semblance of male coloration. When attempting to court females these males rapidly assume a much greater degree of coloration, and may attempt to hold a territory. However, because they are smaller than the proper territorial males, they are easily chased away from the available females. The success rate for these males has been estimated at 5%.

Once large enough, all males assume a

territorial strategy, which is extremely successful at about 93%.

The success rate of fertilisations is partly a reflection of the energetic expenditure involved in each strategy. A territorial strategy is very demanding energetically, because of the large areas (aggressively) defended by this species relative to body size, but is also very successful. Sneaking requires little energetic input, while a semi-territorial strategy involves an intermediate energy expenditure.

There is apparently no genetic difference between any of the males. Those which adopt sneaking or semi-territorial strategies are forced into it by the domination of larger males, and their control over large areas of the substrate. It's interesting to note that territorial males do not recognise the sneaking strategy that they, themselves, used to adopt. Perhaps they remember how ineffective it is!

Widespread occurrence

Note that the species in which sneaker males have been described are evolutionary very diverse. There are likely to be many more species discovered in which some males show similar behaviour.

Since the majority of males in such species are typically territorial, it is likely that more examples will be found among cichlids, not least because there are so many of them. Aquarists are probably some way ahead of scientists in owning and observing many species of cichlids, so there may be an opportunity to note previously unrecorded behaviour. After all, someone has to be first.

Since two of the well-documented cases were in maternally mouthbrooding species, this may be the type of cichlid in which more cases are to be found. Any situation when a territorial male appears to spawn with two females simultaneously should be viewed with interest.

The key word is *territorial*, to preclude those species in which many individuals spawn simultaneously, as for example in *Corydonas* catfishes.

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SOME 'SNEAKER MALE' SPECIES

Bluegill Sunfish, *Lepomis macrochirus*
Sea Trout, *Salmo trutta*
South African Mouth-brooder, *Pseudocrenilabrus philander*
Pseudosimochromis curvifrons (a mouthbrooding cichlid)
Ten-spined Stickleback, *Pungitius pungitius*
Desert Pupfish, *Cyprinodon pecosensis*
Symphodus ocellatus (a wrasse)
North American Plainfin Midshipman Fish, *Porichthys notatus*

QUESTION TIME

Having problems? Send your queries to our panel of experts who will be pleased to be of service. Each query receives a personal answer and, in addition, we will publish a selection of the most interesting questions and responses each month. Please indicate clearly on the top left hand corner of your envelope the name of the experts to whom your query should be directed.

All letters must be accompanied by an S.A.E. and addressed to: Question Time, Aquarist & Pondkeeper, 9 Tufton Street, Ashford, Kent TN23 1QN. Herpetology, Julian Sims. Koi, Alan Rogers. Tropical, Dr David Ford. Coldwater, Pauline Hodgkinson. Plants, Barry James. Marine, Gordon Kay.

PLANTS

Which Four-leaf?

I would like to use Four-leaf Clover in the front of my aquarium. The one I see listed by dealers is *Marsilea crenata*, but the only one I can find a description of in my books is *Marsilea quadrifolia*. Can you tell me the difference between these two plants?

Marsilea is a large genus of ferns inhabiting boggy ground throughout the tropical and subtropical world. These plants frequently grow submerged for long periods in time of flooding. There over 80 species recorded. *M. quadrifolia* has been in aquarium cultivation for many years. It grows up to 18in (45cm) or more in height, frequently with its leaves floating on the surface. In poor substrates, it will often adopt a depauperate form with waxy, diminutive leaves growing just a few inches tall. *M. crenata* has appeared during the last 10 years. It was previously named *M. minuta* in reference to its tiny stature. Sub-



merged, it grows just 2in (5cm) high. Like all *Marsilea*s, it has a creeping rhizome and forms large colonies in this way. Temperature: 68-82°F (20-28°C). It demands a brightly lit situation to thrive.

Simlawood secrets

I've got some very realistic pieces of Simlawood in my tank which I feel complement my plant displays very effectively. I'd be very interested to know how Simlawood is made. Can you shed any light? Simlawood is derived from real pieces of wood, which are carefully selected. Plastic casts are made from the originals and these (or moulds) are then filled with a special resin mixture. When set, the pieces are released from the moulds and are allowed to dry. Finally, the finishing touches, using special paints, are applied by skilled workers.



The delicate fronds of *Marsilea quadrifolia*.

MARINE



Short-sighted Moray

I keep a 100-gallon fish-only aquarium containing, among other species, a moray eel, a Porcupine Puffer, a Blue Triggerfish and a Lionfish. Everything is OK, except that I've noticed that the puffer — and others — are constantly getting bitten around the head. Who is the likely culprit, and what can I do to stop it? The culprit is very definitely the moray eel. Without even looking at your aquarium, I can say that without any doubt. The problem is that the moray suffers from poor eyesight and hunts by smell. What it does have is a good selection of very sharp teeth! I'm sure that all hell breaks loose in your aquarium at feeding time and the eel — on smelling food — makes a lunge at it. Now, because of the eel's poor eyesight, and the fact that all your other fishes are trying to get a meal too, it will very often miss the food and make contact with one of its tankmates — the greediest, boldest species, who's always at the front of the queue at feeding time. Your puffer, right? You can't stop this, but take heart. The wounds are very, very seldom serious. The eel doesn't mean to do it, otherwise they would be fatal. You could try feeding the eel

Short-sighted morays (this is a Snowflake Moray — *Echidna nebulosa*) can cause injuries, albeit usually unintended.

separately, after you've turned the lights off. You could also try feeding at both ends of the aquarium. From experience, however, neither of these solutions will work particularly well.

CAUTION: Because of their poor eyesight, NEVER handfeed a moray eel.

Black Spot

My fish have started to act very strangely, breathing heavily, hiding, flicking, exhibiting skittish movements etc, and I've noticed that my Yellow Tang has tiny black spots near its tail. Some of the fish spend long periods in the bubbles from an airstone. A couple have died. What's wrong? Black-spot, which is actually a rather nasty crustacean infection, can be deadly but, fortunately, is easily remedied, once it has been diagnosed. Sterazin, used in accordance with the manufacturer's instructions, works well. However, it really IS important to use it in accordance with the instructions.

TROPICAL



Long-running success

I have now had my hexagonal acrylic community tank for about two years and everything is still running OK.

Would you please advise me as to when/how/if my set-up needs to be fully cleaned out? I believe that there is a time limit with regard to under-gravel filter effectiveness, so I'm a little concerned that I may be allowing my system to run on for too long.

There is a good saying: "if the wheel isn't broken, don't fix it!"

You obviously have a very good community tank and the water quality is apparently excellent... so leave well alone. The shock of a complete breakdown and the potential to recreate 'new tank syndrome' could bring disaster, even death, to the aquarium.

The best way of keeping a long-running system sweet is by lots of partial water changes, but never disturb the bed of nitrifying bacteria. The part changes can include 'hoovering' the gravel and you can push a siphon tube down the uplift of the u/g filter to remove mulm from under the gravel.

Only if the system looks dirty and nitrite or ammonia are found on testing the water, should a breakdown be considered. There are public aquariums that have gravel filter beds and that have remained undisturbed for half a century!



BILLY WHITEHEAD

Similar... but different Tets

I would like to know the difference between *Moenkhausia sanctaefilomenae* and *M. oligolepis*. I'd also like to breed these fish, but don't know how to sex them. Can you help?

Moenkhausia sanctaefilomenae is the Yellow Banded Moenkhausia, which is also known as the Yellow Banded or Red eyed Tetra. Although a South American species, it is

now only available from Asian fish farms.

You can sex these fish by the females having more rounded bellies. A pair will spawn, but they breed best in schools, with a layer of fibre anchored near the surface to catch the scattered eggs.

Remove the breeders after spawning because they eat the eggs. These hatch in two days and the larvae take powdered fry foods followed by freshly hatched Brine Shrimp a week later.

M. oligolepis is the Glass Tetra, which looks very like the Red-

The Red-eyed Tetra is similar to, but deeper-bodied than, the Glass Tetra.

eyed Tetra (even has red eyes) but is not quite so deep in the body and the scales are paler (i.e. glassy). It breeds in the same way. A separate breeding tank with a peaty base and soft water is ideal.

All the *Moenkhausia* species are peaceful, undemanding omnivores, hence their popularity as community tropicals.

COLDWATER

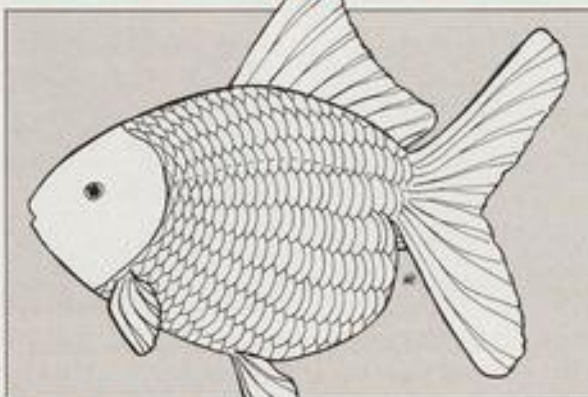
Fading Gold

Since introducing some Goldfish into my pond, two of them have lost their colour and are now almost silver all over. I have had other fish in the pond for a few years and they appear to be in the best of health. What is wrong with my latest introductions?

I doubt that there is anything wrong with the new fish, other than the fact that they have lost most of their pigmentation. This is quite common and there is nothing you can do about it. It can happen at any time during a fish's lifetime and, unfortunately, the lost colour never returns.

Some strains of Goldfish are more prone to this than others, though if you were breeding a line showing this characteristic, you could eliminate the loss of colour with careful selective breeding.

FALLINE HODGKINSON



'Failed' Fantails

I am a newcomer to fishkeeping and have recently purchased six young Fantails.

I was quite pleased with my purchase until I started read-

ing about how the fish should look in a book which I bought at the same time as my fish. It appears that only two of them have their full set of fins and I am wondering how this could have happened.



A well-shaped Fantail, but only show specimens need to approximate this standard.

You must realise that Fancy Goldfish are, in fact, mutants developed over hundreds of years from the Common Goldfish.

By selective breeding, the original type has been skilfully changed into the hundreds of varieties we have today. However, in each and every spawning, Mother Nature 'attempts' to revert back the line to the original ancestors, so there will undoubtedly be some fish that will not conform to the ideal.

If you are not buying fish to exhibit at a show, but merely to give beauty and interest to your coldwater aquarium, then the fact that your fish do not come up to perfection should make little difference to the enjoyment they can give you.

HERPETOLOGY



DICKIE ROO

Active Garters

I have heard that Garter Snakes (genus *Thamnophis*) are very active reptiles. Can you confirm this information?

Yes, Garter Snakes are active reptiles. Therefore, if they are maintained in captivity, they

The Red-sided Garter Snake's migratory instincts cannot be catered for in captivity.

require a larger vivarium than other colubrid snakes.

However, before certain species are maintained in

captivity, careful consideration should be given to their behaviour in the wild. For example, Red-sided Garter Snakes (*Thamnophis sirtalis*) undertake an annual autumn migration of considerable distance.

From the late summer onwards, these reptiles can travel up to 3½ kilometres (over 2 miles) in just a few days to return to their chosen hibernation den.

Such communal hibernation sites are used by hundreds of Garter Snakes every year.

Quite clearly, facilities to duplicate such natural behaviour cannot be provided for this species when it is maintained in captivity.

Scottish society search

I would like to contact a herpetological society in the Edinburgh/Lothian area. Can you help?

I don't have an address of a specific society based in (or near) Edinburgh, but the following two societies have (or had) regional branches, and organise regional meetings:

1 The British Herpetological Society, c/o Zoological Society of London, Regent's Park, London NW1 4RY.

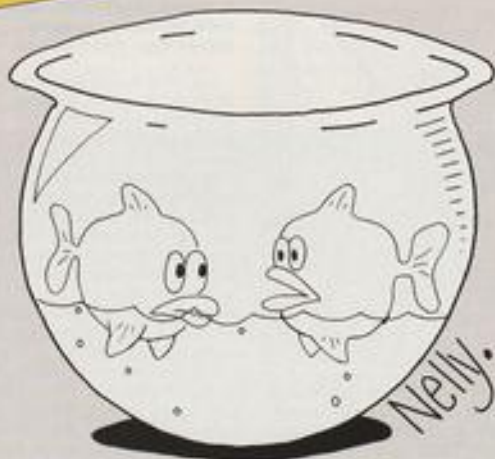
2 The International Herpetological Society, c/o 65, Broadstone Avenue, Walsall, West Midlands WS3 1JA.

In addition to these two potential societies, The Cannon Aquarium & Vivarium have compiled a directory of all the herpetological societies (large and small) in the British Isles. Information about any herpetological society in the Lothian area should be obtainable from the following address:

The Cannon Aquarium & Vivarium, The Manchester Museum, The University, Manchester M13 9PL.

You might also contact Glasgow Zoo. Mr Les Brown, Reptile Supervisor, is a very enthusiastic herpetologist who is particularly interested in captive breeding projects. He might well know of other herpetologists and/or a herpetological society in your area.

The Bowlers



Boy! I was thirsty last night!

KOI



Thanks to John Cuvelier

invaluable, but regrettable, decision to wind up his writing/advisory activities... at least, for the time being.

I am sure that you will all wish to join me in thanking John for all he's so unselfishly done for us and to extend our very best wishes, both to him and Sheila.

As from this month, **Koi Talk** will be under the enthusiastic and knowledgeable management of another highly respected, international Koi authority, **Alan Rogers** (Please see **Koi Talk** elsewhere in this issue of *ASP* for further details). Alan will also be handling the **Question Time** Koi queries, so please address your letters to him from now on, enclosing the usual s.a.e., of course.

We extend a warm welcome to Alan and trust that he will enjoy working with us as much as John evidently has.

John Dawes

Philippines

French aquarists Marie-Paule and Christian Piednoir report on their latest fact-finding trip to Manila.

Photographs by the authors



Marine aquarium fishes inevitably pass through the hands of a local exporter during the journey from their native seas to foreign lands. In the Philippines, specifically in the capital Manila, we encountered the proprietors of two sister companies, Sea World and MB Aqua Resources, the former run by Sharon Onk and exporting to Asia, the latter under the control of Willen Kho and supplying the Australian, European and American markets.

Armed guards

In a working class district of Manila, opposite the huge Makati cemetery, an unremarkable door admitted us to the fish house and offices of MB Aqua Resources, where we were met by Willen, 40 years of age, wearing a smile which could not disguise his Chinese origins. We immediately realised that, in the Philippines, the fish exportation business provides for a comfortable lifestyle.

We received the same impression upon meeting Sharon, likewise Chinese (a race noted for their business acumen), whose premises are situated in a wealthy part of the city. Here, a huge metal door was watched night and day by an armed guard (in the Philippines, anything is liable to be stolen, not just fishes, but everything from tourists' cameras to manhole covers!)

This visit followed our stay on the island of San Salvador (see *Aquarist & Pondkeeper*, December 1993), which we had left the day before, together with the fishes we had caught during the week spent there. We now encountered the same species here and there among other members of the same genera caught in various parts of the Philippines. Willen and Sharon employ 30 fishermen stationed on the coasts of the provinces of Quezon, Zambales and Batangas.

It was in 1988 that Willen first started to export aquarium fishes and installed his holding tanks; 73 all-glass aquaria and 21 concrete vats were constructed. The

20,000 litres (4,400 gal) of seawater pass through an 8,000-litre (1,760-gal) filter chamber filled with sand, coral and carbon, and concealed in the basement.

Since the beginning of his association with Sharon and the creation of Sea World, the combined holding capacity of the two companies has stood at about 100,000 litres (22,000 gal). Natural water is pumped from the open sea more than 150km (93 miles) away, and a tanker shuttle service then brings it by road to Manila to supply the needs of the two businesses.

On their arrival from the various fishing stations, the fishes are distributed among the vats, where they are sorted and counted by the skilled workforce. Each fish is examined by hand before being placed in a holding tank to await departure. The less delicate types, and the juveniles of large species, leave Sea World the next day at the latest, en route for Japan, Hong Kong or Taiwan. By contrast, the more fragile *Centropyge* Angels, together with *Pomacanthus* and *Exocoelopteryx* Angel adults, remain at MB Aqua Resources for 3-8 days to ensure they are in sufficiently good health to endure the long journey to Europe or the USA.

Here, as in all Asian fish farms, little attention is paid to water parameters. There is no need to measure the temperature (so they say!) and, in general, they check the salinity only if there is a problem! This state of affairs is a function of the ease with which fishes can be captured in these waters, though, as we ourselves observed while diving, they are no longer as abundant as in the past. Unfortunately, this attitude to the provision of proper conditions shows no sign of changing, and those fishes which fail to survive are simply discarded, with no questions asked.

Pink basket: Blue damsels

As we wandered along the corridors between the walls of tanks, we found thousands of Dominoes (*Dascyllus trimaculatus*), Banded Clown (*Amphiprion clarkii*) and Blue Damsels (*Christiptera cyanea*) in a fluorescent pink basket. Not far away, young Clown Wrasse (*Coris gaimard*) were frolicking next to two Emperor Angels (*Pomacanthus imperator*), with one juvenile isolated in a plastic pot



Top left, Sharon and Willen — our hosts.

Left, hand examination of the stocks.

Revisited

Far left, (this page), one of our more unusual finds: a Medusa or jelly fish.

Below, Two types of Pygmy Angel: Coral Beauties (*Centropyge bispinosus*) and the appropriately named Golden or Herald's Angel (*C. heraldi*).



Below left, a batch of Clown Wrasse awaiting sorting.

Below right, Blue Damselfish in their pink basket collected together in preparation for shipping.



that is pierced with holes.

The most frequently exported fishes are the members of the Pomacentridae (Clowns and Damselfishes) and Pomacanthidae (Angels), the former because they are very abundant in the natural habitat, the latter on account of their beauty, although they are far less noticeable during dives. Consignments also include numbers of Labridae (Wrasses), such as the Cleaner Wrasse (*Labroides dimidiatus*), and Pteroinae (Lionfishes), notably the black form of the Lionfish (*Pterois volitans*). In addition, there are Long-nosed Butterflies (*Forcipiger*), Moorish Idols (*Zanclus*), Marine Bettas (*Calloplectops alivata*) and Snowflake Morays (*Echidna nebulosa*).

At the back of the premises a display of 500 mini-aquaria of 1/2-litre capacity actually arranged on the stairs accommodate Bicolour Angels (*Centropyge bicolor*), Key hole Angels (*C. nificen*), Coral Beauties (*C. bispinosus*), and Watanabe's Lyretail Angels (*Gemicanthus watanabes*) dashing around boisterously.

At the exit to the fish house there are dozens of individually bagged anemones, waiting to depart for Tokyo, where they will allow clownfishes to follow their natural instincts.

Food market fishes

Of course, no individuals more than 30cm (12in) in length are exported for the aquarium trade, as their chances of surviving the journey would be too small. Any large specimens which are caught are destined for restaurants named "Sea Food Markets" throughout Asia. These establishments, which are especially popular in Taiwan and Hong Kong, display, in tanks superb blue Parrotfish (*Scarus*), various groupers, including the Grace Kelly Grouper (*Chromileptes altivelis*), and all sorts of crustaceans.

It has often been rumoured that many of these food fishes originate from fishermen using cyanide or explosives. Nevertheless, *Chromileptes* costs about £45 in the Sea Food Market in Hong Kong, a windfall for the less scrupulous Filipino fishermen.

Despite their liking for fresh fish between their chopsticks, Asians are keen aquariphiles, and love 'individual' fish with faults. Sharon confessed to sorting Clown Surgeons (*Acanthurus lineatus*), Emperor Angels (*Pomacanthus imperator*), and Regal Angels (*Pygoplites diacanthus*), among others, on the basis of faults in their parallel barring! The 'perfect' speci-

mens go to Europe and the USA, while those with convergent markings are reserved for the Japanese... at a higher price. In fact, these fishes with intercepting lines are commonplace in nature, and in any case who can state categorically what is 'normal'?

Talking of the unusual, Willen and Sharon regularly receive oddities from their fishermen: for example *Stenogobius*



nemoanodes (a white goby striped with black), first discovered at the beginning of the 1980's.

Priorities

Our instructive visit to the Philippines gave us much food for thought. We had been astonished to learn that there is no export recording/book-keeping of fishes from the Philippines. Given that they are counted to establish payments to the fishermen, why not impose an export quota to preserve the collecting localities, as is the case in Hawaii and the Red Sea?

We discussed the problem of fishing using cyanide at length with Willen and Sharon, and found them most concerned for the image of their profession and for its future. Surprise visits to fishing localities allowed them to check that their fishermen, recruited because they used only nets, were acting in good faith.

"Even though cyanide is illegal," they said, "there have been occasional cases of fishing with drugs, and the reduced costs and increased catches using this method are attractive to some exporters. The losses we incur are not our fault, but due to poor conditions at the fishing stations, notably storage in bags, despite twice-daily water changes." The use of tanks throughout the collecting/holding/exportation chain should therefore be a priority in any programme of aid for the Filipino fishermen.

Moreover, Willen and Sharon deplored the fact that fishes from the Philippines have a poor reputation among aquarists.

"It is true", they said, "that fish losses linked to cyanide have occurred among aquarists. Cyanide dissolved in water produces hydrocyanic acid, which causes deterioration of the intestinal mucus, as well as liver and kidney cells, so that the fish dies during the days that follow, after it has started to feed. It is, however, true that we have no way of spotting the problem, nor do the importer and retailer." **MP**

POSTSCRIPT

This article is based on our visits to two exporters in Manila who unhesitatingly opened their doors to us. There are undoubtedly others who take their work just as seriously as Willen and Sharon (we were unable to meet them all!), but we are of the opinion that, regrettably, they are far from legion.

In actual fact, we left France armed with numerous names and addresses given to us by an importer friend. Our intention was to visit as many export businesses as possible, in the hope of being able to return and shout aloud "Cyanide is no longer used!" for all the aquarium world to hear. But everyone we contacted by telephone (except Willen and Sharon), not only refused to allow us to go and report, with supporting photos, on their business, but would not even permit a visit pure and simple, which might have enabled us to understand such a refusal.

Should we "bad-mouth" these people, and say, without actual proof, that their premises conceal fishes caught using cyanide? No, of course not. But why should they refuse the free publicity offered by an article in a specialist aquatic magazine?

We have just learned from Willen that he is ceasing his activities as an exporter of tropical fishes, disheartened by competition which he feels is worse than unfair. Instead, he will raise top-quality roses in future! So now Sharon is running both businesses. She still believes she can prove it possible to make a living in the Philippines from fishes caught by non-destructive methods. Keep your chin up, Sharon!

To sum up, we have not heard the last of cyanide, but let us hope that matters are gradually heading in the right direction.

Marie-Paul and
Christian Piednoir

At other times the Damselfishes and other fish are held in large well-filtered vats.

WRITEBACK

Chlorine spawning doubts

I have just (some ten months later!) read John Dawes' editorial in the August '93 issue of A&P entitled **Sex and Chlorine**.

Recently, I also heard a big splash coming from my 400-gallon pond early one morning. In my case, I thought that somebody had chucked a house brick over the hedge. The house brick turned out to be my three large Golden Orfe thrashing about. They started spawning at 7 in the morning and went on throughout the day, until 9pm! I have had these Orfe since 1985, but this is the first time they have spawned.

The point is that I had just carried out a partial water change. This is, in fact, what John had done before his Koi spawned. He put the success down to being probably due to chlorine from the tapwater. Coldwater treatment is an old 'tropical' trick that works... but chlorine (?)... I doubt it.

F. Polzer,
Nottingham.

Anti-cyanide campaign

I feel that we must respond to the letter from Don McAllister of Ocean Voice International in the May issue of A&P.

The Miniature Reef Society feels very strongly that the issues of cyanide fishing and the use of explosives in the Philippines and other parts of the coral reefs has to be stopped. It is not necessary to catch fish using these methods, but who is going to pay for the nets, even if fish catchers are taught how to use them?

Put aside all the issues about the damage to the reefs and the livelihood of the catchers, and think about whether or not we, as hobbyists, want to buy fish caught with cyanide. After all, a high price has to be paid for fish caught with nets.

Lakeside '94 was about addressing these matters so that the legislators who will eventually impose the bans on imports can see that there is no need for laws to be considered if the issues are being dealt with voluntarily and the various relevant groups can guarantee that all fish are being

net-caught.

Lakeside '94 had to be cancelled because, very clearly, there are people who take the view that if you hide your head in the sand, the problem will go away. Regrettably, it will not.

The Miniature Reef Society will, despite the threats we have received, continue to support

organisations such as Ocean Voice International and worldwide conservation, and we will campaign for a ban on the import of any fish caught with chemicals and explosives. We are receiving support from around the world and, in particular, the EU and the Philippines.

We are therefore looking, in conjunction with the Philippine Government, to being able to guarantee that fish are net-caught in the future.

Peter Newman,
Chairman,
Miniature Reef Society.

FASCINATING FISH FACTS Stuck on you



Although Anglers live on the bottom of the sea, their eggs float on the surface. When they hatch, the young fish spend most of their time hunting for food.

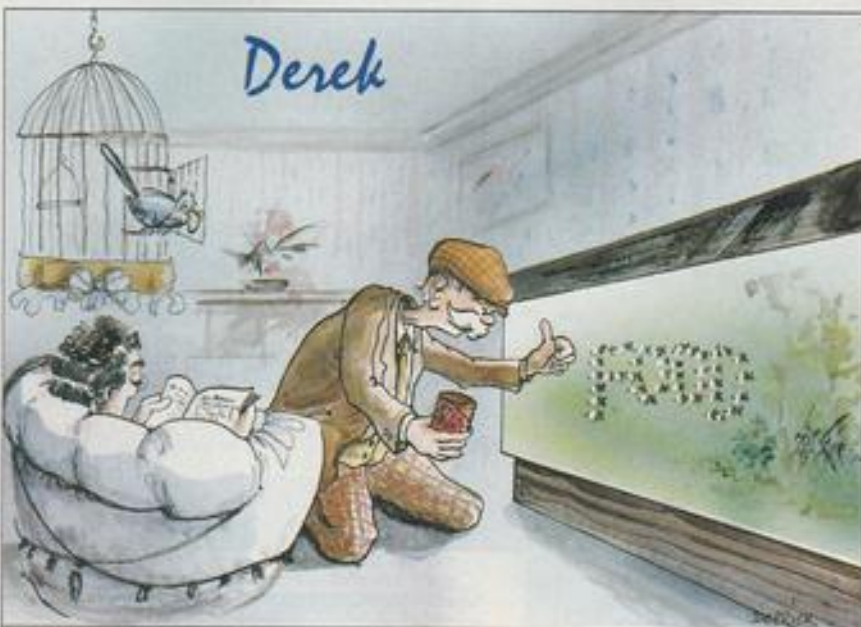
As they begin to grow, they gradually sink towards the bottom and, as they do, the juvenile males seek out the females. Once a male finds his potential mate, he bites her — usually in the belly region. At this stage, the male has powerful teeth with which he hangs on for dear life. The female reacts to the wound by healing it over and, in so doing, firmly 'seals' the male's mouth in as well.

From then on, the male remains firmly stuck on to his mate. He can no longer hunt for food, or swim for that matter, deriving his nourishment via the female instead. The female continues to hunt and grow, while the males (a female may have several attached to her) remain quite tiny. In effect, they become parasitic sperm-producing machines!

When the female matures and her hormone levels rise just before egg production, the males detect these changes and they, in turn, begin to produce viable sperm. When the eggs are eventually released, they are immediately fertilised and begin their rise to the surface of the sea, where they will hatch in due course to start the whole incredible cycle all over again.

Stuck for life!

SUE FAIRBURN



OK, Dr Doolittle, I agree that you taught the budgie to talk but do you really expect me to believe that you can converse with a couple of dozen neon tetras?

Winners celebrate in Blackpool

The Sayers family from Corringham Essex were special guests of 'Aquarian' in Blackpool as winners of the company's Century of Fishkeeping Competition to celebrate the centenary of Blackpool Tower.

Roy and Dorothy Sayers and their children Ian and Natalie were taken by Dr David Ford, senior consultant to 'Aquarian', on a behind-the-scenes tour of the UnderSea World and presented with tickets for shows and rides at Blackpool Pleasure Beach.

The family keeps and breeds tropical fish and is particularly interested in Malawi Cichlids. They also keep Goldfish in an aquarium, and these spawn every year, so the fry are moved to a neighbour's pond.

Throughout May, 'Aquarian' staged a display at UnderSea World to present the delights of owning an aquarium. Two lectures were also given during the month to invited local fish clubs: Dr Ford presented a talk on fish nutrition while David Sands presented Fish Collection in the Amazon.

The lectures were attended by around 200 aquarists, and each received complimentary tickets to Blackpool Tower and the SeaLife Centre.

Some of Blackpool's delights enjoyed by Aquarian's competition winners.



DR DAVID FORD

way network. Lectures and demonstrations will also be held during the show, which is open from 10.00am to 5.30pm on Saturday 29 October, and 10.00am to 5.00pm on Sunday 30 October. Admission is just £2.50 for adults, £1.25 for children and OAPs (children under five years and accompanied by an adult get in free).

For information contact: Arnold Chadwick, Festival Organiser, BAF '94, 9 Bronville Close, Chadderton, Oldham OL1 2RH. Tel: 061 652 6207.

Aquatic help for equines

Aquarists with a photographic leaning have been called upon to help raise funds for the International League for the Protection of Horses (ILPH). The league is organising an animal photo show to raise funds for their cause and aquarists can enter either (or all) of a variety of classes, from Family Pet, to Unusual Pets and Best Friends (two or more animals).

Entries are just 50 pence (minimum entry fee £2.50) and the winning ones will go forward to the final for Best Animal Photograph. Entries or enquiries should be addressed to Sally Davies, ILPH Photo-Show, Coach House, Main Street, Northiam, Rye, East Sussex TN31 6NA. Closing date is 30 November 1994.

Promotion marks TetraMin's 40th

A special promotion is being run by Tetra in celebration of the 40th anniversary of TetraMin flake food. Anyone purchasing a special anniversary 20g tub of TetraMin (retail price £2.10) will receive a free 30ml pack of Tetra AquaSafe (worth 99p).

According to Tetra, TetraMin flake food has been a real success story since its introduction in 1954. Dr David Pool, head of Tetra Information Centre explained, "The food is based upon a combination of over 40 raw materials, and many aquarists consider TetraMin to be indispensable for successful tropical fishkeeping, as it provides a nutritionally balanced diet for all types of tropical fish and regularly comes out on top in independent tests".



BAF '94 set for success

Bookings for this year's British Aquarists' Festival (Bowler's Exhibition Centre, Manchester, 29/30 October) are exceeding expectations, according to organisers, the Federation of Northern Aquarium Societies (FNAS).

The festival, now in its 43rd year, is organised by the FNAS in collaboration with A&P and is fully supported by leading traders, aquarist societies, and specialist societies. Organiser

Arnold Chadwick commented: "We have received a number of enquiries from traders 'new' to the festival, so early booking is recommended to avoid disappointment. In addition, we are expecting more entries for the Champion of Champions stand, which will benefit all hobbyists. All federations from throughout the country are expected to be in attendance to promote and support the fish-keeping hobby."

The event is held at Bowler's Exhibition Centre, Longbridge Road, Trafford Park, Manchester, which is just a few moments' drive from the motor-



CALIFORNIA

PART THREE

Big Basin

Marc Staniszewski completes his trilogy of adventures seeking out California's newts and salamanders.

Photographs and map by the author

My journey eventually concluded in a region where rare salamanders proliferated. After once again crossing the gruelling Central California Basin, I ended up in the small coastal city of Santa Cruz, where I would concentrate my search in the oldest of California's state park system — Big Basin Redwoods — nestled high in the Santa Cruz Mountains.

The cool, rugged terrain contains a mixture of Coastal Redwoods, Douglas Firs, Tanbark Oaks and Madrones. Here, habitat divergence is the word; dense forest to still ponds, meadows to sandstone gorges, and granite outcrops to slow-moving streams.

Rather than following the trail suggested by the official park map, I hiked down a long road which was closed to cars for the

winter but granted me access to more promising, less frequently trodden, terrain. Eventually, I reached a natural clearing where several large redwoods had toppled and the cork bark had been shed.

Almost inevitably, Californian Slender Salamanders (*Batrachoseps attenuatus attenuatus*) displayed their theatrical springing on lifting every stone, bark or log. Under the larger sheets of

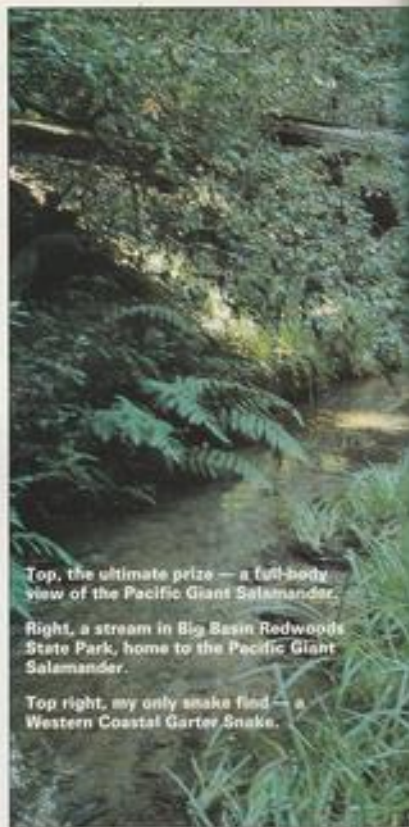
this bark, in the midst of thousands of small black crickets, squatted several bloated juvenile Yellow-eyed Painted Salamanders (*Eumecurus eschscholtzi xanthoptica*), endemic only to the San Franciscan Bay area. Although physically identical to the Monterey form, this one differs in that the upper eye region contains a golden yellow band. These conspicuous salamanders were very abundant, but many lacked or showed regrown tails, which suggested that a common predator stalked the vicinity — one which I would later confront.

Black-tailed relief

My hand map showed a stream was just over a mile away and I realised this to be my best opportunity for observing a shy, clumsy and ultimately rare species which is one of the largest terrestrial salamanders in the world. I made my way through the forest, sometimes inhibited by huge Banana Slugs and increasingly dense bramble-like undergrowth.

After a while, I reached a gorge through which the stream trickled. Scaling the treacherous and steep incline of the loose gorge face held no lasting appeal and therefore I followed it for another 200m.

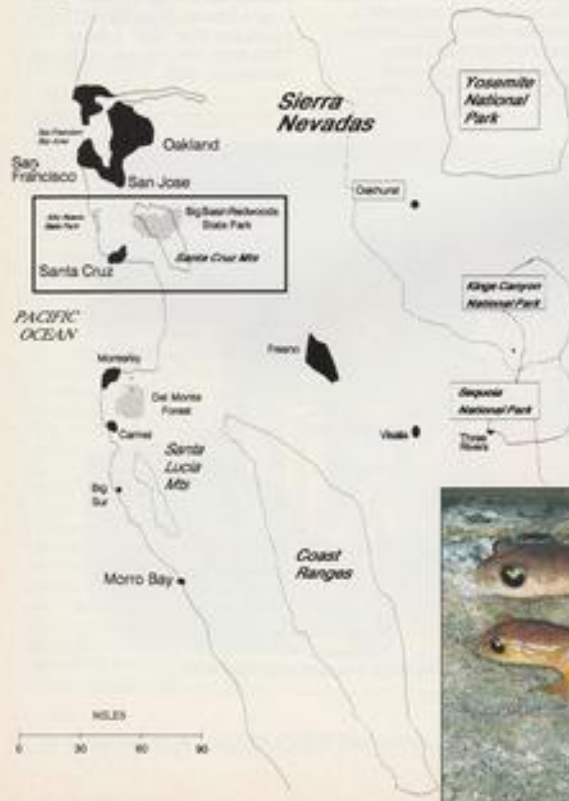
On reaching a point



Top, the ultimate prize — a full-body view of the Pacific Giant Salamander.

Right, a stream in Big Basin Redwoods State Park, home to the Pacific Giant Salamander.

Top right, my only snake find — a Western Coastal Garter Snake.



Dream



where it abruptly widened to form gentle grassy slopes, as I carefully descended towards the stream, there was a loud rustle and grunt in the forests' darkness behind me. Fearing the worst, images of ferocious lynx, cougar and grizzly bears (even though the last bear was killed here in 1886) crossing my mind, I slowly and cautiously turned round.

I gave a huge sigh of relief on seeing a large, Black-tailed Deer (*Odocoileus hemionus*) peering at me as though to say "What on earth are you doing here?" We stood there staring at one another for a while, and even as I took a few steps forward, it remained with a look of obduracy written all over its handsome black face. Yet, as soon as I lifted my camera to get a snap, much to my dismay it bolted. With hindsight, I'm sure it was teasing me, but then again, it was a relief not to find a wolf or cougar mocking me!

Frostbite and disappointment

Returning to the stream, I crouched down and remained quite still to watch for tell-tale air bubbles breaking the stream surface. The larvae of this 'king of the land salamanders' are extremely slow-growing, taking up to three years to metamorphose, and often surface to snatch huge gulps of air.

It was just as the noisy chorus of Pacific Tree Frogs returned to interrupt the silence, that a loud splash downstream had my heart catapulting into my mouth. I crept along the bank just in time to see one large Pacific Giant Salamander (*Dicamptodon ensatus ensatus*) lunge from a rocky outcrop into a deeper region of the stream. Ignoring the freezing water and slippery bank, I vaulted into the stream, almost breaking my neck in the process, and went in 'cold' pursuit.

Unknown to me at the time, I actually passed dozens of these salamanders because such is their coloration and pattern, they blend perfectly with the rocks,

logs and leaves littering the stream banks. Yet, after a while, my frostbitten feet urged me back to dry land, still without a decent photograph of these elusive amphibians to my name. Despondently, I decided to follow a rather crude woodland trail which headed off deep into the forest.

Rare find

There is a particularly fascinating salamander that is so rare that the forests of these mountains provide one of its last refuges. Therefore the thought of even glimpsing a Santa Cruz Climbing Salamander (*Aneides flavipunctatus niger*) had barely crossed my mind. You can imagine my excitement when I approached a recently toppled pine to spot a beautiful black and speckled white adult appearing to be gnawing away at the bark.

Even when I edged to within a few feet, it seemed totally unafraid and I was able to observe it using its diagonally protruding teeth to scrape green algae from the bark which it then continued to devour. It is still not known whether Climbing Salamanders actually derive nutrients from the algae and mould (suggesting that they are the only amphibians outside the larval stage to include vegetable matter in their diet) or the bacteria and other microorganisms which coat such vegetation.

As I went to touch this salamander it skittered off with the surprising agility of a cat and so I strained to roll over the log. I was even more astonished to discover a nest of a dozen jet-black juveniles clinging to the underside. The sucker-like toe pads and long, prehensile tail characteristics of this genus were both evident; these enable this remarkable amphibian to scale the vertical incline of trees, rocks and even glass.

In addition, as there is no requirement for a body of water in which to breed, it usually occurs miles from such sources, with females seeking the moist underside of rotting wood or the roof of an abandoned woodpecker hole in which to deposit their 12-25 eggs during late summer. Larval development continues entirely within the confines of the gelatinous egg, with the inch-long young hatching out 10 weeks later.

Success!

I was to be rewarded a second time in the same clearing, because close to the nest were several short redwood logs and on lifting one, I at last came face to face with a handsome pair of Pacific Giant Salamanders. This bulky, muscular species can attain 14 inches (c35.5cm) and feeds mainly on snails, small Banana Slugs, other salamanders (the main predator of the *Ensatina*), small snakes and even juvenile rodents if it can catch them.

The brown dorsum is attractively mottled in black blotches, and the huge eyes on a disproportionately-sized head give

Left, Californian Slender Salamanders 'spring' out of danger (see text for details).
A pair of attractive Yellow-eyed Ensatinas (male — top).

this salamander an almost sombre demeanour. Although it is an awkward and mainly nocturnal creature, it frequently ventures out in daylight to hunt and, more remarkably, climb trees to capture fledgling birds.

Like so many of the salamanders indigenous to central California, this primitive creature is confined to continually moist, shady and cool habitats provided by the broken belt of Coastal Redwoods, such as that seen in Big Basin, and their survival is wholly dependent upon the continued and fragile existence of these precious, ancient trees.

Reluctantly rejoining the scenic highway north to San Francisco, I was certain of one thing: a fortnight is certainly too short a time in which to explore this vast region, and 1,600 miles travel seemed like just touching the tip of an immense iceberg.

Before departing, I allowed myself one final stop at Año Nuevo State Reserve, 55 miles south of San Francisco in the hope of spying the San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*), because this was one of the remaining sanctuaries of the world's rarest serpent.

The 4,000-acre Año Nuevo is composed of bluffs, dunes, rocky beaches and a mountain backdrop. Close to the park entrance is a marshy freshwater area encircled by a dense growth of razor-sharp rushes and Coyote Bush proving impene-



A rare find — the Santa Cruz Climbing Salamander.

trable without being ripped to shreds.

Disillusioned, I decided to follow the board walk trail to a region called Cove Bay, a sandy stretch of beach which is home to Año Nuevo's most famous resident — the Elephant Seal.

As I followed a line of tourists eagerly waiting to watch these huge mammals basking in the hot sun, there was a scream from beyond a dune to my right. Camera poised, I clumped awkwardly over the sand in time to see a rather flustered

woman hurrying away. Sliding down the dune, I began to make out a faint back thread etched in the golden surface and as I approached, it coiled up, began hissing angrily and comically struck out at me. Unfortunately, it turned out to be a common Coast Garter

Snake (*Thamnophis elegans terrestris*) and not its San Francisco counterpart.

It was only during the 12-hour flight back to England that it dawned on me that the snake in Año Nuevo was, in fact, the only serpent observed during my entire visit; strange, since there are supposed to be 18 species within the area! Then again, I was looking for

salamanders, and I knew that I would be back here in the not-too-distant future, because Big Sur, Monterey, Sequoia National Park, Yosemite and Big Basin Redwoods are surely the stuff that a herpetologist's dreams are made of.

Part 1 of this trilogy was published in the February '94 issue of A&P. Part 2 appeared in May '94.

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Over the weekend of May 21st and 22nd two ponds at Japanese Water Gardens were poisoned with a highly toxic substance during the store opening hours.

The result of the incident has been a loss of all fish in the affected ponds and costs in excess of £60,000.

Please note that this incident affected only 2 ponds with the remaining 10 wholly unaffected. By the date of publication all ponds will be fully functioning and restocked.

Any information leading to a conviction of the perpetrator(s) will warrant a substantial reward.

We hope our misfortune will make the entire industry more vigilant to prevent future acts of this nature.

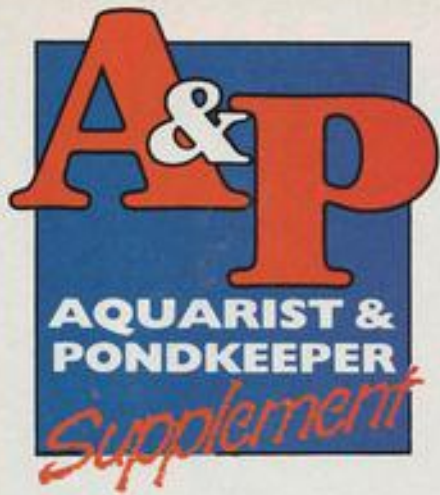
Japanese Water Gardens would like to thank all their customers and suppliers for their valued support during this trying time.

Bernard Channing
16th June 1994



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KOI SURVIVAL FORMULA

Dr David Pool of the Tetra Information Centre shows how winter/spring fish losses can be avoided with just a little forethought and commonsense now and in the coming months.

Koi keeping is becoming increasingly popular throughout the world. However, as the popularity of these fish increases, certain areas are highlighted as causing problems for the fishkeeper. One such area is the loss of Koi during the winter and early spring.

Small fish and particularly high quality specimens seem particularly at risk. Yet, the majority of these losses are avoidable with a little understanding of what is causing them, and by taking some sensible precautions. The following areas are perhaps the most important to consider.

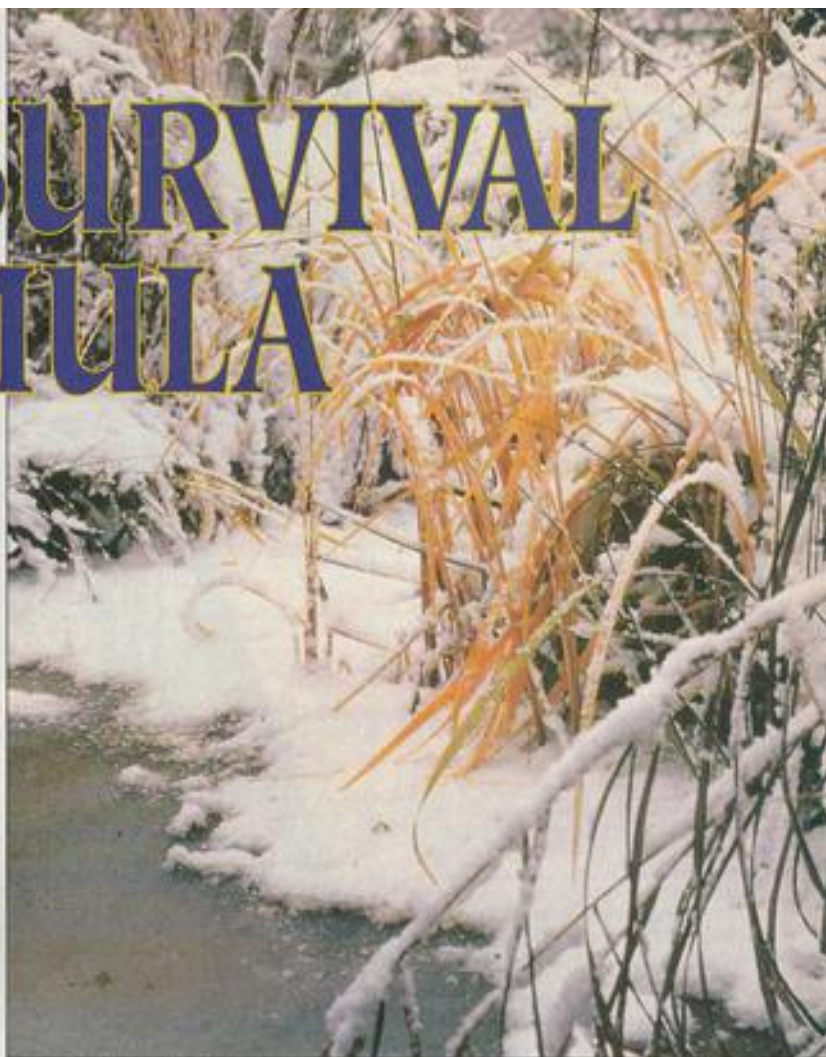
Summer/autumn feeding

Some of the Koi losses which occur during the winter and early spring are due to the fish having insufficient energy reserves in the form of fat deposits and glycogen in their muscle tissue. When this occurs the fish may become very weak and susceptible to a range of diseases.

Small fish are particularly at risk as they have had less time to build up their nutritional reserves, and require more food in relation to their body size than bigger fish.

The solution is relatively straightforward and involves feeding the Koi regularly throughout the summer and autumn. Always feed on a good quality food to ensure that the fish are receiving all of the nutrients they require. Cheaper foods may seem to be good value, but much of the food cannot be digested by the fish, leading to large quantities of fish waste and more maintenance required.

Koi should be fed 2-3 times a day during the summer and autumn, giving as much as they will consume within five or so minutes on each occasion. (See also Adrian Exell's article on diets elsewhere in this Supplement)



An outside Koi pool in the depths of winter. Providing the Koi have received adequate preparation, they should come to no harm (always assuming that the pond, too, has received attention, of course).

Winter feeding

When water temperatures fall below 10°C (50°F) Koi stop feeding on a regular basis and then, as the temperature drops even further, they cease feeding completely. At this time they start to rely on their stored energy reserves. During periods of settled water temperature, or when the temperature rises slightly, they will feed, even at very low temperatures. At such times, feeding a good quality wheat-germ-based food is advisable. Such foods are very easily digested, this taking only a few hours even at low temperatures.

This is important as, if other foods are fed and the temperature suddenly drops, the fish can have the food and acidic digestive enzymes in the intestine for many hours, leading to damage and ulceration.

When feeding in the winter, feed only when the fish rise to the surface looking for food — and only give small quantities.



DR DAVID POOL

Unless you look after your Koi properly during summer and early autumn, they could end up suffering from diseases such as Fin Rot, after a severe winter.

Following the five-minute feeding rule still works; however, the fish only consume a small amount in this period. Also feed during the middle of the day, as the water will generally remain at the same temperature, or even get warmer, until nightfall. If fed in the evening, water temperatures will fall quickly within a few hours of feeding, which could pose problems.

The small quantities of food given to the fish during the winter will supplement their energy reserves and help them to last throughout the cold months.

Filtration

It is well known that Koi dislike low water temperatures. At values of 1, 2 or 3°C (34-37°F), they simply lie on the pond bottom, often on their side, and if this is prolonged, can die. Again, small and high-quality fish seem particularly at risk.

The design of the pond can help considerably in avoiding such low temperatures. In particular, ensure it is big enough and has areas which are, at least, 1 metre (over 3ft) deep. Large ponds have a big volume of water which takes longer to warm up and cool down. Consequently, Koi are not exposed to sudden and potentially dangerous temperature drops.

Depth is important because it allows the water to become stratified during the winter. This occurs because the density of water differs with temperature. As you can see from the accompanying figure, water is at its densest at a temperature of 4°C (39°F). This means that as the pond cools, the water at 4°C settles to the bottom. As it cools further, it then settles above the denser 4°C water, with ice forming at the surface. Koi can survive quite happily at 4°C for long periods.

If the pond is shallow, the action of the wind can mix the warm bottom water with colder surface water, resulting in the temperature throughout the pond dropping to values of 1-2°C (c34-36°F), adversely affecting the Koi.

Similar effects occur if the pond pump is left running at its full rate throughout the winter. So, to avoid disturbing the deep warm water, turn your pump down to its lowest setting and lift it close to the water surface. Also deflect the water returning from the filter to minimise circulation. Directing it against the pond side, or at a piece of rock or wood, is advisable.

Box filters positioned on the pond side act like a fridge during cold spells, with the pump pushing reasonably warm water into the filter which has been cooled to temperatures close to freezing, before it is returned to the pond. Lagging the filter with polystyrene will help to minimise these effects.

Pond heating

A small, but growing, number of enthusiasts have identified the 'cold water' problems which affect Koi, and overcome them by warming the pond water, often to values of 10-15°C (50-59°F). This is usually achieved by installing a swimming pool heater, although more enterprising Koi keepers have extended their central heating systems into the pond and even pumped pond water through a network of pipes covered in rotting manure! (see also David Twigg's article elsewhere in this Supplement).

Raising water temperatures in this way may be costly, both to install and run, but does ensure that your Koi are active throughout the year. There is some con-



A conservatory pond offers Koi complete protection against cold conditions... and the Koi keeper a comfortable all-year-round view of the fish.

cern regarding the use of copper heating elements in these pond heaters, since such elements lead to an increase in the copper concentration in the pond. At raised levels, copper can adversely affect Koi, but there is no evidence that the use of copper heating elements leads to fish losses. Any Koi keepers who are concerned can use a coated heating element which is slightly more expensive.

An alternative to heating the pond is to place the pond in a heated room or conservatory. This option ensures that, in the depths of winter, not only are your Koi nice and warm, but you can also observe them in comfort.

Disease organisms

I have already discussed how small Koi in a pond can be weakened through the winter by using up their food reserves and becoming susceptible to attack by disease organisms.

In addition, there are also problems due

to the Koi's immune system being almost inactive at temperatures below 10°C (50°F). At temperatures of 6-8°C (c43-46°F) and less, the immune system may not be active, but the parasites are also inactive and so cannot take advantage of the vulnerable fish. In late winter, however, the temperature can fluctuate around 10°C, allowing the parasites to increase in numbers, with the immune system not effectively combatting them. As a consequence of this, the Koi (and other fish) often show signs of disease in the late winter and early spring (see Lance Jepson's feature for further details).

Moving fish

Some Koi enthusiasts move their fish into warmer conditions during the winter so that they are not exposed to dangers of low temperatures already discussed. This may be into a tank or small pond in a garage, shed or greenhouse. Care has to be taken when moving the fish. In particular, problems can occur shortly after the fish are introduced into their winter lodgings due to "New Tank Syndrome" and the build-up of ammonia and nitrite.

Gradually introducing the Koi, reducing feeding when first introduced and pre-maturing the filter are all advisable. Avoiding overcrowding is also important, as the outdoor pond is usually considerably bigger than the tank or pond for the winter. Overcrowding leads to poor growth, poor water conditions and increased disease incidents.

Selecting sensitive Koi to move will help overcome such problems. As I have already mentioned, small fish and high-quality specimens are most at risk and would benefit from the extra care.

If your Koi are moved to a pond in a greenhouse, care also has to be taken to avoid rapid temperature changes, particularly during bright spring weather. Garages have their own unique problems if the Koi have to share the space with your car. Petrol and diesel fumes in excessive quantities can adversely affect your fish, so please ensure there is good ventilation.

Conclusion

Avoiding losses and ensuring the fish are in the best possible condition should be every Koi keeper's aim. The winter and early spring are periods when your fish are weakened and susceptible to disease. However, with an understanding of how fish are affected by cold conditions, and a little thought, many potential problems can be avoided.



Small Koi are often more susceptible to problems than adult fish.

DAVID POOL

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AQUARIST AND PONDKEEPER AUGUST 1994 47

Adrian Exell of Interpet follows up his spring diet tips with advice on how to feed your Koi during the coming autumn/winter months.

What you feed your Koi in late summer and autumn will significantly affect their chance of surviving the cold winter months. In a natural lake or pond, fish control the amount and type of food they eat, as well as the frequency of feeding bouts. They will therefore compensate feeding behaviour so that it is optimal for the time of year.

In our Koi ponds we control the fishes' food type and availability. We therefore have to be aware of the fishes' changing needs at different times of the year so that we can compensate for them.

This article is intended to follow on from the article in the April *A&P* Koi Care Supplement entitled **The Complete Diet Guide**. This time I will therefore focus on the nutritional needs of Koi as they prepare for and go through the winter months.

FISH NUTRITION REVISITED

Just to refresh your memory, a fish's diet consists of a number of key components:

1 Proteins

Proteins are made up of amino acid building blocks. The fish's digestive enzymes break protein down into its amino acid components. These are then absorbed into the fish and rebuilt into fish tissue for body repair and growth.

Protein typically represents over 50% of a carp's natural diet and the normal energy sources are relatively scarce. Carp have thus evolved to utilise protein as a source of energy as well.

The negative side effect of using protein as an energy source in an enclosed pond system is that this process produces large amounts of ammonia.

2 Carbohydrates

Carbohydrates are large molecules built up from monosaccharide building blocks (sugars), such as glucose. Enzymes break carbohydrate down into its component form and sugars are either used to generate energy, or stored as glycogen or fat in body organs and muscles for future use.

In mammals, carbohydrate is the major source of energy. Carps' natural diet is relatively low in carbohydrates and, as such, they exhibit a relatively poor ability to digest and utilise them. Fortunately, the

SEASONAL DIET GUIDE



Actively feeding Koi during the summer. Reserves laid down at this time will help these fish during the winter starvation period.

manufacturing process in fish food production makes many carbohydrates more available to fish, as the starch carbohydrates in products, such as wheat and maize, become gelatinised.

3 Fats/Oils

These constitute the most concentrated sources of energy. Fats produce 9.1 Kcal per gram, versus 5.5 Kcal per gram for protein and 4.4 Kcal per gram for carbohydrate.

Fish utilise fats and oils as an energy source very effectively, and foods containing a relatively high fat content have the advantage that the fat is used for energy and the protein is then spared for the more desirable activities of growth and healthy tissue formation. The spin-off from this 'protein sparing' is that far less ammonia waste is produced by fish fed on this type of diet.

Fats are made up of lipid building blocks and many of these are essential dietary ingredients in their own right. For example, phospholipids are a key part of all cell structures.

4 Vitamins and Minerals

These are essential building components and catalysts for many of Koi/carp's life-giving processes.

TEMPERATURE EFFECTS

Koi are cousins of the wild carp which originate from eastern Europe, the Danube, Arol, Asov and Caspian Sea drainage basins. Their optimum temperature appears to be around 28°C (82°F) but they can survive and adapt to a wide range of temperatures.

Koi, like all fish, are *ectothermic*. This means that they have no means of maintaining their body temperature. A Koi's body temperature is dictated by the temperature of the water it lives in.

The accompanying diagram shows the mean air temperatures in Britain throughout the year (this equates roughly to pond water temperatures). As you can see, the water temperature in your Koi pond varies significantly from month to month. The water temperature, and hence the body temperature, affects all the fishes' biological processes and influences its feeding behaviour and nutritional requirements.

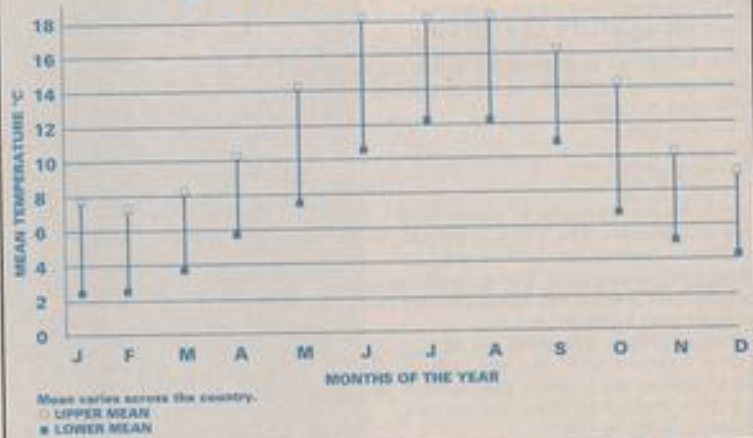
Temperature directly affects the amount a Koi will eat. Research shows that the optimum diet for an adult carp at 26°C (79°F) is 40.75mg of food per kilogram of fish i.e. 4.0% of its body weight, while at 14°C (57°F) this drops to 3.87mg per kilogram, or 0.4% of body weight, and, ultimately, at 5°C (41°F) — or even marginally higher — carp stop feeding altogether.

This change in food intake is related to:
(a) **Metabolic rate** (the speed at which life-giving processes occur). This halves



Despite keeping an ice-free hole open using a pond pump, no feeding will be taking place... or should even be attempted... under these conditions.

MEAN MONTHLY TEMPERATURES IN THE UNITED KINGDOM



for every 10°C (18°F) reduction in water temperature;

(b) **Food conversion efficiency** (how much of the food taken in is actually utilised). This increases from between 2-4:1 at high temperatures, to closer to 1:1 at lower temperatures. This is because the decrease in enzyme activity and absorption of food at lower temperatures is compensated for by an increased affinity of enzymes for the food item they break down;

(c) **Gastric emptying rate** (the rate at which food passes through the gut). This reduces from 32.7% per hour at 27°C (81°F) to 6% per hour at 9°C (48°F), so the fishes' digestive system has longer to work on the food at a time when enzyme activity is at its lowest.

TEMP/DIET CHANGES

1 Proteins

Less protein is required at low temperatures, since growth rates and tissue repair are significantly reduced. The protein requirement drops from a UK optimum summer level of 33% (with a fat saving level of 7%) to around 22-28%.

However, it is critical — given the reduced enzyme activity at low temperatures — that the protein supplied in low-temperature food is from a highly available source. This means it should be easily digested and have a high biological value.

◀ Different protein sources are made up from different combinations of the 23 forms of amino acid. The proteins with the highest biological value are those which not only contain the 10 essential amino acids, but also match as closely as possible the amino acid profile of fish tissue. This ensures that very few amino acids need to be synthesised by the fish and few are excess to requirements and excreted as ammonia.

Not surprisingly, the best biological value protein sources for Koi are from fish and crustaceans, and the worst are vegetable origin proteins (the best of these is wheatgerm). Another reason for avoiding vegetable sources is that the enzymes which break down vegetable protein are poorly adapted to cold water. This is because the carp's natural diet is very low in vegetable matter in the cold months of the year, dropping from 20% in July to about 10% in September and October, and almost nothing in the winter.

2 Carbohydrates and Fats

One of the key reasons why Koi are so successful in the northern hemisphere is their ability to survive long periods of starvation. This allows them to hibernate through the long cold winter months.

Carp are capable of surviving long periods without food because they very effectively store energy in their heart, liver and muscles in the form of glycogen and fat deposits. They also break down and utilise their own white muscle reserves. The vast bulk of white muscle in fish is, in fact, only used for occasional explosive escape/chase swimming.

Interestingly, carp which are winter acclimatised can survive 136-159 days without food, while unacclimatised fish only last 36 days between 7°C (45°F) and 10°C (50°F) without food.

Now is the time to ensure your fish are adequately fed so that they enter the winter starvation healthy and with their glycogen stores, fat deposits and white muscle larders full enough to see them through to the spring.



DAVID TWIGG
Acclimatised fish such as these can go for surprisingly long periods without food during autumn and winter.

PREPARING FOR WINTER

Feed a food through the summer and into autumn with 33% protein, 7% fat, a high energy-to-protein ratio — this ensures energy stores are laid down — adequate vitamin and mineral levels, and, preferably, one of the foods now available which contain immuno-stimulants to maintain the fishes' health level at an optimum. Most of this information should be found on the food pack.

Allow your fish to dictate the amount they eat, feeding two to three times per day (morning, lunchtime, if possible, and evening) as much as the fish will eat over a 10- to 15-minute period (ensuring, where possible, all fish get a look in). Optimum food intake in the summer at 20°C (67°F) is 2-3% of the Koi's body weight. If you have a pond full of large Koi, this

equates to a surprisingly large amount of food!

As the temperatures drop over the autumn months, you will find your fish take less and less food for the reasons outlined above.

Coldwater feeding

As water temperatures dip under 10°C (50°F), we enter the world of winter Koi feeding. The instructions on many proprietary fish foods (for simplicity) suggest ceasing feeding fish below 10°C (50°F). Koi will, in fact, feed right down to around 5°C (41°F). However, the amount of food required is significantly smaller — over 10 times less than in the summer.

The key to feeding at this time of year is to offer small amounts of low-percentage protein content (22%), but high biological value food. This food should only be offered if the fish are moving around and active. The advantage of feeding during the winter months is that it has the effect of topping up/supplementing the fishes' winter stores during prolonged mild periods when metabolism rises and energy needs increase.

Ideally, try and keep an eye on weather trends and avoid leaving fish with undigested food in the gut, since it has been suggested that this can cause problems, although I have never seen any scientific confirmation of this.

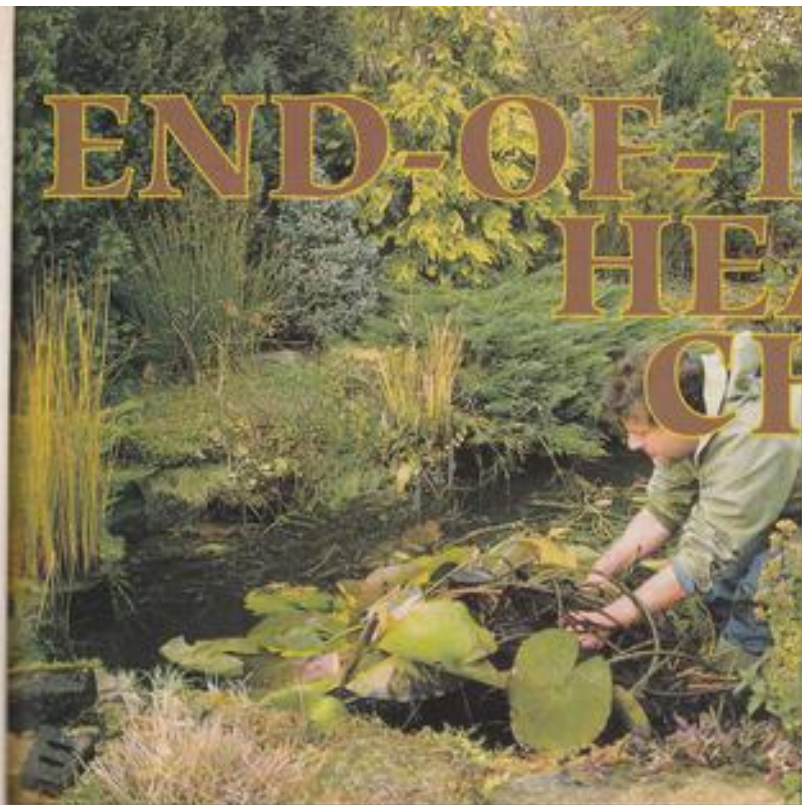
As an aside, some Koi keepers now heat their ponds during the winter period. It is essential if you are going to heat your Koi pond that you do so sufficiently to get the water temperature up consistently at a level where the Koi feed enough to replace the energy lost through their increase in metabolism, i.e. ideally, above 10°C (50°F). (see David Twigg's article elsewhere in this Supplement for more details of pool heating).

A fuller understanding of the influence of the seasons of the year on Koi nutrition should allow you to lay the foundations now, in the late summer and autumn, for a trouble-free winter and spring. **177**



Nowadays, there is a wide range of Koi foods available to meet every keeper's wishes and every fish's needs.

END-OF-TERM HEALTH CHECK



Tending to in-pond and pondsides vegetation in autumn will avoid winter health problems resulting from rotting leaves and stems.

In the two previous articles (April and July '94 issues of *A&P*) I have taken a look at some problems associated with, first, the spring months, then the summer. This time, I am looking at problems encountered through autumn into winter, along with some non-seasonal disorders. I will also be dealing with some of the difficulties with rearing fry.

BROODSTOCK & FRY

Earlier in the year I looked at some problems associated with spawning, especially egg-binding and secondary traumatic damage. What is often overlooked is the preparation of broodstock.

A thorough physical examination early in the season is important, taking care to check for any signs of ulceration, or parasites. Please remember to check *underneath* the fish, as lesions on the belly and anal fin can easily be overlooked.

Correct feeding is important, as both sexes require extra protein for normal ovarian/testicular growth and function. Fats are also important, with significant reserves being laid down in the liver. These are utilised for energy during spawning and, in females, are needed for egg production. Therefore, diets with at least 8% lipids (fats) and 35-40% high-quality protein should be provided. Failure to provide this may result in broodfish with reduced spawning vigour, reduced fertility and poor hatching.

Care of eggs & fry

Once released into the water, a Koi egg must be fertilised within 30-60 seconds (sperm remain viable for 1-2 minutes).

Often, up to 40% of a spawning can be infertile. To try to reduce this, use at least two males to each female during spawning.

Following spawning, the eggs absorb water and swell, in a process called *hardening*. This is achieved by osmosis, water entering the relatively concentrated egg, from the dilute surrounding medium.

In waters which are excessively hard, with high levels of dissolved salts (such as certain spring waters), the difference in the levels of dissolved substances in the egg, compared with the surrounding water, may not be sufficient to induce osmosis and, hence, normal hardening.

Other causes of egg mortality and low hatchability include low oxygen levels, incorrect water temperature (fatal below around 16°C-61°F; above 25°C - 77°F - stimulates development but may produce weakened and deformed fry; over 30°C - 86°F - usually rapidly fatal. Rapid temperature changes will also cause embryonic death) Bacterial and fungal diseases can also cause serious die-offs of eggs and newly hatched fry.

After around two to six days (depending upon the ambient water temperature) the fry hatch out. At this stage, they show marked light avoidance, seeking darkened areas in which to lie to absorb their yolk sac.

Lance Jepson rounds off his series of articles on year-round prevention, diagnosis and treatment of Koi health problems.

Photographs — unless otherwise indicated — by the author

After 48 to 72 hours, fry development has progressed to the stage where they can become free-swimming. Following a quick dash to the surface to take in a gulp of atmospheric air which is forced into the swimbladder, the fry alter their behaviour and seek out light, which usually draws them towards the highest densities of their food — infusoria.

Excessive levels of illumination or inadequate provision of shaded areas in the first two to three days can be stressful to fry, possibly opening the way to secondary infections. Very high or low temperatures are also stressful and, if uncorrected, may cause fatalities. This is also true of rapid temperature fluctuations. Further, growing on fry at too high a temperature can cause a loss in colour.

Following hatching, the oxygen requirements of the fry increase dramatically and, again, as the fry become free-swimming. Factors which further exacerbate this demand are high temperatures, high stocking densities, and overfeeding.

Poor water quality can also cause a loss of fry, especially high ammonia and nitrite levels. Some poor waters may have a thick, proteinaceous film at the surface, making it difficult for the fry to take in air into their swimbladder.

Gross overcrowding of the fry will lead to stunting. Koi closest to the original wild carp can grow at a prodigious rate, often out-competing their brothers and sisters for food, and if the size differential is too great, then cannibalism may result.

While on the subject of food, growth of the fry can also be reduced by feeding insufficient food, or poor-quality foods lacking in essential amino acids such as arginine and valine (see **Adrian Excell's** articles in the April '94 **Supplement** and elsewhere in this one for further guidance

on the subject of Koi nutrition)

Young fry do not possess a fully functioning immune system and this, combined with a rather delicate constitution, means that they are susceptible to a wide range of diseases. Many bacterial and fungal diseases can attack these young Koi.

Some notable parasitic infections include:

1 *Icthyobodo (Costia) necator*, which attacks the eggs and subsequently any carp fry which hatch. Overcrowding and high temperatures can cause explosive increases in *Icthyobodo*, resulting in mass fry mortality.

2 *Sphaerospora renicola*. Uncommon in the UK, this myxosporean parasite is the cause of Swimbladder Inflammation (SBI) in carp fry which can present as balance problems, inappetence (loss of appetite); at high temperatures (25 to 30°C — 77 to 86°F) the signs of SBI increase, with associated mortality.

Should the carp survive to the following year, they may then show vague signs, including anaemia (pale gills) and kidney enlargement. Secondary bacterial infections of the swimbladder are common, with one or both chambers filling with pus-like material, and with gross thickening of the swimbladder wall.

3 *Bothrioccephalus*. As the fry grow, they change their feeding habits to include small crustacea, including *Daphnia* and copepods. This can expose them to certain worm infestations, such as *Bothrioccephalus*, which uses a copepod as an intermediate host.

4 In a pond situation, or if one is using live food, a watch should be made for the presence of predators, such as the voracious dragonfly larvae, or the anemone-like *Hydra*.

NON-SEASONAL PROBLEMS

1 Dermocystidium koi

This is a peculiar parasite, possessing characteristics of both fungi and protozoa. It causes cysts in the muscles and skin. The life cycle is unknown, and although there is no recognised treatment, it rarely causes problems.

2 Sporozoan parasites

This group of parasites includes a number of species pathogenic to Koi. Included are *Sphaerospora renicola* (see above), *Chloromyxum cyrini* and *C. koi*, which infect the gallbladder, *Myxosoma djardini* and *M. encephalini*. The first of the Myxosomas causes yellow-white cysts in the gills, leading to breathing difficulties and death; the second infects the blood vessels of the brain.

Henneguya sp. manifests as cysts in a

CARE OF EGGS AND FRY

Fungal infections of eggs
Malachite Green, either as a bath at 5.0mg/l for 60 minutes, or 0.2mg/l as a continuous bath.

Bacterial infections of eggs
Antibiotic required (varies). Erythromycin at 50mg/l is absorbed across the egg shell.

Fungal and bacterial infections of fry
Where appropriate, treat as for adults.

Ichthyobodo necator
Use proprietary medication.

Sphaerospora renicola
No recognised treatment.

Bothrioccephalus
Praziquantel at 10mg/l for 3 hours at 22°C (72°F).

Predators such as Hydra and dragonfly larvae
In water, treatments are fatal to fry, therefore attempt to control by screening all introduced plants. Control in large pond not feasible.

A young Koi with an abnormal swimbladder (probably a sign of inflammation). Both parts should be of equal size, whereas — in this case — the caudal (posterior) half is unusually small.



variety of organs, especially the gills and skin, while *Eimeria* sp. can cause severe enteritis (gastric disorders).

3 Fish tuberculosis

Classically, this disease is caused by infections with either *Mycobacterium marinum* or *M. fortuitum* (although others may be involved). This is a long term, debilitating disease which can present in a variety of ways, depending upon which organ(s) is (are) affected. Common presentations include longterm weight loss, or spinal curvature (due to collapse of infected back bones).

4 Tumours

Koi are potentially very long-lived and, as in all animals, tumours can be found in older specimens. In addition, longterm exposure to water pollutants can induce tumor formation.

5 Fatty Liver Disease

In the wild, carp spend a large part of the day foraging for food. This is partially because they lack a stomach, and so are unable to store one large meal to digest at leisure, and partially because much of

their natural diet is nutritionally poor, so significant quantities need to be ingested.

In captivity, Koi are usually fed high-quality, energy-rich diets. Any excess foods not used to provide energy for swimming, egg production, metabolism and the like will be converted to fats and stored, particularly in the liver.

Over the years, these stores can become so great that normal liver function is disrupted. Unfortunately, fatty liver is usually diagnosed at post mortem.

Force feeding energy-rich diets to accelerate the growth of young Koi can bring about a similar situation. Low levels of dietary vitamin E will fail to prevent this fat turning rancid, which is a further complication, advanced cases of vitamin E deficiency resulting in Sekoke Disease (appetite loss, poor growth, muscle wastage and death), which will not be seen if one feeds a good-quality brand of food.

WINTER WIND-DOWN

Autumn is just around the corner, and with the shortening days and lowered average temperatures, Koi begin to undergo a series of physiological changes that will help them to survive through the winter. These changes involve alterations

to the muscles, nervous system, blood and metabolic pathways.

Another important consequence of lowered temperatures is the suppression of the fishes' immune system, such that the fish are less able to deal with infections (although, fortunately, the disease processes of most infections are also slowed down).

At the risk of repeating myself, now is the time to recall the Disease equilibrium:

FISH + PATHOGEN = DISEASE

In preparing the fish and the pond for winter, our objective is to keep this equilibrium to the left. Consider:

1 Vegetation

Vegetation in the water comes from two sources: in and around the pond. Dealing with aquatic vegetation first, autumn is the time to cut back water lilies and other plants as the leaves start to die. Leaves from surrounding deciduous trees can also be a problem and are best dealt with by covering the pond with a net, or using a skimmer.

In both cases, if vegetation is left to decompose, then water quality, as is often repeated, can suffer badly, stressing the Koi and putting them at a disadvantage.

2 Filters

Filters can be cleaned out at this time of year, as there is plenty of time for the beneficial bacteria to recolonise the media

before winter temperatures slow down the bacterial proliferation (see **David Twigg's** article for further discussion of this topic). With multi-chambered filters, clean out one chamber per week. If you have the facility, change the pond intake from the bottom drains to one part way up the water column. This tends to preserve a static, deeper layer of water which, thanks to the unusual properties of water, will remain at around 4°C (39°F) irrespective of the weather above the surface, providing an ideal place to sit out the coldest months.

Ponds which do not have this facility, or which are not deep enough, will subject the Koi to a constant water flow, forcing them to swim, thus using up valuable energy reserves, and exposing them to water being continuously cooled by its journey through the filtration unit. Reducing the water flow will help, but this should not be stopped altogether, as the bacterial colonies, necessary for the filter's function, will be starved of oxygen.

3 Examinations

If possible it is worthwhile gently catching each and every fish in early autumn, giving them a quick examination to check for small ulcers, external parasites and the like. Any obvious lesions or infections should be dealt with at this time, if necessary isolating individuals in a heated treatment vat to encourage rapid healing before the fish are exposed to the rigours of winter.

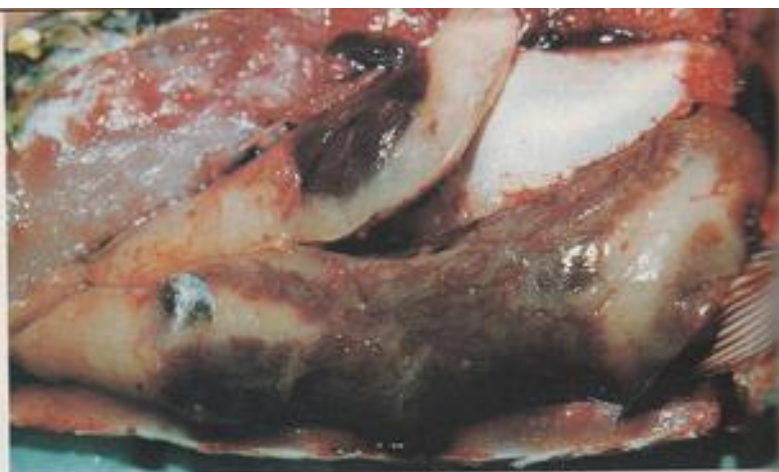
4 Feeding

As the average water temperature starts to drop, our thoughts turn towards the vexing subject of feeding. Koi see out the coldest months of the year in a state of apparent dormancy, living off stored deposits of fat and protein. (For full treatment of this subject, see **Adriana Exell's** aforementioned article).

It is worth noting that a temperature drop (from 20 to 10°C — 68 to 50°F) will reduce protein digestibility, and since, during autumn, we are not trying to encourage growth, we can see that, apart from it being wasteful to feed excessive (and expensive) levels of protein at this time, reduced digestibility can also lead to a bacterial overgrowth on protein left in the gut.

5 Immunity

As daylength shortens and temperatures fall, the Koi immune system becomes less effective, and one may see the first signs of Carp Pox, or a reoccurrence of bacterial septicemias and ulcers. These latter conditions should be attended to immediately.



Post-mortem on a Koi exhibiting fatty liver disease.

NON-SEASONAL DISORDERS

Dermocystidium koi

No recognised treatment.

Sporozoan parasites

No effective treatments. *Eimeria* may respond to antioocidal drugs — consult your veterinary surgeon

Fish Tuberculosis

Treatment problematic. This disease is infectious to man. Consider humane destruction of fish if diagnosed.

Tumours

Surgical removal may be feasible if tumour is small. Euthanase fish if tumour interferes with normal function or behaviour

Fatty Liver

Avoid force feeding. Supplement with extra dietary vitamin E. Feed lower protein and fat diet to remaining fish.

Sekoko Disease

Unlikely if feeding a reputable brand of food. Supplement with extra vitamin E.

6 Dormancy

During the winter, Koi appear to enter a state of hibernation, characterised by reduced activity, a reduced response to external stimuli and a low respiration rate. It is not a true hibernation though, as the fish can still respond to stimuli, and their sluggish attempts to swim away in these circumstances may be more a reflection of their inability to react to the stimulus, rather than perceive the stimulus.

Therefore, breaking any ice that form at the surface with a hammer is not a good idea, as shock waves will be sent through the water, where they will be sensed by the Kois' lateral line — a stress that may be too much in their weakened state. A floating heater is a much better way of keeping an area of pool surface clear.

Reduced metabolic rate means a sluggish circulation, which, in the longer finned so-called Butterfly Koi, may lead to congestion in the fins, predisposing them to damage and disease.

At these very low temperatures, the immune response of the Koi is so sluggish as

to be virtually ineffective. Fortunately, the majority of pathogens are also depressed by the low temperatures, so their ability to produce disease is reduced, although over a prolonged period of time, they may still build up to problem levels.

CLOSING THOUGHTS

This just about rounds up my year-round Health Checks. In them, I have covered a wide range of problems — some common, some not so common, — which can afflict Koi.

There is still much to be learned and treatments to be devised. Off-the-shelf remedies are often good, but they can never be cure-alls. Vets and biologists do not always have the answers, either, but with their training and access to specialist they are often your best bet.

Longfinned varieties, such as Butterfly Koi are more susceptible to fin health problems than their shorter-finned counterparts during cold spells (photograph reproduced with thanks to King Fisheries)





A poly-tunnel affords effective winter protection.

'COLD COMFORT' PREPARATIONS

David Twigg takes you through all the main steps that will help your Koi enjoy a comfortable life during the colder months of the year.

Photographs — unless otherwise indicated — by the author

Writing an article for the autumn in August is quite a task for several reasons, not least of which is the feeling that I should be in the garden doing the very essential maintenance associated with this time of year! But, seriously, what is done now is, itself, an important part of preparing for the months ahead.

In the UK we have an almost seven-month long winter if the naturally achieved pond water temperature of 10°C (50°F) is taken as the reference. Below

Feeding during summer on higher-protein diets should be followed by a more digestible wheatgerm one as temperatures begin to drop.



this temperature, the metabolism of Koi is working at a very slow, low level and therefore feeding is at a minimum, if there at all. Consequently, Koi are at their weakest and, thus, prone to infection. We must get our Koi as strong as possible before entering this period.

Preparing Koi for the long spell ahead, which, again in the UK, is very variable in its weather pattern, with both long cold spells, as well as mild ones, occurring several times during the period and causing swings in water temperature, becomes very important. So what can we do to get the process under way? There are several things that can be done, so I will work my way through them.

Feeding

The correct type of **food** is just as important for Koi as it is for humans; in fact, probably more so, because Koi have many more variables to cope with.

During the summer months it is wise to feed the higher protein pellets when water temperature is above 15°C (60°F). Choose good-quality food that provides for the essential diet and also contains those minerals and vitamins that go towards building healthy bodies. Lack of any of these basic building blocks can cause problems, ranging from poor coloration and poor growth, through blind-

ness and deformity, to vital organ damage.

Summer, then, is the last chance for Koi to build up the reserves they need to see them through the long British winter. Continue to feed regularly on the "little & often" principle, but as temperature drops in the autumn, start to introduce into the diet the wheatgerm type of pellets until only wheatgerm is fed. The generally accepted temperature at which feeding should cease is around 7°C (45°F) (but see **Adrian Excell's** article on nutrition elsewhere in this **Supplement** for a fuller discussion).

General management

Housekeeping is the hardest thing to do in Koi keeping! It is vital that water quality is kept at its highest so that the good done by an appropriate feeding regime is not undone by the stress brought about through poor water.

Keep bottom drains 'pulled' regularly and the pond and filter chamber bottoms clean. It is not necessary to have clinically clean ponds but, obviously, the more debris there is on the bottom, the more likely it is that pollution of the water will take place.

Autumn is a time of falling leaves and clearing these from the pond surface is generally an additional task at this time of year. A surface skimmer is the norm in Koi ponds today to carry out this task for us. If a surface skimmer is not used, then floating leaves can be prevented by the use of a net covering or, if allowed to fall onto the water, collected with the aid of a small fish net as an alternative.

If leaves are allowed to become water-logged and sink to the bottom of the pool, the decomposition process will start very rapidly, decreasing water quality. The incidence of harmful bacteria and gases in the pond will increase, thus raising the chance of opportunist attack on Koi resulting in skin damage, for example. This is not a good time of year, with water temperature falling, to be treating infected wounds.

Pond heating

Water temperature can be a life saver. If the winter can be shortened by the use of some form of water heating, then the Koi will be eating longer and therefore will not deteriorate so far during those 'reduced' months of winter.

Some Koi keepers heat their ponds to a high temperature all year round and they will not have the problems faced by those of us who can only extend the autumn and bring spring in earlier. They may, however, have other problems to contend with, such as those linked to a loss of sense of season. There are benefits to be obtained by our Koi if they endure a short winter; excess body fats can be used up and unaided eggs ingested, for instance.

If full heating is not an option, then my own method may be next best. I use an

A walk-in pond cover.



Pond heating of some form is becoming ever more popular among Koi keepers. This is an adapted swimming pool installation.

electric swimming pool heater (on Economy 7) to hold up the temperature during the colder, longer nights, thus minimising the swings of temperature during autumn and spring. This gives my Koi a gradual run into winter, without all the trauma of sudden cold spells that cause the metabolism to shut down, only for that 'Indian Summer' to start them up again a few days later.

Shortening the winter in this way also allows for the gradual transfer of diet from the high protein of summer to the lower protein cereal one of the wheatgerm variety for the cooler water temperatures as mentioned above.

New fish

Another of the summer activities that can be directly related to autumn and winter is the purchase of **new stock**. Although most specialist dealers will have given some form of quarantine to newly imported Koi, it is possible for some parasites to slip through the net (metaphorically speaking, of course).

Treating Koi under cover is much easier than doing so exposed to the elements.

I have for instance, just read of a dealer who says he will give seven days quarantine before placing newly imported Koi on sale. I think this should really be called a "settling period" during which the fish are allowed to recover from the stressful experience of many hours in a polythene bag, while flying from what, to them, must seem like the other side of the world.

Some parasites will not announce themselves in such a short space of time and if bought without proper examination, such fish may carry them into your pond. If parasites are suspected, they should be checked for under a microscope at the time of purchase and, if found, treated at that time. (see **Lance Jepson's** feature for full health guidance.)

Addition of chemicals to the pond in autumn to combat parasites will certainly deteriorate water quality, and must surely harm the filter bacteria. Unless necessary, therefore, a pond treatment may not be wise at this time of year. Some Koi keepers do give their pond a prophylactic ('just

in case') treatment to kill any parasites which may have been brought into the pond by new fish, but really, this should only be done after a microscopic examination has proved the pathogens to be there.

Pond covers

Covering the pond during the colder months is another way of conserving heat and extending the feeding period. If covers have not already been constructed, then now is the time to



get down to the drawing board, with the aid of a few Koi friends, and come up

with a design that will be readily erected, without too many bulky panels (they should be easy for one person to handle), and such that they will store easily during the summer months, yet still be strong enough to withstand winter storms and winds.

I started by building a low-line cover with clear plastic hinged panels down one long side of the pond. Its shortcomings soon became apparent! In order that I could keep a close eye on my Koi, I needed to be in the kneeling position, with one of the panels lifted and my head inside the cover. While this was all very well on a dry day, it was certainly not so good when it was raining or snowing!

The top of this cover also had hinged panels, and if I had a poorly fish, or wished to vac off the pond, then these were raised to allow access. It was not really convenient, as it meant having to wield a net or vacuum hose around the supporting posts. In addition, heat was lost from the pond, so I started looking for an alternative.

◀ A friend of ours in the Koi club suggested that a horticultural poly-tunnel might be the answer. I investigated the viability and cost of this form of cover, only to find that it was really very reasonably priced, so a poly-tunnel it was to be for the next three or maybe four years.

The beauty of the poly-tunnel was that I was able to get inside with all my gear, nets, bowls, Jabsco 'vac' pump, etc. and perform all the necessary housekeeping tasks in the warm and dry, well protected from the elements.

As some regular readers will know, last year my wife decided that something a little "lower line" was preferable, so a Koi house was constructed out of timber and polycarbonate sheet off-cuts, with the poly-tunnel polythene being used as a roof covering. This structure is made up of panels that simply bolt together and, because of the weight of the timber frames, need little tying down. I have two internal nylon guy-ropes tying the centre tops of the two end panels to hooks on the pond wall to give that extra support when the gales blow up.

Whatever form of cover is used, it has to be a plus, and I am sure the Koi appreciate it as much as we do. It really makes Koi keeping an all-year-round hobby.

Water flow

Does a way of by-passing the waterfall or watercourse exist in your pond system? Water flowing along such a path will cool quickly and would therefore be better taken out of the circuit during the cold winter weather. If it does not, then perhaps a look at a way of doing just that while we have the benefit of the warm light evenings may be worth considering.

If heating is not installed, or is used only for keeping the chill off, then consideration should also be given to reducing the rate of flow of the water circulation. Feeding will have been reduced, if not stopped,

FILTER GUIDE

Filter maintenance (as opposed to filter shut-down) is something that has developed over the last few years. Ideas have changed from the days when the pump was switched off and it was necessary to empty and strip down the filter chambers to ensure that nothing was left to decompose during the winter months.

Many readers will be slowing the flow of water through their filter systems as the weather cools down to ensure that two important parts of Koi keeping are satisfied. The first of these is to **keep water quality fresh** by continuing to pass it through the, albeit reduced activity, biological stages, and secondly, to **minimise water disturbance and consequent stress** to Koi while they are in their almost comatose state.

Under these circumstances maintenance of the filter system is really a continuation of the normal housekeeping carried out during the earlier, warmer time of the year, but at a reduced frequency. Each chamber should therefore be back-flushed periodically to prevent a build-up of harmful detritus which is a constant danger to water quality.

There are many forms of filter media in use today. Each has to be treated differently according to how it is used. It is possible, for example, to use filter brushes either to act in the early chambers as a block to floating solids, or later in the system as a biological medium on which bacteria grow. The same reasoning applies to foam sheeting, and with these types of media, they need regular maintenance by cleaning to prevent clogging when used early in the system, but should not be disturbed too much when used solely as home for a bacterial bed.

Matting, gravel and Canterbury Spa are other media types that should be maintained regularly, also based upon their particular function in the filter system. If kept free from blocking by regular maintenance during the summer months, these media will need little attention during winter.

As is so often the case, though, with so many things in modern-day Koi keeping, these filter maintenance tasks **must also be carried out and adjusted gradually**, so as to minimise the changes in water quality. It is this major fact that can determine how our Koi survive the rigours of the unpredictable British winter and come successfully through to health in the variable British spring.

so it will not be necessary to maintain the same sort of flow as is required during the summer months when suspended solids have to be carried away to the filter and extra oxygenation needs to be provided for the Koi at a time when water is warm and thus holds less oxygen.

Filters

It is necessary to **keep the biological stages of the filter system working**, even if at a tick-over-rate, as this will keep the water in the pond fresh and the filter will pick up in the spring much more readily.

If not already turned off, the airstones should be removed from the pond, or the filter system, to prevent further cooling of the water. If, however, a glasshouse or shed stands in a warm sunny spot, then it may be that the air-pump could be left

running in it, with the airstones left in place. The air-pump will be pushing warm air into the water and that will also help maintain bacterial activity, as well as reduce the overall drop of water temperature. If the pond is heated, this pre-warmed air will help reduce the cost of holding the temperature at 10°C (50°F).

To minimise the chance of reducing water quality when all of these changes take place, it is wise to **adjust all parameters gradually** over a period of time. A flow valve in the pump outlet can be "nudged" each day until the desired flow is achieved. The taps on the air-pump can also be slowly adjusted in a similar manner.

When our editor asked me to write this article on "preparing for winter", I had not thought of it turning out the way it has. It appears to be a "what should I be doing at this time of the year?" summary, but then, on reflection, I suppose they are one and the same thing, really. I wish you and your Koi well for the coming cold months. **119**

Hinged panels make maintenance possible with low-line designs of pond covers. You do still have to get round the uprights, though.



said for the kidney and spleen, but rest assured that they are well protected.

As I said at the beginning, disease is certainly NOT an isolated issue. The key factor contributing to disease — or lack of it — is stress... or lack of it. Some fish carry so many pathogens that they are like time bombs waiting to go off. All will be well, though, providing they live a stress-free existence, but, when they ARE stressed, it takes no time at all for pathogens to strike.

So, we can tell from all of this that we need to minimise stress — if not eliminate it altogether. This is where that link comes in. Stress comes from different angles, not just aggression, and if we observe the rules concerning the three main issues, then our fishes all have an even chance of dying from old age. I have repeated the old stocking rule many times, but it still seems to need airing, so here it is!

For the first six months, 1in of fish to every 4 gallons of seawater. Thereafter, 1in of fish to every 2 gallons.

These levels should be reached gradually; it is also vital to get the stock-mix right. Make sure that only compatible species are kept. If you keep your

aquarium slightly understocked, then there is room for the odd mistake. However, keep it slightly overstocked, and that little mistake could be fatal.

The mistake could be a slight overfeeding. Again with feeding, slightly underfed as a matter of routine and the fish will all live to a ripe old age. Overdo it on a regular basis and you will find yourself on a slippery slope of death and disease. The balance of the aquarium will be upset and this will lead to stress, leading, in turn, to disease. Nothing causes more stress than deteriorating water quality.

If you keep a collection of compatible species, then again your fish will die of old age. An imbalance of species will lead to overfeeding, in order to ensure that the weakest get their food. The same outcome as before ensues. There could also be stress caused by bullying, leading to fish which are always carrying small wounds. We saw earlier how wounds are a site for parasites to mount their attack.

Stocking — Feeding — Disease. It should now be clear: follow the rules on the first two issues, and the third should never arise.

Hazardous birth

Sea Turtles find their way back — inexplicably — to the very beach where they were born to lay their eggs. The female heaves herself up the beach to dig a pit some 3ft deep. In this, she lays around 100 eggs, which she covers with sand before returning to the sea, leaving the, as yet, unborn young to develop and hatch alone.

Getting out of the nest takes a major effort on the part of the young, and a single hatchling would probably die in the attempt. Sheer numbers are essential if the nest isn't to turn into a grave.

The hatchlings must work in unison to free themselves, so the first of the young do not try to dig themselves out immediately, but wait for others to hatch. Eventually, about 100 miniature turtles work together to raise the entire nest chamber like a lift, raising it through the sand. The turtles at the top dig upwards, while those at the bottom compress the sand beneath and around them. This lower crowd of turtles appears to stimulate those digging, spurring them on to work harder.

Eggs generally hatch at night, when the sand is cooler. However, should the turtles at the top dig upwards too soon, when the sand is too hot, they slow down and become almost torpid. When the temperature has fallen enough, the digging continues.

Despite this, there are still hatchlings that get through in daylight hours. These run two risks as they battle their way to the sea. They could easily die from heat exhaustion from the baking hot sand, or risk being eaten by birds or crabs. In fact, birds sometimes gather next to the nest, waiting for hatchlings to appear, when they pick them off one by one. Frigate birds hover above, then swoop down to pluck the baby turtles from the beach.

In some tropical countries, hatchlings even run the risk of being eaten by monitor lizards and, when they get to the sea, there are all manner of predators waiting beneath the waves. Life's not easy when you're a baby turtle!



JACK JACKSON

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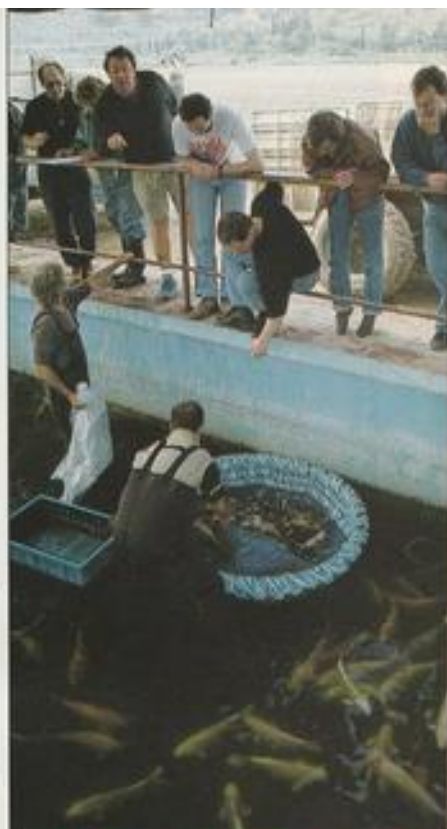
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Above, hoppers provide high-protein food to growing Koi in the massive outdoor ponds. Right, hand-picking by importers is one of the most exciting times of the season. Bottom right, billowing clouds of Koi eggs seen during incubation in zugerim.



THE LAND OF PROMISE

Over recent years, the domination of the world market in ornamental carp, Nishikigoi or Koi, by Japanese producers has become challenged by a nation which is little larger than the combined size of the UK counties of Devon and Cornwall. From small beginnings less than two decades ago, the land of Israel has developed an ornamental fish industry which is now producing Koi, the best of which can begin to lay claim to being among the best in the world.

Situated across the northern third of Israel, just five kibbutzim collectively form the co-operation of Mag Noy which markets its production of Koi and ornamental Goldfish, mainly to Europe and the USA. Although Israel has for centuries produced carp and other varieties as food fish for internal consumption, it is only in the last 15 years that the ornamental fish industry has developed, and Mag Noy represents the largest proportion of that industry.

Mag Noy's main kibbutz, where newly-opened offices complement extensive rearing, sorting and packaging facilities, is situated at Hazorea, half an hour's drive from the northern port of Haifa and just an hour or so from Tel Aviv. On an area formerly occupied by now-redundant cotton-fields, ponds and lakes containing over two-and-a-half million cubic metres of water (once used to irrigate the cotton-fields) provide the perfect ingredients for the successful rearing of Koi. Despite an average rainfall of around 600mm, the region had been suffering drought at the time of my visit (March 1994).

A personal overview of the development of the coldwater fish industry in Israel by Stephen Smith.

Photographs by the author

The other kibbutzim are also situated in the northern third of Israel: at Ma'agan Michael and Ma'abarot, both near the coast; slightly inland at Gan Shmuel; and, on the eastern border with Jordan, at Kfar Ruppim in the Jordan valley itself. Close co-operation is afforded between all the kibbutzim, and the latest to join the corporation was Ma'agan Michael, which lent its name to the company's new title Mag Noy (formerly Dag Noy, *dag* meaning fish and *noy* loosely translating at 'ornamental for the garden').

Secrets of success

So how do these Middle Eastern 'Davids' go about producing fish which claim to challenge the production of Koi by the 'Goliaths' of the Far East?

What struck me as one of the overriding elements in the Israeli success was that the company is run very much as a commer-



cial operation. As in any manufacturing operation, every piece of product represents income. Therefore, every fish produced is a valuable source of income, upon which depends the livelihood of every member of the kibbutz.



Left, fish are gradually cooled prior to transportation. Left below, the quality of Koi from Israel is beginning to rank among the best in the world.



Therefore, a great deal of emphasis is placed upon research, to ensure the best possible future for the industry, and upon the well-being of each fish throughout its development and through every procedure right up to its point of destination.

For example, brood fish are identified by means of an electronic 'tag' in the form of a minute microchip. This is inserted painlessly into the dorsal muscle on one side of the fish just in front of the dorsal fin. Identification of broodstock provides an effective means of monitoring the production of offspring and is important in the development of future generations of good quality Koi.

These fish are subsequently placed in large stainless steel vats, the floors of which are covered with spawning brushes, and the water level lowered to just above the diameter of the brushes. This ensures

that the fish swim physically through the bristles of the brushes, thus increasing stimulation of the female and providing a virtual guarantee that each egg laid will adhere to the spawning brushes.

The same procedure is also carried out for spawning Goldfish, and the varieties produced include commercial-grade Fantails, Comets, Ancestral (Common) Goldfish and Shubunkins, as well as, more recently, Moors, Blue Orandas and Redcaps.

Controlled spawning takes the art of fish breeding into the world of science in a big way and, as a hobbyist first and foremost, it was mind-boggling for me to see spawning on such a massive scale, and with such overwhelming success (apparently, the controlled spawning process has a fertilisation rate of between 70 and 90% — if only I could imitate these procedures in my small-scale hobby set-up!)

Koi production

Three specific spawning methods are used: artificial, semi-artificial and natural. Looking first at natural spawning, this is fairly straightforward and will be familiar to the majority of Koi enthusiasts.

Conditioning of the brood fish starts over the winter months when they are fed with a high-protein diet and the ponds kept in the highest possible condition. Husbandry is, of course, of major importance, and the condition of the water is monitored "as closely as a woman's pregnancy" according to one kibbutznik. A further significant detail is that the conditioning ponds are kept free of grass and

any other material which might encourage the females to lay eggs, and males and females are kept in different ponds.

Spawning is undertaken from around the middle of February, depending upon the weather. Given that weather conditions are correct, the ponds are lowered and spawning mats constructed from cylindrical brushes put in place. For selective pairing of broodstock, the brood fish are kept in cages within the ponds, into which spawning mats have been placed.

Alternatively, the fish are spawned semi-artificially by injecting females with a pituitary extract. Initially, a 20% dose is administered to the females, which are returned to holding tanks for approximately 12 hours. During this time, the males are given a 100% dose and, after the 12-hour period, the females are provided with the remaining 80% of their dose. Males and females are then placed in stainless steel tanks with brushes suspended from the water surface and spawning will take place within the following 12-hour period.

Artificial success

A totally artificial method of spawning is also used and has a remarkably successful rate of hatching, reported at "approaching 90%". Having seen the process first-hand, I wouldn't argue with that!

This method is particularly useful when close monitoring of the parent generations is required (for example, in developing a good strain of, say, Kohaku). This time, equal doses are given to each of the spawning pair and, usually during the early morning, the male milt is 'milked' into a clean and dry glass jar. Dryness is of great importance, as water is the catalyst which activates the sperm, although this will last for up to 48 hours in refrigerated conditions (as opposed to between 50 seconds and 2 minutes when wet). Similarly, unfertilised eggs will last for three to four hours in totally dry, refrigerated conditions, but have between thirty seconds and just one minute of 'active' time when they can successfully be fertilised.

The female is stripped of eggs by hand, into a clean, dry, plastic box (similar to a 'stacker box') which has been sprayed with silicone to ensure that the eggs will not adhere to the box. The milt is then poured over the eggs and immediately water is added; this triggers the fertilisation process, which takes two minutes at the most.

The 'fertilisation' box is then placed on a rocking platform, operated by a slow electric motor, for up to two and half hours, during which time the water is changed regularly.

The fertilised eggs are then placed in

water-filled cones, termed *zuggerin*, for incubation and hatching. This is truly an arresting sight; the collection of eggs appears to 'billow' from the bottom of the cone from the current of water as it rises. This water passes over an overflow and into a large vat before returning through the cones via a small pump. The inlet to the pump is shielded and, as the larvae hatch (within 2-3 days) and make their way to the surface, these are taken into the vat via the overflow.

Fry are fed initially on infusoria and other natural foods, such as *Daphnia*, and artificial food is added as the fish develop; later the fish are transferred to large open ponds for development throughout the summer. Here, the fish are fed twice a day with high protein fish meal.

Harvesting and grading

Even after only a year the fish have put on enormous growth, reaching something in the region of 14 inches in length. I had the privilege of donning waders and becoming involved in seining one of the ponds.

Approximately 2000 fish were said to be accommodated in the growing-on pool we seined. Despite the efficiency of the technique, just about 800 or so fish were caught, and these were carefully scrutinised and selected for quality (ie size, colour and health) before being placed in a water tank hitched to a tractor.

This tank is then transferred from the



Comets are among the ever-expanding varieties of coldwater fish produced in Israel.

rearing ponds to the depot at the kibbutz itself, where the fish are next conditioned and prepared for despatch.

I was greatly impressed with the method used for grading fish. Once they have been scrutinised for quality the fish are placed in the first of a series of small vats, where they are passed, in a manual operation, through a grille. The slimmest fish pass through and those which remain are then graded with the next size of grille, and so on. The length of the fish are, in general, proportional to their width, so the result is that the fish have, effectively, been graded according to length.

Prior to despatch the graded fish are then cooled (1°C per hour, down to 10°C). It is essential that as many fish as possible reach their destination in as fine a condition as possible, and thus, the cooling process lowers their metabolism and helps them to overcome stress during transit.

By far the most exciting time on the kibbutz is when the importers arrive with their customers for hand-selection of Koi. To prepare for hand-picking, the growing-on pools are netted using a hand-held seine, and the highest grade of fish are transferred to shaded viewing pools.

Shallow water aids the catching of selected fish for viewing, and these are placed in floating paddling pools for closer inspection. The process of hand-picking can take a couple of hours, and the atmosphere at the poolside is one of intense excitement.

Significant advances

There can be no doubt that the Israeli coldwater industry has come a long way in a short time. From small beginnings as a food fish industry less than two decades ago, production of ornamental fish has grown apace, aided by the technology and understanding which the past twenty years have brought with them.

The producers of Koi in Israel would, I am sure, be the first to admit that there is still a long way to go, but (and these are personal observations only) they are getting there.

If you are looking to buy (or sell) good-quality coldwater fish, you will find them in shipments from Israel. And, if you are a specialist looking for quality Koi, they are there too; but I would advise you to go and 'pick the best' for yourself!

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THE RULES

1. Write your answers to the competition questions on a postcard or stuck-down envelope.

THE QUESTIONS

- 1 Name two advantages of the new **Pond Workers** in-pond filter.
- 2 What two common problems is the **Pond Workers** designed to deal with?
- 3 What advantage does **Pond Workers'** jug-style shape have over traditional filters?

2. Write your FULL name, i.e. including full first names and address, in BLOCK CAPITALS on your entry.
3. Send your completed entry to:

**A&P Pond Workers Competition,
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4. Closing date: entries must be received by **31 August 1994**, at the latest.
5. Only **ONE** entry per household will be accepted.
6. No correspondence will be entered into regarding the competition.
7. The judges' decision will be final.
8. No responsibility is accepted for entries lost, delayed or damaged in the post, and proof of posting will not be accepted as proof of delivery.
9. The prizes will be awarded to the first three correct entries drawn at the end of the competition.
10. The winners' names will be announced in the **October 1994** issue of *Aquarist & Pondkeeper*.
11. This competition is open to all residents of the UK, excluding employees and families of **Aquarist & Pondkeeper**, **Dog World Ltd**, **Pet Business World**, **Interpet Ltd**, and their agencies.

Tropical lily boom

With the booming sales of conservatories, and with more and more people buying second homes abroad, there is a renewed interest in Europe in the culture of tropical water lilies.

Due to extensive hybridising work carried out this century in the US, few original species are offered for sale by nurserymen. However, species are still imported from Africa and the Far East for the aquarium trade, but these are species which retain their underwater foliage for an extended period. Their blooms are generally unexciting, but this is unimportant from an aquarist's point of view.

These lilies are imported by the thousand as dormant tubers collected from the wild. They are inexpensive, and are therefore replaced on a regular basis, as in the comparatively infertile conditions pertaining in aquaria, the plants are unable to build up their starch reserves for subsequent growth cycles.

Sri Lanka exports huge numbers of the red and blue *Nymphaea stellata*, while Thailand exports the white *N. lotus*. Madagascar offers, along with various *Aponogon* tubers, the blue-flowered *Nymphaea capensis* var. '*Madagascariensis*'. From West Africa comes a mish-mash of wrongly named species generally known as African Red

GROWING TIPS

BY BARRY R JAMES

Photographs by the author

or Green Lotus. These are probably varieties of *Nymphaea haudelotti*.

Tropical water lilies for pool use need temperatures of between 75-82°F (24-28°C) to thrive. They also need abundant sunlight, and a rich substrate.

These lilies are divided into two groups, comprising those that open their flowers during the day, and those that bloom during the evening, night and early morning. These latter are often very heavily scented, and will pervade the conservatory or

Mediterranean terrace with their delightful perfume, often mixing with Jasmine to produce an almost heady sensation.

Tropical lilies differ from their hardy counterparts in several respects. For example, their tubers are small and nut-like, while their flowers often stand proud of the water surface on long stems, and their leaves often have indentations on their margins.

The colour range is more impressive and includes many delightful shades of blue and

really intensive yellows, as well as the normal red, pink, white and other shades of the spectrum found in hardies.

Those fortunate enough to garden in the Mediterranean areas not exposed to frosts may leave their plants outside all winter, otherwise they should be lifted in late autumn and the tubers stored for the winter in cool moist sand in a frost-free room.

Day bloomers seldom produce more than one tuber per plant, and they are somewhat elongated and conical in shape. Night bloomers, on the other hand, produce rounded, somewhat warty, tubers, often several to each plant. The main tuber seldom survives the winter in storage and the smaller secondary ones should be selected. In the US, it is common practice to re-buy these plants every year, treating them as annuals, but due to the higher prices charged in Europe most people make the effort to persist with their own stock.

Of the many varieties available in the UK, I've selected a list of my own favourites.



Left, the lovely underwater foliage of the tropical lily *N. maculata* Green. Centre, the delicate bloom of *Nymphaea capensis* from the island of Madagascar. Right, St. Louis Gold: a day blooming yellow lily.

1 DAY BLOOMERS

St. Louis Gold — a smallish variety with deep yellow flowers set off against beautiful green foliage. Ideal for small ponds.

Yellow Dazzler — a medium grower with dazzling yellow scented flowers.

Pamela — a strong grower with giant sky-blue flowers up to twelve inches (30cm) in diameter. Leaves are green, marked with brown.

King of the Blues — a medium grower with flowers some eight inches (20cm) in diameter. They are navy-blue with yellow stamens, also tipped in blue.

Evelyn Randig — deep magenta-cose flowers, the leaves being heavily spotted and splashed with purple.

General Pershing — a medium grower with lilac blooms. Some consider this the finest variety available.

2 NIGHT BLOOMERS

Emily Grant Hutchings — the flowers are some ten to twelve inches (25-30cm) in diameter, amaranth red with dark-red stamens, considered by many to be the finest night bloomer in cultivation.

Sir Galahad — pure white blooms, medium grower with apple-green leaves.

NOTE: most of the above varieties would cost between £20-£40 each.



Growing young fish together offers about the best formula for future compatible breeding pairs to form



DISCUS

BY STEVE DUDLEY

DISCUS BREEDING TIPS

To have a fair chance of breeding Discus there are numerous factors to be taken into account. Here are some of the main ones.

1 Water quality

This one is of the 'details' which is great importance. It can be considered under two categories: tapwater purification, and efficient bacterial filtration. Water purification will be totally dependant on the quality of water in your area. In hard water areas, for example, one would use Reverse Osmosis or Twin Column De-ionisers; both will

reduce hard water to soft. Unfortunately, the latter is not capable of removing all the heavy metals present in the water.

On the other hand, the Reverse Osmosis unit produces water that is classified as 'dead water' and no fish could live too long if kept in such sterile conditions.

It is essential to add certain chemicals to both RO and de-ionised water so that it can be tolerated by aquatic life. There are plenty of additives available from Discus specialists that can be utilised with both types of water, so check these out.

Soft-water areas would prefer to have an easier task when it

comes to breeding soft-water fish (surprise, surprise!) No need to use RO or Deionisers here.

Breeders in such areas can supply permanent soft water which, often, is of the same consistency each time. However, although water is quite soft in my own area (30-50 Micro Siemens) there is still a need for further purification to remove organic material and pesticides present in raw tapwater. I removed these with Carbon Block Cartridges which are very efficient; even heavy metals are reduced to safe levels, producing a higher survival rate of young Discus.

2 Bacterial filters

The ideal candidate for this — in my view — is just a simple sponge filter operated by an airpump. My reason for this is that such a filter provides good water circulation without disturbance, is easy cleaned,

Golden Rules

- 1 To help seed a new filter set it up in an established healthy aquarium for a few weeks.
- 2 If you have Discus babies and have trouble feeding brine shrimp while you are out at work, why not prepare and freeze the shrimp larvae in ice-cube trays for one of the family to feed while you are away? The fish enjoy these larvae just as much.
- 3 Fry need at least a 30% water change every day when in their own tank.
- 4 Never change too much water in breeding tanks while fry are still on the pot or spawning site, as some may be at the top of the aquarium and will be stuck there until you have topped up.

does not damage fry (in fact, the sponge has often been used as a clean site to adhere newly hatched larvae).

When all is said and done the filtration capacity of just one of these filters is capable of

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SIONS

handling a tank housing two reasonably sized fish and 100 youngsters without any problems for the first three weeks, by which time the fry should be moved to new living quarters anyway, with their own appropriate kind of biological filter.

3 Compatibility

The easiest way of obtaining a compatible pair of Discus is to allow them the opportunity of choosing themselves. When the selection has been made, it would be advisable to remove the fish to a breeding tank, otherwise the disruption of a territorial pair will cause the other inmates some discomfort.

A large pair of Discus can be housed quite comfortably in a 24 x 12 x 18in (60 x 30 x 45cm) tank complete with heater/stat and sponge filter, which could have been seeded by introducing it to the main aquarium for a week or two prior to the fish. This provides the Discus with nitrite-free water, allowing courtship to

White unfertilised eggs (there's one visible in this shot) will be picked off by one or other of the parent fish.

continue, and an increased chance of getting things right first time around.

Don't forget to add the spawning cone!

Egg protection

Spawning usually takes place in the early evening, although some fish may vary, especially where inexperienced pairs are involved.

Spawning can take about an hour. When complete, the pair will usually settle down to fan the eggs. At this time, it is not essential to leave aquarium lighting on all night, as even brooding Discus will need to rest!

After two days the eggs will darken, if fertile. Dependent on temperature, they will begin to hatch at about 60 hours. Any



BOB WATSON

Fry rearing tips

After five days Discus fry begin their search for food, namely the flanks of the parents who take on a rather dark appearance. This actually coaxes the youngsters to their sides, where they graze on the abundance of mucus produced around the top part of the body.

Disaster may strike if the fry don't reach the food. This is why I only use small breeding aquaria as there is no great distance between parents and offspring. If you find that fry congregate towards the top of the aquarium, then just lower the water level to the height of the largest parent fish and, within a few hours, most of the fry will be at their parents' sides.

During the next few weeks, it would be advisable to leave a little light on overnight, but not a lot.

This allows continuous feeding and also helps prevent fatalities and ensures a healthy start for young Discus.

After 2-3 weeks the addition of newly hatched brine shrimp is a must. Feed sparingly for the first few days until the fry realise that these tasty morsels are food. Normally, I will introduce shrimp when I see fry venturing away from the parents and pecking at debris on the aquarium floor or the filter sponge.

When you are satisfied that all babies are eating shrimp, they can be transferred to separate living quarters.

white eggs are infertile and will be picked off by the parents.

If your eggs fungus, your water is biologically unstable and a perfect balance will need to be achieved in order for fertile eggs to develop free of fungus. Fungus can actually be due to the aquarist being too clean

with the filters and water. This problem can be overcome by the frequency of water changes being cut down, thus helping beneficial bacteria to reach reasonable levels, which, in turn will counteract the fungal spores that damage fertile eggs.

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MOVING WATERS PART 1

Each to its needs



Corals like this Tooth Coral (*Cataphylla plicata*) require water that is turbulent enough to ruffle their tentacles, as seen in this shot.

Many African Rift Lake species, like the Tanganyikan Turchifer (*Cyathopharynx turchifer*) do best in water with some movement in it.



Mindful of the fact that water turbulence in aquaria does not usually receive the attention it deserves, Philip Hunt sets out to rectify the situation.

Until recently, the subject of water movement in aquaria was afforded little attention outside the realms of the public aquarium and the laboratory. Here, tide-pool tanks would be made more realistic by using dump buckets to simulate

wave action, or else river and stream tanks, used to house such species as trout, would have water vigorously pumped through them.

Not so long ago, the average home aquarium, freshwater or marine, coldwater or tropical, had an undergravel filter pow-

ered by an airpump; power filters were the province of the fortunate few. Water currents were just a by-product of getting water into and out of the filter, be it a canister or a gravel bed.

'Current' developments

With the advent of compact, quiet, submersible water pumps, and the possibilities they offer, all that has changed. Now, undergravel filters are usually driven by powerheads, external canister filters are (relatively) cheaper and more widespread, and the internal power filter, that hybrid of the old-fashioned box filter and the powerhead, appears in more and more tanks.

This, however, is yesterday's technological news. Trickle filters, many times more efficient as biological water purifiers than anything previously seen, also depend, to a large degree, on those same water pumps, usually the more powerful variety, to deliver clean water back to the tank.

The net result of these changes in aquarium technology is that aquarists now have to think about water currents, and can control them to their advantage.

Working things out

The fundamental question to ask is how much water flow is desirable in a particular tank; only when this is determined, can the technical issues of what type of movement is required and how to achieve it be addressed.

The level of water movement depends critically on the requirements of the inhabitants of the aquarium, and to work out which plants or animals appreciate turbulent water, and which do not, the best approach is to consider their natural environment.

Varying needs

Marine creatures are used to constant water movement. The sea is never still, and many of the fish and invertebrates kept in aquaria come from coral reefs, where wave action can be fierce. To imitate the turbulence experienced by, for example, surgeonfish foraging on the reef crest, would require the fishkeeper to fit a heavyweight pond pump onto a small aquarium!

There are, of course, sheltered areas in the lee of rocks or coral formations, or in lagoons, and in these areas brisk currents only occur for brief periods as the tides turn.

Most of the familiar sessile (fixed) marine invertebrates seem to thrive in conditions of turbulent water. The only notable exceptions to this are the Mushroom Anemones of the genera *Rhodactis*, *Diconoma* and *Ricordia*, which are happier in relatively quiet water, though they still need a gentle current.



Left, Leather Corals (this is a species of *Lobophytum*) produce a 'skin' of mucus all over their body — note the small particles of detritus on the surface. Right: the mucus is stripped off by water currents — note the 'strings' of mucus, particularly well visible in the bottom right-hand corner.

Corals and anemones are dependent on water movement, because they make use of currents in several ways. Those organisms that filter-feed, including many corals, rely on the currents to bring planktonic food into contact with the polyps.

The second, and probably more important, reason to keep water moving in the invertebrate tank is that, for many corals, waste products must be removed by flow. Leather Corals, for example, can often be seen to retract their polyps and shed a skin-like mucus into the water, which has the dual function of removing wastes and displacing detritus which has settled on the polypary.

Most other corals also contract from time to time, exchanging the water inside the coral with the external environment, and taking waste products with it. Even the carbon dioxide produced by the respi-

ration of the coral diffuses out into the water through its surface.

All these processes depend on a vigorous flow of water over the coral to wash away wastes and deliver fresh water for respiration.

The large tropical sea anemones, usually species of *Heteractis*, kept as hosts for clownfish, are also lovers of turbulent water. Unlike corals, anemones are mobile, and frequently creep around the tank until they find a suitable spot, usually the point where water movement is most vigorous.

Many corals and anemones require strong illumination for the function of zooxanthellae, the symbiotic algae living in the tissues of many coelenterates. Another function of water movement for many of these animals is to expose more of the tissues to light, to increase the efficiency of photosynthesis.



Rudd (*Scardinius erythrophthalmus*) and other still- and slow-water species dislike strong currents.



While the wild ancestor of the fancier varieties of Goldfish is a very resilient fish, the round-bodied types, such as the Pearlscale, must not be kept in turbulent conditions.

This is achieved best by the back-and-forth motion produced by waves in the sea. First, one side of the tentacles is exposed to the overhead light, then the other side, and so on (see accompanying diagram). The net effect is to increase the effective surface area exposed to sunlight.

Wave action is also important to many marine algae, especially those from 'high-energy' environments (such as the reef crest or a rocky shoreline), for the same reason.

Invertebrate tanks, then, require vigorous water movement which, in addition to the effects discussed above, facilitates gas exchange with the atmosphere, resulting in the high oxygen level required. Marine fish also enjoy the same conditions.

Freshwater tropicals

Freshwater fish hail from more diverse habitats, and care must be taken to match the water movement of the tank to that of the natural environment. While fish vary in their requirements, freshwater aquarium plants seldom appreciate turbulent water, most of them having originated in swamps, forest pools, or broad, slow-moving rivers. If a well-planted tank is desired, water movement should be minimal.

Many tropical community fish come from relatively calm water, and thus appreciate the same quiet tanks favoured by the majority of plants. The well-planted community tank is thus ideal for most of its usual inhabitants, such as Guppies, Platies and Swordtails, most tetras and other characins, and such inoffensive cichlids as Angelfish and Kribensis.

There are many exceptions, however; such fish as Congo Tetras, Clown Loaches, 'Sharks', and many species of barbs, are found in faster waters. Most South and Central American cichlids are slow-river or stillwater species, whereas many, but not all, catfish come from fast, powerful streams and rivers.

An interesting alternative to the heavily-planted community tank is a river aquarium with a good flow of water, decorated mainly with bogwood or curio wood and rounded boulders, and stocked with a variety of riverine species; a shoal of Congo Tetras and some *Synodonis* catfish would make a good African river community, for example.

Large lakes mimic the sea to some degree in terms of water movement, particularly at their shores, so it comes as no surprise that African Rift Lake Cichlids, particularly rock dwellers such as *Mobius* and their Tanganyikan equivalents, thrive in well-oxygenated tanks with plenty of water movement.

Coldwater species

Coldwater fish can also be divided into still- or slow-water species and riverine types. In the latter camp, the most familiar species is the Golden Orfe, whose high oxygen requirements are well known. Many of

the newer additions to the coldwater aquarium, particularly American species such as the various shiners and darters, also hail from fast rivers and streams and have much the same requirements.

Among the native British species which find their way into aquaria, Stone Loaches and Bullheads are fast-water species, whereas the Common Carp (and therefore Koi), Tench, Roach and Rudd are all principally found in lakes, ponds and quiet rivers and thus require calm tanks.

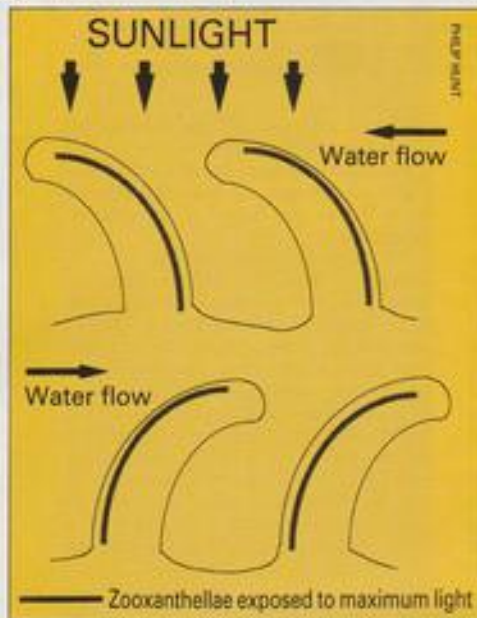
Goldfish are also descended from inhabitants of still, muddy pools, and are superbly adapted to this environment; not only do they (in common with other members of the carp family) possess the Weberian apparatus, an anatomical adaptation of the swim bladder which renders their hearing extremely acute, but, as anyone who saw the BBC's *Supersense* series some time ago will remember, their eyes are also sensitive to both infra-red and ultra-violet light, allowing them to see in very murky, turbid water.

Not so tough

While the Common Goldfish is an extraordinarily resilient creature, fancy types are not so tough, and vigorous water currents are to be

avoided in tanks which are home to such fish. Round-bodied forms such as Ranchus, Orandas, Pearlscales or Fantails often have difficulty enough in swimming

The effect of wave movement on coral tentacles and their resident zooxanthellae (see text for details).



in still water, and there are few more pathetic sights than watching Fancy Goldfish struggling against the current from a powerful powerhead.

Although many fish, particularly freshwater species, will adapt to conditions which are quite different from their natural environments, the aquarist would do well to remember that millions of years of evolution have moulded each species of fish to suit a particular habitat.

If the aim is to provide an aquarium which is as stress-free as possible for its occupants, which will lead to healthier fish, improved chances of breeding and larger, more colourful specimens, then a tank which matches, as closely as possible, the natural home for which the fish is adapted, is desirable. One major factor in achieving this is providing the correct degree of water movement.

For those who keep marine invertebrate or reef tanks, there is really no choice: if corals and anemones are to thrive, the aquarium water must be turbulent.

Having decided, on the basis of what the inhabitants of the aquarium will be, how much water movement is desirable, and of what type this should be, the next problem is how to achieve the required level. That will be discussed in Part Two.

(TO BE CONTINUED) **87**

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Tomorrow's Aquarist

BY GINA SANDFORD



Flipping amazing

It never fails to amaze me as to what some of you will get up to if there's a prize up for grabs, and when I received the following press release from South Ockendon Garden Centre, it just had to be included in TA...

Daniel West, aged 13, from Thurrock, Essex, arrived at **Fishy Friends** at South Ockendon Garden Centre, looking the real Mc-Koi, in full wet suit, flippers and goggles.

Daniel had taken up the garden centre's promotional challenge of "The first customer to turn up at the garden centre in a diving suit and goggles and flippers will receive a £100 aquatic voucher."

Daniel West in full 'flipping amazing' gear, and **Jamie McDonald**, manager of 'Fishy Friends' at South Ockendon Garden Centre.



Fishy puzzle

If you're looking for a present for a younger brother or sister who likes fish, **Orchard Toys** have a fun Goldfish Bowl floor puzzle in their range which should appeal to young aquarium lovers. This big-shaped puzzle — it's actually in the shape of a goldfish bowl — has twenty chunky pieces ideal for little hands, and has plenty of underwater action to keep the young ones amused.

Unfortunately, they didn't send me the actual puzzle, so I couldn't get my youngest daughter to road-, or should I say, floor-test it for me. It retails at about £5.95 and is available from most good toy shops. There is also a free catalogue available. Ring 0602 373547.



to spend at Fishy Friends". "I wanted to buy some fish, and the £100 aquatic voucher was a great incentive for me to slip into my wet suit and goggles," he said. (Perfectly logical and sensible, I think!)

Jamie McDonald, manager of Fishy Friends, commented:

"We didn't think that anyone would be mad enough to take up the challenge — which was intended as a bit of fun during our Aquatic Weekend. It was 'flipping amazing' to see two wet suit clad customers, both aged 13, Daniel and John Baker, waiting outside the garden centre."

John Walsham, owner of South Ockendon Garden Centre, then set the boys another challenge to decide the winner. Once the doors of the garden centre were open, they ran a race to Fishy Friends. Daniel was first, winning £100 aquatic voucher, while John received a £10 voucher for being such a good sport!

A colourful picture to put together showing exciting underwater life.

Snails v Hostas

For some reason snails seem to be able to detect Hostas from a great distance. Planted in the moist conditions of a bog garden or pool side, I can understand why the snails take advantage of readily available food in a habitat that they, too, enjoy.

Therefore, having had several plants succumb to a snail's advances in the past, I decided to put the new young plants I had acquired on top of the rabbit hutches. Thus, four feet from the ground, in the centre of a very rough piece of roofing felt that covers the top of the rabbit hutches, and with a few slug pellets in each pot, they should be safe from snails. Ha! Wrong again!

The following morning, I went out to feed the rabbits and was greeted by a disaster zone inhabited by snails. They had attacked and consumed varying amounts of all the Hostas except for two — the blue ones, Bressingham Blue and Halcyon. This posed the question: what have these two got in their leaves that the marauding molluscs don't like?

The snails, all 37 of them, were despatched over the garden wall. The Hostas were tidied up and, fortunately, recovered from their ravages. The pale green with white edges varieties suffered the most, but these have now produced a flower spike or two. However, I'd love to know what protects the blue ones. I can't find any answers in the books so far — maybe I'm looking in the wrong places. Any ideas?

Pond edge scene with leaf-damaged Hostas (the broad-leaved plants) that have served as dinner for hungry slugs and snails.



STUART INCE

PONDERINGS

It has often been speculated that Goldfish varieties with types of eye malformation, such as those sporting large bulbous eyes like the Moor, or wobbly, fluid-filled eye-sacs like those found in the Bubble-eye, or eyes which turn upwards and therefore only see what is happening above them, as do the Celestials, are at a great disadvantage when feeding, especially if kept with other more robust varieties.

I have kept and bred these varieties and cannot agree with such claims.

I have kept all these types in outdoor ponds with other varieties, including faster-moving varieties, such as Common Goldfish and Shubunkins, and they certainly hold their own at feeding time. Bubble-eyes, Lionheads and Fantails live and feed happily together in tanks and, if anything, the Bubble-eyes are the first to get at the food.

Research by eminent scientists has proved that Goldfish have a sense of smell two million times keener than our own, so even if their vision is in some way impaired or obstructed, their sense of smell makes amends for their other shortcomings.

Besides, fish do not depend solely on their eyesight to locate food and find their way around, for water is sometimes murky and, at night, visibility is nil. Nor do they rely only on their sense of smell. Most fishkeepers are familiar with a fish's lateral line but probably not with its function. In fact, it is a delicate and highly responsive line of sensors that pick up minute changes in water pressure. Objects in the water bounce back pressure waves to the fish, giving it a picture of its surroundings.

Sensible precautions

One precaution I do take with delicate varieties during the pond breeding season is to remove the round-bodied, fancy types for a while. This is for their safety, because the males of the slim-bodied types such as Common Goldfish and Shubunkins, can be much too enthusiastic and rough during spawning activities. The slower-moving, fancy fish are unable to escape over-zealous advances and can be quite seriously injured.

Many years ago, I was shocked and puzzled when I discovered several injured fish with scales rubbed away on both tanks. On inspection, I found

them all to be female, but the reason for their injuries came to me only after seeing a 'pack' of Shubunkins harassing slower-moving Fantails almost to exhaustion.

Goldfish companions

Do goldfish need companionship? I would say without hesitation the answer is YES. After studying some of my own fishes' behaviour when kept in a solitary situation compared with the same fish housed with others (whether they be larger or smaller), brings me to the conclusion that Goldfish do appreciate company. They are bolder, their health is better, they have better appetites; in fact, they just look 'happier'.

Watch the reaction of a newly acquired fish once it has been removed from solitary quarantine confinement and introduced into the company of the other established tank- or pond-mates. At first, it may appear shy, but very quickly, it regains its confidence and really does look happier.

So convinced am I of this that if one of my fish needs to be given treatment in the hospital tank, I try to make sure that it has company, usually by providing a fish lacking what I would term "quality", but still being ideal for companionship purposes.

However, this action would depend on the treatment of course. I would not, for instance, subject a healthy fish to share a tank with a sick fish if medication had been added to the water, but if two aquariums are standing side by side so that the fish are able to see each other clearly, the sick fish usually responds to treatment more quickly and, therefore, is well on the road to recovery faster than it would if treated alone.

'Controlled' surprises

Breeding Goldfish in a controlled environment, where the fishkeeper has almost total control over the events taking place, is always a fascinating business. It is great to be involved in aspects of breeding, such as choosing the prospective parents, the approximate timing of the spawning period, the

Pauline Hodgkinson presents a further selection of thoughts, tips and anecdotes for pondkeepers.

Photographs by the author

Good-quality young Lionheads from equally good parents. Like most spawnings, this one contained its fair share of surprises.



lengths of the period for the eggs to mature and hatch, and all the many aspects of rearing the fry and choosing those to be grown on, providing, of course, that we have the full co-operation of the prospective couple!

Nothing is taken for granted, but the surprises, and often disappointments, as well as the joys, keep on happening. Anyone looking for a real challenge should give Goldfish, and especially Fancy Goldfish, a try.

I have, on several occasions, heard it said by people who have purchased breeding stock from good, well established line-bred stock that they have failed, in turn, to produce anything of any consequence when they spawned the fish. There may be

many reasons for this, so it might be hasty, and possibly foolhardy, to discard the fish without giving them a second chance.

I well recall a pair of Fantails from a strain I had been working with for several years. I spawned them and about 90% of the fry had single tails. This was a great disappointment, particularly since in the past, all the spawnings from this group had produced few fish with such a fault.

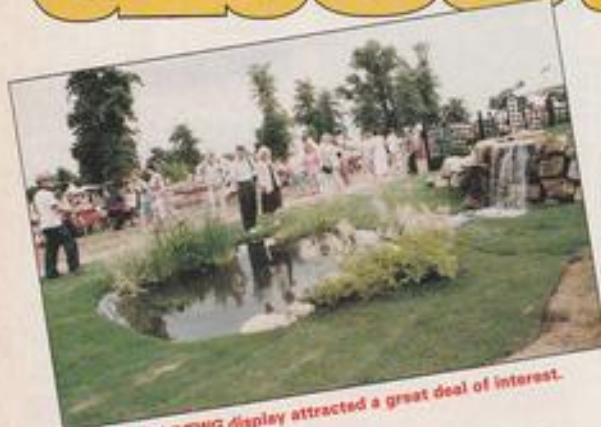
Four weeks later the same pair spawned again and, this time, the results were very different. Almost all the young had twin-tails and they eventually proved to be some of the best fish the strain had ever given me.

It would be extremely difficult to pin-point the precise reason why

out and about

HAM

Small water features are really 'in', as Airport Aquaria discovered with their great range of Waterways models like the Ali Baba.



Our own A&P/TWG display attracted a great deal of interest.



Looking as if its always been there, Dorking Aquatics' two-week-old (!) display, the Silent Pool was a deserved Gold award winner.



Hampton's great for new ideas. How about these intriguing shapes from Flowform Design Research Group?

"Water, water, ev'rywhere and nary a drop to drink" could be a line from Coleridge's Rhyme of the Ancient Mariner that could equally well apply to Hampton Court in early July. Here, water was the life-blood of exhibits at the world's largest garden show.

Hardly any display lacked the magic ingredient of water movement, whether it was part of the Aquatics Village or not. The Ugly Bug Garden, the Magic Roundabout Garden, the tremendous international panoramas in the Daily Mail Pavilion, all incorporated aqua vitae to a greater or lesser extent. However, it was to Aquatics Village that our attention was drawn.

The true image of village life is one of the inter-dependence between its dwellers, each sharing both day to day burden, as well as its triumphs. Thus, it was at the Hampton Court Flower Show 1994, with the 'Aquatic Villagers' toiling away during the frenetic days of build-up, then genuinely feeling glad for the winners during the public days that followed.

The Royal Horticultural Society must take full credit for this happy state, for the rewards of Medals were generously distributed in a seemingly fair manner. Usually, with the conventional 1, 2, 3 placings, the 'also-rans' are cut off sharply, but this year there were no fewer than 3 Golds, 3 Silver-Gilts, 2 Silver and 2 Bronzes awarded — a reflection on the very high standards on display.

The emphasis chosen by most designers for '94 was firmly placed upon water in the garden (no matter on what scale), but for those visitors whose particular interest lay in the fish content of such arrangement, there was disappointment, as these were hardly featured, other than as just another component in the overall grand picture. Having said that, what grand pictures there were to see!

Given the luck of the site draw, designers had to cope with uneven ground and/or obstinately-placed, resident trees. Add to this the responsibility of having to return the site to normal after the event, and it will be appreciated that the minimum of soil removal was the order of the day!



The Tudor Rose Award, winner, Wanda Wicker's Wonderful Water Garden, was stunning, with several cascades running beneath iron-ore-streaked limestone bridges to form shallow pools; a hidden Lily pond was a delightful surprise tucked away from these streams, while Wanda, the Wicker Lady herself, presided over the whole scene.

Linking two pools with a rushing stream would apparently require a clearly-obvious gradient in the land, but the creators of the Water Lover's Garden achieved the effect with hardly any visible 'fall' at all.

Each display was required to have a theme (described by text for the benefit of visitors and judges alike), and that provided for the Silent Pool was both eloquent, moving and based on legend. Given the story of a rescue-turned-to-tragedy, the display became, despite the thousands of people around, a truly tranquil and meditative scene.

Interest in fish was featured (albeit in a definitely non-keeping context) by the 'Compleat Angler'; here, the angler's rod nestled on its rest, the rowing boat tied up nearby by a small boathouse. Isaac Newton would

AMPTON'S GLORIOUS SPLASH

By Peter Furze of the Federation of British Aquatic Societies.

Photographs by Jon Montgomery.

have been proud of it.

Cameo Water Gardens showed just what can be accomplished in small spaces: the **Japanese Water Garden** was authentic in every detail, conifers and granite, water flowing in the traditional direction from east to west, the Tea Ceremony scene and, of course, the Shishi-odoshi deer-scarer. The **Lakeland Stream** was all drama and tumbling waters, while the **Oriental Water Patio**

Features took miniaturisation even further into tub containers with self-contained low-voltage pumps and a delightful scaled-down pond complete with timber bridge and pygmy lilies.

Hardy plants, well-suited to our cooler climate, were highlighted in the **High Peak Garden** and here the drama of enormous rocks down which tumbled torrents of water was balanced by the tranquility of the calm lily pool at the end of the run.

Illustrating a technical product is a challenging prospect, but **Pumping at the Right Angle** displayed a clever play on words, with the water garden being laid out in strict 90 degree angles — a design play even extended to the shape of the garden seat.

Waterways featured an L-shaped planked patio overlooking a large free-standing lily pond whose water tumbled down a sleeper built weir into a lower natural pond; all of the waterside plants were ablaze with colour, matched by frequently-visiting azure-blue damselflies.

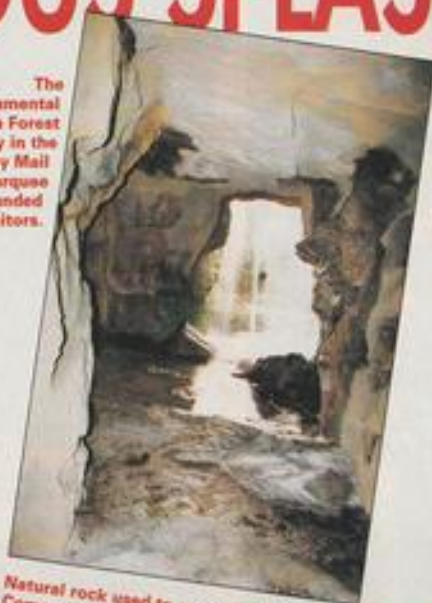
The **Flowform Garden** was a display which needed some understanding: at first sight, the modern forms of the water channelling sculptures seemed at odds with the garden proper, but closer investigation of the facts excellently presented showed that each 'shape' had a real aquatic purpose — to encourage aerobic bacteria by providing oxygen-saturated water by virtue of their scientifically-deduced designs, and to circulate the water into the ponds at the proper rhythm for optimum cleansing action.

For fishkeepers, the **Secret Water Garden** provided the best view of actual fish — showing off some excellent Koi in a pond which travelled beneath a wooden bridge walkway.

It seemed a shame that other really impressive displays should go unrewarded; A&P's and **The Water Gardener's Spring** (as in source of water, rather than season) **Water Garden** was almost Niagara in miniature. The Goldfish seemed quite content with this arrangement, so much so that they spawned in the nearby calmer pond, overlooked by the flowers in the joining bog garden!

Once again the Aquatic Village

The monumental Rain Forest display in the Daily Mail marquee astounded visitors.



Natural rock used to maximum effect: the Very Interesting Rock Company's top award winner.

The FBAS had a super selection of displays to show visitors... with experts on hand to offer advice.

Lowars — who supplied the pumps for all the displays — had a striking exhibit themselves.



HAMPTON COURT HONOURS

Tudor Rose Award and Gold Award:
Wanda Wicker's Wonderful Water Garden by The Very Interesting Rock Company.

Gold:
The Silent Pool by Donning Aquatic Centre

The Water Lover's Garden by L.W. Landscapes Ltd

Silver-Gilt:
Cameo Water Gardens by The Federation of British Aquatic Societies

The Complete Angler by Hows Green Garden Services

High Peak Garden by Ken Hogginsbotham

Silver:
Pumping at the Right Angle by Lowars U.K.
Waterways by Anglo Aquarium Plant Co.

Bronze:
The Secret Water Garden by Tetra.
The Flowform Garden by Flowform Design Research Group

lived up to its reputation as being the place to see all that's best in outdoor aquatics and to marvel at what can be done in such a short space of time and, in some cases, in such short spaces. If you visited the show and still haven't been persuaded to take up this enjoyable hobby by this display, then you never will.

Finally, on a personal note (and if our Editor will allow it), I would most sincerely like to thank those gifted garden designers from **Egmont Water Gardens, Town & Country Garden and Chenies Aquatics** for their talents which gained a Silver-Gilt Award for the **Federation of British Aquatic Societies**. Our advisory service on pond and filtration problems, together with society location information, were truly enhanced by their presence.



DAVID TWIGG'S
**KOI
CALENDAR**



Left, Brian Phillips' Grand Champion Sanke at the South Hants show. Centre, Judges Kate McGill and Kevin Jackson hard at work at the Middlesex and Surrey Borders show. Right, this Tancho Sanke, owned by Jean Lingwood, took the Grand Champion trophy at the MSS event.

main winners, and Gary Prichard, Chairman BKKS, presented them with their prizes: Grand Champion, Size 5 Sanke, **Brin Phillips** (this Koi was also Grand Champion last year and Adult Champion in 1992); Supreme Mature, Size 5 Hikari Utsuri, **Ian Frome**; Supreme Adult, Size 4 Showa, **Alan Purnell**; Supreme Baby, Size 2 GinRin Kohaku, **N & H Harnden**; Best Jumbo, Size 5 Hikarimoyo, **Graham Mortimer**; Best Junior, Size 4 Showa, **Nicholas Wood**; Best South Hants Junior, Size 1 Hikarimuji, **Andrew Rose**.

A new trophy was awarded this year for the best Jumbo Koi in Show. This trophy, named "The Lady Jane Trophy" after his three times Champion Sanke, was donated by **Brin Phillips**. Congratulations to Show Chairman **Denis Carter** and his team for staging what I understand was a highly successful weekend. I hope I will be able to make it next year.

Now to a show that I did get to! The Middlesex and Surrey Borders Open Show was, I believe, set up in torrential rain and howling winds on the Saturday but, by the time Lyn and I arrived at lunchtime on Sunday, the clouds had parted, the wind had dropped to an acceptable level and the day continued to improve.

During the day, a record number of visitors passed through the gate to view the 231 lovely Koi on display in the show arena. There were also lots of good Koi on offer by the nine dealers present, who also had a wide range of dry goods to tempt us. The craft, bonsai and plant (Lyn nearly bought an Acer) stalls also had a lot to offer.

Kiddies, or perhaps I should say family, entertainment ranged from the ever-popular bouncy castle, to face painting. The big cat's face seemed most popular!

Having circulated the many dealers and exhibition vats, it was then time to catch up on Koi talk with the many friends we have made over the years and only really get to meet at these highly interesting events.

The judges, led on this occasion by **Walter Reed**, and tasked with the difficult duty of making winning choices, were **Kate McGill, Geoff Kemp, Peter Collins, Nigel Williams** and **Kevin Jackson**. The results they came up with were as follows: Grand Champion, Size 6 Tancho Sanke, **Jean Lingwood**. Jean also took awards for Best Jumbo Koi (Ogon) and Best Tategoi (unfinished) with her lovely Size 5 Showa. Other major awards were: Mature Champion, Size 6 Kohaku, **Alan Barrett**; Adult Champion, Size 4 Kohaku, **Theresa and Bernie Woollands**; Baby Champion, Size 2 Sanke, **George and Kathy Rooney** and finally, with I am sure a proud grandad, Best Junior went to **Sammy Pritchard** with his Size 3 GinRin Kohaku.

I hope that it did not rain after we left to spoil what had been, from our point of view, such a good and enjoyable show. Thanks and congratulations to Show Chairman **Chris Pinchen** and his team for a great day out.

Jobs for the month

This really is the month when temperatures should be at their highest and our Koi at the peak

of health. They will be eating well and producing lots of waste, so it is therefore imperative that we keep on top of the housekeeping tasks. Pull bottom drains and backflush vortex and other filter chambers regularly to ensure minimal build-up of waste and thereby minimise water pollution from that source.

Because of the loss of water in this way, it becomes necessary to top up from the mains. It is known that the domestic supply of water does vary in content from area to area, generally in the amount of chlorine and, sometimes, chloramine added to it to make it fit for human consumption. These chemicals are in addition to the other substances, such as metals, which can also be found in the mains supply. All of these things and others like pesticides are, to one degree or another, dangerous to our Koi and we should take steps to minimise the risk.

Water purifiers that have been tailored to the requirements of the Koi keeper are now available from a variety of sources. It should be remembered, though, that not all water contains the same contaminants, so it may be wise to obtain a Drinking Water Quality Report from your local supply company. This will list the substances found at the time of testing and which are likely to continue to be there for the time being. It should help you "fine tune" your water purifier to your own needs.

We often talk of the need to remove harmful substances from the supply, and that is only right, but water purifiers, by virtue of their action, will also remove some of those things that our Koi actually need. Certain vitamins

and minerals are necessary parts of the diet of Koi to maintain good health. It is therefore essential that this fact is not overlooked and that a well balanced diet is fed to the fish to ensure a continuing healthy life.

August shows

And so to this month's shows: two have been advised for this month and they are both large and well worth visiting. The **BKKS "National" Open Show** is generally regarded as the premier Koi show in Europe and is certainly becoming more international every year.

This hobby of ours is very popular; for example, only a few days ago, I was introduced to a couple of Koi breeders from South Africa. Germany and Holland now have well established Koi clubs and are staging their own National and European Koi shows.

I look forward to meeting some of those overseas visitors at the National and maybe even get the opportunity to attend their shows in the not too distant future.

But back to the show; **Koi 94** which takes place over the weekend **13/14 August** at Billing Aquadrome near Northampton, has a new site within the Billing

parkland. Apart from the now-familiar craft fair (three dozen stands) and children's entertainment, there is a large programme of lectures over the two days, covering everything from Koi Judges' decisions, through filtration and water quality, to parasites and Koi treatments, with a lecture on that allied hobby of Koi keeping, Bonsai, thrown in for good measure. All the country's major Koi dealers will be attending and, surely, everything that one could possibly want to further our hobby will be on sale.

A weekend package with hotel accommodation and a dinner dance on Saturday evening is on offer again this year; full details from **Mrs Fleming** on **091 266 3824**. On-site catering sounds great, with a choice between a sit down carvery and fast food, or maybe just a relaxing drink in the bar would suffice. Contact **Low Jackson** on **0322 463669** for further information about the Show.

28/29 Aug — South East Section Open Show. Ravenswood School, Bromley, Kent. This Bank Holiday (Sunday and Monday) Show, which attracted over 3,500 people through the gate and over 400 Koi entries last year, is looking forward to another successful show this year. 20+ Koi dealers, 12 arts and craft stalls and five

other dry goods stalls, including Bonsai, will be in attendance. Refreshments and other family attractions are on site. Entry is £2.00 adults, £1.00 senior persons, and children are free. For further details contact **Brian Edwards** on **081 857 3952**.

What's on in August

2 — Yorkshire Section BKKS. Monthly meeting. Contact **Phil Swallow**, 0422 343674.

3 — Leicestershire Koi Society. **Bill McGurk** presents a video and talk: Japan & its Koi. British Shoe Corporation Social Club, Leicester. Contact **Pip Ostell**, 0533 609707 or **Kevin Luckman**, 0455 250413.

4 — Middlesex & Surrey Borders Section BKKS. 8pm, Norbiton CIU Club, Kingston. Contact **Gary Pritchard**, 081 841 2894

7 — Crouch Valley Section BKKS. Lower Thames Section visit **Crouch Valley ponds.** Contact **Ron Parlour**, 0277 840863.

Eastend Section BKKS. Barbecue. Contact **Phil Davis**, 0279 443754.

Northern Koi Club. Visit from **Birmingham & District Section**

BKKS. Contact **Tony McCann**, 061 794 1958.

8 — West Wales Section BKKS. Monthly meeting. Post Office Club, Swansea. Contact **Andy Tovey**, 0554 821310.

9 — Nottingham & District Section BKKS. "Open Forum", The Western Club, Derby Road, Nottingham, 8pm. Contact **Shirley Hind**, 0602 810923.

10 — South Hants Section BKKS. Guest speaker at **Denmead Church Hall** is **Helen Bentley.** Contact **George Rooney**, 0420 473169.

Merseyside Section BKKS. Monthly meeting: "Fun Night". Contact **Robbie**, 051 549 2001.

14 — Merseyside Section BKKS. Coach trip to **KOI '94.** Contact **Robbie**, 051 549 2001.

17 — Crouch Valley Section BKKS. Video of visit to Japan. Laindon, Essex. Contact **Ron Parlour**, 0277 840863.

21 — Central Section BKKS. "Open Afternoon" at a member's pond. Contact **Sue Finney**, 021 747 2733.

Middlesex & Surrey Borders Section BKKS. Pond visit to **Wessex Section ponds.** Contact **Gary Pritchard**, 081 841 2894.

28 — Northern Section BKKS. Monthly meeting. Contact **Phil Adamson**, 051 220 2970.

Middlesex & Surrey Borders Section BKKS hosts visit from **Avon Section.** Contact **Gary Pritchard**, 081 841 2894.

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OFI(UK) NEWS

1 SVC guidelines

Ornamental Fish Industry (UK) has issued guidelines to retail customers following reports of a number of confirmed and suspected cases of SVC (Spring Viraemia of Carp).

While the organisation stresses that these cases do not indicate the likelihood of a major outbreak, SVC is a notifiable fish disease and suspected cases must be reported to the Fish Diseases Laboratory, MAFF, 33/33a Albany Road, Granby Industrial Estate, Weymouth, Dorset DT4 9TH.

The only major outbreak of SVC in England and Wales was in 1988 when 40 sites were affected and, until now, there have been only two cases, both in 1991.

According to OFI(UK), a number of the affected sites supply fish into the ornamental fish trade, so a programme of inspection and testing has been instigated by the MAFF, who will visit sites in order of priority based upon the risk of further transmission of the disease.

OFI(UK) advises fishkeepers who are concerned about fish deaths in their garden pond that some of the signs of SVC are similar to bacterial conditions common at this time of the year, and that even if some of the signs are present, they are unlikely to be symptoms of SVC.

"Husbandry and care of fish in garden ponds at this time of year is critical", explained OFI(UK). "Many fish diseases, including SVC, are precipitated by stress. Rising temperatures cause stress

in fish, particularly if associated with over-feeding and consequent poor water quality. Care should also be taken not to overstock ponds at this time."

Full details are available to members of OFI(UK), while a booklet entitled Spring Viraemia of Carp is available from the above mentioned address.

2 Commons touch for Keith

The Parliamentary Agricultural Select Committee has called upon OFI(UK) to provide evidence about the size and nature of the ornamental fish industry in the country.

The committee is conducting an enquiry into health controls on the importation of live animals, including fish, within its remit, and is examining "if statutory and administrative procedures for the control of live animal imports are efficient and effective in proportion to the risk to animal and human health in the UK".

Remarked OFI(UK) chief executive Keith Davenport: "The committee's findings could have far-reaching effects on our industry, and it is extremely important that the inquiry be made aware of the size and nature of the ornamental fish

industry, as well as being appraised of the low risks to humans from diseases transmitted by ornamental fish."



Ornamental Fish Industry (UK) Limited, Bedford Business Centre, 170 Mile Road, Bedford MK42 9TW. Tel: 0234 355315; Fax: 0234 273550.

Goldline appointment

Koi food specialists Goldline Feeds of Retford, Notts, have appointed Ullesthorpe Garden and Aquatic Centre, near Lutterworth, Leicestershire, as sole suppliers in their area of Phoenix 2000 pondfish foods.

Manager Ian Tallis is delighted with the appointment, remarking, "We have always striven for top quality since we took over the garden centre just over a year ago. Phoenix 2000 has achieved a high reputation as a leading food that produces healthy and richly-coloured pond fish so we are delighted to be associated with the company."

Ian explained that Phoenix 2000 has a digestibility of 97%; "which means that not only can customers use the same food all year round, but it will not cause cloudiness in their ponds and will provide less of a strain upon filter systems. An additional advantage is that Phoenix 2000 is manufactured in the Midlands, which is where we ourselves are located, so it is as fresh as it can possibly be."

US approval for Cyprio

Peterborough-based pond filtration specialists Cyprio became the first company in the UK to receive approval from the American product standards board, Underwriters Laboratories Inc., when the company's Ultra Violet Clarifier became accredited, allowing Cyprio to export the product to the USA and include the approval mark (UL) on both the product and associated packaging.

Electrical products without the UL mark are not accepted for import into the USA and, in order to receive approval, a product has to undergo rigorous tests on both mechanical and electrical safety.

When installed, Cyprio's UV clarifiers are operated at a water pressure of five pounds per square inch; under their tests, UL put the product under three times that pressure in order to test the product's durability. Additionally, each electrical component has to be individually approved prior to its construction.

Following UL approval, Cyprio is obliged to carry out tests on all production batches and, every six months, the company's production standards will be inspected by the British Standards Institute on behalf of UL.

Steve Phillips, marketing manager of Cyprio remarked: "We are thrilled to receive this approval from UL and we believe that this is the first of many international accreditations. We are awaiting approvals also by the Canadian Standards Association (CSA), as well as the German Verband Deutscher Elektotechniker (VDE), which are equally important to us."

OSCAR GILLTHROOP



'AQUATIC FANATIC'

BY COLIN HODGSON

I THINK YOU WERE RIGHT LUV!.....THE GUPPIES WOULD HAVE BEEN MORE PRACTICAL!



COLDWATER

JOTTINGS

BY
STEPHEN J. SMITH



Sitting pretty



A simple solution to the problem of a 'wobbly' pond pump was conveyed to me by reader Don Ratcliffe from Birmingham. Don has kept Goldfish in a garden pond for several decades and explained that his pond tends to 'look after itself'. However, the acquisition of a fountain pump presented him with some new problems. It simply would not stand upright!

So, ever-resourceful, Don simply attached the pump to a housebrick, by means of brass screws and plastic plugs, and this assembly now sits 'as solid as a rock'.

How about letting me know about 'handy tips' which have provided a simple solution to your fishkeeping problems. If you have a photograph, or diagram, send those as well, c/o Coldwater Jottings, A&P, 9 Tufton Street, Ashford, Kent TN23 1QH.

Upside-down Goldfish

Keeping Fancy Goldfish tends to present different problems at different times of the year. Just as our fish are overcoming the rigours of our extended winters in the UK, we then have to contend with blanketweed and algae, and low oxygen in the summer (see last month's *Coldwater Jottings*) among other 'challenges'. Who said coldwater is the easy end of the hobby?

A further perennial problem has befallen a large Redcap, owned by Mrs Brenda Holt, of Potton, Bedfordshire. Brenda

contacted me when one of her favourite fish developed swim bladder problems after several years in her pond. "It has been swimming upside down at the bottom of the pond since the beginning of the season", explained Brenda. "At times the fish appears to be distressed. We have tried a treatment of Malachite Green, but to no avail."

Disorders of the swim bladder are not unusual among the more round-bodied (or secondary) varieties of Goldfish. Such varieties have been produced after hundreds of years of line-breeding and their round form has led to a distortion of one of the most important organs of the body, the swimbladder.

In the primary category of Goldfish, which, effectively, are the long-bodied varieties (such as the Common or Ancestral Goldfish, Shubunkin and Comet), the swim bladder is a form of elongated balloon, which is 'pinched' in the middle to form two sections. The muscles control the amount of air within each section and thus the fish's balance which enables it to rise or descend within the water.

The distortion of the swim bladder found in the secondary

category of Goldfish will usually provide no problems whatsoever, even in the most rotund of Fancy Goldfish (the Pearlscale being almost spherical in body shape). However, such fish can be susceptible to changes in temperature, such as the oscillation between warm days and cold nights during the spring, at which time some fish may be seen 'belly-up'.

Sometimes this may last only a few days, sometimes longer. Usually, the fish will continue to eat and move around the pond, and thus you can be assured that they are in no distress. However, if a fish is motionless, then this may be a sign of further disorders (usually stress-related or stress-induced) and you would be advised to isolate the fish and to check the general condition of the water.

Swim bladder problems are believed to be brought on by a spasm which occurs in the controlling muscles and may lead to the bladder collapsing. If this happens the walls will adhere to each other and may not re-inflate. An additional cause of problems could be a systemic infection, possibly caused by stress (again, as a result of

temperature fluctuations); a prophylactic treatment may help to alleviate this and associated problems.

Wobbly pagoda

Here's a tip which might be of interest to Kot keepers who are rather keen on collecting Japanese artefacts as an adjunct to their hobby. Japanese lanterns and pagodas have become a popular addition to the pondside scene, but they can be extremely heavy.

So, when siting such ornaments, especially if on a raised bed (perhaps the rockery adjacent to the pond), do ensure that you provide adequate foundation on which to stand the ornament. Dig a reasonably-sized hole and fill it with concrete, topped with a broken slab. This will help to ensure that the weight of the ornament will not cause the soil below to compact and, eventually, to turn a magnificent pagoda into a leaning tower of Pisa!

Something different

Now that the weather seems to have settled down and it appears that, in the UK at least, we are in for a half-decent summer, I have stocked a small ornamental pool with a number of Red Shiners, *Cyprinella (Notropis) lutrensis* (with the kind assistance of Worldwide Tropicals of Glasgow).

These attractive fish are one of my favourites among the 'non-standard' coldwater fish and make an exciting alternative. The term coldwater really is a misnomer here ('temperate' would be far more appropriate) as it originates from North America and enjoys temperatures around 66-70°F (c20°C).

Therefore, as the summer subsides and temperatures drop, I shall remove the fish to an indoor aquarium, where they will be kept until I can be sure of a further warm summer next season. [See also last month's excellent A&P article on this species by Belgian aquarist Jean Lambinon, Ed.]

Little is made of the 'non-standard' coldwater fish, generally, so do let me know of your 'alternative' varieties for a future Jottings.



MARK HARRIS

Inaccurate Box Turtle report



FROGS AND

By JULIAN

On 29 May, 1994 the *Sunday Mirror* began a campaign to try to stop the importation of Box Turtles from the USA into Britain. These chelonians belong to the genus *Terrapene* and two species, *T. carolina* and *T. ornata* and six subspecies are recognised as inhabiting North America.

The article in the *Sunday Mirror* described some extreme conditions which are alleged to have occurred prior to the transportation of consignments of these reptiles as air freight.

Unfortunately, the report contained serious inaccuracies. For example, two photographs of a totally different species, the Red-eared Slider (*Trachemys scripta elegans*), were used in this tabloid item. The pictures clearly

confidence. The unreliable photographic evidence has cast doubt on other information presented in this *Sunday Mirror* special investigation.

Two great books

Blandford, a division of the Cassell group, have recently published two fascinating books about different aspects of herpetology.

1 **The Reptile and Amphibian Keeper's Dictionary** has been written by David C Wareham. The book is 248

pages in length and is subtitled *An A-Z of Herpetology* — it begins with Abdomen and ends with Zygote.

In total, there are more than 2,000 concise and informative explanations of biological terms. Many of these relate to anatomy, ecology and husbandry, subjects common to other animals and not just encountered in literature specific to reptiles and amphibians. There are also more than 100 black and white diagrams which illustrate some of the definitions and terminology, so providing extra information.

In addition to the explanation of

biological terms, this dictionary has a two-page preface, followed by three pages of abbreviations from AAZPA (the American Association of Zoological Parks and Aquariums) to WWF (the Worldwide Fund for Nature). David Wareham is curator of the Cannon Aquarium and Vivarium at the Manchester



A true Box Turtle from North America with a shell length of nearly four inches and distinctively marked in dark brown and yellow.

showed ACTIVE bright green 'hatchling' freshwater sliders, approximately one inch in diameter. However, they were claimed to be 'four-inch turtles which were being hunted to extinction'.

Surprisingly, these totally incorrect pictures were supplied by TRAFFIC-Europe (Trade Records Analysis of Flora and Fauna in Commerce).

Ironically, the *Sunday Mirror* article ended with a quotation by an expert from the British Institute of Herpetology. He said, "Pet dealers often don't know what kind of turtle they are selling".

It would appear that this investigation was equally uncertain about the species, size and age it was reporting!

Although no one wants to promote an inhumane trade which causes the death of wildlife, inaccurate and sensational journalism which includes quotations from high-profile conservation organisations does little to inspire



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FRIENDS



SIMS

University Museum and his book clearly demonstrates a thorough working knowledge of herpetology. At £15.00 this very informative hardback represents good value and I highly recommend it. ISBN: 0-7137-2318-1.

2 *Chameleons: Nature's Masters of Disguise* is a particularly colourful book which certainly does justice to this family of spectacular reptiles. The text is written by James Martin and the photographs have been taken by Art Wolfe.

This book, 176 pages in length, is divided into sections rather than chapters. The first section — Chameleon Basics — is the

longest. The 50 pages cover many topics, including geographical distribution, classification, anatomy, colour and growth. Black and white diagrams and colour photographs illustrate the different crests, casques, horns and lobes used to identify chameleon species.

The second section provides details of four species which demonstrate particular adaptation to different environmental conditions. The Namaqua (*Chamaeleo namaquensis*) lives in the semi-arid and desert regions of southern Africa, including the Namib Desert, one of the driest places on Earth. In contrast, *C. parvulus* lives in the humid 'jungle' vegetation around the northern coast of Madagascar.

C. hoehneli lives on the upper slopes of Mt. Kenya in east Africa. This inhabitant of high-altitude hardwood forests is a most unusual reptile because it can tolerate cold environmental conditions which would kill most other chameleons overnight.

The African Dwarf Chameleon (*C. pumilus*) is among the most colourful of the Chamaeleonidae family. It is also one of the most primitive members of this group, is totally arboreal and has a natural distribution along the southern tip of Africa.

Other sections in this informative book include: Chameleons in Captivity, and two appendices. The first shows two different methods by which these reptiles are classified. The second lists the world's chameleons, providing scientific name, description, distribution and the year each species was first described. There is also a four-page glossary, a bibliography

and indices to common and scientific names.

This Blandford hardback book is illustrated with 59 colour photographs which admirably support the text, together with several diagrams and charts. Anyone interested in herpetology should certainly make enquiries about *Chameleons: Nature's Masters of Disguise*.

Publication price £16.99 ISBN: 0-7137-2339-4.

HERP FACT Frog parasites

Frogs usually contain several different types of microscopic invertebrates which live as parasites in their gut. Without microscopic examination, the presence of these parasites is not always detectable, as most seem to cause little damage and no symptoms of disease to their amphibian host.

Such organisms, which are dependent on other species, are known as obligate parasites. They are actually 'obliged' to live as parasites to obtain food. The best adapted parasites cause little or no damage to their host. In fact, if an obligate parasite causes the death of its host, then it will also die.



Opalina ranarum under the microscope. There are rows of cilia on the outside and numerous nuclei inside.

Some of the obligate parasites which inhabit the gut of frogs are Protozoa. These invertebrates are often described as "single celled animals", although the term "acellular" is more accurate. This is because the body is not divided into cells.

Opalina ranarum is an example of a parasitic protozoan found in the wet environment inside the hind gut (the rectum) of frogs. *Opalina* is a large protozoan, growing to a length of between 0.4 and 1.0mm. The acellular body is flattened and oval in shape. Each of these protozoa are uniformly covered in rows of cilia which regularly bend to bring about the typical spiral swimming movement. Numerous similar sized nuclei are present within each *Opalina*.

Soluble nourishment is absorbed through the surrounding outer membrane as this parasite has no mouth or gullet through which solid particles of food can enter.

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out and about

by Dr David Ford
— Aquarian
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Innovative A of A Show

The Association of Aquarists (A of A) are a national federation of fish clubs with most of their support in the south, hence they have traditionally held their annual show in southern England, at Kempton Park and Sandown Park racecourses. Problems with sponsorship meant that the 1993 show never took place and the committee discovered that this affected membership. The national Open Show is one time when all members, both individuals and clubs, can get together to discuss fishkeeping and plan for the future of the association.

It was therefore decided that 1994 would see a national show, but they wanted to take the opportunity to make it an innovative show... a new venue, new traders and a different way of showing.

First for Dunstable

The new show was called The European Aquatic Fair, reflecting the fact that 11-12 June was the weekend of the European elections. As Malcom Goss, Chairman of the A of A said, it is planned to make future shows pan-European affairs. There are many well-known aquarists in Germany, France and Holland, but now the Eastern countries have opened up, there must be many experienced aquarists in Russia, Poland, Hungary and so

Best Fish in Show was this excellent Red Shiner.



on, who can contribute to the Fair.

The venue this year was the Queensway Hall, a huge centre that sits like a landed flying saucer in the middle of Dunstable town centre. With its many facilities, restaurants, bars, a 7,500-square foot main hall, 3,500-square foot foyer and upper floor with lecture rooms and hospitality suites, it is a popular venue for regular exhibitions such as collector markets and craft fairs.

The main hall housed the club exhibits and the new feature was that no tableaux were allowed; each society had to put on an information stand instead. There were 12 of these, ranging from freshwater fish of North America (by Tongham AS), to Killifish displays (West London Killifish Association), plus many species of catfish (by the Catfish Association of Great Britain, Thames Valley Catfish Association and Northants District Catfish Group).

Although it cost £2.50 to enter (£1.50 children and seniors) the money was recovered by buying the many show offers from no fewer than 20 traders!

In addition to the aquatic trade stands, innovative displays were a feature, with stands that sold fossils, dried flowers, jewellery and some of the most magnificent Bonsai trees ever seen at an aquarium show. The latest aquatic books were also there, as were rare Livebearers (such

as the *Xiphophorus multilineatus* Long Sword Form, at £25 a pair), Rainbow Darters, MadToms and true albino Corydoras (*C. paleatus*), all brought over from the USA.

Best in Show

The best club display was judged to be the information stand by **Bracknell & DAS** who were awarded the Su Pollard Trophy. The **Best Fish in Show** was a colourful Red Shiner, *Cyprinella (Notropis) lutrensis*

Instead of tableaux, societies set up information stands. Water quality was so good in some of the furnished aquaria, that some fish (these are White Cloud Mountain Minnows) actually spawned!

A social occasion

Visitors to the show had two areas where to sit and discuss aquatic things, with food and drinks available, plus four lectures each day in the lecture theatre. These ranged from Light & Sound displays (**Gina Sandford** and **Brian Walsh**) to Fish Feeding (me), Amazon trips (**Dave Sands**) to Herpetology (**Don Freeman**). Species were covered by **John Dawes** (the Dragon Fish), **Mary Bailey** (Cichlids) and **Malcolm Barnecoat** (Reptiles).

On the Friday evening, exhibitors were given a Disco dance get-together by **Ferdie-Dee**, the clown (who also kept the children amused during the Show). On the Saturday evening, the A of A committee and invited guests had dinner at a nearby hotel called the Old Place Lodge, where most traders and exhibitors stayed at a special rate for the show period.

To make the show viable,



owned by **Dave Caesar** of **Tongham AS** in their display of North American fishes.

The two main displays of fishes were the first round of the **A of A SuperBowl** competition and a new idea — **Fishes around the World**, where each competitor has to submit five fishes, one from each continent of North and South America, Europe, Africa and Australasia.

The highest pointed winner was **Nigel Ridley** of **Milton Keynes AS** who swept the board in the Aquarian-sponsored **SuperBowl**. The Tetra-sponsored **Furnished Aquaria** was won by **Chris Ralph** of **Basingstoke AS**.

All these and more prizes were handed out by **Dave Sands** of the Aquarian Advisory Service.

2,000 paying visitors were needed and, in fact, 2,200 attended what was an exceptionally good aquatic show. However, the centre is capable of accepting more than twice this number, and if the A of A are to make it a true European Fair, with invited speakers and aquarists from Europe, better advertising is needed to fund the high costs of such a venture. The area is still suffering from the recession, so more buyers are needed by the traders to cover their costs, too.

If the A of A address these problems for 1995, we can expect The European Aquatic Fair to be placed on the aquarists' calendar, and traders and fishkeepers alike will be saying "See you in Dunstable".

Most pondkeepers have at some time or other come face to face with the 'pea soup syndrome' — summer is at its height, the deck chairs are out in the garden, and the pond water is as green as the lawn!

This embarrassing and frustrating state of affairs is the result of an explosion of microscopic plants, or phytoplankton, a group of algal species disposed to spending their time floating around in the open water of ponds and other bodies of fresh-water.

Widespread problem

The phenomenon is not restricted to the garden pond because, under certain conditions, it can also occur in lakes and reservoirs, where it causes a correspondingly larger problem. While the pondkeeper has 'only' to contend with the derision of family and perhaps neighbours, the lake or reservoir manager soon gets to hear from anglers, conservationists and a variety of other irate groups.

Decreased water clarity is usually the main problem of the syndrome for the pondkeeper, and this can also cause problems for the lake manager. However, perhaps more serious in lakes are the effects of subsequent oxygen loss when the phytoplankton dies and decomposes towards the end of the summer, which can cause extensive fish kills.

In addition, such phytoplankton-rich water is likely to need extensive and expensive physical or chemical filtration before it can be used as drinking water. For the reservoir manager, this amounts to more than the purchase of a power filter and fortnightly rinsing of its sponge!

The ultimate cause of the problem is that there are too many nutrients, particularly phosphates, in the lake water, with precisely what constitutes 'too many' depending on numerous aspects of the lake in question. The ideal solution is to stop the nutrients from going into the lake, or at least reduce the amounts entering the system.

Where the main source of this pollution is a discrete point, such as a sewage works, improved treatment, typically incorporating nutrient-stripping, can be used to combat the problem. However, treatment is not so easy when the nutrients come, not from a single, identifiable sewage works, but from a general runoff from surrounding fertiliser-rich agricultural land.

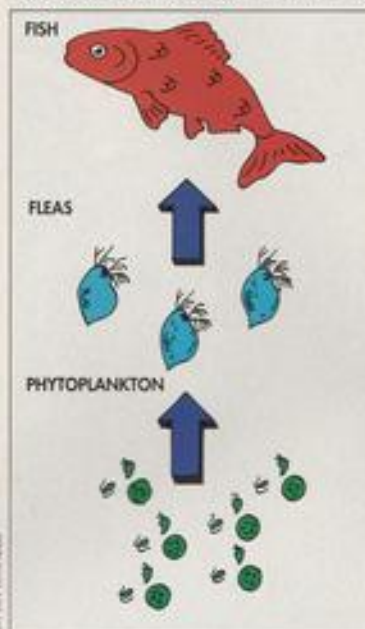
The pondkeeper's options are also limited due to a commitment to a continual introduction of nutrients into the garden pond in the form of fish food.

Even if the addition of new nutrients to the lake is stopped completely, there is likely to be several decades' accumulation

of nutrients in the water and bottom sediments which will still proceed to be recycled within the lake for many years to come. Such nutrient-rich mud can, of course, be taken out of the lake, a technique which has been used a few times around the world, but it is only practical in relatively shallow lakes and, even then, is extremely expensive. Many pondkeepers practise a similar technique with the annual clean-out, but this is a very disruptive process.

The above courses of action are physical or chemical responses to what is essentially a biological problem. Lakes, reservoirs and ponds are not simple chemical reactors, and so their pollution ecology is more complex than may be suggested by experiments performed in test tubes. The relationship between nutrient concentration and phytoplankton abundance is, at least, sometimes strongly influenced by the biology of the latter and associated organisms, including fish.

In order to begin to understand the complex interactions occurring between nutrients, phytoplankton and fish, we need to digress slightly to the scientific discipline of lake ecology, or limnology, as it is more properly known.



Typical phytoplankton — *Daphnia* — fish food chain.

FISH, FLEAS AND

PHYTOPLANKTON

Dr Ian Winfield goes in for a bit of back garden 'biomanipulation' in an attempt to get rid of 'green water' problems in ponds.

Bottom-up or top-down?

The food chain of a lake, reservoir, or even pond, generally starts with nutrients, carbon dioxide and light. These basic ingredients are used by the plants of the water body, including everything from microscopic single-celled algae to strands of Canadian Pondweed (*Elodea*) as long as your arm, to produce organic material in the form of growth and reproduction.

Some of the material produced in this way by the phytoplankton of the open water is then consumed by zooplankton, which are the first link of animals in the food chain. The zooplankton contains many different creatures, but a familiar example, and one which is particularly important in this story, is the waterflea *Daphnia*, which many aquarists and pondkeepers have met as a summer live food in the local shop or pond. In turn, *Daphnia* and its relatives among the zooplankton are eaten by fish. In some lakes, even adult fish feed mainly on these tiny animals, but in most, they are consumed in significant amounts only by young fishes, perhaps in just their first weeks of life.

Some limnologists argue that the numbers of organisms at the various levels of

the food chain are controlled by supplies of their nutrients or food, i.e. the control of the chain is 'from the bottom up.' Others contend that food does not usually limit the populations, rather their abundance is constrained by the effects of their predators, i.e. the control of the chain is from 'the top down'. Although there is considerable argument between the 'bottom-up' and 'top-down' camps, it does appear that, in some lakes at least, the fish populations have a controlling effect on other aspects of the lake's fauna and flora.

The measures of controlling phytoplankton growth described above may therefore be described as forms of 'bottom-up' control, because the problem is being tackled from the nutrient side. As noted earlier, such techniques are often difficult to deploy effectively and are usually expensive. In recent years, the interest of many limnologists has turned to the alternative approach of controlling the phytoplankton using 'top-down' methods by deliberately altering the food chain. Not surprisingly, such manipulation of the biology of the lake has been christened **biomanipulation**.

Biomanipulation

So, in a 'top-down' lake, at least in theory, if the numbers of *Daphnia* can be increased, the water will become clear and the algal soup will become a thing of the past. Again in theory, it should be possible to achieve this state of affairs by getting a really big *Daphnia* culture going and throwing millions upon millions of water-fleas into the lake. However, a culture of sufficient size is impossible on practical grounds and, even if someone did find a big enough plastic bin, what would probably happen would be that the fish would have a field day and eat all of the *Daphnia*, taking us back to square one!

A more practical alternative to directly increasing the *Daphnia* is to remove the fish, and so indirectly allowing the *Daphnia* population to increase by virtue of its own reproduction. This has been done in numerous lakes and reservoirs around the world and, in the right circumstances, most importantly where the problem phytoplankton are edible (well, edible to *Daphnia*), it does work.

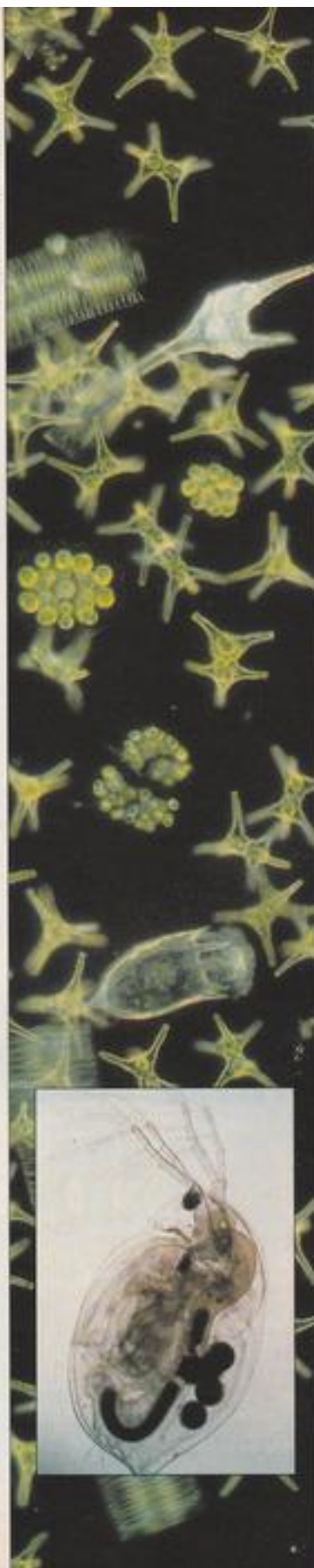
Magic! A green solution to a really green problem. This is biotechnology at its best and such so-called biomanipulation has been the subject of much research and application around the world during the last few years. Not surprisingly, it has also heated things up between the 'bottom-uppers' and the 'top-downers'.

However, you may have noticed a slight problem: things are not too brilliant for the fish. The elimination of fish populations also does not go down too well with fishermen, nor I suppose would it with the average pondkeeper. In addition, if you think getting the last fish out of a tank is difficult, you should try getting the last fish out of a lake or reservoir!

Daphnia — phytoplankton eater par excellence.

DR IAN WINFIELD

INSTITUTE OF FRESHWATER TECHNOLOGY



It is just about impossible to remove a fish population completely, leaving the biomanipulator with a few fish which find themselves in fishy heaven with virtually unlimited food supplies. As a result, individual growth rates increase and more eggs are produced, quickly returning the fish abundance to its former level and the biomanipulator back to square one with the addition of a few more grey hairs.

Having shown that biomanipulation can work, researchers are now directing their efforts towards achieving stability with a gusto reminiscent of the search for the Holy Grail.

Light refuge

Some biomanipulators are now becoming more subtle in their approach. Instead of initiating the mother of all clean-outs, they are looking at the possibilities of providing the *Daphnia* with at least a partial refuge from the attentions of the fish. This way, the *Daphnia* are happy, the fish are happy and the anglers are as happy as anglers ever get. The only losers are the phytoplankton. Good!

The problem is letting the *Daphnia* get at the phytoplankton — which, by and large, are restricted to the well-lit, upper part of the lake — while stopping the fish making a meal of them. In many lakes, *Daphnia* reduce their chances of being eaten by spending the day down in the dark layers where the fish cannot see them, and coming up to the surface at night to feed on the phytoplankton which hours earlier were basking in the sunshine and photosynthesising to their hearts' content.

In lakes dominated by fish such as trout (*Salmo* species) or North American Sunfish (*Lepomis* species) which need relatively high light levels to be able to feed on *Daphnia*, the deep water thus acts as a sort of refuge. In many lakes with algal problems, however, the dominant fish species are often cyprinids (Carp and their relatives) and other so-called coarse fishes which can often feed even at the very low light levels found near the bottom of lakes during the day. Cyprinids also usually dominate the garden ponds of Europe and elsewhere in the form of the Common Goldfish (*Carassius auratus*). Consequently, a light refuge for *Daphnia* is unlikely to exist in such water bodies. What then?

Physical shelter

Well, the most recent research on biomanipulation has been looking at the practicalities of providing a physical refuge for *Daphnia* in which they can take shelter during the day and then come out at night to feed on the phytoplankton of the surface water. In unpolluted lakes, higher plants such as *Elodea* or water lilies may play this kind of role, although the situation is complicated because, in certain cir-

cumstances, they may also offer a refuge for small fish themselves.

Recall that in a lake during the summer, many of the fish feeding on *Daphnia* will be juveniles of only a few centimetres in length, which have their own predators to avoid! In such circumstances, a structure may be required which excludes anything bigger than a few millimetres, but this may be slightly easier for the pondkeeper with a non-breeding population of reasonably-sized goldfish!

The interactions between phytoplankton, *Daphnia*, fish and structure may also be involved in a form of schizophrenia shown by shallow lakes which have alternative stable states of clear water and lots of higher plants, or turbid water and few higher plants.

In the former lakes, the structure afforded by the higher plants may enable the balanced coexistence of *Daphnia* and fish, consequently allowing the 'fleas' to keep the phytoplankton in check. If the lake somehow gets pushed into the 'pea soup' version by phytoplankton, the higher plants cannot get enough light to grow and so die off, while the *Daphnia* find themselves victims of an aquatic St Valentine's Day Massacre, leaving the phytoplankton in algal heaven, and so a vicious circle begins.

Pondkeeping possibilities

This is all very interesting, I hope, but is it any help to the pondkeeper with the pea-green pond? Well, I think that it may be possible to biomanipulate a typical garden pond and suggest it is worth a try if you do not fancy the alternative of going for a hi-tech and hi-cost filtration system like a Koi keeper with attitude! I will also assume that a complete fish removal is not on the cards, although, to be fair to the spouses of this world, it has to be admitted that this is an option.

Essentially, the pond situation parallels that of a tiny lake heavily stocked with fish, with nutrients being added to the system all the time in the form of fish food. Only a small proportion of these nutrients become permanently tied up in the bodies of the fish, leaving large amounts available to the phytoplankton. The result is something of which the Research Department of Campbell's would be proud.

The pond is also relatively shallow and typically stocked with goldfish which, for all their homeliness, have visual and other senses on a par with those of Superman, and so low light is unlikely to offer a refuge to any *Daphnia* introduced to the system. I will also assume that the pond has few higher plants such as *Elodea* or 'Crispa' (*Lagarosiphon*), due in large part to the shading effects of the phytoplankton.

Incidentally, should your neighbour possess a pond which is somehow happily locked into the clear water, abundant higher plant state, I suggest that you dis-

cuss the possibility of a house swap. Failing that, a bucket of snails or a pair of coots would be justified!

Returning to near sanity, the introduction of an artificial physical refuge, coupled with an initial 'seeding' of *Daphnia* may be the answer. The best species of 'fleas' for the job is probably *Daphnia magna* the 'Giant' Waterflea, which can usually be obtained at your local aquarists' shop during the summer months and is ideally suited to the conditions of a small pond.

The refuge itself offers plenty of scope for individual expression on behalf of the fishkeeper, as long as it lets *Daphnia* in and keeps the fish of your pond out. Unless fish spawn in the pond, something with a mesh size of around 1cm should do the trick, bearing in mind that anything finer may become clogged by the inevitable growth of blanket weed, or *Potamogeton*, to give it the classy name. Such a refuge, or refuges (refugia?), should ideally cover a good part of the pond, because although the *Daphnia* will be quite capable of the required up and down migration, to the best of my knowl-

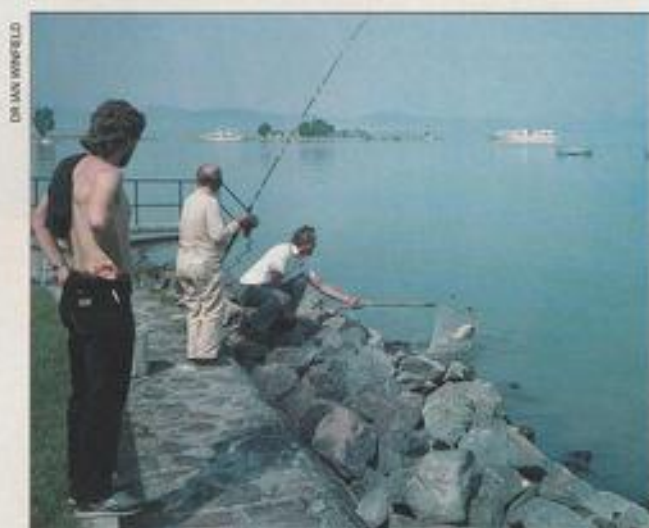
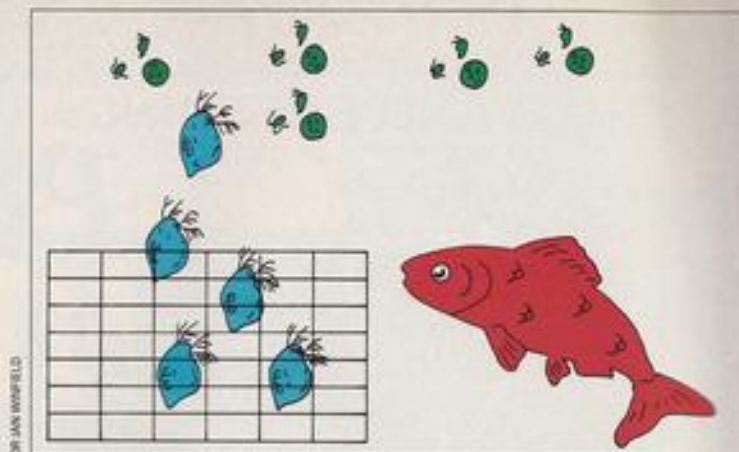
edge, they do not home!

Of course, the refuge will, in any case, be at the bottom of the pond, well out of view of the casual observer, and so aesthetics will not be a problem. If the refuge is made from dark material, it should continue to remain invisible even when (remember, be positive) the water becomes as clear as gin. When the pond gets to this fine state of affairs, the introduction of some real plants could also be considered.

No guarantee

Just as with with biomanipulation in lakes and reservoirs, there is no guarantee that the above pond system will work. If there was, I would be in the business of designing a range of refuges for sale to the Park Departments of the world and looking forward to a rich retirement.

Nevertheless, an attempt at back garden biomanipulation would be easy and inexpensive. All you have to lose is your dignity, but then that probably went the same day that the phytoplankton arrived! **ATP**



A *Daphnia* refuge or cage would protect the fleas from predators.

Lake Balaton in Hungary — a site of much research on fish, fleas and phytoplankton.

KEEPING AND BREEDING:

If you are looking for a colourful, 'easy' goby that you can spawn... again... and again... and again, look no further. Kevin Webb has the perfect candidate.

Photographs by the author

I was introduced to this beautiful fish in 1984 and since then, I have always found tank space for it. Fortunately, my enthusiasm for the Peacock Goby is also shared by a few friends because of its size, colour and behaviour. Between us, we have therefore been able to keep our stocks going from generation to generation for many years simply by replacing each other's losses.

Sex differences

Tatanorhina ocellicauda is a small freshwater goby from Papua New Guinea. The males differ from the females by having a cephalic hump (a hump on the head). The female's head is quite small in comparison. Females also have a black line along the lower edge of the anal fin.

However, I have found that on occasions, some of the females that I have raised from fry, have had this line missing. I feel that these fish should not be used as breeding stock, thus ensuring that this trait is not passed on.

Surprise spawning

The very first time I was aware that my fish had bred was when I could not find the male. He had been missing for several days, so I decided to remove the rocks which formed a cave system.

I expected to have to take out the remains of his body but found, instead,



The black 'eye' or ocellus at the base of the caudal fin — responsible for the ocellicauda part of the name — is clearly visible in this female.

A Peacock From Papua



A spectacularly coloured male.

that not only had he not died, but he was guarding a batch of eggs which were stuck to the underside of a rock!

Planned breeding

Nowadays, I have several 18 x 8 x 8in (45 x 20 x 20cm) aquaria with breeding pairs. They all have elaborate rock cave systems to give them plenty of scope to spawn. The water in these aquaria has a temperature of approximately 76°F (c24.5°C), a pH of 7.3 and GH (Hardness) of 33; they are filtered by polyfilters.

The fish are conditioned on bloodworm and other live foods and I still use the same system of waiting until the male disappears. I then look to see where he has spawned and usually take out the rock and place it in one of my smaller breeding tanks with plenty of aeration.

Occasionally, my Peacocks have spawned on the side of the aquarium glass. I have even spawned them inside clay plant pots and the shell of a coconut.

Eggs and fry

The eggs are transparent at first and eye up within a day or so. They seem to be attached to the rock by a thread, and shimmer with the movement of the water. It takes about a week for the eggs to hatch. The fry are also transparent and about 4mm long (0.2in).

They usually lie on the bottom of the tank and make jerky intermittent attempts at swimming, often gliding back to the aquarium floor just like a leaf or piece of paper... apparently totally lifeless. This

- #### PEACOCK GOBY FACT FILE
- 1 *Tatanorhina ocellicauda* is commonly known as the Peacock Goby or Peacock Gudgeon.
 - 2 The males and females both grow to a size of 2.5 in (1.8in) (standard length) — from snout to base of tail.
 - 3 Males have a large hump on their head.
 - 4 Females have a black line along the lower edge of the anal fin.
 - 5 Peacock Gobies can make good companion fish, but probably are better in a species tank.
 - 6 They are undemanding with regard to water conditions: a temperature of around 75°F (c24.5°C) a pH of 7.3 and a GH of around 23 suits them fine.
 - 7 They prefer live foods such as bloodworm, Daphnia, brine shrimp, glassworm, Grindal worm and white worm.



Spawning under way. The fish nearer the camera is the male.

condition lasts for about a day.

The fry are fed on infusoria at first. After a couple of days, a very small quantity of newly hatched brine shrimp is added to the aquarium. If I can see the fry with red stomachs, I then know that they are ready to take newly hatched brine shrimp and micro-worm. After about a week or more, they become little yellow replicas of their parents.