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'Know-it- all-itis' at large

Have you ever experienced a closed mind... at close quarters? I have — especially this year it's frightening.

I don't know why it is but, over the past ten months or so, I've encountered more victims of the sad affliction of 'Know-it-all-itis' (omniscience) than at any other time I can remember. Please allow me to explain.

If I were to edit a particular issue of A&P and discovered that I hadn't learned anything in so doing, I'd be devastatingly disappointed. I'd also be extremely worried, because such a situation is, quite simply, not on. Every single month, without exception, I learn something new (usually, a great deal)... and I know that I always will. One month, it could be that a particular cichlid is now *Herps* instead of *Cichlasoma*, or that a species of livebearer produces 60 fry every four weeks, instead of 20 every eight weeks... or whatever.

I believe that this is a sign of possessing a mind that is, at least, reasonably 'open'. I therefore have great problems dealing with the opposite condition... and it is this that I have recently encountered with disconcerting regularity.

I have — I kid you not — been duly informed by several aquarists, that they won't read or buy an aquatic magazine because "there's nothing that (they) can learn". Can you believe this? Nothing? Not even that there could just possibly be some fun somewhere among the more than 20,000 known species that might be every bit as fantastic as their favourite catfish, or barb, or cichlid, or Koi, or butterfly...?

Come on guys (yes, they've all been males)... open up. Grow up! How can such people conceivably say that they know everything? How can they possibly have a mind that is so closed that it will refuse to accept that there's no way that they can be genuinely omniscient? Personally, I find this character trait baffling, to say the least... and very sad. How do you feel about it? Have you come across such instances lately? Please drop us a line — we'd love to know.

John Dawes

The Tiger Barb (*Barbus tetrazona*) has long been, and still is, one of the most popular freshwater tropical fish; this, despite its reputation as being a troublesome character in the community aquarium. This reputation is largely unfounded, and mainly due to our ignorance with regards to the species' requirements.

Tiger identikit

Before looking at the care, maintenance and breeding of this fascinating fish, it is worth examining exactly what it is and what it is related to.

The Tiger Barb is a member of the genus *Barbus*. This genus is a large and widespread grouping of fish, ranging from the large Barbel (*Barbus barbus*), a common fish in many UK rivers, to the tiny Cherry Barb (*Barbus titzei*) from Sri Lanka.

The genus *Barbus* includes many species which are not believed to be directly related, if you examine their evolutionary history. Because of this, a number of attempts have been made to break down the genus into smaller groups.

One suggestion was that it could be divided on the basis of the number of barbels into the genus *Puntius* (with no barbels), *Capoena* (with 2 barbels) and *Barbodes* (with 4 barbels). However, further examination showed this was not an adequate solution. The Tiger Barb, having no barbels was placed in the genus *Puntius*, according to this classification and the name *Puntius tetrazona* is seen in some books on fishkeeping.

Origins

The Tiger Barb originates from Indonesia, Borneo and Sumatra, where it is found in slow-moving rivers and streams. Fish that are available from aquatic shops are all now bred in aquaria in fish farms in South East Asia.

Selected breeding has resulted in several colour varieties, of which the most popular are the green and albino forms.

Albino Tiger Barbs are very popular, but care should be taken when selecting them to avoid individuals without a gill cover. This genetic deformity occurs in a small number of fry in most spawnings of this variety.

Care

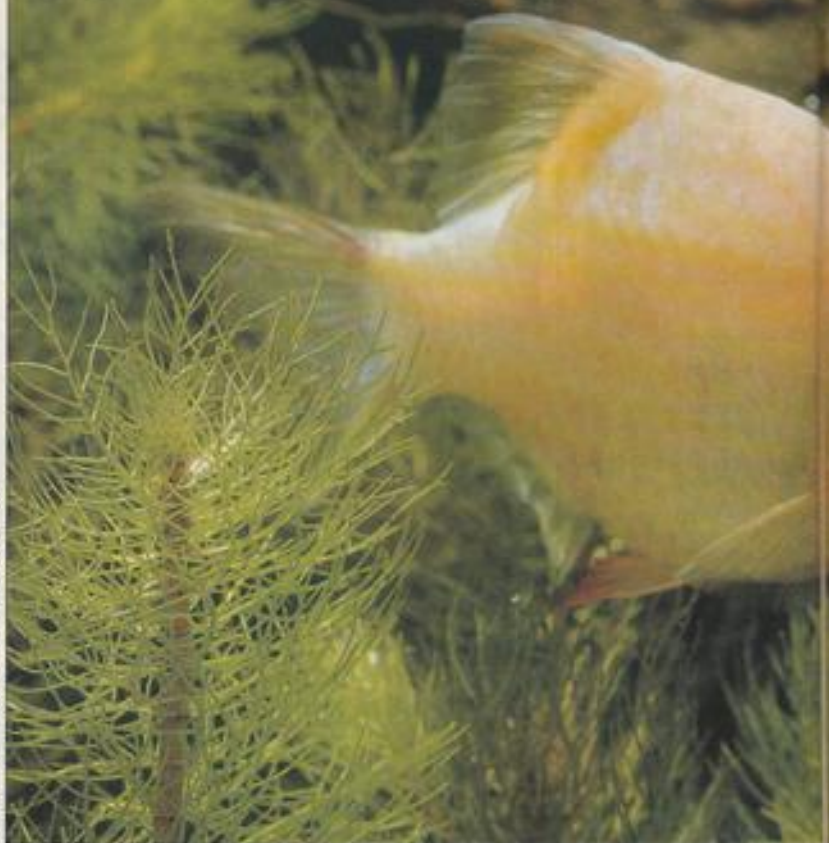
Looking after Tiger Barbs couldn't be more straightforward. They are hardy, will tolerate a range of water conditions and readily accept dried foods.

A temperature of 75-82°F (24-28°C) is

Albino Tiger Barbs are very attractive and require the same conditions as the other types.

TROUBLESOME TIGERS?

Tetra's Dr David Pool sets the record straight with regard to the often misunderstood, but highly desirable and delightful Tiger Barb.



HARRY GIBBER/FLORIDA TROPICAL FISH FARMS ASSOCIATION



HARRY GIBBER/FLORIDA TROPICAL FISH FARMS ASSOCIATION



The Champagne Tiger Barb first appeared in 1989. Superficially, it looks like an albino, but note the lack of red in the fins.

ideal, as is a pH of 6.5-8.0, GH (General Hardness) of 2-10°dH and a KH (Carbonate Hardness) of 1-6°dH.

They are sensitive to elevated levels of pollutants, so a good filter and regular partial water changes are advisable. Some water movement is also advisable, both to ensure there is plenty of oxygen in the tank, and because Tiger Barbs enjoy swimming in and out of the water current.

Tigers can live for up to 4-5 years in aquaria, which is longer than they live in the wild. As they age, they start to lose their colours, and can become more solitary.

This is an active species of fish; therefore, provide some areas of open water in



A shoal of Green Tiger Barbs. When kept in numbers, fin-nipping is reduced.

the aquarium. The ideal is a mixture of open areas and some densely planted zones. These planted areas will be used during spawning, but also allow the females to escape from the males when necessary.

An aquarium of at least 24 inches (60cm) in length, and preferably larger, is advisable. Although Tiger Barbs are not large, growing to around 3in (7.6cm) they should be kept in groups of at least four individuals. In the wild, they live in much larger shoals and are constantly searching for food, chasing or displaying to each other. This behaviour will be reproduced in the aquarium if the fish are kept in small groups.

However, if kept individually, or in pairs, they can become boisterous and indulge in chasing and nipping the fins of the other fish. It is just this behaviour, resulting from them being kept in too small numbers, that has given them their reputation as 'bullies' and 'fin nippers'.

Within the shoal, individual fish will quickly establish a pecking order. Usually, the largest fish is at the top of this order, and the smallest at the bottom. Once established, the pecking order prevents anything more serious than the occasional skirmish. However, a period of chasing and displaying will occur whenever new Tiger Barbs are added.

Feeding and breeding

Tiger Barbs are omnivorous feeders, meaning that they consume a mixture of plant and animal material. In the wild, the majority of their diet is made up of insect larvae, fry and aquatic invertebrates. A good-quality flaked or granular food is therefore ideal in the aquarium. This can be supplemented with colour-enhancing foods and freeze-dried foods on a more occasional basis.

Tigers are active fish, generally, but are particularly so at feeding time. In view of this, they should be fed away from more timid species — or the food should be spread across the surface so that they all have a chance.

Given suitable conditions, Tiger Barbs are very easy to breed, and will often do so in a community aquarium. Under such

conditions, most of the eggs will be consumed, so it is much better to separate the parents into suitable breeding quarters.

When the fish are mature, distinguishing males and females is relatively simple. The males tend to be smaller, thinner and more brightly coloured — particularly their fins. The female is much fatter, particularly when full of eggs and ready to spawn.

One male to one female, or, better still, two males to each female, will generally result in a successful spawning. These fish should be conditioned on good-quality foods for several days before being introduced into the breeding tank. This should comprise of a 18-24 inch (45-60cm) long tank decorated with bunches of fine-leaved plants.

If added in the evening, the parents will often start their courtship display and chasing the following morning at dawn. Up to 200 eggs are released among the plants. After they have finished spawning, the parents will start to devour the eggs, so they should be removed. If spawning does not occur within 3-4 days, separating the males and females and re-introducing them 7 days later will often work.

The fry hatch after 2-3 days and, after a further 1-2 days, are free-swimming. At this stage, they can be offered newly hatched brine shrimp and powdered foods. The fry require 4-5 feeds per day, and need to be fed in excess to ensure each one gets enough food. Regular partial water changes are therefore essential.

Tiger Barbs are good fish to add to a community aquarium, particularly a newly set up one. Their bright colours, active nature and hardiness will ensure that they become one of the centres of attention within the tank. But remember the warning about numbers to keep: at least 4, if you don't want them to live up to their troublesome reputation. **AAA**

This is the wild-type Tiger Barb which, despite the appearance of other forms over the years, is still a strong favourite.

FACTFILE

Scientific

Name:
Barbus tetrazona

Size:
3 inches
(7.6cm)

Origin:
Borneo,
Indonesia & Sumatra

Water requirements: Very tolerant of a range of pH, hardness and temperature values. Avoid raised levels of pollutants.

Feeding: A good-quality flaked or granular feed as a regular diet. Occasional feeds with colour-enhancing foods.

Sexual differences: Males are smaller, slimmer and more brightly coloured.

Breeding: Relatively easy with 1 or 2 males to each female. Scatter up to 200 eggs among plants. Fry hatch after 2-3 days and are free-swimming one day later.



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Tomorrow's Aquarist

BY GINA
SANDFORD



Hey Jo...

Last week I received a letter from **Matt Bond**. He has been having a run of bad luck... no, that's not the right phrase, *abysmal* luck would be closer to the truth. It all culminated with **Matt and Jo Beal**, plus three of his mates, being involved in a serious car crash.

Matt and Jo have been swapping words of wisdom through **TA** for some time now, so he didn't have to wonder if I'd print the following message to Jo for him. It reads: "Just say that I'm sorry and wish that she wasn't involved, as she's one of the best mates I've ever had..."

We all hope that you all make a swift recovery.

Great TA-type book

The Fascinating Fresh Water Fish Book

By: John R. Quinn
Published by **John Wiley & Sons Ltd.**
ISBN 0-471-58601-3
Price: £9.50.

Have you ever picked up a book and thought, "Gee, I wish I'd written this!" Such is this book. Aimed at young people, it encourages them to go out and explore life in streams and rivers for themselves and guides them on the equipment and skills needed to maintain those fishes in an aquarium. We start with the basic equipment and the funda-



MIKE SANDFORD

The Scat is perhaps the best-known and most widely available brackish species.

amentals of setting up an aquarium, this chapter ending with a warning about the need to have patience before introducing fish into the aquarium.

There follows what is probably my favourite chapter: **Let's Go Fish Collecting!** This is a gem, full of tips and ideas for collecting; which nets to use and where to use them, fish traps and, of great importance, how to transport your catch home. So, while you are waiting the minimum 48 hours for your aquarium to settle, you can plan your trip, organise your clothing/footwear, make and/or check your nets and traps and ready your transportation containers. Oh, and don't forget your sandwiches and liquid refreshment!

Introducing the catch to its new home, feeding, etc. are amply covered, and the remainder of the book is devoted to the fish themselves.

At first glance, you may be dissuaded from buying this book because it deals with native North American fish but, take a closer look. The parallels between them and our native fish fauna are similar. We have Pike, Minnows, Bass, Bullheads (but ours aren't catfish; they equate more to the darters) which inhabit the same sort of environments as their North American counter-

parts, so the advice given in this book will still work for us. And don't forget, there are many species of native North American fishes now finding their way into the hobby, so you will be sure to glean some useful snippets of information about them from between the covers of this book.

Without talking down to students, it covers the need for controlled collecting, and care of the surrounding environment, while still being able to enjoy learning about this ecosystem and for them to become aware of the effects that even minor changes, such as the removal of too many plants from a river bank and the resultant erosion and excess silt in the water, can have on this delicate web of life.

A must for younger biology students, more mature biology students and their teachers. *The Fascinating Fresh Water Fish Book* is exactly that... fascinating!

Brackish thoughts

Have you ever tried keeping brackish water fish? In practice they are no more difficult than any other. The only difference from freshwater is that you use

marine salt to get the salinity about right. Usually, it is recommended that a specific gravity of 1.005 is fine. But is it? (Pure water has a specific gravity of 1.000).

When you sit and think about it, the salinity in brackish water regions, for example, estuaries, changes twice a day with the rise and fall of the tide. In pools it will increase with evaporation and decrease with rainfall — but not necessarily twice a day; it may be very saline for three or four days and then suddenly drop after a storm. All the animals cope with this change and yet we try and keep the salinity stable at 1.005.

We can create wave machines to imitate the lapping of water on stones and roots but, as far as I'm aware, we've not come up with an easy solution to the change in salinity.

I wonder what would happen if we did provide this salinity change. Maybe we would get more successful spawnings. Perhaps our fish would grow better. Who knows? Yet another of life's little imponderables.

WORMS FOR FREE

I guess you've read the usual bits and pieces in books about feeding larger fish on earthworms, but how many of you actually do it? It's such a pain digging up the dirt just to get the odd worm or two... but there are a couple of ways to overcome this.

For the first one you need to overcome your fear of picking up these slimy, wriggling creatures. After dark, on a warm damp evening, take a torch and shine it across a lawn. You should see worms about. Provided you don't approach like a herd of elephants, you can usually pick up enough for your fish's needs before the worms get a chance to pull themselves back underground.

The second method needs a little less effort. Take a piece of hessian sacking, the sort sometimes offered for lining pond baskets, and place it on the garden. Then, each day, tip all your old tea leaves on top (after letting the tea go cold!) If you don't have loose tea leaves, you can split tea bags. Provided you keep it damp, this mound of leaves encourages worms into the hessian, and all you have to do to collect them is lift the corner of the hessian and pull out the worms. Even in really cold, frothy weather, I've collected a few worms by this method.



The larvae are grown on to 10mm in this large 'larval' room.



A maze of suspended aeration lines in the high-production rearing room. Right, Bottom drain fry collecting.

CLOWNING AROUND IN THE BAHAMAS

Roger Foggitt, Tutor in Aquatics at Sparsholt College, looks at the supply of captive-bred marine fish, and at the breeding methods used, some of which could prove useful in starting, or incorporating into, home-breeding programmes.

Photographs by the author

Thanks to David Pool of Tetra UK, Sparsholt College and Godfrey Waugh of Aqualife Research Corporation, I was lucky enough to get the chance to visit Walker's Cay and see how one of the

largest producers of marines goes about breeding and rearing its fish. However, standing on the tarmac at Fort Lauderdale airport looking at our transport to the island where Aqualife's hatchery is located, I wondered if it was luck or fate!

The island itself (in Abacos, in the Bahamas) is approximately one hundred and fifty miles east of mainland Florida, so the flight took approximately forty five minutes. On our arrival, I felt consoled by the fact that I was in a seaplane, because even though we were five hundred feet up, it was easy to see that the runway had a surface on it akin to the worst piece of British road I'd ever seen. It also happens to be the ONLY road on the island and less than four hundreds yards long. The presence of a very damaged single-seater plane at the end of the runway bears a message to all those attempting to land!

Walker's Cay is approximately three quarters of a mile long, has a permanent population of about forty (other workers boat in each day from neighbouring islands) and consists of a large hotel com-

plex and marina at one end, a power station (of sorts) and the Aqualife hatchery at the other, connected by the runway I've already mentioned. It's a very disconcerting feeling when turning onto the main road/runway not just to have to look left or right for oncoming traffic, but also UP just to make sure that no planes happen to be using the tarmac at the same time as yourself.

The island is surrounded by small coral heads and reefs well within easy snorkelling distance of the shore, each teeming with marine life, a veritable aquarist's dream.

Aqualife's hatchery concentrates mainly on the production of marine clownfish, such as Tomatoes, Perculas, Maroons, Pink Skunks and Saddlebacks, mainly for the aquatics market, although they are also large producers of the Neon Goby (*Gobionema oceanops*).

Research on breeding other species for mass production, such as the Green Banded Goby, a fish indigenous only to the Abacos islands, and various species of Angelfish, is also being carried out by the company's extremely knowledgeable hatchery biologists.

The hatchery

The seawater used in the hatchery is taken, not directly from the Caribbean Ocean, as you might expect, but, to avoid large fluctuations in temperature and salinity, it is drawn from boreholes approximately thirty metres deep, just outside the backdoor.

All breeding and rearing systems rely on a total loss through-flow water supply system. The temperature remains fairly constant at 24/25°C (75-77°F) with a relatively high salinity of 35/36‰ (parts per thousand).

Before entering the building, water is first pumped through two five-metre tall 'de-gassing' towers in order to stabilise levels of dissolved oxygen and carbon dioxide, then pumped under high pressure through two huge sand filters in order to remove any particulate wastes. This also helps to remove very high levels of iron found in the water pumped from the boreholes which, up until a few months ago, was a considerable problem to the hatchery.

Egg production

Production of fish begins in the breeding room, where the pairs of breeding adults are put together, sometimes with an anemone, in a small 40-litre (c9 Imp. gal) aquarium and left to 'get on with it'. Each aquarium contains two tiles, one of which acts as a shelter, and the other as an area for the female to deposit her eggs.

All clownfish like to feel safe when breeding and will not do so in open areas; the usual spawning site in the wild is just at the base of a commensal anemone,

which gives the eggs added protection.

The tanks are checked at the beginning of each day, as the fish usually spawn at dusk. If a pair has spawned, the slate on which the eggs have been laid is left with the parents for approximately seven days, after which time it is removed and a clean replacement added to the tank. This is not altogether as easy a process as it may sound. Female clownfish are highly protective of their eggs, although parental care only lasts as long as the eggs are unhatched, and to separate a batch of eggs and an upset mature female Tomato Clown usually ends up with the 'intruder' receiving a few nasty nips!

The spawning tile is then transferred to a separate hatchery tank.

Larval production

The problem with isolating the eggs from the adults is that the pre-hatching parental care provided by the female is



At four weeks old, the fish are already large enough for selling.

removed. This usually consists of the female gently fanning water over the eggs to keep them aerated and fungus-free.

To get over this problem, Aqualife use a very cunning top secret method to keep the eggs aerated. I promised not to reveal the system used, but methods of doing this can be found in many breeding manuals for clownfish.

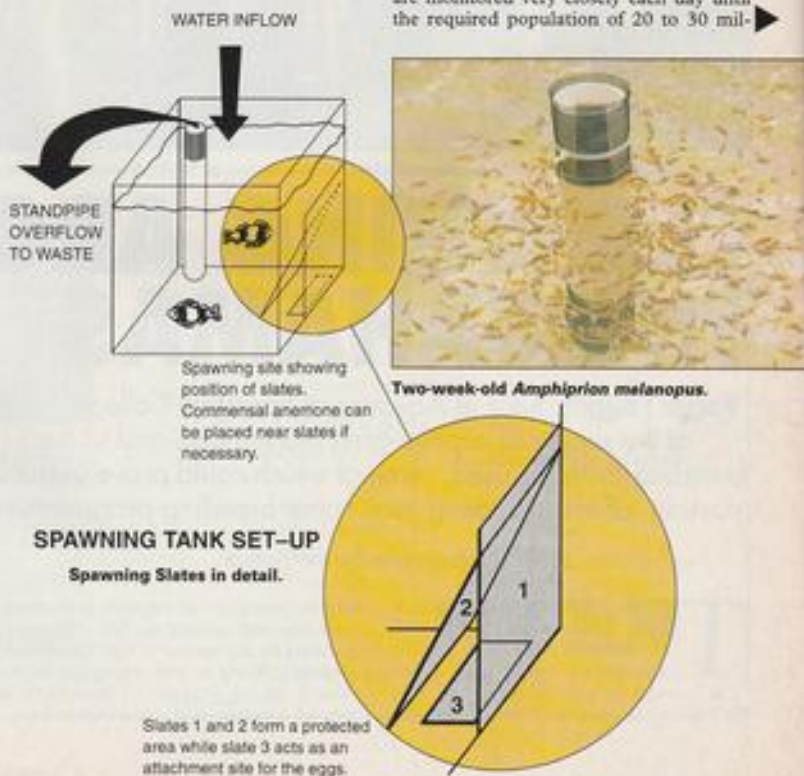
Incubation of the eggs at this stage takes about 24/48 hours and, after hatching, the larvae are left in the hatchery tanks until large enough to be moved to the larval development area.

Livestock culture

Unlike Britain, the Bahamas are blessed with a generous supply of sunshine, which is very useful, because the first stage of livestock production carried out on site is that of culturing algae, such as *Tetraselmis*.

Algal production takes place outside in large cylindrical containers known as 'sun tubes'. These hold about 600 gallons (2,700 litres) of seawater, which is enriched with fertilisers before a small amount of algae is added. This is then left in the sunshine to multiply until a rich green culture is produced.

This culture is now transferred inside the hatchery to large three-metre-square (10ft) tanks. These, once filled with an algae/seawater mix, are used to culture rotifers, which are the first foodstuff to be fed to the newly-hatched clownfish fry. The rotifers are cultured from eggs and multiply extremely rapidly, as long as food is available in the form of algae. Numbers are monitored very closely each day until the required population of 20 to 30 mil-



tion is produced after about five days. The rotifers are then transferred to a holding tank.

The other livefood used in the hatchery, particularly for the feeding of the larval fish, is brine shrimp. As with the rotifers, this is done on a huge scale.

Brine shrimp are hatched out in large conical containers and fed to the fish at eight, twenty four or forty eight hours old, depending on the size of the larvae. Over 625 million brine shrimp are hatched out and used as fish food each week in the hatchery.

Other foods used include pureed euphausiid shrimps and pigmented flake foods, to name but two.

Fry development

After the freshly hatched larvae reach about 5mm (0.2in) in length, they are transferred to the fry development area and are grown on using the brine shrimp and ground flake as food until they reach 20 to 25mm (0.8-1in) in length.

Transferring the fry to the grow-out area is the next stage, and this is done by what must be the most stressful method of moving fish I've seen, but the hatchery staff assured me that they have had no problems using this approach.

The technique simply involves opening the bottom drain of the tank and catching



The fry are introduced to their new home in the grow-out department.

the fry in a net as they are drawn through a two-inch (5cm) pipe!

Once harvested, the fry are moved to the grow-out tanks. New arrivals to grow-out are treated with furazanolone as a general anti-bacterial agent. It was interesting to note that when being transferred to the grow-out tanks, the 250 or so fish, on being introduced to the tank, would bunch together as a squirming ball, which would eventually break up into a more regularly spaced shoal of fish.

One major problem with the growing on of clownfish is the hygiene of the tanks.

Clownfish regularly rest on the bottom at night, and if a layer of detritus is allowed to settle during the day, then the fish become very prone to bacterial infections. Therefore, each one of the 200 tanks has to be meticulously cleaned twice a day, every day — the equivalent of doing a gravel clean-out on 20,000 three-foot (90cm) tanks twice a day!

Colour monitoring

The colour of the fish is also closely monitored. It is surprising to note that to get a good-coloured Maroon Clown, it is best kept in a dark-sided tank, while to get a good-coloured Percula, it is best kept in a light-coloured grow-out tank.

The clownfish in the grow-out tanks are fed on a diet of ground flake, euphausiid shrimp and brine shrimp until they reach an average size of 2 to 2.5 inches (5-6.4cm), at which time they are packaged and sent by boat to Grand Bahama Island, from where they are flown out to wholesalers worldwide.

The quality of the fish produced by Aqualife is very high, with good coloration and good body shape. The purists may say that a farmed fish never looks as good as a wild-caught one, but I would hazard a guess and say that if I put a farmed clown next to a wild-caught one, few of us could tell the difference.



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Anton Cass of Aquafight guides you through the confusing Discus 'name maze'.

Photographs: Max Gibbs -
The Goldfish Bowl, Oxford

When faced with the phenomenal number of apparent varieties of Discus available for sale, aquarists, especially those who are just beginning, or even contemplating beginning, to keep Discus can be forgiven for suffering from what could be classed as a form of aquatic shock! Indeed, it is bad enough trying to come to terms with the many Latin names involved in the hobby, so when faced with other, supposedly common, names which appear to relate to fishes which are incredibly familiar to each other, many people find it a touch too involved.

The object of the exercise here is to try to shed just a little light on the problem and, perhaps, with the help of history (aquatic, that is) show just how a fish like the Discus has so many 'handles'.

To begin with, the Discus in its wild state is not exactly free from confusion, as there are many areas in which Brown Discus overlap the range of the Blue and, likewise, the Green Discus overlaps the range of the Blue.

Also, nature plays her own little part in the puzzle by allowing the development of numerous localised geographical variations in the many different rivers (rios) and lakes (lagos) of the Amazon river system. Names like Tefe Green, Red Coari, Manacapure Red and Alenquer Red, all refer to actual locations, lakes, rivers and places in South America. In essence, any fishes bearing such names should ideally be caught in the appropriate area, or spawned of such fishes, to be correctly thus called.

Main types

In all Discus, as stated, there are variations, but the main basic colour forms are reasonably distinguishable. At this point, it is probably a good idea to define these:

1 BROWN DISCUS

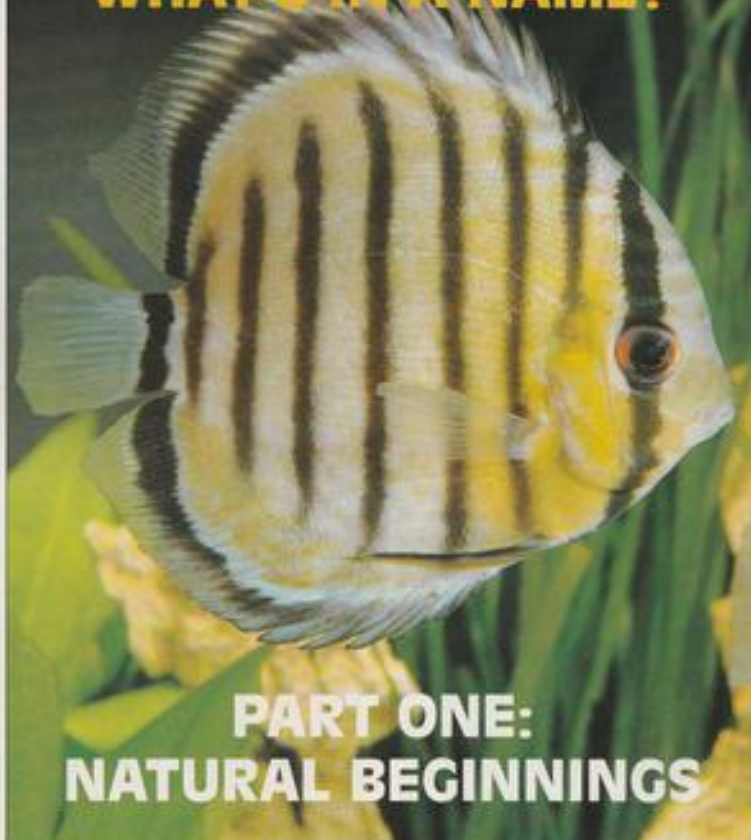
(*Symphysodon aequifasciata axelrodi* Shultz 1960).

Located in and around the Belem area, this is probably the easiest Discus to keep. As the name suggests, the body is primarily a golden brown colour with blue lines extending a few millimetres along the head and occasionally in the anal fin, although in a large percentage of specimens, this area is a reddish brown.

This is a fish which many people overlook and yet a good specimen is a glorious sight. Basically, this is the Discus that can

DISCUS

WHAT'S IN A NAME?

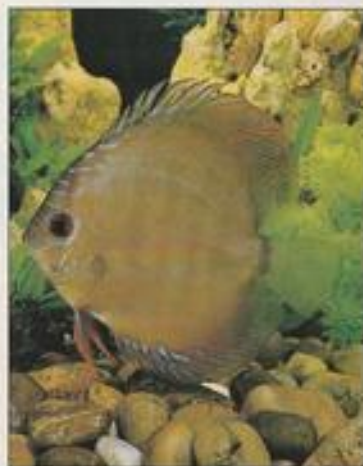


PART ONE: NATURAL BEGINNINGS

This Green Discus (*S. a. aequifasciata*) exhibits numerous similarly-sized vertical lines on its body.



The Blue Discus (*S. a. haraldi*) shows great variation.



A suitably brown Brown Discus (*Symphysodon aequifasciata axelrodi*).

usually withstand a somewhat wider range of conditions, in both temperature and water chemistry, due to it being found in regions that are subject to much more varied influences than some of the others.

2 BLUE DISCUS

(*Symphysodon aequifasciata haraldi* Shultz 1960).

Named after the famous ichthyologist and fish collector Harald Shultz, this fish's region radiates out from Manaus in central Amazonia. The primary distinguishing factor is that the lines always extend farther into the body from both the head and the anal fin.

This is a species that exhibits great variation, depending upon location, and even among individuals, with many specimens looking not much different to good Brown Discus. Others are magnificent, with their blue lines extending nearly across the body. There is one fish known as the Royal Blue in which the lines actually do pass the entire body length. This is a much sought-after animal which appears all too rarely.

In my experience, the ones I have had have all been males, something of a puzzle for which various theories have been expounded. The two most common of these are that there is a race of these fishes from an, as yet, unnamed region, or that these magnificent specimens are, in fact, target animals, i.e. the ones that appear to show up, luring predators toward them, thus giving the rest of the shoal a chance to evade attack.

I have to say that the latter is my belief on three counts, the first being that if there were a race of Royal Blue Discus, why are no females shipped? In fact, a race of fishes could (obviously) not survive without both sexes! Over the years, over 30 of these individuals have been in my possession and all have been males; in addition, others that friends of mine have had, have likewise been males.

The second reason for support of the 'target fish' theory is that when Royal Blues are bred with Blue females, it appears that not all the fishes are coloured thus, with a good percentage of them being normal Blue Discus.

The final reason for the support of this line is a recent conversation with our editor, John Dawes, regarding Discus he caught in the Rio Negro (Heckels, I believe, in this case) all having quite severe fin damage in the form of large chunks being actually removed. I remembered many wild fishes, especially a good proportion of these Royal Blues, also having damaged fins, despite the high-speed regeneration properties that Discus possess.

John informed me that the reason he had been given for this, was that these fishes (which were huge, extremely fit specimens), were target or 'sentinel' fish — waiting on the outside of the shoal. They are thus the last to evade attack, as

they are the last to reach cover among the undergrowth. The missing pieces taken out of the fins were thought to represent piranha bites. It seems more than possible therefore that Discus may, by developing such a system, have evolved a social structure of considerable advancement.



The Heckel can always be distinguished by the bold, broad line halfway down its body.

DISCUS FACT FILE

1 Brown Discus: *Symphysodon aequifasciata axelrodi*

Variations: Alenquer Red
Location: Rio Tocantins, Rio Tapajos, Santarem, Belem.

2 Blue Discus: *Symphysodon aequifasciata haraldi*

Variations: Royal Blue, Manacapure.
Location: Widespread in numerous forms around Manaus, especially to the west and southwest.

3 Green Discus: *Symphysodon aequifasciata aequifasciata*

Variations: Rio Coari, Rio and Lago Tefe, Rio Nanay, Rio Japura.
Location: Western Brazil and Peru.

4 Heckel Discus: *Symphysodon discus*

Variations: Blue-faced, Red and S. Discus Willischwartzii.
Location: State of Amazonas.

3 GREEN DISCUS

(*Symphysodon aequifasciata aequifasciata* Pellegrin 1903.)

Again, this is a fish which is subject to diverse geographical variation, ranging from a khaki coloured specimen with light greenish lines, to magnificent animals which show numerous green lines upon a golden background. In many specimens there are numerous red dots highlighted by an overall greenish hue when the fish is in peak condition.

Rivers and lakes, i.e. Rio Tefe and Lago Tefe, all produce interesting specimens, as do the Rio Nanay and the Rio Coari. Without doubt, many other rivers also produce their own stunning variations. In fact, one specimen recently seen was of a green body colour overlaid with bright red

dots. It has to be said that this may have been a natural sport, as others in the group, while being of similar colours, were not as spectacular as this individual, the like of which I have only seen once before. (It also had fin damage of the type detailed above).

An interesting possibility is that the red spots seen on many individuals may, in fact, be caused by iron in the water. This formed the basis of an account some years ago by Dr Eduard Schmidt-Focke concerning some Green Discus he bred. The offspring never showed any red spots at all. However, when his brother spawned the same fishes, the young he raised did show the red markings. After meticulously checking everything, the only difference was that the water used by Dr Schmidt-Focke's brother contained iron, so the conclusion drawn was that this was the factor required to bring out the red.

It may be significant that many fishes from the more western section of tropical South America, i.e. towards Peru, do seem to show more red than their more easterly cousins. For example, Angels have been imported with reddish spots on them, while *Apistogramma agassizii* (Agassiz's Dwarf Cichlid) has a red form which has its origins in this region.

Another interesting factor concerning water chemistry affecting coloration can be seen in the Alenquer Red Discus. Obviously originating from Alenquer, the fishes inhabit water which is extremely low in any form of mineral content. As a result, they tend to look just like extremely washed out Brown Discus, hardly justifying their high price tag. Once spawned in water and with a higher mineral content, though the young fishes exhibit the stunning red-brown coloration from which they obtain their name.

4 HECKEL DISCUS

(*Symphysodon discus* Heckel 1840).

Easily identified by the fifth prominent vertical body bar, this species was the original Discus. Described by the famous Viennese ichthyologist Dr Johann Heckel in his *Annalen des Wiener Museums*, most specimens are of a brownish to reddish brown in base colour overlaid with grey to blue-grey narrow horizontal lines. The famous bar is noticeable in healthy specimens as a thick black line but, in certain moods, and in poor or ill fishes, this fades to a mid-grey.

This species also exhibits geographical variation, most notably with the Blue-faced variant, possessing a mid-blue head and gill covers, and the 'Willi Schwartzii' originating from the Rio Abacaxis, or Pineapple River. Named after the famous fish collector and exporter, the late Willi Schwartz, this Discus is the only species to date that has been found south of the main Amazon River. It is a stunning fish enhanced by a golden yellow hue noticeable, particularly, in the fins.

(TO BE CONTINUED)

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WASPET

Dragon Fish restrictions lifted

Permission has been granted by CITES for unlimited commercial exports of Red, Golden and Green Dragon Fish (*Scleropages formosus*) by Rainbow Aquarium, Singapore. The Dragon Fish has, for some years, been listed under CITES Appendix I, which forbids trading in the species, and the granting of permission (while still retaining the species within Appendix I) follows intensive captive breeding by private breeder Ho Kian Huat of his Rainbow Aquarium (a member of Ornamental Fish International), in collaboration with the Aquaculture Branch of the Fisheries Division, Primary Production Department (PPD) of Singapore (see News A&P December 1993). "The outcome is far better than expected," remarked John Dawes, editor of A&P, who



Filming under way, with A&P editor John Dawes and wife Vivian (co-ordinator for the project) in the foreground.

worked as a consultant to produce a film about the successful breeding of Dragon Fish in Singapore, as part of an application to CITES for permission to export captive-bred specimens of the species. In addition, John explained, permission is normally granted with a quota, but the permission granted to Rainbow Aquarium for the Dragon Fish is unlimited. The decision is a major milestone for Ho Kian Huat, who

has invested heavily in a well-planned programme of captive breeding of Red Dragon Fish, in conjunction with PPD, involving the use of electronic micro-chip tagging to assist with keeping detailed records. To contribute to conservation of Dragon Fish stocks in the wild, PPD will tag all fish kept within the farm, and allow it to sell only specimens of the second filial generation (F2) that have been tagged and certified by the Department. Buyers must therefore ensure that, at the time of purchase, the code of the tag, when read by a scanner, tallies with the tag code number stated on the Certificate of Identity issued for that fish.

The tag, which is an electronic transponder consisting of a coded microchip embedded in a glass casing, is implanted into the dorsal muscle when a fish is about 15cm Total Length. It has been demonstrated that there are no adverse effects on the fish due to its being tagged, and a tagged specimen, after conditioning, behaves and looks exactly like a non-tagged one. The microchip carries a 12-digit code which is the serial number of each fish. The code comprises a prefix number, "8888", exclusive to PPD, followed by 8 alpha-numeric characters, unique for each fish.

The Certificate of Identity will have the tag number of the fish stated on it. To confirm the authenticity of the Certificate, one needs to use a bar-code scanner to read the 30-digit bar-code at the left-hand bottom of the Certificate. This bar code will be the sole reference for the particular fish described on the Certificate of Identity. Without any doubt, the first-ever sales of Singapore-bred Dragon Fish will raise a flood of interest from both the trade and hobbyists worldwide.



Giant aquarium proposals

Detailed proposals have been submitted for the UK's first major city centre public aquarium, as part of an extensive £5m development in Birmingham. The application has been made by Vardon Attractions, operators of a hugely popular network of 14 Sea Life Centres around the UK coastline and at Scheveningen, Holland, as well as the Cornish Seal Sanctuary. The plans incorporate what will be Europe's biggest collection of freshwater and marine creatures, including native sharks, sting rays and eels, and would expect to attract in excess of 300,000 visitors per annum. The site of the proposed development is at Brindley Place, opposite the world-famous prestigious National Indoor Arena. World-renowned architect Sir Norman Foster has been commissioned to work on the project; his award-winning designs include Stanstead Airport and the Hong Kong and Shanghai Bank. Work is scheduled to start in 1995, as soon as planning consent has been received. David Newman, development

A magnificent adult Red Dragon



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An impression of the proposed £5m public aquarium.

director of Vardon Attractions, told **A&P** that this project represents a very important development for the company, adding: "Brindley Place is the ideal location, combining prominence with easy access from throughout the country."

The plans have received a warm initial welcome from Birmingham City Council: "This proposal is extremely good news for Birmingham," said **Cllr Steward Stacey**, chairman of the council's Planning Committee. "It has always been intended that Brindley Place should include a major leisure attraction, and this development will provide Birmingham with a visitor centre for people, both locally and from further afield. I am also delighted to have an architect of the renown of Sir Norman Foster involved with the project, and hope that he will produce the quality of building that Birmingham now deserves and expects."

Food in demand

Hobbyists are reminded to seek veterinary authority to obtain medicated foods containing antibiotics. The advice is given by **King British**, manufacturer of medicated flake and pellets which have proven effective in the treatment of ulcers, Furunculosis, bacteraemia and septicaemia, and which incorporate an antibiotic in their formula.

Explained **Peter Webb**, sales director for King British: "Some clients think, quite

incorrectly, that we are being difficult if we refuse to sell Medicated Flake and Medicated Pellets without the correct veterinary approval. However, the fact is that we are simply complying with the law."

Peter told **A&P** that such products can only be supplied with a written directive from a vet, so hobbyists are advised to contact King British to establish which product is required and at what price, before sending their cheque and the written veterinary directive.

King British Aquatics Ltd., Haycliffe Lane, Bradford, W. Yorks BD5 9ET. Tel: 01274 573551/576241; Fax: 01274 521245.

Weston Stop Press

Seahorses appeal to everybody, but their aquarium culture often proves to be problematical. Now, hobbyists wishing to learn a lot more about these creatures can do so at the **Interpet**-supported **Supreme Festival of Fishkeeping** at Pontin's Sand Bay, Weston-Super-Mare on 5-6 November, where **Dr Amanda Vincent**, the foremost authority, who recently won a prestigious Royal Geographic Society-sponsored award for her work on Seahorses, will be giving an illustrated presentation.

Visitors can take in several other lectures, see the biggest award-winning indoor water garden and society tableaux, watch the final rounds of the Aquachamp Competition, see a furnished aquarium race, look at hundreds of specimen fishes in the European Open Show and the Supreme Championship Final, or talk to a resident panel of experts.

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Above, two-year-old high-quality Koi.

Below, a superlative Kahaku from the Tomoin lineage.

KOI: TRACING BLOODLINES

Alan Rogers weaves his way through the wonderfully intriguing world of Koi pedigrees

Photographs by the author



The subject of Koi keeping portrays different things to different people. For most, it is simply a hobby, but can never be termed a simple hobby. For others, it's a way of life, a means of earning a living. For the minority, it means a lifelong dedication, continually searching for, and hopefully dreaming of, ultimate perfection. It is of this latter group, which the subject of bloodline inheritance is really all about.

The knowledge of generations is customarily passed down from father to son. Frequently, changes are developed from an advancement of historical understanding of the subject, or the progress of modern technology, or, perhaps, simply an individual's sole desire to rise to the pinnacle of perfection. Anything which sets such high standards is, of course, rarely achieved, probably coming only close to the ideals after a 'galaxy of time' has elapsed.

The hobby of Koi keeping is just one of these subjects. Over recent years, rapid interest and improvements to the hobby have been advancing at an amazing pace in Japan, UK and Israel. Many hobbyists in the United States, the Far East, South Africa and numerous countries throughout Europe have now also developed an amazing passion for Koi.

Tategoi secrets

The subject of *tategoi* (so-called 'incomplete' Koi) has been kept a deeply guarded secret by breeders until comparatively recent years, certainly until Western hobbyists began to recognise the many aspects of culling, combining together years of training and an expert eye for Koi appreciation. Yet, there are no absolute guarantees that true champions will be the result of many sessions of culling from a particular spawning, for Koi breeding is not an exact science.

Practically any attempts to purchase one-year (*nisai*) or two-year-old (*tosai*) genuine *tategoi* are rejected by Japanese Koi breeders, irrespective of any level of monetary offers. A further year or two in a mud pond could see their investment multiply many times over. A permanent source of such quality would soon change a modest breeder into a very wealthy man, so it can be said that a fortuitous spawning can turn a breeder's stature from rags to riches, literally overnight.

Nishikigoi origins

Until the early 1950s, Koi keeping was a hobby for the breeders only. In those earlier days, the fish were, in the truest sense of the word, merely coloured carp.

However, sometime later, the name of *Nishikigoi* was to surface, metaphorically speaking, of course. These early attempts at raising coloured carp bore little resemblance to their relatives of some years later. This period was the start of promoting changes in the arts and skills of raising excellent quality Koi as we know them today.

The birthplace of *Nishikigoi* was Niigata, and the villages of Takezawa, Yamakoshi, Kamagashima and Utogi will always be synonymous with claims to the first recognisable lineage of today's *Kohaku*. Utogi has now been incorporated into Ojiya City province, and a stone monument with the words "Home of *Nishikigoi*" stands at Takezawa primary school, proudly presented by the Yamakoshi *Nishikigoi* Breeders Co-operative Association in 1966. For a great many years, the infancy of this hobby was to remain in this region.

In 1890, Kunzō Hiroi of Utogi village purchased a female Koi with a red head and mated this with another of his Koi, a male *Sakurakana* (bearing the orange dapples of a fawn deer). Great excitement later spread through all the villages of Niigata prefecture, as many of the off-



Koi mud ponds at Mushingam, Japan.

spring displayed random red and white pattern arrangements. It was this spawning that proclaimed to be the foundation seed of Kohaku lineage today.

With this new-found wealth, Hiroi established himself as one of the first known professional breeders in history, his bloodline becoming known throughout the region as *Gosuke*. Other farmers in the area, encouraged by his success, attempted, in the years that followed, to establish similar bloodlines. By the time of Hiroi's death in 1915, many successful years of spawning had established the strain as the objective for future standards of many other breeders.

The continuance of the *Gosuke* lineage was now inherited by Tomoemon Hoshino of Takezawa Village. The prestigious bloodline of these Kohaku which were, indeed, direct descendants from that early heritage of Kunzō Hiroi, came to be known as the *Tomoin* line.

He was unquestionably one of the finest breeders of Kohaku in all of Niigata at this time, producing many excellent Koi from pedigree stock.

Other contributions

As time passed, more famous names were to appear, such as *Yagozen* and *Buketa*, who contributed equivalent bloodlines of excellent quality.

Shortly after the Second World War, Tomoin were producing Kohaku displaying soft clear white skin and bright clean reds with regularity. The objectives of Tomoin and Yagozen now were to concentrate on developing improved patterns.

Kohaku with red abdomens and red heads were disliked from very early stages. Red colour extending down to the mouth was known as *hanazuki*, and that completely covering the face was *mozukaburi*. Both were disliked because it was said that they lacked feature refinements. Large markings on the body were preferred and were called *omoyo*; small patterns were called *komoyo*.

New breeders continued to develop the

Gosuke-Goi lineage and, in later years, numerous new strains such as that of *Hoshino*, *Mito* and *Takanoi* clearly established their own unique part of this historical chapter.

Later lineages

The most important varieties as far as Japanese breeders are concerned are *Kohaku* (red/white), *Taisho Sanke* (tri-coloured Koi — red/white/black) and the *Showa Sanshoku* (black/red/white). Collectively, these were known as the *Go Sanke*, the three most important families.

Mr Eizaburo Hoshino of Takezawa was the first to produce *Taisho Sanke* with red and black patterns on a white skin. In 1927 Juckichi produced the first known *Showa* by mating a *Ki-Utsuri* (yellow and black Koi) and a *Kohaku*. This first line resulted in the *Showa* displaying yellow/brown coloration.

The great improvement came a little later when Tomiji Kobayashi succeeded in enhancing the red by using a *Yagozen Kohaku*. Many fine *Showas* today illustrate and grace the elegance of the *Yagozen Kohaku* line, and Kobayashi is synonymous to this day with excellent *Showas*.

Another breeder who contributed to the historic Kohaku lineage was Bubeita Sato. As recently as 1954 in Yamokoshi, he successfully spawned a five-year-old Tomoin male Kohaku with a six-year-old female. By the late fifties this line was known as *Buketa-goi* and showed all the principal characteristics of excellent quality skin typifying the grace of fine bone china, bright strong reds and excellent body shapes.

The strong *Hi* (reds) were especially noted by their response to excellent water quality conditions. Up to this period no special awareness or significant importance had been attached to this aspect of water management in earlier breeding methods.

Yagozen was a lineage which was developed just after the end of World War II by

another man, strangely enough bearing the name of Hiroi once again. In a small village close to Ojiya City, he crossbred a Tomoin female Kohaku with a lesser known *Monjiros* male. For the next decade, improvements to the line were very highly respected and fashionable. Indeed, this bloodline Kohaku was the first to claim a Supreme National award at the very first Minister for Agriculture Festival in the early sixties.

The precise number of breeders in Japan today is unknown, but I am told that, in the Niigata area alone, there are estimated to be around 1200 in just a few square miles in this mountainous province!

The monopoly of good-grade Koi remained within the Niigata Prefecture for many years. This was not due to lack of demand, but due to the extreme difficulty of transporting Koi to other areas. Certainly, stocks did reach other provinces as far away as Kyoto, Hiroshima and Kyushu in watertight wooden crates by a crude railway system, but very high losses of around 80% were encountered.

The problem was overcome in the 1950s with the introduction and resourcefulness of the plastic bag, supplemented by additional oxygen from welding cylinders. From this point, Koi breeding, production and transportation took a great stride forward. The invention of the plastic bag was to be the key that would introduce Koi to the outside world, and by 1970, transportation by air made large consignments possible to many corners of the earth.

Breeding explosion

In these early boom years, many spurious breeders paid very little attention to filtration, specialised feeding, colour and variety standards. In addition, there were no authoritative works of reference to survey with regards to ideals or variety basics.

In 1968, the first magnificent production of a book depicting coloured Koi, entitled *One Hundred Best Nishikigoi* appeared on the market; it was written by the late Mr Hideo Miya of Ojiya City. He produced this book from an idea originating from the very first staged All-Nippon Nishikigoi show.

The quality of these early photographic 'stars', based on today's standards, was poor, but from this initial reference, many breeders and hobbyists agreed to accept that a standard needed to be prescribed and, by the mid-70s, Koi were beginning to resemble the familiar look of today.

The Koi market exploded, with breeders and dealers springing up everywhere, and there was a great demand for this coloured carp worldwide. However, by the late 1970s, when Koi keepers were beginning to understand a more in-depth perspective to Koi-related topics, the demand from quantity to quality became the main criterion. Certain varieties were becoming popular and serious hobbyists were unquestionably becoming highly selective.



Left, culling under way. Centre, searching for those elusive tategoi. Right, interested crowds at the 1993 Ojiya Dealers Show.

Another new era was about to begin, for now, some breeders were moving away from random and volume production of general grade Koi, to more specialised and selective spawning. Some breeders stuck firmly to their old systems and soon realised that the dealers were only purchasing 5% of their stocks and disregarding the rest. This, of course, was the result of their customers' demand for superior quality.

Vital culling

Other breeders, recognising this demand, attempted to raise only superb-quality stocks, by culling out all inferior grades, thus endeavouring to produce solely for this 2% lucrative market. Prices increased dramatically, and the necessity for heavy culling found many dealers, either destroying 65-75% of their spawning, or moving the lower grades onto less demanding markets. These modern breeders became greatly respected and, obviously, wealthier by enduring those initial years of trial and error! Many breeders stopped production and turned into dealers in search of that quality market.

Thousands of hours are spent culling millions of Koi individually, several times over from each spawning . . . every year. There is no machine or device that can perform this immense task, for only the expert eye and movement of hand can direct the selected Koi into the correct container.

The word *tategoi* simply means, "a Koi that has a good potential future for improvement", often the signal for an early inauguration into that exclusive 5% market. Champion *tategoi* will be those highly privileged, possibly unique and, most definitely, memorable. Great rarities of this class would qualify the Koi into that elite 2% market, and are frequently described as "one in a million!"

Over recent years, skilful breeders have been able to produce very high-grade Koi from established bloodlines with consistent regularity, and many of the names are therefore quite famous now. Some experienced hobbyists in the UK can, in fact, recognise a Koi by its bloodline and even identify familiar characteristics of the lin-

age. Often, this can give an indication of how the Koi will develop in later years.

In the early seventies, breeders were faced with a number of problems, most of them revolving around the continual search for good parent breeding stocks. A breeder, having found such pedigrees, would then be faced with a massive long-term investment, fully aware of the very high risk; low Koi losses in Japan have never been guaranteed, and a number suffered bankruptcy and family disillusionment with such ventures.

The second problem was to ascertain which Koi produced the best offspring. Frequently, one female would be used with three or four males and, often, one specific male paired with a particular female would produce by far the best results. However, as a Koi only spawns once each year, the test results can be very frustrating and long term before true evaluation can be made.

There are, in fact, true stories of breeders buying back their original champion Koi raised from their own bloodlines. One particular story is of a specific female Sanke returning to the original breeder after nearly a decade of success around the show circuit. This gentleman had to pay nearly three times the original selling price to reinstate it as a parent breeder. The prices paid to buy back certain Koi as breeding stock often exceeded the original asking price.

Recent bloodlines

In Ojiya City, Mr Haswegawa uses a broodstock of *Sadazo* bloodline to produce his annual spawning, with an enormous success rate. This very modest and quiet man invested most of his life savings in quality parent stock, to be rewarded for his patience and beliefs in producing a remarkable line of *Kohaku* in the early eighties.

Mr Sakai of Isawa uses *Matsumoto* lineage to produce ultimately very large 'humpbacked' females, similar to those of *Tomoin* and *Yagozen* heritage.

Torazo, *Dainichi*, *Hoshikin*, *Miyatora*, *Mirashou* and *Choguro* are just a few of the most famous bloodlines that have developed over the last decade or so, but there

are many more inspiring quality breeders, too numerous to mention, who also produce very high-grade Koi.

Many established breeding Koi are often 20 years old or so, and generally have few or no colour markings. Many carry signs of scars inflicted during the frantic sessions of the spawning rituals over the years. However, if you were to even be remotely interested in purchasing such a specimen, your offer would be met with hilarious outbursts of laughter for days!

There are many other breeders attempting to reach fame and stardom, many of them by entering and winning Koi shows, for publicity and kudos is all-important in this celebrity world, and for the winning exhibitor . . . the start of a week of heavy drinking and celebrations with his closest friends. It would be considered that he now has the rightful claim to the coveted position of elite Koi breeder, adding his name to the hall of fame, alongside *Gosuke* and *Tomoin*.

Enlightening experiences

Over the years, my trips to Japan have enlightened me on how this hobby changes at astonishing speeds. The endless search for improvement in every aspect of Koi breeding, bloodline refinements, water quality improvements and medical treatments, are just a few of the areas where complacency will never be permitted by this elite band of professionals.

Gosuke, *Tomoin*, *Yagozen-Goi* and *Buketsu-Goi*, along with many others, have fashioned themselves a little piece of historical excellence and, to this very day, modern Koi keepers can respect and appreciate the end results of those early achievements.

I said earlier that Koi breeding has never been an exact science, but who knows, maybe those dedicated and knowledgeable carp farmers from the 'Land of the Rising Sun', will, one day, have something further to say on this subject. After all, it is still acknowledged that ultimate perfection has yet to be accomplished. *Sayonara!*

Books

Collins pocket reef guide to Coral Reef Fishes of the Indo-Pacific and Caribbean

By: Robert Myers (text) and Ewald Lieske (illustrations)
Published by: Harper Collins
ISBN: 0-00-219974-2
Price: £12.99

In these days of superb underwater photography, a marine book that doesn't include colour photographs would normally stand very little chance of success. Then there are the exceptions... This excellent *Pocket Guide to Coral Reef Fishes* does not have a single colour photograph. Instead, there are over 2,500 hand-drawn colour illustrations which, in my view, are far superior in conveying the sorts of features required from a field guide.

I was particularly impressed by the simple way in which significant characteristics of the various species are indicated on

each page. For example, page 57 provides the explanatory text for the accompanying page (p.58) of eleven illustrations of yellow, white and black butterflies. Under normal circumstances, unless I knew what I was looking for, I would find such an array of similar-looking fish quite confusing. This would be especially so if the illustrations consisted of photographs taken under different lighting conditions, or with fish orienting themselves at differing angles to the camera.

Here, though, all the fish are nicely lined up facing in the same direction. This, in itself, is a major help, but what really makes the illustrations even more useful is that a single, salient distinguishing feature has been selected for each fish and is indicated, quite

simply, by means of a small thin line. As a result, the Red Sea form of the Threadfin Butterfly (*Chaetodon auriga*) can be easily distinguished from its wider-range equivalent from elsewhere... and so on.

This approach extends throughout the book (wherever relevant, of course), making it a delight to work through, and raising the value of the illustrations well beyond that of being (mere) well executed colour pictures of the 2074 species covered.

I thoroughly enjoyed this book, and feel that anyone interested in the fishes of the Indo-Pacific and Caribbean regions will likewise find this profusely illustrated, packed-to-overflowing volume as useful as I did.

John Dawes

The Right Way to Keep Pet Fish

By: Reginald Dutta
Published by: Elliot Right Way Books
ISBN: 0-7160-2025-4
Price: £3.99

Reading this book is like stepping back in time to the days before technology overtook the hobby. It's not that I decry technology — it has its place — but some of it should also be treated with caution.

Originally written some 30 plus years ago, the basic techniques stated for successful fishkeeping still hold true today. In revising the book, our regular contributor Dick Mills, himself an eminent fishkeeper and author, has done an excellent job of combining current thinking in the style of Reginald Dutta.

The text covers just about everything you need to know to keep healthy fish, from finding a reputable dealer, setting up your first tank or pond, introducing and keeping your fishes, to dealing with infections, diseases and pests that may appear in your aquarium or pond.

The final section covers some of the commonly available species and has line drawings that vaguely resemble the fish in question. If time was taken to update the text, why didn't someone do the same thing for the illustrations?

In the fish section we have a line drawing of a Sucking Catfish that looks as if it has scales (catfish don't have scales) instead of three rows of body armour, while in the plant section, there is a *Cryptocoryne willisii* which looks more like a piece of *Potamogeton* — if you close your eyes and squint!

However, I like the text; the information is there and methods are tried and tested.

My one reservation is that although it has been 'revised', it, at least to my mind, is still dated with such phrases as "The chauffeur used to feed the fish...". Who has a chauffeur these days?

This aside, *The Right Way to Keep Pet Fish* would make a worthwhile addition to your bookshelf and, at £3.99, it wouldn't break the bank.

Gina Sandford



UNDER THE FANG

Thailand-based
Galen Harris Valle
takes a closer-than-
normal look at the
widely
misunderstood —
but nonetheless
highly venomous —
Cobras

*Photographs by the
author*

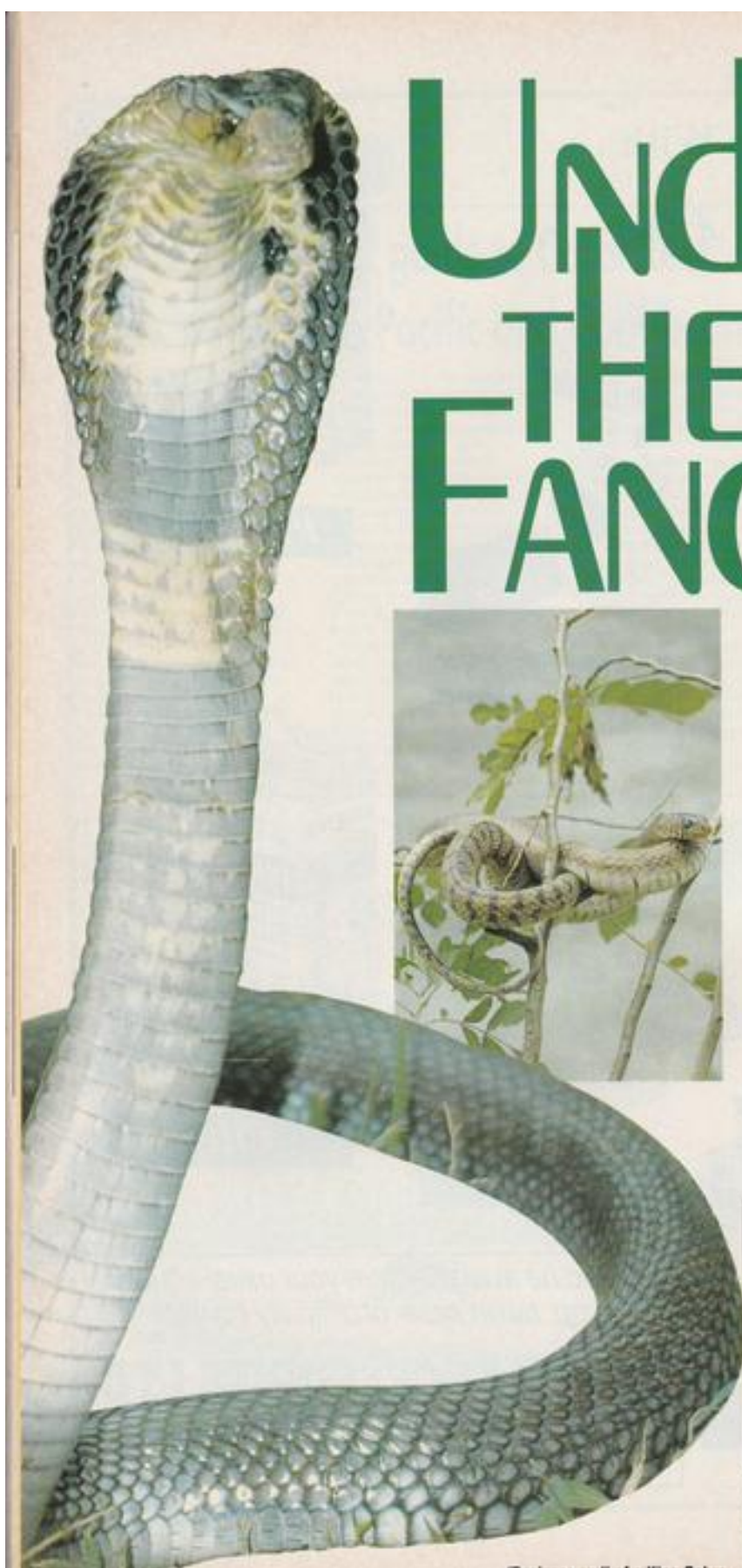
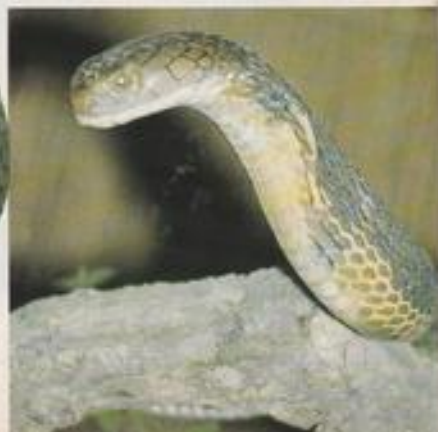
The first time I came in contact with a cobra in the wild, I couldn't believe it. I had heard stories of this supposedly vicious creature throughout my life. Therefore, when I finally came face to face with one, my first considered reaction was simply to drop dead on the spot and save myself and the snake a lot of trouble!

F.B. Simpson must have been a victim of the same misconceptions in the late 1800's when he wrote: "Death is certain in the case of an Indian Cobra (*Naja naja*) bite, except perhaps if a bystander should have an axe in his hand and chop off the limb a good way above the bite."

It was a good thing that I didn't drop dead during that first encounter, because all it really amounted to was a glimpse of the back of the snake as it made its characteristic hasty retreat into a clump of bushes.

Left, Monocled Cobra (*Naja naja kaouthia*) in 'classic' posture.

Left above, Cobras are good climbers.



Other Cobra Species

Besides the confusing taxonomy of *Naja naja*, that of the entire genus is still in doubt. According to current classifications, there are, debatably, about six other species of *Naja* — most with several subspecies — occurring on or near the African continent.

***Naja nivea* (Cape Cobra)**

Occurs in South Africa and Namibia; colour variations from brown to bright yellow.

***Naja mossambica* (Mozambique Cobra)**

Mozambique; rust to brown coloured. Thick black band across nuchal (hood) area.

***Naja haje* (Egyptian Cobra)**

Africa — except far south, and Arabian Peninsula. Grey to brown dorsal scales. Ventral scales pale yellow. Prefers dry areas.

***Naja melanoleuca* (Black-lipped Cobra)**

Occurs in savannah regions in the southern part of the African continent. Black with thick white bands on underside of neck.

***Naja nigricollis* (Spitting Cobra)**

Also occurs in savannah regions of southern Africa. Range extends farther north than *N. melanoleuca*. Black with red area on underside of throat.

***Naja oxilana* (Central Asian Cobra)**

Occurs in Central Asia and is the most northern of cobra species. Yellowish-brown dorsal scales with indistinct black bands encroaching on ventral area. Bands become more distinct on underside of neck near nuchal area.

Reference: *The Completely Illustrated Atlas of Reptiles and Amphibians*
TFH Publications, Inc

Cobras are primarily nocturnal. However, they do often sun themselves in the daytime, and those encountered during daylight hours are usually hesitant to strike, owing to their marked inability to focus on objects in bright sun.

Frustrating encounters

More recent meetings with cobras have been more frustrating. I have often read in *A&P* and other publications about pond owners having trouble with cats ... but snakes?

Having just moved into a house with a sufficient amount of land to build a pond, I placed a number of Oscars which I had bred into a holding tank (actually, another 'salad bowl' like the one described in my *Betta* article in the March '93 issue of *A&P*) in my yard for later transfer when I get the actual pond built. (Yes, I am going to populate my pond with Oscars ... more on that when we see how it works out).

One evening, I went outside to find one of my fish being consumed by a cobra. I lack experience in this sort of situation, so I decided to act decisively: I decided to go back in the house!

When I came out several minutes later,

both snake and fish were gone. My holding tank is now covered, and I have not suffered further losses — but I don't see myself being able to cover the pond, so I may soon find myself in a similar situation to that of many western pond owners, except my fish may suffer a somewhat more 'interesting' fate.

There is no other reptile that has gained such notoriety, over such a large area, among such diverse cultures. Species of cobra occur from North Africa to East Asia; other members of the family Elapidae (30 genera, about 100 species) occur worldwide.

Cobras have made a significant impact on every country in which they are found, and also in western countries where it isn't. We are all, for example, familiar with Kipling's *Rikki-tikki-tavi* and his heroic effort to save his owners from a vengeful widowed cobra. This is no small feat for an animal that is primarily nocturnal, shy, and reclusive.

Cobras in history

In Egypt, the hieroglyph of twin Spitting Cobras represented the two lands of Egypt, and a coiled cobra sitting on a bowl was the symbol of Ejo, the goddess of the north; that hieroglyph later developed into the symbol for "goddess" in general.

A crown in the image of a rearing cobra was worn by the sun god Ra, and the ancient Egyptian belief that closely connected the cobra with the idea of the daily death and rebirth of the sun is similar to a common Hindu belief discussed below.

Cleopatra was said to have committed suicide by the bite of the asp (experts are divided in opinion about whether an "asp" was a cobra or a viper).

On the Asian subcontinent, the cobra is worshipped even today and festivals are regularly held in the snake's honour (Nagas). During the Naga Panchami festival, cobras are purchased from vendors and released as a means to make merit, and pictures of snakes are distributed to friends in a ritual quite like that associated with Valentine's Day in the West.

The early Dravidians — a subgroup of the Hindu race now numbering around 100,000,000 people primarily in South India — worshipped the cobra and believed that their chiefs would take the form of cobras in the afterlife. Other dynasties in Southeast India believed themselves to be descended from cobras and wore crowns made in the form of the rearing snake.

Cobras have long been considered to be village gods and local guardians, and holes known to be inhabited by cobras are surrounded by bowls of rice and offerings of curds and saffron. Cobras are also thought to have power over the weather, and are often prayed to during times of drought in the hope that they will bring rain.

Worshippers of the Hindu deity Shiva are familiar with the cobra. Just as Shiva represents the destruction necessary for renewal, the cobra is equally a symbol of life and death. Human sacrifices were made in adoration of the snake and arrows used for hunting tigers and leopards in East Bengal were coated with cobra venom, which was also applied to arrows meant for killing humans — much like those used by the Tartars were coated with viper venom.

Cobras have an undetermined range in Northeast Asia (although the Chinese Cobra *Naja naja atra*, does occur in China and Taiwan), and there are few customs directly related to it as an individual species, with the exception of the Chinese belief that cobra meat is a powerful aphrodisiac and the gall bladder was thought to be a cure for rabies.

However, snakes in general have a definite place in Northeast Asian life. In China, snakes are thought to be the spirits of plants and trees. The dragon, perhaps one of the most popular Chinese deities, is known to have the nature of a serpent.



This variety (subspecies?) of *Naja naja* is sometimes referred to as the Suphan Cobra.



The best-known species is probably the King Cobra (*Ophiophagus hannah*). This is a young specimen.

It is hatched in the form of a snake and is thought to take two thousand years to develop into the standard dragon form; this closely relates to the Malay word for dragon, "naga", which was the Sanskrit basis for "naja" the scientific name for most cobras.

The god of thunder in Japan takes the form of a snake, and white serpents have great significance, which is likely to be related to the Buddhist belief that the sacred White Cobra is considered by some sects to be the messenger of the Lord Buddha.

In Malay folklore, the cobra is said to have a bright 'snake stone' in its head which makes it visible at night and, according to some, the universe is surrounded by a huge serpent which feeds upon its tail.

'Charming' snakes

The King Cobra (*Ophiophagus hannah*) is used by Burmese snake charmers by whom a promise is traditionally made to release the snake on a certain day, and the snake is never harmed when in captivity. The snake is often subjected to a fast of about ten days after capture in order to calm it enough to be safe to work with.

The Burmese look down on colleagues who use the Indian Cobra (*Naja naja*), as they are well aware of that snake's day blindness and nearly futile striking ability.

The secrets of a snake charmer's art are often passed on from generation to generation in Burma, where the mortality rate among practitioners is rather high, as the antidote is not widely available.

The commercial snake charmers who give shows for tourists in Thailand will usually not get anywhere near a King Cobra for the same reason — with the exception of the handlers at the Pasteur Institute mentioned below. This fact was made very clear to me by the director of a snake farm in the Mae Rim Valley, near Chiang Mai, when I entered a King Cobra's enclosure to take photographs.

Scientific misunderstanding

Asiatic cobras seem to be misunderstood even by some scientists: until quite recently, Asiatic cobras (with the single exception of the King Cobra) were all lumped into a single species *Naja naja*, the Indian Cobra. However, recent studies of scale counts, colour patterns and internal organs have shown that there are at least ten species of Asiatic cobra.

This misunderstanding has led to some loss of life in Thailand and Malaysia, where those bitten by the Monocellate Cobra were given antidotes for the Equatorial Spitting Cobra and vice-versa. Now most snake-bite victims in Southeast Asia are given a cocktail antidote which seems to be effective.

Cobras in Southeast Asia are most common in rice paddies, where they become semi-aquatic and feed mainly on fish and frogs. They also occur near human habitation, where they feed on rats and other rodents.

Indian Cobras mate at the beginning of the year and there are some reports of

care of the unhatched eggs by both the male and female — this would signify a kind of temporary monogamy. Eight to twenty-five eggs are generally laid in a hole and the young measure about 10cm (4in). Neonates are often far more aggressive than adults; they will even rear and spread their hoods at birth.

Those who wish to observe cobras in the wild should wear high boots, as *Naja* strikes by simply falling forward and the vast majority of bites are below the knee.

The King Cobra is the largest and most deadly venomous snake in existence. It has been reported to reach a length of eighteen feet (although twelve feet is more common) and is characterised by its comparatively small hood in relation to its body size.

Few people are bitten by King Cobras in the wild, due to the fact that, although it has a wide range, it needs a large area for hunting and it is not at all common.

Victims of King Cobra bites are generally limited to those who work handling them — such as at the Pasteur Institute at the Thai Red Cross compound in Bangkok, where handlers enter a room full of King Cobras — pushing the rearing specimens out of the way — to select individuals for milking.

The King Cobra is also a timid snake, and the high mortality rate of its victims is due more to the amount of venom it injects (up to 250 times the lethal amount) than its potency. It differs from other cobras in that it hunts primarily in the daytime, and in that it builds a nest by pushing plant matter into a pile with its body. It mates in January and builds a nest in April or May. The clutch consists of 20-40 eggs and the hatchlings are about 50cm (20 inches) long.

Closing thought

In closing, I would like to stress that cobras are greatly misunderstood, shy animals that we still have a great deal to learn about.

The chances of being bitten by a cobra in the wild are about the same as getting struck by lightning, so now I have to go put on my high boots and fix that lightning rod out in the yard!

FASCINATING FISH FACTS

LINEA LORNA

It may look like a dragon ... or even a zebra ... but a turkey?



Many-named turkey

Pterois volitans has possibly more common names than any other fish. It may be called Scorpionfish, Lionfish, Dragonfish, Cardinal Scorpion or even Cobrafish.

These all point to the species' unique combination of great beauty and danger. As well as its lovely markings and extended, flowing fins, *Pterois volitans* also carries a set of extremely venomous spines on its dorsal fin.

These fish can only swim slowly, thanks to their over-large fins, and therefore often wait, motionless, for prey to come within range. The stripes on the body help to break up the body outline, and explains another one of its names, the Zebrafish.

If disturbed by a diver, a *Pterois* will swim slowly away, looking — some say — rather like a strutting turkey. The gait gives the fish its first common name, Turkey fish. Some turkey!

Canadian approval

Following approval earlier this year from the American Standards Board for Cyprio's Ultra-Violet Clarifier (see *News*, August 1994) the product has now received accreditation from the Canadian Standards Association.

According to Cyprio, the company is the first in the UK to receive such approval in Canada, so they are now able to use the approval mark 'CSA' on the product and associated packaging and export their range of Ultra-Violet Clarifiers into Canada.

Explained **Steve Phillips**, sales manager for Cyprio: "In order to gain approval from CSA, the product had to pass stringent tests on all mechanical and electrical components, most of which must also carry CSA approval. One of these tests involved the assessment of emissions affecting the ozone layer."

He added: "We are all very excited. Export markets are growing for the company and, now that we have achieved these recent approvals, we will be able to expand the number of ponds worldwide that can claim to have the Cyprio Clear Water Guarantee."

Cyprio Limited, Hards Road, Frognall, Peterborough PE6 8RR. Tel: 01778 344502; Fax: 01778 348093.

'Model' pet superstore

Pet City in Chatham has received high praise from PTIA consultant **Peter Curry**, who concluded that the superstore is "a model for anyone seeking a working example of how pet

animals should be displayed and offered for sale".

Pet City stocks no fewer than 215 different types of fish, with the most popular selling varieties being Neons, Guppies, Zebra Danios, Platies and Goldfish. The company boasts that there are up to 15 thousand fish in-store at any one time.

The coldwater systems are filtered through a centralised unit incorporating a sand-bed filter and cartridge cleaner, while the tropical aquaria are filtered using individual undergravel systems and, in larger tanks, Fluval external filters and separate heating.

Pet City has 20 pet superstores throughout England and Scotland, with the company's livestock quality controlled by ex-RSPCA inspector **Rob Clarke**, who was also commended in the consultant's report.

"The livestock supervisor displayed a range and depth of knowledge that assured me she was competent to care for the range of species and numbers of animals in her charge," the report said. "She showed she had the knowledge to feed and house the animals satisfactorily and how to recognise ailments and institute an appropriate course of action."

Lowara go for Gould

UK water pump manufacturer **Lowara** has changed its name to **Goulds Pumps**, to reflect the fact that the company will be selling all of the product ranges produced by Goulds group companies.

Lowara has been a member of the Goulds group since 1987, and has concentrated on the Lowara range of high-quality stainless steel equipment. "As we will be involved in handling



Lowara (now Goulds Pumps) directors Jean and John Thorne at the Axminster headquarters being built for the company.

additional equipment produced by Goulds group companies, it was thought that using the name Goulds better reflects the full extent of our activities," explained managing director **John Thorne**. He added: "For more than ten years, the company has constantly increased turnover, despite even the depths of recession."

Jean Thorne, director of marketing communications at Lowara, explained: "It is due to the spectacular success of this venture, and the fact that we are now responsible for the manufacture of the next generation of high-tech Goulds pumps, that it was decided to expand the company's interests to sell other pumps manufactured by the group."

An export department has also been created by the company to handle Goulds group products in other countries, and a major production plant is to be built at

the company's Axminster headquarters (see *News A&P*, May 1994).

Goulds Pumps Ltd, Millwey Rise Ind. Est., Axminster, Devon EX13 5HU. Tel: 01297 33374; Fax: 01297 35238.

Record orders for KB

Aquatic supplies manufacturer **King British** continues its fighting talk with news of record orders taken at the aquatic trade's leading three shows this year: Pet Index and GLEE, both held at the NEC, Birmingham, and Interzoo, held in Nürnberg.

A spokesman for the company remarked: "Other aquatic manufacturers have been retreating from a depressed marketplace, while King British has kept production lines working flat out for all of its food, water treatment, and electrical products." He added: "Both the trade and hobbyists have been clamouring for our products".

He explained that the chief executive of William Sinclair Holdings — the parent company of King British — promised an aggressive sales campaign at home and abroad after a £500,000 investment in new plant.

The company's fighting talk continued with King British managing director **Keith Barraclough** exclaiming: "We have started a worldwide battle to increase our market share and we have no intention of slowing the pace". He added: "We will attack, attack, and attack again to continue to increase our share



Part of the magnificent tropical fish displays at Pet City in Chatham, which has received high praise from a PTIA independent consultant.

where it has a wide distribution. Its close relative, the Smooth Green Snake (*Ophedryx varialis*) is not usually recommended as suitable for captivity, as it does not seem to do well.

Although similar in colour, the Rough Green is distinguished by its scales, which bear a small raised keel, giving it a rougher appearance than its cousin. Full-grown Rough Greens are longer, 22-33 in (56-84 cm), with one specimen of 45½ in (116 cm) having, so far, been recorded. The Smooth Green is smaller at 14-20 in (36-51 cm).

Unlike *O. varialis*, *O. aestivus* tends to be more arboreal. It is an excellent climber and spends much of its time in bushes, usually near water, and frequently enters the water. *O. varialis* is normally found on the ground, seldom climbing, and is sometimes referred to as the 'Green Grass Snake'. The Rough Green is occasionally called the 'Vine Snake', but this name more correctly belongs to another species.

The Rough Green Snake is a dainty, attractive species with a light-green dorsal surface. Some specimens also possess a few light blue spots along the sides of the anterior part of the body. The ventral surface is usually plain white or yellowish.

We first kept this species some fifteen years ago when substantial numbers were imported. The specimens we purchased were carrying large numbers of mites which had to be eliminated. Two of our snakes turned out to be Smooth Greens which soon succumbed.

Rough Greens are still occasionally available and are not too expensive, although prices vary. About five years ago, a number of gravid females were among imports and several keepers managed to hatch the eggs. We purchased five babies from different sources (to avoid inbreeding), and these thrived and have bred over the last four years.

CAPTIVE CARE

1 The vivarium

Two males and three females are housed in a vivarium measuring 33 in (height) x 24 in (length) x 18 in (width) — 84 x 61 x 46 cm. The vivarium is constructed from malamine-faced chipboard, all the joints being sealed with silicone sealer. The base and a few inches of the walls were given three coats of yacht varnish to make them moisture-resistant. The front consists of a 6-inch (15 cm) fascia board, a sliding glass panel and a ventilation panel of 4 inches (10 cm) at the top.

The substrate is a mixture of loam-based potting compost, small bark chips and chopped Sphagnum Moss laid on top, with further clumps spread over these.

The back and sides are covered with one-inch thick granulated cork sheet. The rest of the furnishings consist of one Tree

ROUGH GREEN FACT FILE

Scientific name: *Ophedryx aestivus*
Common name: Rough Green Snake
Natural distribution: USA — South New Jersey to the Florida Keys, west as far as Texas and Kansas and into Mexico.
Size: Male — 22 to 28 in (55 to 70 cm)
Female — 32 to 34 in (80 to 86 cm)
Number of eggs: 2 to 7 (may have more than one clutch in a season)
Size of eggs: 35mm (1.4in) long, 9mm (0.35in) 9mm diameter
Incubation period: 35 to 40 days at 82 to 86°F (28 to 30°C)



Suitable vivarium decor for Rough Greens.

Ivy (*Fatsia lizei*) and one small palm, which are left in pots placed in plant saucers. A few dead branches are fixed in various positions. Pieces of cork bark are also supplied for hiding places.

Heat is provided by a thermostatically controlled 40 watt spot bulb and, since the snakes are diurnal (active during the day), an 18 in Trulite tube is fitted.

MAINTENANCE TIPS

Vivarium temperature: summer up to 86°F (30°C) daytime, 58 to 60°F (14 to 15°C) night. Winter cooling period is 3 months at maximum of 65°F (18°C) day, 55°F (12 to 13°C) night
Photoperiod: summer — 14 hours; winter — 7 to 8 hours
Humidity: daily spray, but conditions must not remain wet
Feeding requirements: crickets (brown or black) dusted twice a week with calcium and vitamin supplements
Water: provide dish (fresh daily) but usually prefer to lap leaves when sprayed

Vivaria for Rough Green Snakes must be absolutely escape-proof, as their narrow bodies can squeeze through amazingly small gaps. The daytime temperature can rise (in hot weather) to about 86°F (30°C), in which case, all lights are switched off. At night, no heat is used and the room temperature in summer drops to about 58-60°F (14-15°C). In summer, the photo-period is 8am-10pm.

A light spraying each morning creates sufficient humidity, but the vivarium must not be too wet. By about mid-day, the vivarium has dried out, apart from an area under the food bowl. The soil in the plant pots is also kept moist, and this degree of humidity would seem to be adequate. If the vivarium is too wet, skin problems will result.

2 Feeding

Food in the wild is stated to be crickets, grasshoppers, larvae of moths and butterflies and spiders. Our specimens thrive on an exclusive diet of crickets (*Acheta* and *Gryllus*). Food is supplied every day, and, twice a week, the crickets are dusted with vitamin/calcium supplements.

A large glazed dog bowl with an incurved rim tends to restrain most of the crickets until they are eaten, and the snakes will often hover over this food bowl awaiting the arrival of their food. A small water dish is also provided, but they seldom drink from it, preferring instead to lap water from the leaves and walls after the daily spraying. Other keepers have reported that some specimens will take Wax-moth larvae (waxworms).

3 Breeding

Our first breeding was in July 1990, when two eggs were found in the moist area underneath the food bowl. As we didn't think the snakes were yet mature (obtained as babies in 1989), this was a pleasant surprise. Mating had not been observed, so the exact gestation period is not known.

Young specimens are not easy to sex but, when mature, females are longer than males and have a greater girth (about twice that of the males). Males are roughly the same thickness as a pencil and possess a longer tail i.e. the distance from the cloaca to the tail, tip. The female's girth will increase slightly when gravid, thus accentuating the difference.

Because of their wide distribution (S. New Jersey to the Florida Keys and west as far as Texas and Kansas and into Mexico) Rough Green Snakes must experience a variety of winter conditions. A cool period may therefore be necessary for successful breeding. In winter, we reduce the vivarium temperature to a maximum of 65°F (18°C) day, and 55°F (12-13°C) at night. On mild days, these temperatures may be exceeded. The photoperiod is reduced to 7-8 hours.

Under these conditions, the snakes are less active and feed less frequently (food is supplied every third day only). This 'winter' period extends from the end of November to the end of February.

4 Incubation

The eggs are 35mm long, with a diameter of 9mm. To incubate them they are placed in clear plastic boxes with a few fine ventilation holes. The boxes contain about 2 inches (5 cm) of moist vermiculite and the eggs are buried so that the upper surface is just visible. The moisture content is checked weekly and adjusted when necessary.

After 35-40 days at a temperature of 82°F (28°C) our eggs hatched, producing babies varying between 6 and 9 inches in length (15-23cm) and not much more than ¼ in (0.3cm) thick. The babies are a greyish appearance, as though they were ready for sloughing. After a few days, the skins were, indeed, sloughed and they began to feed on small crickets.

The juveniles were extremely active and were therefore kept in a sweet jar containing 2 inches (5cm) of moss. The jar was given a light misting daily to provide drinking water and to keep it very slightly moist. Since these snakes must not be kept too wet, adequate ventilation in the form of a piece of nylon curtain secured by a rubber band was used and the jar was



Male and female compared: the male is considerably thinner.

kept warm, about 78-80°F (26°C).

As a rough guide to feeding, crickets which are about the size of the babies' head must be offered, gradually increasing them in size. Once feeding, the babies can be transferred to a small vivarium similar to that of the adults.

In the first three years of breeding this species, we've always found the eggs were laid towards the end of July and always under the food bowl. In 1993, at the beginning of June, a baby Rough Green was seen basking among the plants.

A search of the vivarium revealed four other babies, and under the plant pots, 6 viable eggs and 3 desiccated eggs. The plant pots have three 'feet' which leaves a narrow space between the pot and the saucer, sufficient for the snakes to squeeze in and lay eggs. Conditions under one pot must have been just right for the eggs to survive. Over the four years we've kept Rough Greens, clutches have averaged 4-5 eggs per female.

Rough Green Snakes make ideal vivar-

ium subjects which exhibit a gentle disposition. Occasionally, they may try to bite, but such a bite is negligible. They are easy to cater for and have the advantage that they are diurnal and may be housed in a furnished vivarium.

Much of their time is spent climbing among the plants and branches, where they move about with a swaying movement of the head and neck constantly flicking the tongue. They can, however, move very quickly and, if startled, may launch themselves into a flying leap when the vivarium door is opened.

Like many other snakes, if Rough Greens are not used to being handled, they can produce a strong-smelling fluid from the cloaca.

Ideal choice

This species would be ideal for people who, understandably, have an aversion to feeding mammal/birds to snakes; as crickets are readily available, there are no feeding problems.

Their small size also means that housing does not become a problem as with pythons etc, and unlike with some snakes, several specimens can be housed together. Although the Rough Green Snake is comparatively cheap and still imported, captive-breeding should be attempted, as this would help to reduce the numbers taken from the wild.

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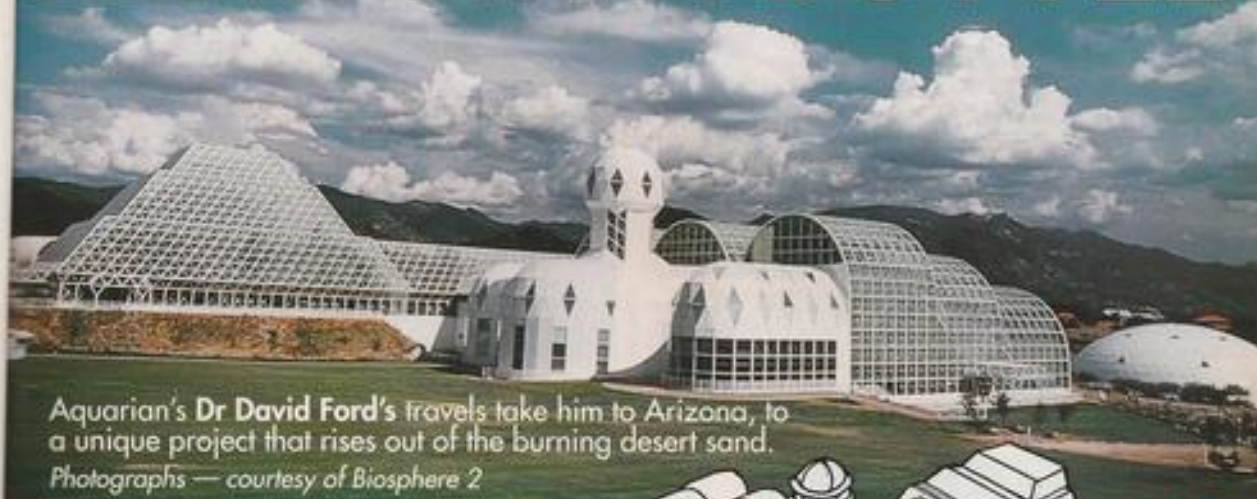
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OCEAN IN A BOTTLE



Aquarian's Dr David Ford's travels take him to Arizona, to a unique project that rises out of the burning desert sand.

Photographs — courtesy of Biosphere 2

About two hours drive from Phoenix, Arizona, is a visitors' complex built in the desert to service the tourists' needs when viewing a remarkable project at close hand. Although well established as a tourist attraction, Biosphere 2 is actually a serious scientific experiment.

Starting in September 1991, eight scientists (Biospherians) shut themselves away in a glass bubble for two years to study their totally isolated and enclosed system that emulated Biosphere 1 (the Earth). Since then, new crews have entered the glass dome and data have flowed out on the interacting effects of a totally controlled environment. The project is planned to last 100 years and should pave the way to similar units on the moon or Mars, as well as help us understand, and hence control, the earth's environment.

Privately funded (it cost £100 million) the dome consists of 8,000 double-layer glass panes in a stainless steel frame over a buried liner that isolates the interior environment totally from the outside world. 100% of its air, water and nutrients are recycled, the life energy source being the Arizona sun shining into the giant greenhouse.

The heat expands the internal air (leak rate is less than 10% a year) so west and south of the

glasshouse are two white coated geodesic domes connected by underground tunnels. These expand and contract with the air as the sun rises and sets over the desert, acting like a pair of lungs that breathe nearly 2 million cubic feet of air per day.

The biosphere contains six 'biomes': a tropical rainforest, savannah, marsh, desert, a farm with human quarters, plus . . . an ocean with a coral reef! Spread over three acres, the biomes have 1,000 sensors that take readings 360 times an hour, so the computers now have three years of data ready for analysis. Biosphere 2 was created originally with doubts about its effectiveness and plagued subsequently by personality problems, but this enormous mass of data is attracting many scientists from all the major universities, and researchers, rather than tourists, are queuing up to be involved in the experiment.

The ocean is 900,000 US gallons and consists of a mix of natural seawater and Instant Ocean salts. It is initially shallow, sloping down to 10 feet depth, where the coral reef is built, and then 25 feet to the base. The reef is mainly Caribbean, with Damselfish, Abudefdufs, Angels, Butterflies, Wrasses and schools of



- 1: A Fog desert
- 2: Salt marsh, with flow to sea
- 3: Tropical savannah
- 4: The ocean with its coral reef
- 5: Rain forest
- 6: Agricultural section

Doctorfishes and Striped Parrots swimming over hundreds of soft and hard corals.

Talking to their latest marine biologist (by phone!) Matt Smith, he reported that he has surveyed 30 Species of fishes and 830 living colonies of corals. The ocean is 35 ppt (parts per thousand) saline at 25.5°C (78°F), but daily temperature changes are plus and minus 0.7°C (1.26°F).

The fish and corals are not artificially fed at all; the system is totally self-sustaining. There are problems with algal blooms, but the fish are breeding and surviving and nitrate levels are under 30 ppm (parts per million). The ocean was originally filtered via algae-scrubbers, but these proved less effective than hoped and have been recently replaced with protein skimmers.

The only freshwater fish are tank-held Tilapia which are fed from rice crops growing on human excreta, but this self-sustaining system is still experimental, and the Biospherians reported that the fish have not (yet) been eaten!



A Biospherian routinely checks the progress of every living thing in the ocean.

Bare v furnished tanks

The advantage of keeping Discus in bare tanks is an essential consideration for the serious enthusiast. It is the only way in which to house large quantities of fish in order to keep them in peak condition, without the worry of water contamination via the rotting debris that accumulates within furnished aquaria.

However, if you only have a few fish per tank to look after, then from an aesthetic point of view, a furnished aquarium with plants, gravel and rocks can be quite rewarding for the hobbyist and will be enjoyed by his/her Discus.

My preference is for 'clinical' all-bare aquaria, since they are more convenient for several reasons. Water quality, for example, is paramount, and when raising young fish, vast amounts of food and water changes are necessary to attain good growth. This would be impossible to achieve in a furnished aquarium.

Cleaning fish debris on a daily basis is a chore, but it is a sure way of preventing the passing on of internal gut parasites. This

also aids bacterial filtration from being over-burdened with fish waste, ammonia, nitrite and nitrate levels which are always being diluted, thus keeping them to a bare minimum.

If you were to breed your Discus in furnished aquaria, the chances of having lots of fry are pretty slim.

With gravel beds, water will become harder over a period of time. There will also be some loss of water through evaporation. Under these conditions, a male would find it quite difficult to fertilise eggs. If he did succeed, after the fry becoming free-swimming (after five days on the spawning site) they would be doomed, becoming trapped in the maze of the gravel bed, especially when the lights are switched off.

Discus will adapt to both furnished and unfurnished surroundings and will be quite happy, so the question to be asked is what you, the hobbyist, intend to do. There is no hard and fast rule regarding how to keep a Discus aquarium, as there are numerous choices available and all seem to work. Some undoubtedly have more advantages than others, but all appear to achieve the same end result... if managed properly.

DISCUS



BILL TOOLEY

Relatively large eyes and shortened bodies identify these otherwise beautiful young Discus as runts.

Another pointer is body shape. At worst, the overall shape of Discus should be round, this, to include finnage. If the total appears long or arrow-shaped, then it represents a poor fish.

Quality stock should have a round body (in addition to overall) shape. The finnage gives these quality Discus a higher appearance and such specimens often command a higher price tag.

A rare 'commodity' is the high-bodied Discus in which eye position is 1/3 up from the base of the chest bone and the body shape is higher than it is long; the forehead is almost vertical.

Although this could be the shape of things to come, at the moment, such features would be considered to be a slight distortion of the name Discus, since the name itself indicates a round fish.

Spotting runts

There are numerous ways in which one can spot poorly kept Discus. A runt could be any size up to 10cm (4in) in body size, but the size of the eye usually gives the game away.

Reasonable specimens have their eyes positioned two-thirds up from the base of the chest bone; the lower the positioning, the poorer the fish.

When Discus are not eating, they lose weight. However, the eye still grows, so when the fish begins eating again, the body is not in proportion to the eye, which thus, ends up having a lower position on the head.



STEVE DUGLEY

Bare tanks are easier to manage than furnished ones... and Discus will be happy enough under such conditions even to breed.

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DISCUSIONS

BY
STEVE
DUDLEY



During the first few feeds, some of the fry may have some difficulty catching the shrimp, so be patient. Feed them once per day, preferably in the morning, so that the food will be consumed well before lights out. Remember to siphon off any uneaten shrimp; if not, they will pollute the aquarium.

By the third day of weaning, all the fry should be taking the brine shrimp nauplii. At this stage, you have the choice of removing the fry to a prepared 5-gallon tank or leaving them with the parents for a week or so, which will be of no detriment to either.

If you have chosen to move the fry, they will need brine shrimp every 2-3 hours, so have plenty on the go; you will be amazed how much can be consumed! I once watched a 10-day-old fry consume over 200 tiny shrimp in just 10 minutes! Change water just 20% once per day, in a 5-gallon tank and just use a foam sponge for filtration, to be cleaned every three days in aquarium water.

Care of new fry

When they reach the 'ripe old age' of 5-7 days after feeding from parents (?), fry may wander from the brood in order to seek out some other tasty morsels, in addition to the nourishment which they get from their parents. It is common practice to introduce newly hatched brine shrimp as an additional food at this stage.

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GOLDEN RULES

1 To hatch brine shrimp eggs, use 1-tsp cooking salt per pint of water per 1/2 tsp eggs at 80°F (27°C). Add 1/4 tsp bi-carbonate of soda in soft water areas.

2 Don't leave breeding pairs with eggs or fry illuminated 24hrs per day, as they will become exhausted and stressed.

3 When purchasing new fish, be aware of their dietary needs and the water chemistry they are being kept in. This enables you to simulate their needs as near as possible, ensuring a quicker settling in period.

4 Good egg hatchings are observed between pH6-pH8.3. Any higher, the infertile eggs will become fungused and cover fertile eggs. However, fungus only attacks dead tissue and will not destroy healthy fertile eggs.

mix other foods at this stage. When preparing beefheart, first grate it to a fine dust from frozen; then it can be pulverised using your fingers. By doing this, the water in the meat will evaporate, leaving just the meat. This will have a consistency of a meat paste and, if administered correctly, will not cloud the aquarium water. The prepared food can be rolled up into little feeds and re-frozen.

As the fry grow, they can be weaned off brine shrimp after 4-5 weeks and the beef diet can be supplemented with dry foods with additional vitamins and mineral supplements. Remember to increase the amount and size of food as the fish grow; all foods must be bite-sized for optimal growth.

At the age of 6-8 weeks the juvenile fish should all appear Discus-shaped and all runts and deformities should be culled along the way.

The first colour should appear in the fins and on the head region; the rest of the body colour and pattern will follow over the coming months.

Care of older fry

After three weeks of intense feeding with nauplii, the fry will be ready to take finely grated beefheart; it is not essential to

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DAVID TWIGG'S

KOI CALENDAR

Show results

Central Section BKKS held their annual two-day show at the Avoncroft Museum of Buildings, Bromsgrove. Arriving early on the Sunday morning, I was able to walk around the show vats and take some photos at my leisure.

The obvious centre of interest, for me, was the first Japanese entry into a UK Koi show. This lovely Koi, a Kuchiben Kohaku, was in almost the first vat that I looked into, with one other Koi, a Size 5 Showa (J.S.C. Special Award winner).

On looking to the winners' board, I was surprised to find this gorgeous, but obviously stressed, Kohaku placed 3rd. Enquiries made revealed that this fish had jumped out of the vat on the Friday night. What a terrible shame! Fortunately, I was told not too much damage was done, but this event obviously had a bearing on the placing of the fish in its class.

Continuing around the show ring brought me sight of many more lovely Koi, including the Grand Champion Kohaku belonging to Ian Stewardson. This was just one of four lovely fish Ian had entered.

Photography over, I moved into the dealers' section of the marquee where, by this time, many people had accumulated and were milling about around various Koi dealers, admiring the fish on offer and the other goods on sale. Chatting to many of the stall holders has become part of my routine, and is a very important and enjoyable part of my day. But now to the major prizewinners:

Ian Stewardson, Grand Champion (Kohaku), Best in Size 5 (Showa) and Best Mature Koi (Showa); **Tony Carter**, Best Adult Koi (Showa) and Best in Size 4 (Showa); **Chris Fullelove**, Best Baby Koi (Kohaku), Best in Size 2 (Kohaku) and Best in Size 1 (Showa); **Mike Osbourne**, Best in Size 3 (Kohaku).

My thanks to Show Chairman **Ken Smith**, and his team of tireless workers for putting on yet another good show.

My thanks also to **Dave**



This beautiful Kohaku was a the first Japanese-owned fish entered in an English Show.

Wilson, editor of the Northants Section BKKS newsletter for sending the results of their Annual Show. I regret that I was unable to get to this, my Section show, due to work commitments, but I understand that it was a great success.

The Grand Champion was entered by **Jackie Bess**, **Ann Byles** won the Ladies prize and the award for the most Unique Koi, as well as Best in Show Size 1 and Best Size 1 Tategoi. Best in Show Sizes 2 and 3 went to **Ann's** husband **John**. Well done to them and well done also to the following 1st prize winners in each of the three size groups: **Dot Robinson**, Size 1 Sanke; **John Perkins**, Size 1 Showa; **Ann Byles**, Size 1 Koromo; **Hikari Utsuri**, Size 2 Kohaku; **Kawarimono**; **S & M Oatham**, Size 1 Tancho, Size 2 Utsurimono, Size 3 Kawarimono; **Sylvia Day**, Size 1 Hikari Utsuri; **Pete Robinson**, Sizes 1 + 3 Hikari Moyo, Size 2 Hikari Utsuri; **Brian Calcutt**, Size 2 Sanke; **Hikari Muji**; **John Byles**, Size 2 Showa, Size 3 Sanke, Tancho and Kin-Gin-Rin; **Dave Wilson**, Size 2 Bekko; **Bryan Moore**, Size 2 Koromo; **Kath Perkins**, Size 2 Asagi/Shusui; **Sandra Wilson**, Size 2 Tancho; **Nigel Siamsey**, Size 2 Kin-Gin-Rin; **Mike Binns**, Size 2 Hikari Moyo; **Nick Bess**, Size 3 Showa; **Albert Day**, Size 3 Hikari Muji.

Watch out!

Winter is definitely with us in November. Once again, at time

of writing, I think that winter has arrived early! Yesterday morning, my pond water temperature (unheated) was 12.6°C (54.7°F) and by this morning, it had fallen to 8.7°C (47°F) — overnight, we had torrential rain and I heard on the news that many parts of the country had flooded roads. I really must get my heater back in circuit before the temperature drops to a point where I have to stop feeding my fish.

That brings me nicely to the reason why my heater is not in circuit! "Watch out, there is a thief about" came true in my rear garden a couple of weeks ago. Yes, my two green Tropical Marine Centre UVS's were stolen from my working system, and not a drop of water was spilt! It would seem that the thief (or thieves) knew what they had come for and exactly what they were doing. I had often thought of the possibility of having fish stolen, but not the equipment, so now it is a case of making even more items secure.

So, with our editors' permission, I will ask readers to report to me or the police if they have recently been offered, in suspicious circumstances, a couple of second hand, green-tubed, TMC 30Watt UVS's joined in the shape of a 'U'. I can identify them quite easily.

Jobs for the month

With winter covers in place, it is easy to allow our Koi to become "out of sight out of mind". It may be that they are still feeding, if only on remaining blanket weed, so cleaning of the pond is still necessary. As mentioned in earlier columns, if at all possible, arrange covers so that minimum disturbance is caused when keeping an eye on the fish and 'vacc'ing off.

If Koi are obviously looking for food, then subject to water temperature being above about 7°C (44.6°F) and a cold spell not being predicted for the next few days, small quantities of easily digestible food, such as boiled wheat or barley, can be given and will be readily consumed.

WHAT'S ON IN NOVEMBER

1 — Border Koi Club, Monthly meeting, Contact Mrs Amy Fisher, 0228 813623.
Yorkshire Section BKKS, Monthly meeting, Contact Phil Swallow, 0432 343674.
2 — Leicestershire Koi Society, AGM, British Shoe Corporation Social Club, Soudamoor Road, Leicester, Contact Pip Ostell, 0533 606707 or Kevin Luskman, 0455 250413.
3 — Middlesex and Surrey Borders Section BKKS, "Show by Stiles" presented by Gary Pritchard (Chairman BKKS), Nobblon C.I.U. Club, Kingston, Contact Gary, 081 841 2894.

6 — Northern Koi Club, Pond Open Day in Manchester area, Contact Tony McCann, 061 794 1958.
Eastend Section BKKS, Meeting starts 7pm, Wellstead Community Centre, Vicarage Lane, East Ham, London, Contact Phil Davis, 0279 443754.
8 — Nottingham & District Section BKKS, AGM, The Western Club, Derby Road, Nottingham, 6pm, Contact Shirley Hind, 0852 810923.
9 — Merseyside Section BKKS, Monthly meeting, Millbrook Manor, Knowsley Village,

Contact Robbie, 051 542 2001.
11 — Heart of England Koi Society meet in Warwick, speaker is Kate McGill, a BKKS judge, Contact me, 0926 495213.
13 — Central Section BKKS, Monthly meeting, T.P. Riley Community School, Bloxwich, Contact Sue Finney, 021 747 2730.
14 — Northants Section BKKS, Monthly meeting, Saints Social Club, Contact Brian Calcutt, 0604 784954.
West Wales Section BKKS, Monthly meeting, Post Office Club, Swansea, Contact Andy Tovey, 0554 821310.

18 — Crouch Valley Section BKKS, Photo competition, Meeting in London, Essex, Contact Ron Parlow, 0277 840863.
26 — Middlesex and Surrey Borders Section BKKS, Annual dinner-dance, Contact Gary Pritchard, 081 841 2894.
Northern Koi Club, Annual dinner-dance, Worsley, Contact Tony McCann, 061 794 1958.
27 — Northern Koi Club, Speaker is Paul Stacey of Shirley Aquatics, Novotel, Worsley, Contact Tony McCann, 061 794 1958.

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, Alan Rogers, Tropical, Dr David Ford, Coldwater, Pauline Hodgkinson, Plants, Barry James, Marine, Gordon Kay.

PLANTS



Iris alternatives

I have a very tiny pool measuring 35in in length, 18in in width and 12in in depth (90 x 45 x 30cm). I have a small shelf at one end which is only 6in wide.

Is there a miniature Iris available, as all the ones I have come across are far too tall?

There are no really miniature aquatic Irises. However, a good substitute is one or other of the *Sagittaria* species which are members of the Iris family and exhibit many of the same characteristics.

S. californicum which, as its name suggests, is a native of California, is a short tufted plant some 6-8in (15-20cm) in height, with grassy leaves and terminal umbellate cluster of bright yellow star-shaped flowers.

Slightly taller, but with blue flowers, is *S. bellum* from Idaho.

Both species will thrive in moist to boggy soil and should be grown in such a way that the crowns are slightly above the

water surface. Both seed freely and new plants can be produced from seed sown in a cold greenhouse in early spring.

Goldfish-resistant plants

I have some Fancy Goldfish which keep eating my plants.

Would you suggest a couple of suitable species that would resist such attacks?

Goldfish are very destructive to most plants, as you have discovered. I therefore suggest you use the following—

1. The Umbrella Plant (*Ophipogon japonicum*), which is a strong aquatic, with tough, wiry, grass-like leaves.
2. Variegated Rush (*Acorus gramineus variegatus*), a stiff, upright plant with pretty leaves striped in green and yellow.

You should be able to obtain both these species without difficulty.

***Sagittaria californicum*: a suitable alternative to dwarf Irises.**



BARREY JAMES

MARINE



CARE OF THE WILD

Female turtle photographed at night at her nest on a Greek beach.

Help for turtles

My family love the Greek Islands and are going again in a few weeks time. We also love turtles and have read your concerns for them.

How can we help? We are off to Zakynthos.

The most useful help that you can give is of a practical nature. On a beach, known to be a nesting site, the eggs will have been laid some months ago and — by late summer — should have all hatched.

If there are still some nests on the beach, be careful that you do not trample over them. Nests are usually found at the back of the beach. Also, do not go onto the beach at night.

More especially, do not light fires on the beach after dark — even if you are allowed to do this — and please don't play music. All of this would completely disorientate any hatchlings.

TB Fears

I know this sounds weird, but I have become very worried about Fish TB. I recently saw pictures of rashes caused by Fish TB and am now scared that I may catch it if I put my arm in my marine aquarium.

Stop worrying! Piscine TB is a disease caused by the bacterium *Mycobacterium marinum*. There are several species in the genus, including the one which causes human TB.

However, *M. marinum* does not commonly infect people, although there have been isolated cases, and the pictures you saw were probably of these.

People can only be infected if they:

- (a) run a tank in which TB is present, and
- (b) have an open wound which they thrust into infected water.

TROPICAL



Breeding Cherry Barbs

I would like to breed Cherry Barbs. Please help me.

The Cherry Barb (*Barbus titteya*) was found originally as shoals in shaded streams of Sri Lanka, but is mass produced in Far Eastern fish farms these days. To breed this species, you need to reproduce the Sri Lankan habitat.

Place a shoal (the fish become stressed if single, even with other barbs, if not of the same species) in a tank with a dark bottom (mud or black gravel) and tall plants (Amazon Swords, Vallisneria etc.), but a free-swimming place at the front.

Use neutral to slightly acid (5.5pH), medium soft (12 to 18°GH) mature water at 25°C (77°F).

Have another tank set up similarly, but with dense vegetation, for the breeding pair, or remove the unpaired fish to make the holding tank the breeding one. Let a pair form naturally (the males are sometimes deeper-bodied — which makes them look like a female ripe with eggs — but develop a bright red colour when courting).

Only one or two eggs are laid on leaves via a thread during each spawning pass, but this continues until there are 200-300. However, the fish may eat the eggs, so use dense plants to hide them and even feed the pair during spawning (blood worms are eagerly taken). Remove the pair at the end of a spawning day and the eggs will hatch a day later.

Feed the fry on infusoria, then ground flake (including vegetable flake), then freshly hatched brine shrimp.

A trio of Cherry Barbs. The male is the brighter coloured fish in the centre.



AQUARIAN FISH FOODS

HERPETOLOGY



Blue-striped Garter Snake in characteristic resting pose.



DOCK #1079

Blue Garter Book

Can you please direct me towards any books which give information about (i) the natural history and (ii) the requirements in captivity of Blue-striped Garter Snakes (*Thamnophis sirtalis similis*) — also known as Florida Garter Snakes?

Garter Snakes — *Their Natural History and Care in Captivity* by Roger Sweeney is published by Blandford. This book contains information on vivarium design and furnishings, feeding and breeding. Thus, at £12.95 it is a good starting point for herpetologists interested in members of the genus *Thamnophis*. ISBN: 0-7137-2271-1.

The book contains 128 pages and the text is divided into three sections:

Part One covers different aspects of the natural history of snakes in general and members of the genus *Thamnophis* in particular.

Part Two deals with captive husbandry. Subject headings include housing, heating, handling, health care, breeding and feeding.

Part Three contains an identification key for thirteen of the sixteen species of *Thamnophis* found in North America. The key is followed by a description and distribution map for the thirteen named species, together with descriptions of forty-one subspecies.

Six species from Central America, which are not generally available to the hobbyist, are also mentioned briefly.



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COLDWATER



Low-down on mussels

I would like to know more about freshwater mussels. Can you help me in any way?

There are several species of freshwater mussels.

Perhaps the best known among aquarists is the Swan Mussel (*Anodonta cygnea*). This species has a relatively long life span (about 10 or 11 years); its age can be determined by the number of concentric lines on either of the two equal size shells. Like other freshwater mussels, it is not edible.

Water is passed through the gills, allowing oxygen to be extracted and small animal life and algae to be trapped for food. The water is then expelled through a second siphon. The Swan Mussel needs a bed of mud to move around on; it also likes to submerge partly in the mud when not moving around by pushing itself with its muscular foot.

The female produces about a million eggs which she keeps within a brood pouch called the marsupium in the region of the gill. There they remain for about 9 months and develop into larval forms called glochidia. In spring, these tiny creatures are ejected into the water, whereupon they attach themselves to fish, usually to the fins and gill area, so, in fact, they become

fish parasites. This life cycle is common to other types of freshwater mussels.

Soon, the skin of the fish grows over the tiny larva forming a cyst. The larva when first released into the water has its two half shells open but, on reaching the fish host, it clamps the shell shut and uses teeth at the edge of its shell to hold onto the skin. Here it feeds as a parasite on its host until it changes into a young mussel, when it will fall away after breaking free of the cyst.

Painter's Mussels (*Unio pictorum*) can reach a size of 4 inches (10cm) and take their name from when they were used by artists to hold their colours.

Pearl Mussels (*Margaritifera margaritifera*) are slightly larger and found in fast-flowing rivers. Occasionally, small pearls are found in this species.

The Swollen River Mussel (*Unio tumidus*) is small and found in slow-flowing rivers and canals.

Although, as larvae, the mussels I have mentioned are fish parasites, they do not appear to trouble their hosts too much. In fact, the Bitterling uses the Swan Mussel (in which the female deposits her eggs) as a nursery for the young.

Because of their useful connections with the Bitterling, Swan Mussels are usually available from water garden centres and aquatic shops during the summer months.

Female Bitterling (with extended ovipositor, or egg laying tube) examining a Swan Mussel.



LAURENCE FERRON

KOI



Pupal feeding

I have been told by a friend that feeding silkworm pupae is very beneficial to the growth of my Koi and would encourage my females to spawn regularly each year.

I have searched for information from various sources and have found very little help on this subject. Can you please advise me?

Silkworm pupae are 'natural' and can constitute highly nutritious food for Koi to consume, but certain precautions must be observed before they are offered.

It must be emphasised that the freshness of the food is most important, and as most of the pre-packaged pupae sold in this country display no date marks, this appears to be the first problem.

The protein content of silkworm pupae is 54%, with a fat content of 29.5%, so from just this part of the content analysis, 'highly nutritious' is definitely not an understatement. Rinsing in warm water for a couple of hours prior to feeding will help release any residual oil, always evident on the skin of silkworm pupae.

Any high protein food must only be fed in water temperatures above 68°F (20°C) to aid relief of the digestive tract and, at these levels, digestion is easily accomplished. It is quite a rare phenomenon for unheated ponds in the UK to maintain temperatures in excess of 68°F for very long, even in our hottest summers, so here lies the most critical problem with regular use of this food.

Silkworm pupae, as a sole diet, is somewhat deficient in essential vitamins and minerals to sustain a healthy existence, so it is imperative that this be supplemented with a more balanced diet. Feeding any food with a high fat content should be monitored carefully at all times; it is never in the Koi's best interest to ever receive high levels of fat on a regular basis.

I would therefore say that the random or sole administration of silkworm pupae to your female Koi approaching breeding time would be detrimental.

Light-sensitive bacteria?

My external filter is quite shallow (only 18in — 45cm). I have been told that I can completely cover it during the worst of the winter period to prevent it from freezing.



BOB COOPER

An in-ground filter such as this one will only require surface protection over the coldest winter period. Its bacterial population will continue to tick over whether or not the cover used excludes light completely.

My question is: do the nitrifying bacteria need natural light for survival, or is it advisable to cover with heavy-duty transparent plastic material?

Firstly, you never stated as to whether the shallow filter is above or below the ground level. If below ground level, you have natural insulation from the soil itself for all sides, and only the surface would need winter protection.

If exposed above ground level, and of the plastic/fibre-glass type, then in the worst of the winter, consider it necessary totally to insulate the unit. If the filter is constructed of brick/block design, the thickness should give a high level of frost protection, although further insulation would never go amiss.

Maintain a water flow through the filter all winter, although most of the bacterial activity will be greatly limited in temperatures below 40°F (c 4.5°C); equally, any ammonia/nitrite levels will be reduced.

Your nitrifying bacteria within your filters require no light whatsoever to sustain a working efficiency. In fact, many systems function all year round and maintain full effectiveness devoid of all sources of light. As long as they have healthy water and adequate oxygen levels, the Nitrobacter and Nitrosomonas bacteria still accomplish their objectives in the Nitrogen Cycle while subjected to total darkness.

ALGAE: FRIENDS OR FOES?

**PART
TWO**

Allies and Control

Chris Rosam completes his two-part review of these non-flowering plants that can benefit or destroy... depending on species and conditions.

While the freshwater aquarist will discourage algae, the marine one may wish to encourage selected species of the larger macro-algae, which are commonly referred to as seaweeds. They are not, of course, "weeds" in the normal sense of the word.

Some desirable species

The most commonly available marine algae are the *Caulerpa* species, which frequent the quiet shallows of the tropics.

C. prolifera, *C. mexicana* and *C. taxifolia* all grow rapidly, the last two having attractive feather-like 'leaf' structures. *C. racemosa* is sometimes available and known as the Grape Caulerpa due to the berry-like growths on the stalks.

Halimeda species are often known as Cactus Algae, as the calcium-reinforced heart-shaped segments that grow in long chains have a prickly feel and look like the Prickly Pear Cactus.



THYRON MANDOUZIS



CHRIS ROSAM

Top, encrusting coralline red algae, such as these photographed in Roatan, Honduras are exceptionally beautiful.

Above, *Caulerpa prolifera*—a fast-growing species which has the typical "seaweed" appearance.

Right, this part of a large patch of *Halimeda* shows why it is known as the Cactus Alga.



THYRON MANDOUZIS

Under favourable conditions all the above species grow quickly.

One of the most attractive, although rarely available, marine algae is the Mermaid's Cup, *Acetabularia*. The plants have the appearance of an inverted toadstool, and are lime-encrusted.

The introduction of living rock may bring with it many species of algae or their spores. If lucky, species of *Valonia* or Sea Bottle may be discovered. The plant appears as a cluster of small balls that are easily punctured. Each of the balls is a single cell which may measure several centimetres.

All the aforementioned are green marine algae from the predominantly freshwater class, the Chlorophyceae, and only grow at depths up to 10 metres.

Red and brown algae from the Rhodophyceae and Phaeophyceae grow at deeper depths, the former to depths as deep as 100 metres (330ft). These red algae are only occasionally available, despite their obvious attractiveness and there being some 4,000 species.

Algal control

Many fish are often celebrated as 'algae eaters' and some, clearly, are. However, it should be recognised that the capacity to consume algae by the fish is normally limited to grazing on non-motile green species. Only the difficult-to-obtain Siamese Flying Fox (*Crossocheilus siamensis*) is known to eat 'Beard Algae'. No fish are known to consume blue-green algae.

The phytoplankton species that make green water are, in nature, grazed upon by animals such as *Daphnia* and *Cyclops*, but in the closed ecosystems of ponds and aquariums, these creatures do not survive the attentions of fish.

The marine aquarist wishing to cultivate selected algae needs to choose his or her fish carefully to ensure they are not partial to algae, of course.

By far the best approach to suppressing unwanted algae is to ensure that there is no oversupply of nutrients, and that any undesired algae face stiff opposition from fast-growing aquatic 'higher' plants or macro-algae. Therefore, don't overfeed your fish or overstock your tank — and carry out regular water quality maintenance routines.

Algicides are best used — in my opinion — as a last resort, and should never be added to a marine set-up, where they may destroy the desirable large algal species referred to earlier in this article. Compounds that aim at controlling algae by establishing some form of balance or equilibrium (particularly in ponds) are more environment-friendly than strict algicides and are worth considering, especially in lightly planted ponds.

It is often suggested that algae can be suppressed by a reduction in lighting levels, which may well be true. But, at the same time, aquatic plants will also be sup-

COMMON SPECIES OF ALGAE

FRESHWATER	MARINE
Cyanophyceae. (Blue/Green Algae) Velvety covering that can grow at a frightening rate. They always demand immediate action.	Cyanophyceae. The Blue/Green Algae may appear in a red form. Just as pernicious as their freshwater counterparts.
Rhodophyceae. (Red Algae) Beard Algae which form dirty coloured tufts that can quickly smother a tank. Difficult to remove mechanically. Should not be allowed to get out of control.	Rhodophyceae. When available, can form very attractive plants well worth cultivating. The Red Algae can grow at depths down to 100 metres (330 ft).
Chlorophyceae. (Green Algae) These fall into two categories: motile and non-motile. The former create green water and include species such as <i>Volvox</i> and <i>Pandorina</i> . The latter are represented by <i>Spirogyra</i> and <i>Chlorella</i> (blanket weed species).	Chlorophyceae. Most of the commercially available marine algae are from this group, including <i>Caulerpa</i> , <i>Halimeda</i> , <i>Acetabularia</i> and <i>Valonia</i> . They all grow in the warm shallow waters of reefs. <i>Halimeda</i> is the only species likely to be found on the seaward side. All are an asset to the marine aquarium.
Bacillariophyceae. (Diatoms) Coloured brown but are, in fact, green algae. The cell wall is impregnated with silica.	Phaeophycophyceae. (Brown Algae) Virtually all marine. This classification includes the Giant Kelps such as <i>Nereocystis</i> and <i>Macrocystis</i> , specimens of which often measure over 100 feet (30 metres) long.



Species of red algae, like *Bryothamnion segortii*, are capable of growing at greater depths than their green and brown counterparts.

pressed, making them less able to compete for excess nutrients. Once lighting levels are restored, the algae may well profit again if over-supplied nutrients have not been removed. In addition, under reduced lighting, brown algae may develop.

Aquariums and ponds should always be kept clear of dead or rotting leaves, as, during the process of decomposition, phosphates previously stored in the plant are released, ready for exploitation by algae.

The next time you are plagued with an



Codium geppii — a small green alga that grows in clumps and would be eagerly grazed by marine fishes and algal-eating invertebrates.

algal problem, try to appreciate that if it were not for the algae, there would be no life on earth! They appear in fresh bodies of water as nature's 'pathfinders' to establishing life and a food chain; it just happens that this does not always fit into our ideals as aquarists and pondkeepers. The main exceptions are, of course, the marine algae which can be used to great effect, not just as decorative additions, but also as water quality improvers, and should therefore be considered an integral part of every marine set-up.

BELIZE

PART TWO

Amazing

In the second (final) leg of his Belize expedition, Peter Stafford comes across some fascinating frogs, toads, salamanders... and a legless amphibian.

Photographs — unless otherwise indicated — by the author

Although it can rain at any time of the year in Belize, towards the end of May the skies become more and more overcast, and the showers, light at first, turn to heavier, prolonged downpours. Within a matter of days, the ground becomes saturated.

The hill-side streams begin to flow again, the rivers begin to swell, and small depressions on the forest floor fill with water, creating temporary pools. From the beginning of June to the end of December, up to 60 inches (150cm) of rain will fall!

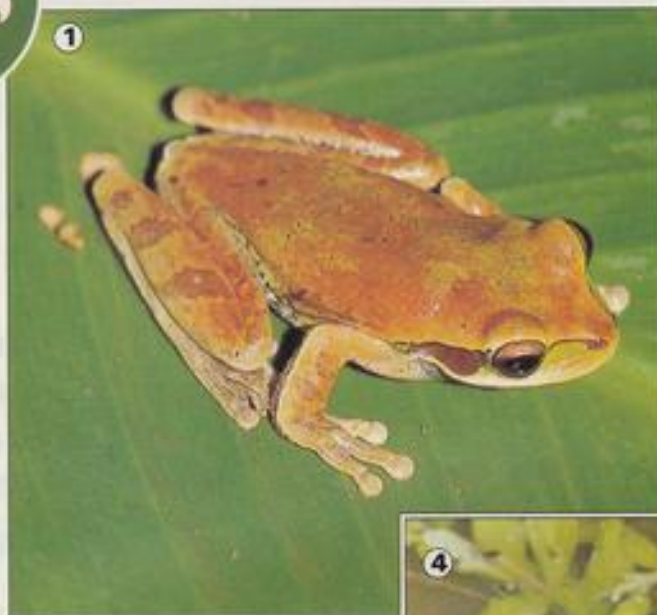
Wops and Giant Toads

With the arrival of the wet season, hordes of frogs and other amphibians seem to appear literally overnight. Many of the thirty or so species have remained inactive or dormant since the preceding rains, and been waiting for this moment to resurface and start breeding. Most of the activity takes place in the evening and often continues through much of the night when, even if it has not been raining, it still drips from the canopy due to the condensation of mist and low cloud.

As darkness approaches, the forest begins to resound with the 'chirps', 'booms', and 'whistles' of amorous frogs and toads trying to out-compete their neighbours and attract a mate. In places, they may assemble in their thousands, and the ground seems to 'heave' with slippery spawning amphibians, all proclaiming their desire to breed at the tops of their voices.

One of the most unusual calls is that made by the male Mexican Burrowing Toad (*Rhinophrynus dorsalis*), a species which ranges throughout much of Central America. In Belize it is known as the "Wop", a name which describes its hollow, 'moaning' croak, and the united voices of these toads *en masse* is a sound that has to be heard to be appreciated.

This amphibian is not really a toad at all, but an unusual frog which lacks a



1

Smilisca cyanosticta, a smaller and more slender species than *S. baudini*, is distinguished by the presence of blue spots on the backs of the thighs.

2

Bufo variceps, a common and highly variable species of the forest floor.

3

Eleutherodactylus chac, a small leaf-litter frog named after Chac, the Mayan God of rain.

4

The "Wop" or Mexican Burrowing Toad, *Rhinophrynus dorsalis*.

breast bone, and it has a tongue attached by its base at the back of the mouth, rather than by its end at the front, like most frogs and toads.

As its name suggests, the Mexican Burrowing Toad is adept at burrowing, and uses a hard spade-like tubercle on the hind feet to shuffle backwards down into the soil. When caught by surprise and frightened, it can also inflate its body like a balloon.

After spawning, its eggs float to the surface of the water, where they hatch into

Amphibians



tadpoles which are peculiar in having several long 'whiskers' around the mouth.

Central America and the Caribbean are the native homes of the largest of the true toads, the Giant or Cane toad (*Bufo marinus*), a gluttonous beast that grows up to ten inches (25cm) long and will devour anything that it can fit into its cavernous mouth. In Belize it goes by the name of "Spring Chicken", which is also applied to many of the frogs. This same species was imported into Australia in the 1930's to help eradicate the Cane Beetle, since when it has spread uncontrollably over much of the country with disastrous ecological consequences.

The much smaller *Bufo variegatus*, which also ranges into the southern United States, is a more appealing and colourful species, and is one of the most abundant, or at least conspicuous, amphibians inhabiting the forest floor. Both species are common and seem to breed at any time of the year.

Tree frogs

There are twelve kinds of Tree Frog in Belize. Two of the earliest species to appear in the wet season are *Soulinca cyamotera* and *Soulinca basini*, which can often be found calling from puddles or water-filled tyre ruts on muddy roads, or, for that matter, anything else which con-

tains water, including cisterns and old buckets. The characteristic short, loud and explosive "wonk, wonk, wonk" of these frogs is unmistakable.

Most other species, on the other hand, tend to wait for more rain and wetter conditions before starting to emerge. One of the largest species, *Phrynosoma temalosa*, occasionally found in gardens, is characterised by a thick, glandular skin which exudes an unpleasant, copious white slime when handled, while the Casque-headed Frog (*Tripterygion petasatus*), with an extraordinarily-shaped head, is possibly the most bizarre.

Under a *Heliconia* leaf by a jungle pool, or sheltering in a bromeliad, you might find one of several species of the genus *Hyla*, but perhaps none are more endearing, though, than the two species of Red-eyed Tree Frog, *Agalychnis moreletii* and *A. callidryas*, the latter of which has brilliant red eyes and attractive barred markings on the lower flanks.

At dusk, the males of *A. callidryas* can often be heard calling from high up in the trees around jungle ponds, from where they descend after dark to breed. Clinging pairs deposit clutches of about fifty eggs in clumps on leaves, branches and aerial roots above the water, from which, at the appointed time, the tadpoles wriggle free and drop into the water below. The peak of breeding activity for Tree Frogs seems to be from about the middle of June into July.

Perhaps the most taxonomically complex group of amphibians in this part of the world, and difficult to distinguish, are the frogs of the genus *Eleutherodactylus*, occasionally known as Stream Frogs or Rain Frogs. The genus is represented in Belize by only four species, but as a whole they comprise one of the most speciose groups of all vertebrate animals, with several hundred described to date, and, undoubtedly, others still awaiting discovery.

Most are terrestrial in habits, living among leaf litter on the forest floor or in rocky hill-side streams. They are powerful jumpers and evade capture by leaping aimlessly in all directions and then quickly burying themselves out of sight. In appearance, they look very much like the 'typical' frogs of the genus *Rana*, but, on close examination, they can be recognised straightaway by the absence of any webbing between the toes on the hind feet.

Another group of amphibians which can be difficult to tell apart are the salamanders, especially when they have just metamorphosed from the larval stage and are still very small. When they have grown a little in size, the numbers of grooves, or costae, on the flanks can be used to help identify them.

One of the four species in Belize, *Bolitoglossa macrinii*, rather unusually for a salamander, is almost entirely arboreal, living among suspended 'dead fall' and

Amazing Amphibians

Part 1 of Peter Stafford's Belize report — Amazing Reptiles — was published in the September '94 issue of *A&P*.



The Red-eyed Tree Frog, *Agalychnis collidryas*

TREE FROG FACT FILE

Classification: There are approximately 450 known species of tree frog (family Hylidae), two-thirds of which are grouped into the genus *Hyla* and the remainder distributed between 31 other genera. In the Middle American region there are some 15 genera and 115 species, of which 6 are endemic to the area.

Altitudinal distribution: The majority of species are found below 700 metres (c.2,300ft), but some occur in high cloud forest up to and above 3,000 metres (c.9,850 ft).

Breeding habits: The Middle American Tree Frogs show considerable diversity in their breeding and egg-laying habits. Some species, such as *Triprion petasatus* and *Hyla loquax*, lay their eggs in masses, either free or attached to vegetation in ponds, while a few species, including those of the genera *Smilisca* and *Phrynopyga*, are known to spread their eggs in a film on the surface of the water. Another group lays eggs in small, quiet pools or puddles, and some in streams attached to rocks or beneath decaying leaves. The Red-eyed Tree Frogs of the genus *Agalychnis* lay their eggs on vegetation overhanging ponds and streams, and the eggs of a few other species have been found in water-filled cavities in trees and in bromeliads. In an unusual Panamanian species, *Hemiphractus panamensis*, the eggs are carried in depressions on the back of the female, where they develop directly into miniature frogs, while in *Gastrotheca ceratophrya*, also from Panama, the eggs are carried in a dorsal brood pouch to undergo metamorphosis.

It may not look much like a sheep, but *Hypopachus variolosus* certainly sounds like one.



Bolitoglossa mexicana (this is a newly metamorphosed specimen) is one of four salamander species found in Belize.



epiphytic plants, and using the water-filled rosettes of bromeliads in which to breed and lay its eggs.

The Sheep Frog

Frogs of the family Microhylidae, often known as Narrow-mouthed frogs, are secretive, nocturnal creatures that feed almost exclusively on ants and termites.

There are two species in Belize, *Gastrotheca elegans* and *Hypopachus variolosus*, the males of which give a call that sounds like the bleating of sheep; in other parts of its range, *Hypopachus* is, in fact, commonly known as the Sheep Frog. Both species are small in size, never

more than about two and a half inches (c.6.4cm) in total length, with plump bodies, a small head and rather pointed snout, and are prodigious burrowers. A closely related species from the southern United States, *Gastrotheca olivacea*, is known to share its burrow with a tarantula, where the two live in symbiotic harmony.

Amphibian or worm?

The rarely seen caecilian, *Gymnopsis sistroura*, is perhaps the strangest of all Belize's amphibians. Totally blind, with a layer of bone covering a pair of rudimentary eyes, its segmented body superficially resembles a large earthworm; it is also

completely subterranean in habits, which probably accounts for it remaining undiscovered in the country until 1991.

The caecilians are more representative of the South American herpetofauna, and Belize seems to be virtually the most northerly geographic limit of these animals.

At the end of December the downpours become less frequent and the ground starts to dry out. The toads and some of the terrestrial frogs will remain active, although with not quite so much fervour, during the hot dry months that follow, but many others like, the delicate Tree Frogs, prefer to find a damp hole in a rotten tree somewhere and hide away until, next time around, the rains come once again. **A&P**

WRITEBACK

First aid with a difference

My wife and I decided to move home to live in an area we had always liked. We investigated the market, found a property which satisfied our desires and our bank balance, and a few weeks later, we moved in.

The garden appealed to me right from the first sight when we went to view the property. It required a good deal of work on it, but the size was ideal. It had good potential. At the end nearest the house, there was a small fish pond. To find out how deep it was, I put a stick into the water. To my surprise, I disturbed a large Goldfish. I did not think for a minute that there might be a fish in such a small, dirty-looking pond. Actually, I discovered there were two Goldfish in the water, each about seven or eight inches in length.

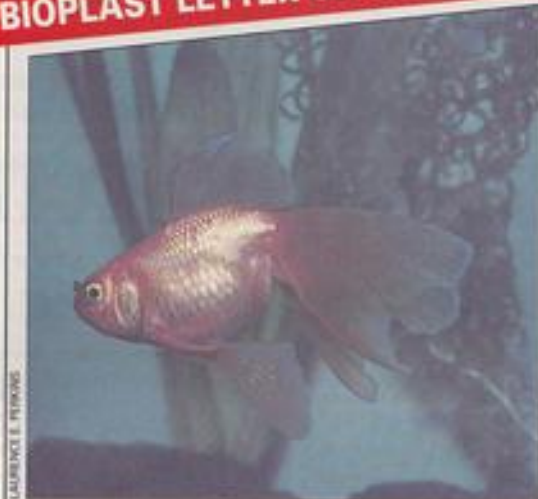
I decided to re-organise the garden and to include a large fish pond, into which I could put the two Goldfish I had discovered and add a few more. An old tub full of rainwater stood outside the greenhouse. I therefore caught the two fish and put them into the tub until their new home was ready.

After a few weeks, all was set for stocking the enlarged pond. The first fish I caught quite easily but the second one proved more difficult. In my efforts to catch it, I disturbed an amount of soil and grit which had been lying at the bottom of the tub. I filled the water with a great cloud of 'dust', so that by the time I had caught my second fish, it was gasping. The debris must have got into its gills.

I quickly released the two fish into the new pond. One of them swam off immediately, quite happy in its new surroundings. The second, however, just floundered about for a few minutes and then rolled onto its side, almost dead. I took it out of the pond and placed it in a small bowl of water at the edge of the pond. I really had no idea what to do with it, but more in desperation than anything else, I tried to massage it by alternately pressing gently around its gills and then slowly releasing the pressure. After my first aid training, I considered this exercise as the nearest thing I could think of to artificial respiration.

Although I felt I was fighting a

BIOPLAST LETTER OF THE MONTH



LAURENCE E. PETERING

Second class coldwater fishkeepers

I am writing to answer Stephen Smith's recent question: Why is it you don't see many quality coldwater fish in 'general' Open Shows when, in a coldwater show such as the SPASS Open, you see hundreds of entrants? You might not like what I am going to say, but as I see it, being a coldwater fishkeeper myself, most of the clubs concerned treat coldwater fishkeepers as second class to their tropical counterparts.

Most of the judges, when it comes to the Best Fish in Show, always seem to sway to the tropical fish, when the coldwater fish may have had more points. I know all this will be denied, but you hear them saying things like "Oh it's only the coldwater fish over there". If you are asked, "What fish have you benched today?" and you tell them, the normal reply is "Oh, coldwater fish", and they promptly walk away.

You do start to think why you bother. Further, when, to get a show class Veiltail, for example, you may have to pay forty pounds plus, and then risk taking it and benching it in a room that might be set up and

Producing a quality veiltail is not quite the same as producing a show standard Neon... so why do coldwater fishkeepers get a raw deal at shows?

heated up for tropical fish, is it worth stressing the fish, or even losing it so it can be looked down on, instead of admired?

I used to be a member of the local fish club and I always felt that when you were benching for the club, you were just making up the numbers. Another thing they never seemed to understand was that my fish always came first, but if the conditions weren't right and I didn't bench them, I was just in a bad mood.

In short, if you lose a Neon, you just go down to the shop and get another one, but to lose a Veiltail is not quite as simple. However, in a 'general' Open Show it's just another Goldfish, whereas, if you go to a coldwater show, the fish is appreciated for what it is and what it has taken to get it to show standard.

I hope all this doesn't make me sound too bitter, as I'm not, but I always speak as I see things.

J. Lumley,
East Cowes, Isle of Wight.

Strong words! What do other readers think? Please let us know. Mr Lumley will shortly be receiving a parcel of goodies from Bioplast (UK) Ltd. (Tel: 0435 630230) for his forthright, thought-provoking views.

Ed.

losing battle, I didn't want to lose the fish. I had become quite attached to them and, in any case, I thought one would be lonely without its partner. I could not afford to buy others of that size and if I had, it would not be quite the same, really. So I continued working on the fish, although, after fifteen minutes or so, it looked quite dead. As I continued my pressure exercises I thought I noticed some movement in the fish's gills. A few seconds later, I was sure I had seen some movement. I gently lifted the fish from the bowl and placed it into the water at the edge of the pond. For a moment it lay helpless, and then, to my surprise, and utter delight, it swam away.

Three years later, we decided to emigrate. When we left, the fish was still there, along with the other big one and fifteen smaller ones. As far as I know, it is still alive today.

Joe Wharton,
St. Helens,
Merseyside.

Dubious barley straw

I read the report by William Wildgoose (A&P, Sept '94) on barley straw with great interest. Before I tell you of my experience with straw, the details of my pool are: shaped like a figure eight, measuring 40ft in length, 20ft wide, 6ft 6in in the middle, and 4ft deep. My fish were in the pool for 12 months before I built a filter system; the water was pea green and I only saw the fish when they came up to feed.

On completion of the filter, the water cleared in about two weeks and I was able to see and enjoy my fish. However, within a further couple of weeks, you've guessed it: blanket weed started to grow; it only took two days to cover the entire pond. I was using a garden rake to pull it out.

I tried all kinds of treatments, which only managed to break up the stuff for two or three weeks before it was back with a vengeance. By now, I was so disillusioned with the never-ending maintenance, that I was at the point of selling the fish and filling in the pond. Bearing in mind that I had kept fish for over twenty years, this demonstrates just how fed up I really was.

I then remembered reading an

article in **Koi Talk** in one of my old A&P's on the subject of blanket weed. This article sang the praises of barley straw as a cure for it. I re-read the article (I never throw any away) and off I went and bought a bale of the stuff, broke it up into small quantities and filled some old sprout sacks with it.

I was pleasantly surprised to see the weed breaking up in a few weeks. Yet, instead of this being the miracle cure I was looking for, it turned out to be my worst nightmare, greater than the weed itself. My pool returned to the colour of pea soup, I lost four large fish (their gill filaments turned a brownish grey colour and became clogged up) and the filter was unable to handle the volume of blanket weed passing through. Prior to the turning green, the water went yellow in colour, the fish became lethargic and went completely off their food.

Determined not to let it beat me, I emptied the pool, housed the fish in a temporary tank, jet-washed the pool from top to bottom, cleaned the filters and started afresh. The fish were returned to crystal-clear water. Cracked it? Not likely! Within less than a week, the stuff was back again.

A colleague then told me about

WRITEBACK



Every pondkeeper's scourge — green water. Barley straw may effect a 'cure', but only if used according to instructions.

algicide treatments. I've therefore resorted to this and it has solved my problem as promised and, for a record fourteen weeks to date, even during a heat wave, I have boasted gin-clear water free from blanket weed.

Colin Fitter,
Dudley.

William Wildgoose comments

The article was written mainly about the harmful effects on fish health which develop when straw rots anaerobically. My intention

was to show that just adding barley straw to a pond is not without its problems, rather than a discussion on algae control. My professional interests are in the field of fish health, and investigating technical problems often involves trying to understand factors outside my area of training. I am certainly not a specialist in aquatic weed control, and I am sure this is a very specialised field. Therefore, I can only offer a limited response to Colin Fitter's letter.

The facts about the use and effects of barley straw are the result of recent research, despite its being used for many years. Although articles have appeared periodically in the past, I have never seen any reports about its adverse effects on fish. In the case of barley straw, I suspect that there have been many problems with its use in the past, just as described in Colin's letter. However, it is probably more through luck that some pondkeepers were successful, although I am sure no-one knew why it worked.

The letter describes a scenario similar to my own experience where the straw probably rotted anaerobically. There are insufficient details given about the size of the pond and exact quantities used and the degree of compression of straw in the bags. The fish deaths were possibly the end results of stress and toxic chemicals in the water, and examination of the gills, liver and kidneys may have confirmed vital tissue damage. As my article discussed, the Aquatic Weed Research Unit recommends barley straw is used carefully and following the guidelines given.



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out and about

A new world at Ullesthorpe

By Stephen Smith

Photographs by the author

The exterior of Ullesthorpe Centre belies a vast area of comprehensive garden and aquatic supplies.



Ullesthorpe's sparkling Koi pool accommodates some fine quality specimens.



A large range of aquatic accessories complements an extensive selection of aquatic livestock.



A pair of Blue-lined Rasboras (*Leptobarbus hoeveni*), approaching five inches in length, in the tropical fish house.

There was always some mysterious charm about the series Dr Who, especially surrounding that enigmatic construction the Tardis, which was significantly bigger inside than it appeared to be from the outside. Such is the feeling at Ullesthorpe

Garden and Aquatic Centre. Nestled 'off the beaten track' in the heart of the Leicestershire countryside and in the middle of the M1/M6/M69 motorway triangle, the true extent of the centre is deceptive when you first arrive. However, behind the

façade lurks an extensive retail outlet providing, as their own publicity leaflet states, "for all your gardening, water gardening, and aquatic needs — under one roof". This is no idle boast. I had the honour of opening the site a few years back under its previous

owners (see *Out and About*, A&P, February 1990). Unfortunately, things didn't really work out for them and, early last year, the site was acquired by owners Steve and Alan Tallis, who put Steve's son, Ian and his fiancée Ruth, in charge.

Ruth and Ian embarked on their new venture with an enthusiasm which surely deserves success, completely refurbishing the centre and turning the business into a major attraction for visitors throughout the UK. During my visit, I bumped into a group from Surrey who 'tour' garden centres, and who were able to proclaim Ullesthorpe as "one of the best they had ever visited."

So what are the attractions? Naturally, the truly impressive aquatic centre was a major focus of my attentions. A 7,000-gallon Koi pool forms the centrepiece and its sparkling waters accommodate some pretty stunning Koi, including a magnificent Kujaku and an enormous Chagoi which, with a £2,000 price tag, is a major attraction.

A full selection of Koi of all sizes and prices is available, as well as some rather attractive Fancy Goldfish, all reasonably priced and displayed in ultra-clean display vats. A purpose-built tropical fish-house with over 70 display tanks, again kept in pristine condition, provides a comprehensive range of species, while the highlight of the aquatic section is a magnificent purpose-built marine life centre which is one of the best I have ever seen (see *Seaview*, A&P, February 1994).

A full range of tanks, treatments, food and aquarium accessories, as well as ponds, liners and aquatic plants, are also provided to the endless stream of aquarists and pond-keepers who visit (and they seemed to be non-stop!).

When you're not looking at the fish, the centre as a whole gives you an extensive range of shrubs, conifers, roses and plants, as well as the full range of gardening paraphernalia, in an extensive indoor and outdoor layout, including a display centre laid out like an ornamental garden — complete, of course, with a large ornamental pool.

Finally, in my book, the prerequisite of any such attraction is a coffee-bar, and Ullesthorpe boasts a large conservatory 'Tea-Room' with patio, where you can sit back and contemplate turning your own dreams into reality.

Ullesthorpe Garden and Aquatic Centre, Lutterworth Road, Ullesthorpe, nr Lutterworth, Leicestershire LE17 5DR. Tel: 01455 202144; Fax: 01455 202585. Opening times: 9am-6pm April-October; 10am-5pm November to March.

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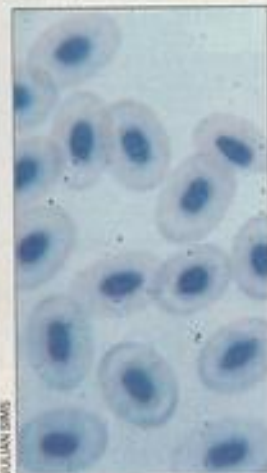
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Different red cells

The red cells which give frog's blood its colour are very different in shape and structure compared to the red cells in the blood of mammals, including humans.

Red blood cells carry oxygen around the body, and the speed at which they circulate limits the maximum rate at which an animal's metabolism can work. For example, one factor which determines how many times a Common Frog (*Rana temporaria*) can leap is the amount of oxygen it can get to the hind leg muscles so that they can contract. Lack of oxygen results in a slowing down of muscle contraction due to fatigue.

Human red blood cells are circular in shape and, as such, are very quickly carried in the liquid part of the blood called the plasma. As a result, oxygen is efficiently transported from the



Red blood cells of a frog as seen using a microscope. Note the elongated shape and the presence of a dark nucleus in each cell.

lungs to where it is required elsewhere in the body.

In contrast, the red cells in the blood of frogs are elongated (as seen under the microscope and in the accompanying photograph). Due to this different shape, they cannot circulate as quickly. They also contain a nucleus. Functional, circulating

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FROGS AND

By JULIANE

Tree-dwelling provisions

As most species of tree-living snakes like to bask, their vivarium should be as large as possible and relatively tall so that strong branches can be firmly arranged. It is important that the branches used form a secure platform on which the snakes can rest and bask in safety without fear of collapse.

Natural sunlight is very beneficial to all reptiles for the maintenance of health and vivid body coloration. Unfortunately, the useful ultra-violet (UV) rays in sunlight, which help to make vitamin D in the skin, are filtered out by the glass in windows and the glass of a vivarium. Thus, an alternative source of ultra-violet must include specific types of fluorescent tube, for example, the aptly named True-Lite — manufactured by the Duro-Test Corporation in the USA, where the tubes are known as Vita-Lite.

Alternatively, a Blacklight tube (manufactured by GE Lighting) could be used. This type of tube has 'black' glass and therefore emits no visible light, only ultra-violet.

A silvered spotlight can also be used during the day to create a basking 'hot spot' so that the snakes can raise their day-time body temperature.

A warm background environ-

The beautiful but bitter
Pickerel Frog.



DAVID SPENCER

FRIENDS



NSIMS

mental temperature should be maintained at all times, day and night. This can be achieved by using a suspended ceramic infra-red heating unit, a small wall heater encased in a tube (mounted high up and very well protected from the inhabitants of the vivarium), or a heating pad. These sources of heating must

HERP FACT Pickrel Frogs — squared and bitter

The Pickrel Frog (*Rana palustris*) is a North American amphibian which has a natural distribution in south-eastern Canada and throughout the central and eastern United States, from Wisconsin to Maine in the north, southward through the Atlantic states to the Carolinas, and westward into Texas.

This species is easily identified from its close relatives, the Leopard Frogs, because Pickrel Frogs have **square spots** arranged in two parallel rows down their back. These dark markings are uneven in shape and size and have the appearance of squares drawn by young children. Although the squares are irregular in outline, these 'spots' are not circular as on the aptly named Leopard Frogs.

Throughout the habitat naturally colonised by Pickrel Frogs, few species of snake eat these amphibians. This is because, as their common name suggests, the glands in their skin produce distasteful protective secretions — refer to **Herp Fact** in the June '84 edition of *A&P*. "Pickrel" originates from the Greek word *pikros*, meaning "bitter".

Due to the production and release of these particular secretions, it is advisable to keep Pickrel Frogs in a vivarium set aside for them and with no other amphibians (or reptilian inhabitants). As a further precaution, thoroughly wash your hands after any contact with this species of frog.

be controlled by a good-quality electronic thermostat.

It is advisable to control the basking spotlight by a time-switch. This will establish a regular day and night lighting cycle for the snakes. All types of fluorescent tube should be turned off at night-time.

Finally, as previously mentioned, most species of arboreal snake are active climbers and it is therefore essential to include strong branches in their vivarium. However, precautions must be taken to ensure that these branches do not allow the snakes to come into contact with a lamp which is used to create the basking hot spot, or a suspended ceramic infra-red heater, if this is used to provide warmth.

Clin's herp history

"Reptile keeping as we know it, i.e. on a scientific basis, was a British creation". So writes **Clin Keeling** in his latest book *A Short History of British Reptile Keeping*. ISBN: 0-9514690-9-6.

Clin admits to drawing on three of his previous books: *Where the Lion Trod*, *Where the Zebu Grazed* and *In the Beginning*, to illustrate and highlight examples of reptile keeping in Britain. Even so, this 27-page book is the first time the history of reptile keeping in Britain has been presented in one specific volume. The book is divided into four chapters.

The first is entitled "Those who went before us", and traces the earliest records of herpetology in Britain. Appropriately, the chapter starts with the first known keeper of reptiles in Britain, William Laud (1573-1645), an Archbishop of Canterbury and owner of a Spur-thighed Tortoise (*Testudo graeca*).

It is generally acknowledged that the first public Aquarium in the world was opened in Regent's Park in 1853. What is less well known is that the first ever public Reptile House was opened at Regent's Park four years earlier.

In the second chapter, Clin traces the history of reptile keeping at the London Zoological Garden — a section of the book entitled "Two Houses in London NW1". The first reptile to arrive in June 1828, two months after the Zoological Garden had been

officially opened in April was an Aldabran Giant Tortoise (*Geochelone gigantea*) from the atoll in the Indian Ocean.

Chapter three is entitled "Where are they now?" It is the shortest of all, just two pages in length, and discusses some oddly-named reptiles which are difficult to trace in the scientific literature of today.

As its name suggests, chapter four, "The Private Sector", reviews the role of the individual herpetologist.

Clin wishes to emphasise that this is "a home-produced publication", and therefore it may lack the final finishing touches and 'polish' of a commercially produced book.

Although I note Clin's caution,

A SHORT HISTORY OF

BRITISH REPTILE KEEPING



C.H. KEELING

this is a very interesting and unusual publication and it will make an informative addition to any herpetological library. This paperback book would also make a unique Christmas present which won't break the bank and it can easily be sent to distant friends and relatives.

The cost is \$4.50 (which includes postage and packing in the UK) or £8.50 (in Sterling) for overseas orders.

A Short History can only be obtained direct from the author. Orders together with a cheque for the required amount, should be sent to:

Mr C H Keeling,
Educational Services in
Practical Zoology,
13 Pound Place,
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out and about



In spring 1993, the Swallow Aquatics East Harling retail centre opened its doors to the public, following, as it were, in the footsteps of the 'other' Swallow's ongoing success at Rayleigh in Essex. Now, some eighteen months later, the centre is really showing its true worth as a retail outlet of excellence.

Crucial to the high quality of livestock is, of course, the water in which it is kept and, in this department, proprietor Mick Seaby and his staff deserve the highest praise. The easiest thing in the world is to stock a new retail centre to its limit right at the start, just to impress customers. The consequence of such action is often a rapid breakdown of the biological system which just can't cope with the 'raw' conditions or the overload of killer toxins like ammonia.

There are two main options open to you:

- 1 Run your biological filters on light initial stocking levels, gradually increasing the load over a period of, say, several extra months, and then, once the systems are fully mature, open for business, or
- 2 Set up your biological systems, seed them, stock lightly and, after a few weeks — once you've seen that they are coping adequately with biological demand — open your doors to the public.

Both approaches are perfectly valid... and both work well if handled properly. However, it takes a little extra courage to opt for the second alternative, as this opens you up to the possibility of a certain amount of criticism from uninformed visitors who may not be aware of the critical need for filter maturation, and who may expect to see tanks packed to overflowing with spectacular fish from Day 1.

Mick Seaby had the courage needed to go for the second option and has

By John Dawes

Photographs by the author

proved to those few doubters who commented on the relatively light initial stocking levels that, if you do things right to start with, and don't expect miracles overnight, you will soon be reaping the benefits of your philosophical convictions.

We paid a second visit to East Harling recently and the health of the tropical freshwater and marine stocks (the rush of the coldwater season was already well on the decline) was really second to none I've seen anywhere this year.

For instance, hard corals which had been kept for several months at Rayleigh and had been transported to East Harling before it opened, were bursting with energy and health; many of these (at least) two-year-olds were actually spreading. In the same show tank, a pair of *Pseudochromis fridmani*, the Orchid or Fridman's Dotty-back, were so happy with the conditions that they had even decided to spawn! From hardy to delicate, I couldn't spot a single unhealthy fish anywhere.

The same goes for the freshwater species selection which, in addition, is so wide ranging that it caters admirably for the needs of the single community tank owner at one end of the fishkeeping spectrum, to those of specialist aquarists and those looking for unusual one-offs, at the other.

The African Rift Lake species were particularly impressive during our visit, especially since the Malawi and Tanganyikan offerings were supported by a tank of the glorious Lake Victorian Haplochromine which is

The selection of freshwater tropicals contains something for everyone.

The inverts (some of which have been maintained for well over two years) are of exceptional quality.

IMPRESSIVE EAST HARLING



Among the freshwater inverts (which included colourful crabs) was this impeccable Blue Crayfish.

A small fraction of the aquarium plants on offer.





becoming known as the Flame Back Cichlid (*Haplochromis obliquidense*).

If your leanings are towards the more frequently encountered species, then you are certain to find them at East Harling. If you are looking for a less frequently seen selection, then cast your eyes over the accompanying list. It is far from exhaustive and may not include the particular species you are currently looking for, but it at least gives you an insight into the thinking that pervades the company's approach to the scope of its stock. My feeling is that, if a species is available within the trade, then Harling will either have it... or can get it.

The hardware and dry goods section is equally all-embracing and, while we were there, even further units were being put up to extend the already extensive range. And then there are the aquarium plants... and the forthcoming amphibian and reptile departments.

Swallow Aquatics import the vast majority of their livestock themselves. They then back this up with their own acclimatisation facilities and add things further with the careful way in which they handle incoming shipments (I witnessed this myself at first

The dry goods department is as spacious and well stocked as all the others.

hand). So, perhaps, we should not be too surprised at the high quality of their fish, plants and inverts, but surprising or not, it's heartening to see.

If I sound impressed with what I saw, it's because I was, and not just with the above, but also with the spotless cafeteria, the still-impressive coldwater section (despite the fact that we were nearing the end of the season), and with the staff, who were both helpful and extremely knowledgeable.

For further details, contact **Steve Clifford** (Manager), **Michelle Seaby** (Assistant Manager), **Eddie Miller** (Marines), **Dylan Priest** (Freshwater) or **Mark Matthews** (Coldwater). **Swallow Aquatics (Harling) Ltd.**, Harling Road, East Harling, Nr. Thetford, Norfolk. Tel: 0953 718 184; Fax: 0953 718 145.

A FEW UNUSUAL SPECIES SPOTTED DURING OUR VISIT

Freshwater

African Tiger Fish (*Hydrocynus vittatus*), Flame Back Cichlid (*Haplochromis obliquidense*), Mosquitofish (*Gambusia holbrooki*), Albino Red Tiger Oscars (*Astronotus ocellatus*), *Telmatochromis bifrenatus*, Hybrid between *Neolamprologus brichardi* x *leleupi*, Silver Needlefish (*Boulengerella aol*), Leopard Spiny Pleco (*Pseudacanthicus leopardus*), *Protoclitapia polleni*

Marines

Blue-spot Angel (*Chaetodontoplus caeruleopunctatus*), Blue Box Fish (*Ostracion meleagris cantanum*), Longfin Snapper (*Symphoricarthus spilurus*), Passer Angel (*Holocentrus passer*), Aiddle or Lemonpeel Butterfly (*Chaetodon semilavatus*).



THE WATER GARDENER

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ON SALE AT LEADING MAGAZINE OUTLETS

WATER'S EDGE

BY DICK MILLS

(NOTE: Some entries in this report carry the new/proposed alterations to telephone/fax numbers beginning 01.)

Now you see it, now you don't

A good proportion of visitors to the **AQUA-SOIL** exhibit at the recent GLEE Show at NEC probably walked past one of the new products without even noticing. The **AQUA-FILTER** looked like any other well-furnished flowering terracotta patio pot at this predominantly garden equipment/furniture show, until you took a closer look (or took notice of the explanatory sign).

The generously-proportioned pot hides a unique biological filter system, the inlet and outlet connectors being cleverly hidden at the base. The flower display is supported on a steel tray beneath which the spraybar directs incoming water over 'Bilow' matting and then through Bilow scramble material below and back to the outlet. The assembly is capable of accepting water flows from 250-700 gph and would not look out of place anywhere in the garden or on the patio, and no-one would think it was a valuable pond accessory.

Also new is the **AQUA-TWIRL**, a sturdy three-pronged, 6ft6in long tool for removing floating blanket weed.

Details of products, including the company's original name-setting product from: **AQUA-SOIL PRODUCTS LTD.**, Blue Waters Estate, Bovey Tracey, Devon TQ13 9YF Tel: 01626 83515; Fax: 01626 835585.



Hi-tech topics

With the name **EHEIM** comes synonymy with engineering excellence that many would expect hard to improve. The new **PROFESSIONEL** range of filters simply explodes that myth — both in use and in design. As the company's brochure states right at the outset this is "a new dimension in filter technology."

Previously, fitting a cylindrical unit into a square space below the aquarium always resulted in wasted space, so the new filters (Models 2226, 2228) are square, allowing for more practical space allocation and, incidentally, a more stable footing. Removing the pump head no longer means releasing those stainless steel clips, then prising up the top with the rubber seal obstinately refusing to let go; four sturdy clips (one at each corner) now work with the built-in (and retained) gasket and recessed handles to make removal quite easy. Hose connections are integrated with

double tap connectors and a locking clamp into one single unit. Inside, the filter medium holders have retractable handles and occupy all of the internal space, but can be removed separately.

Wet and dry filters have been around a little time now (see Eheim's PULS Filter), so it is unsurprising that this feature has been incorporated with the new filter body shell. Models 2227 and 2229 are easily recognised — they have an externally-mounted 'water/gas exchange tube' (my words) and three hoses (one is for technical operation purposes along the lines of a breather tube). Having (it is claimed) an efficiency surpassing trickle filters, the wet/dry filter uses bi-directional water movement to allow for maximum contact time between bacteria colonies, making for faster decomposition of toxins at much faster rates.

Due to larger debris breakdown facilities, servicing may only be necessary around the six-month period but, obviously, this depends on stocking (and feeding!) levels. Because of the 'to and fro' emptying and filling operation of the filter, a pulsating water output is achieved, creating wave-type action water currents within the aquarium.

Optional extras for all models include built-in heaters (the

THERMOFILTER models, 2326, 2328 for conventional canister types, 2327, 2329 for wet/dry models) and remote-, or filter-top situated **CONTROL UNITS**. Unlike earlier Thermofilter models, all new models are suitable for freshwater and saltwater use.

Although **JOHN ALLAN AQUARIUMS** are the distributors of the products described above, they, too, have contributed to the new products for next year. Their **CONTINENTAL** range includes 6 and 8-sided free-standing aquariums, plus a rather intriguing looking 'River Bed Unit' which features (for want of a few better words) a 'shallow end'. All are set on smart black pedestals or sub-aquarium cabinets. These complete combinations include waterproof lighting systems.

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

Quick on the trigger

Newcomers to pondkeeping could well be forgiven for being mystified by all the technical jargon and wealth of, perhaps, hard-to-understand equipment offered to them.



Fortunately, **KING BRITISH** sympathise with them and have recently adapted one of their treatments to be easier to use. Dispensing **POND PRIDE WATER CONDITIONER** with a trigger action takes all the worry out of dosing levels and, as newcomers need as few worries as possible in their new hobby, KB are pleased to listen and to adapt to customers' needs and suggestions.

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

Little/large products

Highly innovative ideas in **FOUNTAIN PUMPS, NOZZLES, LIGHTING, FILTRATION** — even a table-top version of the tubular **TORNADO WATER FEATURE** — demonstrate that **OASE** covers everyone's needs, from the smallest to the most flamboyant.

Ultra-compact, highly energy-efficient, low overall height **AQUARIUS 240** and **300 FOUNTAIN PUMPS** move up to 4 and 6 litres per minute at heights of 0.5 and 0.8 metres, respectively, thanks to new impeller technology.

Up to four **LUNAQUA MINI HALOGEN LIGHTS** (ideal for indoor fountains and 'bubbling stone' displays) can be powered from a single transformer.

Newly-developed **FOUNTAIN NOZZLES** create spectacular **Bursting Stars, Silver Arch** and **Dancing Jewels** effects, while the **TRIPLE BOWL FLOATING LIGHT** offers a new way of adding dramatic emphasis to a fountain jet.

The table-top version of the **TORNADO DANCING VORTEX** contained in a clear tube and

enhanced by a built-in halogen lamp is equally decorative on a window sill, desk or as a centrepiece for an indoor plant display.

OASE's well-proven **EURO-POND FILTER POOL** now comes in a more compact version; water pumped to the unit rises slowly through the coarse and fine filtering sand and then through the root system of planted vegetation in the 200-litre capacity basin, emerging naturally and effectively bio-filtered, completely cleaned for return to the pond.

Details of all products from: **OASE (UK) Ltd.**, 3 Telford Gate, Whittle Road, Andover, Hampshire SP10 3SF. Tel: 0264 333225; Fax: 0264 333226.

Nice fish, shame about the wallpaper!

Sometimes, the background really can make, or destroy, the beautiful effect of an aquarium, but when using natural materials inside the tank, some care should be taken.

Sunken branches and logs have long been seen as ideal items, not only for decoration, but also for the fish to use as refuges. However, some pre-aquarium use preparation is necessary to prevent water-staining or to stop unwanted substances leaching out into the water.

Fortunately, aquarium hobby suppliers have researched and developed look-alike replicas from safe manufactured materials. **ROLF C. HAGEN**, for example, have recently introduced **AQUATIC DRIFTWOOD**. Made from moulded polyester resin, the



range includes gnarled, weathered tree roots, bark and trunks which are non-floating, durable and completely non-toxic. The extra good news is that where, in the past, resin replicas have been relatively expensive, items in the Hagen range have broken down this barrier and are offered at really affordable prices.

Details from: **ROLF C. HAGEN (UK) LTD.**, California Drive, Whitwood Industrial Estate, Castleford, West Yorkshire WF10 5QH. Tel: 0977 556622; Fax: 0977 513465.

Neat finishing touch

Rather than just using the standard paving slab (of various colours maybe) you can now edge your new pond with something different. **REMANOID** have come up with **EASY EDGE**, a series of grey 'bricks', five in a set, which give a very attractive finish to the pond surround when set in and pointed up.

For those without a pond, but wanting a moving water feature just the same, perhaps somewhere near to the house or patio, the new **TERRA-POT** could be the answer. The terra-cotta pot, 19in or so in diameter and 13.5in high, can easily contain a small re-circulating pump and an attractive mound of cobbles or small pebbles.

Details from: **REMANOID LTD.**, Unit 44, Number 1 Industrial Estate, Medomsley Road, Consett, Co Durham DH8 6SZ. Tel: 0207 591089; Fax: 0207 502512.

Menu for winter success

INTERPET's Adrian Exell has cooked up the following menu for ensuring your pond overwinters successfully:

- 1 Feed fish with a premium food

before hibernation. Do not feed below water temperatures of 10°C (50°F).

- 2 Clear pond of dead vegetation; trim back marginals and waterlilies.
- 3 Treat pond with a beta-oxidiser to break down remaining vegetation.
- 4 Add physiological salt to reduce fish stress.
- 5 Clean filters to help maintain water quality.
- 6 Net pond to stop leaves blowing in.

Of these, No 1 is for the fishes' energy stores which must be loaded up with protein, vitamins and minerals in order to sustain them through the winter. Food offered at below 10°C (50°F) may well be taken by the fish, but may then lie undigested in their gut, causing disease.

Interpet's **SLUDGE BUSTER** will effectively 'clean up', while **POND GUARDIAN** tonic salt will reduce stress and guard against disease. Flow rates through filters, including the new **POND WORKERS** in-pond filter, should be reduced to avoid over-cooling of the pond. Should you decide for a comprehensive autumnal clean out, then **POND BIO-START** will 'jump start' the bacteriological filtration system in minimum time.

Despite the pond's apparent dormant state, treatments are still important, especially as the fish are in a weakened state through hibernation and need all the protection they can get.

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

Be a 'Pools Winner'

Nothing to do with the nation's No 1 winter sport, but with the range of pool products from **WATERLIFE RESEARCH**. Many of the products are, of course, very familiar, tried-and-tested favourites among aquarists, but the new presentation aims to make doubly sure (by attraction



first, and detailed instructions for use second) that the correct product is selected for each intended specific use.

ALGIZIN may be the name of the remedy, but you must specify 'A' or 'P' formulation, depending on what you intend to cure: 'A' is strictly for the elimination of algae, as it lacks the medicinal properties found in 'P', the powerful remedy for parasitic infections, which, incidentally, when used as directed, is a preventive against blanket weed. STERAZIN P and MYXAZIN P complete the disease control part of the pools winning range, with Myxazin being reformulated to make it more suitable for pond use, especially effective against wounds, damaged fins and ulcers, but also very handy for sterilising nets and other livestock handling equipment.

Initial good water conditions can be ensured by using POOLSHIELD, the new water conditioner and de-chlorinator when setting up the pond, and at subsequent water changes or topping up. Poolshield is totally harmless to nitrifying bacteria.

The POND NITRITE TEST KIT assists in regular checking that water conditions are being kept at optimum levels and is inexpensive and accurate to use. Similar in performance and cost per test (around 9p) is the POND pH TEST KIT.

PONDFLORA is a scientifically formulated tablet plant fertiliser which requires periodic application around once every 6-8 weeks during the growing season to promote healthy and strong plant growth.

Look out for Waterlife products in their distinctive new packaging and you, too, could be a pools winner — without all that publicity and 'it won't change my lifestyle' self-deprecating attitude; only your pond will change for the better!

Details from: WATERLIFE RESEARCH LTD, Bath Road, Longford, West Drayton, Middlesex UB7 0ED. Tel: 01753 685696; Fax: 01753 865437.

WATER'S EDGE

Pumps and planters

The new FUTURA range of fountain pumps from CYPRIO feature a two-stage operation: the easily detachable first stage filter cage eliminates larger waste particles, while the fine-grade internal foam second stage traps smaller sediment. The range offers five models, handling flow rates from 85-380 gph. Fountain and waterfall tee, telescopic fountain tube and fountain nozzles and integral flow adjusters are included.

The PRIMA range of submersible 'sump-type' pumps has been extended downwards to include lower flow rate models, down to 350 gph.

Two new TEST KITS each have a double function: one covers ammonia and pH, the other tests for nitrite/nitrate.

FILTER START is a concentration of nitrifying bacteria for rapid maturation of biological filters, while SLUDGE DEGRADER breaks down accumulated solids and reduces pond and filter maintenance.



The square PLANTER 500's are aptly named 'Cosmetic Filters', as they hide biological filters within their decorative 'terracotta' finish exterior. An additional plinth doubles as an extra water feature returning a sheet of water to the pond and also hiding a Cyprio ULTRA VIOLET CLARIFIER at the same time, for maximum water clarity.

Details from: CYPRIO LTD., Hards Road, Frognall, Peterborough PE6 8RR. Tel: 0778 344502; Fax: 0778 348093.

More for '95

With over 50 new lines introduced by HOZELOCK in 1994, you'd think that they'd need a rest for '95. However, new additions have already appeared ready for the new season.

Two new submersible pumps, the SP8000 and SP11000, have been developed especially to cope with moving large amounts of water 24 hours a day. The hard-wearing ceramic sleeve protects the shaft for durability, while the vertically-situated outlet makes for easy fountain and waterfall hose attachments; a non-return valve is built in as standard. Performances, for example, at 4 metres head, are 60 and 80 litres/minute respectively.

There are no fewer than five new PRE-FORMED PONDS of modest sizes, the different shapes allowing for accommodation anywhere in the garden. Two models, the IRIS and the ARUM have specially designed edges to create natural-looking marsh areas more easily. All ponds (made from black HDPE) are deep enough to accommodate submersible pumps and are guaranteed for 20 years. Associated with these ponds are two new PRE-FORMED WATERFALLS.

Details from: HOZELOCK LTD., Haddenham, Aylesbury, Buckinghamshire HP17 8JD. Tel: 01844 291881; Fax: 01844 290344.



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COLDWATER

JOTTINGS

BY
STEPHEN J. SMITH



Winter filter facts

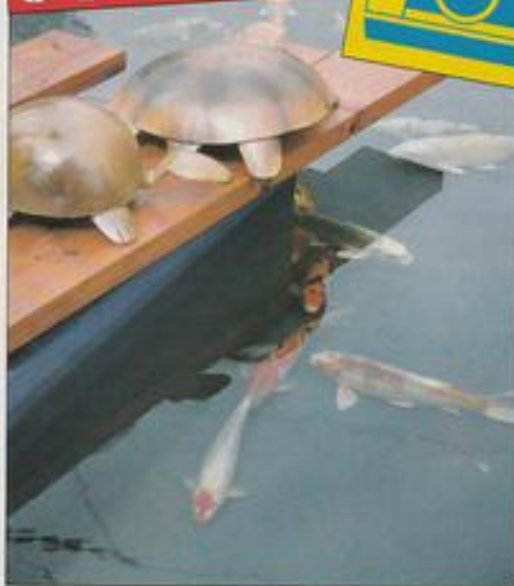
Despite the fact that the outdoor side of the hobby is beginning to close down, there are still a number of activities which really must be taken care of — and now. The worst of the winter will be upon us soon (if not already!) and if these jobs don't get done now, then you may never get around to them.

Among these activities (a polite word for 'chores') is to give your pond a thorough cleaning, in order to remove all traces of sludge and decaying matter so that your fish will be given the best chance for survival throughout the coming cold season. BUT, and it is a big but, the one job that you really do NOT have to contend with is to strip down your filter.

I have been amazed at how many people I have met over the years who believe that they must thoroughly clean the filter and switch off the water pump through the winter months. However, these same people have often been the first to let me know about their fish losses early in the following spring.

In my opinion, it takes at least a year (i.e. a complete annual cycle) for a filter to reach maturity — perhaps longer. One Koi keeper I know reckons that, really, three years is nearer the mark. During this time, the bac-

PHOTO JOTTING



Snapping tortoises!

Herpetology is not my strongest subject, though I do have a penchant for tortoises, perhaps because of the pet tortoise I kept as a very young child.

I am also intrigued by the myriad designs of ornaments which are available to decorate the garden, whether with a water feature or not, so I couldn't fail to be impressed with two of the most attractive ornamental tortoises I have ever seen.

This pair was 'snapped' during the official opening of Mag Noy's new offices at Hazorea, Israel, where they provide a superb complement to the offices' ornamental Koi pool.

Have you made, acquired or encountered 'unusual', eye-catching, or just intriguing ornaments as part of your fishkeeping hobby? Do let me know for a future Jottings together with a photograph, if possible.

terial colony within the filter has had time to develop and to reach a balance, so that it can cope readily with breaking down organic matter suspended and dissolved within the circulating pond water.

Don't forget, your filter medium is home to, literally, millions upon millions of microscopic living organisms which are working 24 hours a day, 365 days a year, to keep your pond water as clean and as pure as possible, whatever

the weather might be doing.

So why kill them all off at the end of each year, just as they are beginning to get into their stride? By all means rinse some of the medium through to remove debris which has accumulated by mechanical filtration and which may be beginning to clog the media, but please, give those bacterial friends a chance. Let them thrive and your pond, and its fish, will be healthier for it.

Winter food for thought

One of the 'golden rules' of keeping fish in outdoor ponds has been to cut down on feeding from the beginning of November, reducing it to no food at all throughout the coldest weather, and only resuming feeding at the onset of spring. Sound advice.

Some pondkeepers advocate the use of wheatgerm as an alternative to high-protein foods at each end of the season. Again, this advice has been based upon sound experience over decades.

However, information supplied by Gold Line Feeds, manufacturers of Phoenix 2000, has stimulated my grey cells, as it stands on its head the ethos of feeding wheatgerm to coldwater fish.

According to Steve Kuzio, director of Gold Line Feeds, the use of wheatgerm has become outdated, now that technology can produce a food which, they say, can be fed all year round, except in the lowest temperatures.

Feeding fish at the coldest of temperatures is, of course, not advisable: cyprinids do not have a stomach and will not easily digest food at water temperatures below 40-45°F (4-7°C), but I am prepared to listen with open ears to advice about a food which will ensure that my fish stand a better chance of being healthier immediately after over-wintering, as a result of correct feeding in late autumn.

"Many fishkeepers are not fully aware of what wheatgerm actually is," Steve Kuzio explained. "As the colder months approach, pond keepers feed their fish with wheat germ simply because they believe that this type of food is more easily digested than the high-protein summer foods."

The use of wheatgerm has, of course, always been considered important. But, with today's technology, food is extruded having been cooked at very high temperatures. This releases nutrients such as starches, sugars and proteins at cellular level, which otherwise would not be digested by the fish. A high-digestibility food has many benefits over wheatgerm cereal foods, mainly

Obit for a gentleman

I was personally saddened to hear of the death towards the end of August of a great UK Goldfish keeper, Lewis Emery. Lou was one of the hobby's gentlemen, and his warm nature and friendship will be sadly missed.

However, Lew does leave the hobby with a tremendous legacy; as a member of Bristol KS he was, I understand, one of the original team who initially developed the Bristol Shubunkin; Lou was responsible for the development of the fish's distinctive caudal fin.

A & P extends its warmest condolences to Lou's family.



STEPHEN SMITH

Part of the outdoor display — currently undergoing refurbishment — at Wyvern Centre.

being more digestible than wheat-germ itself, and thus giving rise to fewer water quality problems."

Steve concluded: "Such foods can be fed at lower temperatures, enabling you to feed your fish virtually all year round. Also, the load on filter media is reduced, while you actually need to feed your fish less in volume and so you are also saving money!"

Busman's holiday

When I take a holiday, I find it difficult to steer clear of aquatic establishments, and this was the case during late summer when I

took my family to the West Country for a few days' break. I was delighted to 'accidentally encounter' no fewer than two aquatic retailers in Somerset, each with contrasting styles but achieving success with similar aims.

1 Wyvern Centre, at Crossington, near Bridgwater, in Somerset, provides for all ranges of aquatic interest, including pond and aquatic supplies, landscaping, and even swimming pools. Within the site is an impressive aquatics centre providing everything, from some well-maintained tropical fish, to a range of Fancy Goldfish and some tidy Koi, supplemented by

an extensive range of equipment for ponds and aquariums.

Brothers Mike and John Stabbins have been partners at the centre for over eight years and they explained that it has been a major attraction for aquarists for many miles. "We aim to appeal to the general aquarist and pondkeeper," explained Mike. "Customers travel from as far afield as Manchester and Birmingham, as well as Devon."

2 Mark Durston-Sweet has been running his business, Blakeway Fisherys (this is the official spelling) for over nine years and has scored a hit with Koi keepers from all over his

area, as well as Bristol and further afield. When I dropped in on my way home from holiday, I was lucky to catch him, as he opens only on Thursday and Friday afternoons, and all day Saturdays and Sundays. Mark provided a friendly welcome and proudly showed his display of imported Koi, his stock of which, he explained, had been well and truly dented by a very popular weekend sale within the previous couple of days.

Mark runs his business on his own from a barn at his parents' farm, and also grows fish on. His stocks of Koi and pond fish are kept in well-filtered vats, with the health of the fish being of paramount importance. As well as fish, the business also provides pond accessories, foods and treatments.

I thank both establishments for their warm welcome; both deserve continued success.

Wyvern Centre Limited, Cossington Lane, Cossington, Bridgwater, Somerset TA7 8LU. Tel: 01278 723019.

Blakeway Fisherys, Blakeway Farm, Wedmore, Somerset BS28 4UB. Tel: 01934 712532.

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Pack Size: 70 gms

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This diet also contains the most modern type of colour enhancer available and will not cloud the water.

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SEAVIEW

BY GORDON KAY



Deformities & hot spots

It is unusual for me to bring you two items from the same publication in one month, but a recent issue of *Sea Wind* the bulletin of Ocean Voice International — contained a couple of things which I thought you may like to read about.

The first was called **Abnormal Molluscs of Batangas Bay** by James L. Barnett. This starts by saying that the number of mollusc deformities has been steadily increasing over the past six or seven years. Abnormalities like deformed shells, over/undersized shells and shells having large barnacle clusters attached, have all been reported.

Apparently, barnacles have been found in increasing numbers on gastropods (eg snails) — something which has been very rare until now, mainly due to the fact that gastropods are too active for barnacles to grow on them. The article cites many possible reasons for this phenomenon. Things like fishing with explosives and poisons, anchorage, garbage and the dumping of toxic waste, as well as illegal deforestation, were all put forward as possible causes (what a surprise!). However, as the article also states, much more study and research are needed before a definite cause can be identified and a remedy applied.

One thing that is known is that this is not an isolated case. Mollusc abnormalities, along with coral bleaching, happen all over the world.

Speaking of coral bleaching — that's what the second item's about. It appears that there is a massive bleaching of coral now occurring in the South Pacific. This was interesting, because the bleaching is occurring in "hot spot" areas, where temperatures are over 1°C (1.8°F) above normal. There was a hot spot which formed in January which "migrated" from between 20 and 30 degrees south and 120 to 140 degrees west, to between 15 and 25 degrees south and 130 to 170 degrees west in one month alone.

Bleaching began in the Society Islands and the Tuomoto Islands in March and was followed by Samoa shortly afterwards. By



Bleached Brain Coral photographed in Roatan, Honduras.

THEYRE M. DONALD

April, temperatures about 30°C (86°F) were stretching from Samoa to the Solomon Islands. It seems that scientists in French Polynesia and Samoa reckon that this bleaching could be the worst case yet and that there could be very high coral mortality.

Observers need to be watchful for bleaching, which could be starting in other areas. Areas like Fiji, Micronesia, the Philippines and Indonesia could all be affected, if these hot spots continue to grow and migrate at the current rate. Bleaching could even be occurring there now, and new hot spots could have formed in the Caribbean and Indian Oceans by the time you read this.

Apparently, a paper on the subject of coral bleaching, written by Dr Thomas Goreau, of the Global Coral Reef Alliance, and Dr Raymond Hayes of Howard University Medical School in Washington DC, established that this 1°C temperature hike has preceded all major bleaching events since 1983, when satellite data became available. The Global Coral Reef Alliance and other interested parties have called upon the United Nations Conference on the Development of Small Island States to protect their reefs by adopting measures which will, hopefully, ensure that global warming will be held within the 1°C upper limit set out in Framework Convention of Climatic Change.

Now, I'm no scientist and I'm

merely putting my own personal views across here, but it seems to me that these two issues are inextricably linked. We simply cannot continue to abuse our planet — sorry, the planet we live on — and not expect (or accept) the consequences. Do we truly believe that we can carry on dumping all sorts of filth into the sea, hacking down forests and acting in a totally irresponsible manner — individually — and not affect the wellbeing of our world on a global scale? When will we ever learn?

Surges and turbulence

And now for something completely different — some aquarium stuff, which I know many of you enjoy.

SNIPPETS



JOHN DAVIES

This juvenile wrasse shows the first colour changes that will convert it from a Twin-spot into a Napoleon Wrasse. Twin-spots and Napoleons are the young and mature stages of *Coris aygula*.

1

Wrasse are a large and divergent family of fishes, many of which are popular in the aquarium hobby. Species of *Coris*, for example, have brightly-coloured juveniles, some of which develop into equally brilliant adults, although others, sadly, become dull and lose

their appeal. Wrasse often show three colour patterns through their lives: a juvenile pattern, a female pattern (which often is the same as the juvenile) and a supermale pattern. Adult males which don't make supermale status are usually coloured like females.

We all know — or should — about the importance of aeration in the aquarium. Good, strong aeration will, by breaking the air/water interface — the water surface — bring oxygen into the water and also expel other gases, like carbon dioxide (CO₂). However, how many of us understand, I wonder, the importance of water movement completely, because aeration is only part of the story?

As I said, good aeration will both bring in oxygen and drive off other, unwelcome gases. By drawing water up to the surface, it also brings oxygen-starved water up from the depths of the aquarium and takes oxygen-laden water from the surface down to the aquarium bed.

On the reef, however, there is the movement of water backwards and forwards over the reef — called surge — and there is a random movement of water in all directions and at all heights in the water column. This second phenomenon is called turbulence, and it is this turbulence which we tend to forget, but which is vital to the health of the aquarium's inhabitants — especially the invertebrates.

What we need to provide is good laminar flow at varying depths, in order to bring sufficient nutrients like oxygen, trace elements and even food items to the more sessile animals. In addition

SNIPPETS

2

Evolution of the isolated Grey Atlantic Seal populations of the Baltic, North East Atlantic and Canada is producing separate species. Some 95% of the NE Atlantic and 75% of the world total live around Britain.

3

The Dogwhelk is adapted to survive a wide range of conditions. On sheltered shores, the shell is finely spired and intricately ridged, the lip thin and the mouth small. With increasing exposure, the shell becomes thicker, blunter and smoother and the mouth occupies a greater proportion. Individuals taken from either end of this spectrum wouldn't even be recognisable as being from the same species.

4

Chaetodon tinker is a deep-water butterflyfish from Hawaii. Because of this, it is very expensive. Fortunately, it is also relatively hardy.

5

A major paradox of the polar seas is that marine life is several times more abundant than anywhere else. This is because organic matter, rained down to the bottom of the seas, is decomposed by bacteria into nutrient salts and carried by the deep ocean currents to the polar zones where they get brought back to the surface by upwellings. In these cold, but nutrient-rich waters, all the sun's energy is turned into phytoplankton. Crustaceans thrive on this and become abundant food for larger animals.

to this, good water movement will take away waste products by sweeping them away in the currents. With invertebrates like corals and anemones, which are unable to move waste products away from themselves very well, these waste products will settle on the animals and begin to decay. This, of course, will eventually kill them.

Good laminar flow will, moreover, help to keep down detritus accumulation, but perhaps the most important issue here is that of the 'mantle' of stagnant water that surrounds everything — animate or inanimate — submerged in water. This 'mantle' is heaviest in still, or slow-moving, water and, while fishes can cope with this by simply swimming away, invertebrates cannot and, consequently, suffer as a result. Remember that all animals have to perform all of their bodily functions through this 'mantle' of stagnant water, so it makes sense to keep it to a minimum with good water movement.

How you achieve this is completely up to you. I am merely sowing seeds of thought, and besides, it would take two or three *Seaviews* to go through all of the options. All I ask is that you give it some thought and read Philip Hunt's two-part review *Moving Waters*, Part 1 of which was published in the August '94 issue of *A & P*.

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Of all the fish in the family Goodeidae, the Rainbow Goodeids of the genus *Characodon* are by far and away the most attractive and popular. At present, only three species are recognised, one of which is thought to be extinct (*Characodon garmani*), while the other two are listed as Endangered (*Characodon lateralis*) and Threatened (*Characodon aulax*).

All three species come from the more northerly regions of Mexico which were surveyed on the Aquarian Endangered Species Survey '94. This survey was conducted by Arthur Frisby of Frisby Aquatics, Hull, and myself, and gathered much needed information on the status of many desert species; it also turned up some fascinating information about the Rainbow Goodeids.

Fruitless search

The first Rainbow Goodeid habitat which we visited was that of *Characodon garmani* (Parras Rainbow Goodeid). The natural habitat of this species was in the Parras Valley, which, until the early 1930s, had magnificent spring systems containing several unique species of fish, including *Cyprinodon latifasciatus* (Parras Pupfish) and *Styxodon signifer* (Stump-tooth Minnow).

Subsequent development of extensive wine factories, a flour mill, rubber mill and textile factory seriously reduced and modified available surface water. Water pollution, and irrigation systems that carried water to cultivated fields, are also thought to have had an impact on the native fish and caused their decline.

By 1953 a two-day search for the Parras Valley by C.L. and L.C. Hubbs failed to turn up any of these three species. This was confirmed by the eminent Mexican scientist Dr Contreras-Balderas in 1969; all those habitats visited on the Aquarian Survey were also devoid of these three species. We did, however, find *Poecilia reticulata* (Guppies), *Xiphophorus helleri* (Swordtails) and *Gambusia holbrooki* (Eastern Mosquitofish), which are all introduced species to this area of Mexico.

Bold collections

The next species that we looked for was *Characodon aulax*, the Bold Characodon. This fish — which is also known as the Black Prince in the UK and the Black Rainbow Goodeid in the States — is only found in the El Ojo de Agua de Las Mujeres near the village of El Toboso in the state of Durango.

To reach this habitat we took a dirt track off the main road signposted to El Toboso and drove along this for about 1Km before we came to a village called Abraham Gonzalez. From here we turned off along an even more bumpy track to El Toboso some 7 Km further on. In the village itself we found a small trickle of



Eastern Mosquitofish and Swordtails collected in one of the streams at Parras. These, plus Guppies have been introduced into this part of Mexico to the detriment of the native species which have all but disappeared.

THE RAINBOW GOODEIDS

Two out of three ain't bad, as Derek Lambert discovered when he went in search of some rather special Mexican Livebearers.

Photographs — unless otherwise stated — by the author



This is one of the springs at El Toboso which feed the stream and pools which are the only known habitat of *Characodon aulax*.



A group of wild-caught *Characodon audei* photographed at the site of capture.



A captive-bred male *Characodon audei* from the old collection made during the early 1980's.



River at Los Berros — the original collecting site of *Characodon lateralis*.

water, but no sign of the spring and pond where the fish had previously been found.

Fortunately, a young lad on horseback showed us the way through scrubby desert to the springs, but unfortunately, we reached this habitat quite late in the day and had to leave before we had completed the survey. However, this gave us the excuse to return the next day and spend much longer than we really should have studying this habitat and fish.

A few small springs bubble up among the trees and the water from these converges into a small stream which flows into a series of pools and finally peters out

in the desert, only a few hundred metres away from its source. We tested the water, both at the springs, and in the various pools downstream, and found it to be 120ppm hardness / 100ppm alkalinity / 7pH. The temperature of the water in the springs themselves was a constant 21°C (70°F).

We only found Bold Characodons in this habitat, but they were relatively prolific, with the greatest concentration in heavily planted areas with flowing water (these were also the areas with the greatest numbers of insects and crustacea which make up the bulk of this species' diet). While at the habitat, we were able to determine that they were just as prolific as they had always been and the habitat had not significantly altered. Fortunately, no exotic species have, as yet, been introduced.

Our present captive stocks date back to a collection made during the early 1980s (probably 13 April 1983) and have been closely inbred for all of that time. For this reason, we were particularly interested in seeing how the wild fish differed from our captive inbred stocks.

Essentially, they proved to be the same, except in coloration. Our stocks had only a hint of a salmon pink in the ventral region and the fins were jet black. The wild fish had red in the males' body and fins, the fins having far less black than our captive stocks. Having maintained and bred this new collection since February, I am certain the difference is purely due to the environment and diet, since the cap-

RAINBOW GOODEID FACTFILE

- 1 The genus *Characodon* contains three species, of which one is already thought to be extinct and the other two are listed as Endangered and of Special Concern in the wild.
- 2 The Bold Characodon (*C. audei*) has more than one common name. It will also be found referred to as *Characodon* sp. "El Toboso", Bold Goodeid, Black Prince (coined by Ivan Dibble in the UK) and the Black Rainbow Goodeid (coined by James K. Langhammer in the USA). However, I have used the common name designated in the naming paper of this species — The Bold Characodon.
- 3 All species can be sexed by the notch in the male's anal fin which is present from very early in life.
- 4 Rainbow Goodeids are undemanding with regard to water conditions, provided it is on the slightly hard and alkaline side of neutral.
- 5 The temperature should be maintained at approximately 21°C (70°F) for the Bold Characodon and between 10°C and 23°C (66-73°F) for the Red Rainbow Goodeid (*C. lateralis*). Higher temperatures than these tend to shorten the life of these cool-water Goodeids and can lead to health problems.
- 6 The diet should contain plenty of live foods, but rich meaty foods such as beef heart can cause digestive problems with the Red Rainbow Goodeid and should be avoided for this species.
- 7 The Bold Characodon is best bred by isolating a gravid female in a small aquarium for the last few weeks of pregnancy because the other adults in the tank are prone to attack and kill new-born fry. The Red Rainbow Goodeid seems to breed best in a well planted colony tank. Never use breeding traps on either species if you can avoid it, since these tend to stress the pregnant female and cause her to give birth prematurely.
- 8 The fry are quite large at birth (7-10mm (SL) 0.3-0.4in) and grow quickly on regular feeds of live baby brine shrimp.

tive-bred F1's (First Filial Generation) look exactly like those of the old strain. During this time, the wild fish have developed more black in the fins, and the red has decreased.

In captivity, Bold Characodons require a large aquarium with plenty of hiding places, since they can be somewhat aggressive. Their diet should contain a mixture of live and flaked foods, with the emphasis on meaty foods. A good carnivore flake should be fed on a regular basis. The temperature should be about 21°C (70°F) and good filtration should be installed; alternatively, regular partial water changes should be conducted to maintain the water quality.

Broods are born on a six-weekly cycle and can number over 50 from a large female. However, such large broods are usually of small fry which grow rather slowly and make poorer adults than fry born in more normal sized litters of between 10 and 20 young. While sexable at about two weeks old, juveniles do not start to breed until they reach two months old, with the first litter being produced when the female is about 3½ months old.

Red Rainbows

The third species of Rainbow Goodeid is the Red Rainbow Goodeid (*Characodon lateralis*). This species is found only in the rivers, streams and ditches around the town of Durango and has been in decline for many years. On our survey, we visited

THE RAINBOW GOODEIDS

Wild-caught Los Berros female exhibiting the strong black spotting of this collection.



Characodon lateralis male from the old Los Berros collection. As can be seen, this fish exhibits almost no black spotting but does have good red colour.

Note the intense red in this aquarium-bred male *Characodon lateralis*.

AQUARIAN FISH FOODS



a number of known habitats for this species and can confirm the decline of much of the native fauna in these.

The reason for this has been the tremendous growth of the city of Durango since the mid-1960s, leading to an increase in domestic and industrial pollution; there has also been a reduction in the stream flows in the area. Introduced species have severely impacted on the native fish, with the result that of the 11 native species unique to this area of Mexico, it is believed only five still survive.

We did come across a number of populations of *Characodon lateralis* and it was these which gave us our biggest surprise on this trip. All aquarists' knowledge of this species is based on a collection made by Dr R. R. Miller way back in 1969 from a stream at Los Berros. These fish have obviously become very inbred over the years, and males now exhibit a lovely red colour over the whole body and into the fins. Females are a uniform green. Both sexes exhibit varying degrees of black spotting along the lateral line. These black spots can be very large and numerous, producing almost a solid row. Alternatively, they can be just one or two small, almost invisible spots. Either way, the red coloration of the males is pretty uniform in captive stocks.

The first location we found this species at was in the streams and ponds around the village of Abraham Gonzalez. The females of this collection matched those of the captive stocks, except they lacked much of the black spotting. The males, however, not only lacked spotting, but also had little in the way of red coloration. Some fish were a brassy green to blue in colour, while a few had some pallid red in the body and fins. These were certainly nothing like the fish we had in captivity.

The water quality at this location was 200ppm hardness / 180ppm alkalinity and had a pH of 7.6. The temperature in the morning was only 18°C (64°F). Apart

from the Rainbow Goodeids we found Sunfish, *Gambusia speciosa?*, a Pupfish (*Cyprinodon* sp.), *Tilapia aurea* (introduced) and an Atherinid species. Most collections of *Characodon lateralis* came from among the plants, particularly in small ditches with some water flow. The Sunfish were also found in this part of the habitat.

We fished another location near the village of 27 De Noviembre with much the same results. Here, the water quality was 200ppm hardness / 180 alkalinity / pH 8.0 and the water temperature was the same 18°C (64.5°F) despite it being the middle of the afternoon by this time.

Once again, the remarkable difference in colour between the various males was noted, and the fish were generally found in the same part of the habitat. At this location, we did not find any *Tilapia* but we did find some young Carp or Goldfish.

Our final location where we found this species was the original one where Dr Miller collected it in 1969. This location is a stream flowing through the village of Los Berros on the other side of Durango. Here, we found the strongly spotted individuals which are the form we have been working with in captivity, but this time we failed to find any red males at all; the closest we came was a yellowish coloured individual. Once again, the Rainbow Goodeids were mostly found among the plants in areas where they would be subjected to some water movement.

We saw some large cichlids but were unable to identify them, and caught some well coloured *Gambusia senilis*, as well as some Swordtails (*Xiphophorus helleri*). Once more, these last species have been introduced to this area of Mexico. The water quality was 250ppm hardness / 240ppm alkalinity / pH 7.0 and the temperature was 19°C (66°F).

In captivity, this species prefers an aquarium with some plant cover and good clean water. It is far less aggressive than

ACKNOWLEDGEMENTS

My thanks to Aquarian and Frisby Aquatics of Hull for their sponsorship of the Aquarian Endangered Species Survey '94.

A very special thank you goes to Arthur Frisby who was not only a wonderful companion on this trip, but also looked after me when I had my appendix out shortly before returning to England. Without his hard work and care, probably, neither the fish nor I would have returned from this trip!

the Bold *Characodon* and can be bred in a colony situation once the adults have become used to the presence of small fry in the aquarium. Their diet should contain plenty of live foods (particularly crustacea, such as *Daphnia*) but beefheart and other rich meaty foods must be avoided, since these can cause digestive problems.

It is now (as I write) about six months since we returned with some wild-caught fish from Abraham Gonzalez and Los Berros and, apart from the few males from Abraham Gonzalez which had red coloration, none of the other males have developed red. The red males from Abraham Gonzalez have now become deeper in colour, similar to those of the old *Characodon lateralis* collection, so it seems that this coloration is affected by environment or diet. Whether all males of this species are capable of producing red or not, has not yet been determined, and the captive-born fry are still too young to exhibit this feature.

Great potential

At the beginning of this article I mentioned how popular the Rainbow Goodeids are in the specialist hobby, but they also have tremendous potential in the trade as well. The Bold *Characodon* is already being sold in some shops as a normal community fish and, despite its rather boisterous temperament, it seems to do quite well in such a situation.

The Red Rainbow Goodeid, although more nervous, will also live quite happily in a community tank with quieter species. It will only take a large commercial fish breeder to make the effort to obtain these species for them quickly to become popular fish throughout the hobby. 129

HELPING HAND



By Kevin Fox

Under way... at last!

"You dig sixteen feet of back-garden mould.

You don't do it yourself 'cos you're just too old..."

Yes, its 'Pond Time' (at last, I hear you whisper). The patio's been laid (not by me, of course, I just designed it) and launched with a terrific Patio Warming Party. Low body-count though: just the two 'would-be men' who drank themselves stupid!

And then, there it stood: a small mound of stone chippings impaled with a shovel at 45 degrees, silhouetted against the most beautiful sunset I've ever seen. The garden literally screamed at me: "I want a pond! Gimme a pond!" We have a very long garden, around 140 feet long, but quite narrow — 50 feet wide. (which I call Area 'A').

Behind the patio (Area 'B') there is a narrow strip of land around 50 x 10 feet (running up to a decorative wall), and is designated the 'Sun-bathing' plot. Area 'C', abaft of this wall — around 60 x 40 feet (area 'D') is a newly dug and grassed-over area. My wife had this sudden inspiration that half-a-pound of grass seed would do the job! And before we go any further, this is not going to be the position of my first pond.

Thanks entirely to years of reading A&P, I now know considerably more about how to keep most of the various types of ponds. In fact, I'm now struggling to keep up with the latest gizmo or gadget, feeds, filtration and plants. I do have very strong views of my own about the subject of pond filtration systems, the main theme being that they're 20,000 times more complex than actually needed.

My initial plans are, as per the recommendations in A&P, to start with either a small rubber-

liner pond, or a pre-formed GRP (Glass Reinforced Plastic)-based one. The second option appeals mostly. Unfortunately, we're surrounded all about with 3-6 year old children. And, as it only needs an inch of water for someone to drown in, this is a great problem to me.

As already said in the past, being a wheelchair whizz, I don't want the pond on the ground, so

what I have to do is build a plateau and then pre-shape the top of the plateau to fit the base of the pre-formed plastic pond. Having done that, it would be nice to have another plastic pond at the bottom of the plateau, eg. ground level, small and very shallow, to catch the water and pump it back up the hill. This would make the pond accessible to all aquatic lifeforms.

I'll keep you fully informed about each stage, the problems, what worked and what didn't etc. and some pictures. So then you will have no excuses anymore!

Ultimate aim

Once I have successfully run Pond #1 for a few years, work on my ultimate pond will begin. In area 'D', I want a 20 x 30 foot pond (lake?), again raised above the ground and made from cement etc. In this pond I hope to keep, breed and bring on Common Goldfish to show level.

Personally, I am fed up of seeing Goldfish mutations which are quite often sickening to see — my personal views, by the way, I am really looking forward to setting up my first pond as, after yonks of keeping fishes in artificial biospheres, it's going to be nice to see them in their natural habitat — or as near as is possible.

As a final word on ponds, a few days ago I visited my favourite lake, only to find it completely swamped in green algae. Three years ago, the same situation was affecting the place, and the local rangers were working flat out removing boatloads of Blanket Weed.

Unwilling to repeat this intensive labour, the following year they dumped a couple of tons of weed-killer into the lake, and for two years, there wasn't a weed to be found. The thing which worried me was, what on earth did the fish eat once the lake had been cleared of all weed?



It's not there yet... but this is where my main pond will be. Watch this space!

Sorry! But Keep 'em coming

My current condition, unfortunately, dictates that I cannot enter into direct correspondence with any of my readers for the moment. However, that doesn't mean DO NOT WRITE ME! Far from it!

I rely heavily on your input for this column, and I promise to acknowledge ALL letters sent in via the magazine, but extended correspondence is now no longer possible. I am now spending so much time in hospital that it takes me weeks just to catch up on my domestic affairs! I hope that you can understand this.

Until next time. Take good care... and happy fishpond-keeping.



In a community aquarium, *Ludwigia palustris* can be grown in attractive clumps.

FURTHER READING

K. Rataj & Noreman (1978)
Fakta om Akvarieplanter
1+2. Ledemann
Dr. Jiri Stodola (1957)
Encyclopedia of water
plants. TFH Publications,
Inc.

Above water, the leaves become more rigid and shiny. Note the tiny flowers in the corners of the leaf, two nodes up from the water surface.

MARSH LUDWIGIA FACT FILE

Ludwigia palustris Elliot belongs to the family Onagraceae (Ono-thereaceae) which includes more than 20 genera, with nearly 650 species.

Synonyms:

Isondia palustris Linna

Dantia palustris Peit

Ludwigia apetala Walt

Ludwigia repens Foster

Distribution:

In nature, this

plant grows in the south of

Europe, West Asia and

North America (USA) and

can grow in temperatures

from 19-28°C (64-82°F).



GROWING THE MARSH LUDWIGIA

If you are interested in very fast-growing plants for your aquarium, then the Marsh Ludwigia, *Ludwigia palustris*, is an excellent choice. This plant can be bought as a bunch of cut stalks — usually four — kept together by a rubber band and put in a small flower pot.

When you get home, remove the bunch from the flower pot and plant it in your chosen spot in the aquarium.

Basic needs

There are certain things which must be just right, with regard to light and depth of water, if one wishes this plant to grow.

For a start, there must be plenty of light, since this species is especially fond of sunlight, so provide this if it is at all possible. The Marsh Ludwigia is a plant which can grow into a very big bush shape, if one constantly remembers to trim it in the right way, i.e. cutting back the new stalks once they are approximately 5cm (2in) long. In this way, you can produce a very beautiful low bush shape measuring some 20cm (10in) high.

One can also choose to let this plant grow right up to the surface of the water, e.g. in a tank 40cm (c15-16in) high. The plant will then be the centre of the aquarium and, near the surface, it will

Danish aquarist
Jørgen Wimo offers some
expert tips on how to
achieve success with this
beautiful, easy-to-propagate
aquarium plant

Photographs by the author

ramify (branch out) on all sides. Some of the stalks will lie horizontal on the surface and, from these, long roots will reach down into the tank. Other stalks will grow above the surface 5-10cm (2-4in) up in the air, and the small yellow/green flowers will appear in the leaf corners of these stalks.

Main characteristics

From the shining stalk, thick leaves stick out; these are light green on the top side and violet to dark olive green on the underside.

The leaves are positioned opposite each other in twos and have no stalk, or a very short one. The leaves measure 2-5cm (0.8-2in) in length and can be up to 2cm broad. The ribs of the leaves are nearly invisible.

The Marsh Ludwigia is both a swamp

and a water plant, so it is very suitable for use in an aquarium with low water level, or in a vivarium, where the swamp form of the plant will be very beautiful.

The flower consists of four fused sepals which are yellowish green. There are no petals, but there are four stigmas. The flowers do not measure more than approximately 3mm (0.1in) in diameter and are very insignificant.

Propagation

Reproduction is easily achieved by cutting off the top stalk to a length of 5-10cm (2-4in) and planting it in the bottom layer. There, it will automatically go on growing if there is sufficient light and not too much dirt in the substratum. One should never plant these top stalks singly in the bottom layer; they look much better when 4-5 stalks are grown together.

Another method of propagation is to take a long stalk measuring 20-30cm (8-12in) in length and force it down on its side on the bottom. From each leaf corner a new stalk will soon appear and grow towards the surface. This is a particularly quick method of multiplying this plant.

If you can get your Marsh Ludwigia to grow well, then trim your plants every month.

Individual v pond treatments

I have advocated, on more than one occasion, that treating your whole pond with any form of chemicals should be avoided whenever possible. Koi, like most fish, cannot tolerate rapid changes to the water chemistry without developing some form of disturbing and stressful behaviour.

Experienced fishkeepers do not really manage fish... they manage water! The constant demand for improved water quality is paramount to every serious Koi keeper, and it is here that realists often embark on further improvements and fine tuning for ultimate perfection in filtration.

I will be the first to acknowledge that there will be times when the pond must be treated, but as I look back over the last three years, I can categorically say that, by individual Koi treatment, I have been able to control and direct medication to the patient concerned, without forcing healthy Koi to endure illogical treatments. During this period, I have found it unnecessary to administer anything to my two ponds

whatsoever, and that includes any form of algae control treatments.

You will be amazed by the philosophy of Koi keepers who firmly believe that "These two Koi are not well, therefore they must all be suffering from the same problem!" Inevitably, all the pond inhabitants get "Grandma's Castor Oil treatment!"

Individual treatment of Koi in short or long term baths, and sometimes periods of isolation from the main pond, is advantageous all-round. In fact, signs of bacterial problems, such as abdominal dropsy or gill disorders, MUST be tackled in a treatment or isolation facility, and this will vary according to the size of the Koi.

It is amazing how many Koi keepers are not equipped, or ready, to handle such emergencies. The medication chest, inspection bowls or, even a net, in many cases are non-existent, and it is with this in mind that we should look at some bare necessities that should be at hand.



ALAN ROGERS



'Before' and 'after' pictures of a Koi suffering from a bad bacterial infection. Treating such fish in isolation greatly improves your chances of success. The time interval between the two shots is only 14 days.

KOI TALK



by Alan Rogers



Koi undergoing anaesthesia - prior to treatment.

KOI FACT

What are Matsubagoi? Koi varieties which DO NOT fall into Hikari Mui classes (i.e. metallic varieties)

Example: Shiro Matsuba (white), Aka Matsuba (red) and Ki Matsuba (yellow)

plastic or polypropylene purchased at most builder's merchants, available in 50 or 100 gallon sizes. Square tanks are not suitable due to reinforcement protrusions positioned inside; also, the actual corners are a likely source for bruised noses and damaged finnage during immersion times.

It is quite a simple matter to calculate and register various gallonage levels for the accurate administration of dosages by the use of a water meter or a watering can duly marked on a permanent dipstick.

A reliable air pump capable of supplying excellent aeration via airstones is a piece of mandatory equipment and, supplemented with an aquarium heater-type thermostat ranging between 200 to 300 watts, will help maintain steady temperatures. An accurate thermometer will also be required; it is quite incredible how inaccurate and diverse cheap thermometers can be!

Basic needs

A suitable net with a low pan is, obviously, required; it must be long enough to gain access to all the areas of the pond. If the pond is very large, then an assistant with a second net is a must.

Avoid the type of landing/keep nets used by river fishermen, as they are far too deep in design, creating too much drag when attempting to manipulate your Koi into a floating basket or bowl.

Never lift or suspend the Koi

from the water in the net; the struggle that results will probably cause damage to scales, finnage or protective mucus layers. Make sure you have a net large enough to handle your largest Koi, and, indeed, any treatment tank must follow the same basic adequate size.

Many hobbyists have purpose-built fish houses and treatment facilities, which are perfect for all occasions and every emergency. A basic treatment tank which is very suitable is the round water tank manufactured in heavy duty

Two top tips

While any Koi is retained in this type of isolated treatment, there are two vital points that must be remembered. Firstly, never

attempt to feed the patient, even if it is likely that it will accept food. Remember, the tank is only aerated and not filtered. Any long-term treatment in excess of two days will necessitate regular partial water changes of identical temperatures, to remove increasing ammonia levels.

Secondly, do not fill the tank to the top, and always cover for safety sake with a fine net or greenhouse shading. This will still provide important and necessary observation of the Koi, with the minimum of disturbance.

I have often treated 26in (66cm) Koi for periods of two weeks or more with this type of equipment facility and, under the conditions described above, the results have been very successful.

Permanent facilities

A durable treatment facility for the more enthusiastic can be always available and permanently set up in a fish house, incorporating some form of continual filtration, aeration, water changing and even heating facilities.

Obviously, this arrangement will need to be run continuously and with permanently resident live fish to keep the filtration fully active. However, certain medications in this type of facility will

have adverse and traumatic effect on the aerobic bacteria colonies within the filter.

Some arrangements I have seen utilise medicated charcoal in external power filters and, while this is great for normal practice, one would have to bypass this facility during most treatment. The absorbing characteristics of charcoal would reduce the efficiency of many chemical medications.

It would be prudent to be aware that, at times, full sterilisation may be required after certain bacterial and parasitic treatments, and this will be easily achieved with our simple and basic non-filtered tank. Virtually all free-swimming pathogens and parasites are destroyed by a simple drying out process of equipment after use.

'Central heating'

When utilising a heater/thermostat for controlled temperature, I prefer to suspend the unit both vertically and centrally. Experience has shown me that larger Koi can be 'burned' if resting on top of, and touching, a horizontal unit for long periods.

A powerful Koi, if startled, will have no problem breaking a heater against the side of the tank or a large airstone. This situation, if permitted to occur,

can have lethal consequences to both Koi and owner without the necessary electrical safety precautions being observed.

The centrally suspended unit,

describe what may be considered the very bare essentials of backup equipment that every Koi keeper should be expected to have access to.



A good surgical kit is essential if you are serious about treating Koi properly.

on the other hand, is merely moved gently to one side by the 'brush of the tail'.

Short-term immersion dips can always be carried out in one of the large familiar blue bowls frequently seen at some Koi shows, although, in my opinion, small baby baths are not suitable for this purpose, not even for the smallest Koi.

I have endeavoured to

WARNING: Any form of heater/thermostat and/or air pump must be protected by a suitable Residual Current Device (R.C.D.) and overload protection supported by a Miniature Circuit Breaker (M.C.B.).

As my space for Koi Talk is not unlimited, perhaps we should discuss the basic contents of the medicine chest and other beneficial pieces of equipment, such as a microscope, balance scales, surgical instruments and advanced techniques in a later edition. Talk to you soon!

H. TISBURY & SONS FANCY GOLDFISH

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In Part One I discussed the various factors involved in determining which aquarium inhabitants require flowing or turbulent water, and which prefer a quiet, still environment. Having decided what is needed in a particular aquarium, the technical challenge of how to provide the required movement remains. This is what I'll be tackling this time round.

The aquarist can move water in two ways: directly, using a pump, or by bubbling air through it. For gentle currents, using air would appear to be ideal, but airstones and air-driven filters have several disadvantages. For example, many air-operated box or sponge filters, which would provide adequate filtration in a well-planted tank lightly stocked with the typical small community species, are rather ugly and difficult to conceal. Air-driven undergravels are less conspicuous and more efficient, but many people have difficulty growing plants with undergravel filters.

All air-powered systems suffer from the problem of noise, both from bubbles, and from the operation of the air pump, though these are quieter than they used to be. Marine tanks with airstones suffer from salt creep, where splashing water as a result of bubbles bursting leaves crusts of salt on cover glasses, wires and pipes. Air-driven undergravel filters are, in any case, not the best choice for most marine aquaria.

Power choice

Internal or external power filters seem to be the best choice for planted aquaria.

Turbulence from the outlets of these filters can be minimised in various ways. The strongest (and most directional) water flow is obtained if the efflux from the filter is pumped into the tank via a single outlet pointing into open water. To reduce the flow, the outlet can be directed at the side of the tank, which will dissipate the strong current. If a spray bar can be fitted, then this can be set up so that the holes face the tank glass.

If fish which enjoy calm water of extremely high quality, such as *Discus*, are kept, an ideal form of filtration is an overhead trickle filter, fed by the outlet from either a canister filter or an internal power filter, from which the outlet drips or dribbles gently back into the tank.

Surface turbulence

Whatever system is chosen for the quiet water aquarium, it is desirable to have some surface disturbance.

If a power filter is used as described above, the spray bar or outlet should be positioned at the air/water interface, or slightly above it, allowing the outflow to run down the glass into the water.

There are two reasons for this, both connected with gas exchange. Disturbing the surface aids diffusion of gases directly

MOVING WATERS

Ways and means

PART TWO

As Philip Hunt shows, there's more than one approach to controlling water movement in aquaria.



Still-water species such as *Discus*, do well when filtration is of the overhead trickle type.

by increasing the effective surface area, and indirectly by preventing the development of bacterial and algal films, which quickly appear on the surface of still water and interfere with gas exchange.

For a highly oxygenated, very turbulent aquarium, as favoured by marines, river fishes and African Rift Lake Cichlids, the technology is readily available, but some thought needs to be applied to its use.

If plants are not grown, then a power-head-driven undergravel filter can be used, if this type of filtration is adequate. The outlets from the powerheads should be arranged so as to direct the flow out into the centre of the tank. If two powerheads are used, then a particularly turbulent zone will occur where the currents meet.

As for the quiet tank, the outlets of the powerheads should be set to give maximum disturbance of the water surface only. In some powerheads the outlets are

at or near the top of the pump, and these are far more efficient in creating the type of surface turbulence required for good gas exchange than those which have the outlet at the base of the motor block. Also, the 'top-outlet' pumps can be submerged to a greater degree than 'bottom-outlet' ones, while still achieving optimum turbulence, which helps to keep the pump cool.

If power filters, internal or external, are used in this kind of tank, spray bars should not be employed, but the open outlet of the filter should be positioned at the water surface, at one end of the tank. Alternatively, with a canister filter, the outlet pipe can be split with a T-piece and the water returned to the tank at both ends.

It should be noted that this arrangement, like using two powerheads, creates flow patterns which are more appropriate to African Lake cichlids and marines than river fish. The latter are adapted to a

steady 'one-way' current, and are used to taking up position facing upstream. For these fish the use of a single, larger pump may be more suitable. If it is placed near the surface at one end of the tank, a strong, steady current sweeping around the tank will result. This will allow the fish to predict the flow pattern at any point in the tank and position themselves facing into the stream, as they would in nature.

Venturis and skimmers

One thing to examine with care when choosing powerheads is the venturi feature which most offer. Some of these, apart from creating a horrible noise, can blow enough fine air bubbles into the water to make it opaque. Both fish and invertebrates find these fine bubbles intensely irritating.

Other models run more quietly and produce larger bubbles, though often quite careful adjustment is needed to tune the system optimally. Whether the dissolved oxygen content is increased much over that achieved by using the pump to produce a turbulent water surface is debatable, anyway.

In a marine aquarium, venturis can play an important role in aeration, however, as can airstones.

A protein skimmer, whether columnar or venturi-driven, provides a very efficient means of oxygenation; the very fine bubbles produced by the skimmer (which are kept safely inside the reactor) and the long contact time with the water, permit excellent gas exchange, and many reef tanks using skimmers and circulation pumps achieve supersaturation with oxygen, as is found on the reef, without using external airstones or venturis.

Circulating water

In reef systems, where maximum turbulence is required, along with water of the highest possible quality, the outflow of water from the filter may not be adequate to provide oxygenation and water movement, and special circulation pumps should be provided. Powerful powerheads are ideal.

To provide good circulation in all parts of the tank, more than one pump may be required, or a circulation pump can be set up at the surface at one end of the tank and the filter outlet set to direct water across the rockwork of the 'reef' at the other.

As optimum aeration is required in reef tanks, good surface turbulence is essential, especially if reverse-flow undergravel filtration is utilised. The water emerging from the gravel bed in these systems is low in oxygen as a result of the activity of the filter bacteria, so the water must be well circulated and oxygenated by other means.

To achieve good circulation throughout the tank, several powerheads can be dis-



Left, powerheads in various combinations can be used to create the moving, highly oxygenated environment preferred by African Rift Lake species like *Neolamprologus brichardi*.

Left below, feather dusters and other sessile ('fixed') marine invertebrates rely on water movement to bring food their way.



tributed around the tank, concealed among the rockwork. This is a technique to consider when trying to get a sea anemone to stay where you want it.

As always in life, however, there is a price to pay; powerheads generate heat, which is dissipated into the tank water. Reef tanks, with their powerful lighting systems, often overheat in summer, and the extra heat provided by additional water pumps can push the tank to dangerously high temperatures. Obviously, large tanks will be less affected than small ones.

Wave surges

Perhaps the ideal for the reef aquarium is a pulsed flow giving a wave-surge effect. There are several ways to achieve this. Public aquaria often use dump buckets, which can provide a tremendous surge of water, to provide waves in tanks.

Dump buckets are very simple in principle; a counter-weighted asymmetrical vessel is filled with water from a pump, and when the water level reaches a certain point the bucket overbalances and deposits its contents into the aquarium;

the counter-weight then causes the empty bucket to return to its original position, where filling begins again.

Dump buckets need not be the exclusive province of the public aquarium, however; it is possible to build versions suitable for the larger home system, and interested readers are referred to *Dynamic Aquaria: Building Living Ecosystems* by Walter H. Adey and Karen Loveland (Academic Press), for a more complete discussion.

Another method of providing wave motion is to use pumps which are constantly being switched on and off, or alternatively, to use an electronically controlled valve which switches the filter efflux between two outlets.

Many system aquaria, intended mainly for the miniature reef market, incorporate such features. Tunze, for example, include pulsed-flow controllers in several of their filter systems, as do Labaina, who take the whole process a stage further by also producing a tidal tank, for perhaps the ultimate in water movement. This system will pump water into and out of the aquarium in imitation of a natural tidal rhythm (two high tides and two low tides) in each 25-hour period) and also vary the direction and intensity of currents within the tank according to the state of the 'tide' — a magnificent technological feat, at a price to match.

Cheaper alternatives

Making waves need not be so expensive, however. Electronic controllers can be purchased as add-on extras from various manufacturers. These units will control one or more powerheads, switching them on and off at intervals of a few seconds.

If the filter outlet is positioned to give a powerful current, a single pump placed at a distance and controlled by an electronic 'wavemaker' should suffice to produce a good degree of to-and-fro movement. Alternatively, two powerheads could be used, at opposite ends of the tank for maximum effect.

The size of the circulation pump(s) should be matched to the size of the tank; if a single pump is used, it should be powerful enough to match the filter output. After all, pulsed-flow from a 200-litre (44-gal) per hour circulation pump will not make much impact on a 1,500 litre (330-gal) per hour filter output. Similarly, two small pumps set at opposite ends of a six-foot (180-cm) tank will not provide much turbulence.

The choice of pump type is also important; some Tunze pumps, for example, cannot be used with the company's power-timer. It is also not a good idea to try to pulse pumps using ordinary timers with minimum intervals of about five minutes. This does not give the continuous to-and-fro motion of a wavemaker and tends to frighten fish.

Pump damage

For keepers of reef aquariums, one problem associated with using most pumps is that they, in theory at least,

destroy most planktonic organisms which pass through them. There are, as yet, no alternatives to impeller pumps available for the aquarium market, though Tunze claim that their pumps do not produce the shear forces apparently responsible for killing plankton.

That the destruction of plankton is not total will be confirmed by many reef keepers, as the appearance of new 'livestock' in invert tanks is by no means unusual. In my own system, for example, the canister of a large power filter has been colonised by hundreds of small fanworms in calcareous tubes, which presumably got there as

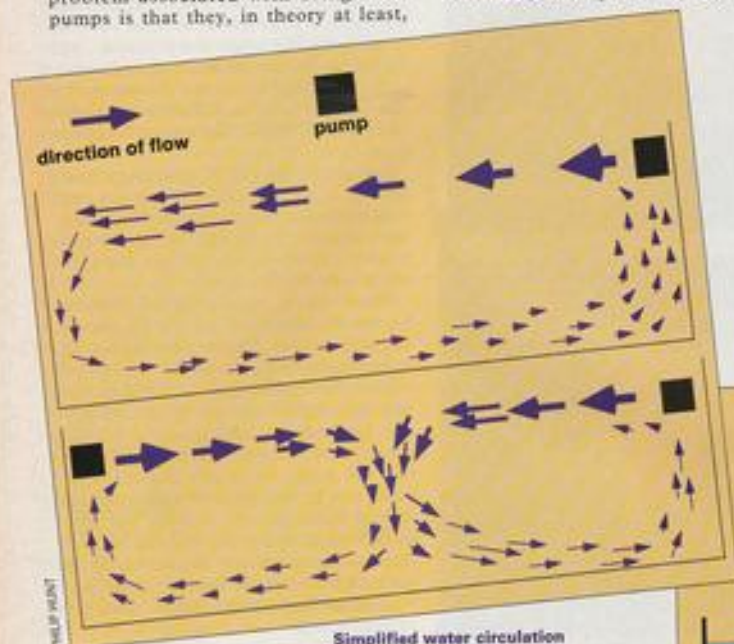
planktonic larvae. It is interesting to imagine what could be achieved in a system with 'plankton friendly' pumps, though.

Water movement, or the lack of it, is an integral part of the natural environment of aquarium residents and, despite its previous neglect, aquarists should consider it carefully when they set up their tanks, just as much as lighting, temperature or any of the other characteristics of the system.

Stress reduction

Although water movement is most critical for miniature reef aquaria, which are the systems which strive to imitate the natural situation most closely, it is also an important factor for all aquatic creatures. By tailoring the physical environment of the aquarium as closely as possible to that of the inhabitants' natural home, we can minimise the stress they experience, meaning less disease, brighter colours and a longer life, with an increased chance of breeding.

No one would argue with the need to have the correct form of lighting for a particular aquarium, and water movement, hitherto a somewhat neglected field, deserves similar attention, being just as important a part of the aquatic habitat. **27**

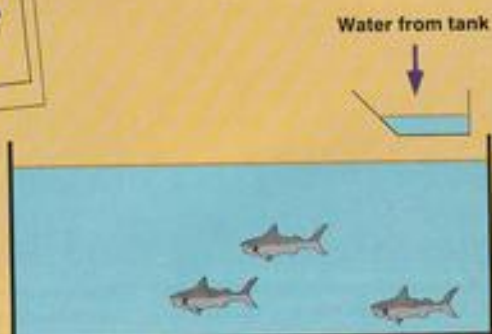


Simplified water circulation obtained with (top) one powerhead or pump, or (bottom) two.

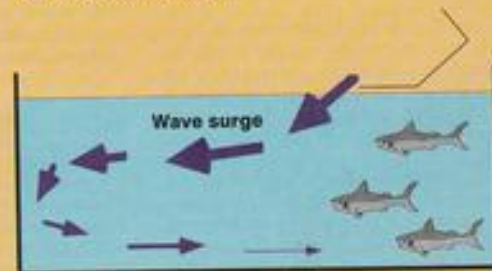


Top-outlet powerheads can be set up as circulation pumps. Note the high degree of surface turbulence produced in this marine system.

OPERATION OF A DUMP BUCKET



1. Dump bucket filling



2. Full bucket overbalances, returning water to aquarium and creating a wave surge

Making waves using a dump bucket (see text for details).

NATURALIST'S NOTEBOOK

BY ERIC HARDY

Successful year for Natterjacks



Mature female
Natterjack
Toad.

MERSEYSIDE
NATURALISTS
ASSOCIATION

dollop of spawn on the sand dune grass 3ft from the water's edge. As the flash (instant/temporary body of water) had been continuously rising

The wet winter and warm spring brought a most successful breeding season for Natterjack Toads (*Bufo calamita*) on the Formby-Southport dunes of north Merseyside. In May, I was with English Nature's warden counting spawning strings on Cabin Hill national reserve, at Formby. If any toads have Shakespearean jewels for eyes, spring nights full of singing toads, filling our dunes with this male voice choir merits this.

We returned to count over 10,000 tadpoles in a bonus the rains had given them. A survey of predation showed many are preyed upon by crows, magpies, herons and three types of gull. To reduce competition with Common Toads (*Bufo bufo*) here, 2,690 Common Toads were removed to the far side of the River Alt.

Natterjacks also inhabit north Walney island, at the north end of Morecambe Bay, but in contrast, only four strings of spawn were found there, where 80 adults bred last year. The colony at Drigg on the Cumbrian coast fared better, but only one Natterjack was found under a stone at Hoylake Red Rocks marsh, their only remaining Cheshire haunt, where they were feared extinct.

While we were counting at Cabin Hill, we came upon a

from rain all season, this answers **Pauline Hodgkinson's** query about finding frogspawn out of water in her June A&P article. I don't know if this is due to competition in the water, where territories are strongly disputed by males. The males are usually the first to go in extinctions of Natterjack colonies.

Laces and Alders

Gauzy green lacewing-flies are usually considered infrequent visitors to the garden or field and not usually listed among river and pondlife insects. Browsing through Colin Plant's recent 300-page *Atlas of Lacewings and Allied Insects*, sent to me by the **Institute of Terrestrial Ecology**, I was surprised to notice eight of its 70 species belong to streams, pools, bogs and mossy watersides, and come well within the province of aquatic life. It's the result of a British Museum-based recording scheme, or survey.

The rather widespread Alder Fly, *Stalis fuliginosa*, has always been found by clean, flowing water, *S. lutana* from both static and moving water, vegetated village ponds, large lakes, muddy streams and main rivers. From Ireland to south Wales, *S.*

nigripes is associated with calcareous lakes, as well as from acid Towy and Taff, where it is caught by beating waterside vegetation to net it. These Alder Flies, *Stalis*, have no particular relationship with waterside alders.

The Giant Lacewing, *Osmylus fulvicephalus*, common in Wales and southern England, is almost always on the edge of streams in the evening. Its grubs live in water-splashed moss.

Slow or static water is preferred by *Sisyra fuscata* one of the Sponge-flies, whereas its relative, *S. dalli*, evolved a preference for rocky, acidic streams, as well as the Surrey Mole, Shropshire's Colemere and Liangollen canal.

Acid Welsh bogs and Norfolk fens are the haunt of *Psectra* diptera, with dense tussocky vegetation. The small, flightless Snow-Flea, *Boreus hyemalis*, no longer the rarity it used to be considered, lays its eggs in moorland moss. This is one of the Mecoptera — the Scorpion Flies — active only in winter.

Waterbird oddities

A Russian salmon caused interest when eating a bird, but I recall a researcher marking North Sea tunny telling me he saw one swallow a Wheatear migrating near the sea, and there's an old record of an angler fish, when caught, to have a Red-throated Diver in its stomach.

Other water-bird interests include a Kingfisher rearing four broods in one season; a normally fishing Little Egret flying into a bush and eating berries; Sanderling and Dunlin eating freshwater Zebra Mussels, and a House Sparrow eating mosquito larvae.

It has been discovered that individual Ospreys can be identified by their head pattern or plumage.

A hybrid between Grey and Purple Herons was a true *rara avis*.

JOHN KUNAWALZER



Exceptional
Kingfisher
(see Waterbird
Oddities).

Nature Notes

1 Las Vegas is not only a gambling centre. Three biologists at the University of Nevada there, **Hill, Hillyard and Hillyard**, have shown that toads taste salt with the sensory function of their skin in choosing habitats.

2 The skin of the South African Frog, *Pyxicephalus adspersus*, kills dogs with its toxin.

3 A new species of Barking Frog, *Eleutherodactylus surdus*, has been found on the Pacific slope of the Andes in Ecuador.

4 The rare terrapin, *Batagur baska*, known by its conspicuously small head, has been found breeding in Bengal.

5 Sea snakes do exist. The Persian Gulf Sea Snake, *Hydrophis lapemoides*, is the centre of a distribution study. They are more venomous than most land snakes.

6 A natural assembly of young Green and Hawksbill Turtles has been found on the fringing reef of Wuvulu Island, in Papua New Guinea.

7 Biologists at Kagoshima University, Japan, have made a study of the barnacle *Chelonibia testudinaria*, which attaches itself to the carapace of breeding Loggerhead Turtles in the way that other barnacle species are addicted to certain whales, even codfish.

8 A biologist at the University of Tennessee has been studying the diet of the Fishing Bat, *Noctilio spinorinus*. Ranging from Mexico to Argentina, it's one of the two hare-lipped bats with a divided, fleshy upper lip instead of a nose-leaf. It has much enlarged hind feet with large claws to catch surface fish by flying close to the water. It uses its high frequency call echoes from any fish near the surface.

9 Canadian biologists have studied the underwater calls of ice-breeding Grey Seals.

10 Seal distemper virus continues in Wadden Sea Seals in Europe, where it caused deaths a few years ago.

11 Grass snakes still favour south Cheshire's Wybunbury Moss, but not the Adders I noted there in the 1950s.

12 A recent award will enable Mere Sands reserve in Lancashire, near Rufford, to create a pond-dipping lake with walkways for school children's studies.



Best in Show, a London Shubunkin over 3in (Class 17) GSGB standards.

NGPS Show

The Northern Goldfish & Pondkeepers Society held their traditional annual show at the Trinity United Reform Church in Atrincham with a display of (mainly) Goldfish judged to GSGB standards.

There were 38 classes, and 30 exhibitors made 235 entries, mainly from NGPS members, although there were also fish from the Scottish and Bristol Goldfish clubs. The Show is sponsored by **Aquarian**, so there is free entry for the public to see prize-winning specimens of Fantails, Veiltails, Moors, Orandas, Pearls, Bristol and London Shubunkins.

The **Best Fish in Show** was a London Shubunkin owned by NGPS member **Bill Cumberland**. This fish was bred by Bill and has also won awards at SPASS, Midland and Bristol Goldfish Society shows. The highest pointed shower was the President of NGPS, **William Ramsden**.

SOCIETY WORLD

The prizes were presented by **Dr David Ford** of the **Aquarian Advisory Service**.

Steve stars at MAPS

A&P contributor and Discus specialist **Steve Dudley** was the star speaker at **Midlands Aquarists and Pondkeepers Society (MAPS)** in September. He provided an informative general talk about keeping Discus, with particular reference to feeding.

Steve has been testing Phoenix 2000 Cichlid and Discus Pellets throughout the year, and his talk complemented a presentation that evening to MAPS by **Steve Kuzio**, director of Phoenix 2000, manufacturer of Gold Line Feeds.



Pictured Keith Watson, chairman of (MAPS), left, welcomes A&P contributor Steve Dudley, right, and Steve Kuzio.

At an earlier meeting **Koi** consultant **Malcolm Hollows** revealed the finer points of pond filtration. The talk covered all aspects of pool construction, with specific reference to designing and maintaining an efficient pool filter.

Also giving his first-ever talk was member **Adrian Binley**, who provided a lighthearted look at fish names and the confusion they can sometimes cause.

The society has grown in stature since its formation less than a year ago, with a membership approaching 60. Meetings are held on alternate months in the Conservatory Tea-room at Ullesthorpe Garden and Aquatic Centre, Ullesthorpe, Leicestershire, and subjects are designed to appeal to all areas of fish-keeping. For information, contact **Keith Watson, 39 Saint Marks Court, Pool Close, Bilton, Rugby, Warks. CV22 7RW. Tel: 0788 811587.**

High Bristol entries

Bristol AS reported a very successful annual Open Show, held at St Ambrose Church Hall, Whitehall, Bristol in September. The total of 330 entries was only two fewer than last year's figure. The **Best in Show** was won by **G. Paull**, from Paignton, Devon, with a matched pair of Metallic Veiltail Goldfish.

November

Tuesday 1 Gloucestershire AS — Meeting with a talk on Wetlands and their importance by **Simon Pickering** at the Bell & Gavel Pub, by the Cattle Market, St Oswalds Road, Gloucester. Details: **Andy Ramsbotham**, Tel: 01452 521609 or **Stewart Evans**, Tel: 01242 527520.

Tuesday 1 & Thursday 10 Fordon AS — Meetings. Details: **Gary Newsome**, Secretary, 11 Beech Hays Drive, Weaverham, Cheshire, CW8 3BT, Tel: 01606 853771.

Wednesday 16 West Yorkshire Marine Aquarist Group — Beginners' night, The Angel

DIARY DATES

Hotel, Tinsley Crossroads, Morley, nr. Leeds. Details: **David**, Tel: 01924 255471.

Sunday 20 OASIS (Ordinary Aquarists Society in Sunderland) — Auction only, Thompson Park Community Centre, Monkwearmouth, Sunderland. Details: Secretary, **Mrs Avril Banks**, 122 Moor Crescent, Gilesgate Moor, Durham DH1 1DL. Tel: 0191 384 1433.

Fordon AS — Auction. Details: **Gary Newsome**, Secretary, 11 Beech Hays

Drive, Weaverham, Cheshire, CW8 3BT. Tel: 01606 853771.
Bridlington AS — Open Show, The Spa Royal Hall, Bridlington. Benching: 10am-1pm. Details: **Mick Jordan**, 12 Greenfield Road, Bridlington, E. Yorks. YO16 4TE. Tel: 01262 674109.

Sunday 27 Association of Aquarists — AGM, The Macintyre Project, Moot Hall, Great Holme, Milton Keynes. 12 noon. Details: **Nigel Aylmer**, Tel: 01908 319324.

December

Tuesday 5 Gloucestershire AS — Meeting with a talk and audio-visual display on Sri Lankan Seascapes, from the FBAS library, Bell & Gavel Pub, by the Cattle Market, St Oswalds Road, Gloucester. Details: **Andy Ramsbotham**, Tel: 01452 521609 or **Stewart Evans**, Tel: 01242 527520.

Tuesday 6 & Thursday 15 Fordon AS — Meeting. Details: **Gary Newsome**, Secretary, 11 Beech Hays Drive, Weaverham, Cheshire, CW8 3BT. Tel: 01606 853771.

Sunday 11 Fordon AS — Auction. Details: **Gary Newsome** (see above entry).



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Loch Ness is the largest body of freshwater in the British Isles.

by Ian Winfield

Exploring Loch Ness

Ask anyone to name a Scottish loch and nine times out of ten they will reply, "Ness". Tell them that you are involved in research there and they will carry on polite conversation for a minute or two before inevitably smiling and asking, "Do you believe in the Loch Ness Monster?"

This very question of *belief* shows a remarkable feature of the history of Loch Ness, which is that, with a very few exceptions, the ecology of this largest lake of the British Isles has rarely been studied. In the absence of hard information, belief is often the only way to understand or deal with a situation.

To some extent this neglect reflects the reluctance of scientists to give anyone the slightest grounds for labelling them a 'monster hunter', but it also reflects the fact that to undertake research on a water body as large as Loch Ness, which is 36km in length, up to 2.4km in width and up to 239.5m in depth (c 22 miles x 1.5 mile x 785ft), requires correspondingly large amounts of money! For a long time, the ecology of the food chain of Loch Ness has remained a mystery waiting for someone or something to provide adequate funding.

Good fairy Urquhart

While good fairies rarely appear in scientific funding circles, the next best thing came

Fish ecologist
**Dr Ian Winfield and
Nicholas Witchell,**
broadcaster and founder
of Project Urquhart,
describe recent research
at the UK's largest and
most famous lake.

along in the form of **Project Urquhart** (named after the historic castle on the loch's shore) which was formed with the 'simple' purpose of putting scientists to work at Loch Ness so that we may better understand how it functions and what life it contains.

In addition to bringing hard cash, Pro-

ject Urquhart was also able to bring 'goods in kind' to Loch Ness in the form of scientific equipment complete with company logos seeking 'free' publicity for their makers in an international market place. High media exposure was also helped when the satellite TV company, *The Discovery Channel*, funded all of the fieldwork in 1993, transmitting an hour-long documentary in Europe and the USA during the autumn.

Inevitably, the question arises of "What about Nessie?", and the reply of Project Urquhart, as it should be in any scientific investigation, is to retain an open mind.

This article describes one component of Project Urquhart carried out by scientists of the Freshwater Biological Association and focussed on the food chain of the loch's open water which, as has often been said, has a greater volume than all of the combined lakes and reservoirs of England and Wales. To put things into context for the keen aquarist, the 6.4 billion cubic metres of water in Loch Ness could be used to fill over 88 billion standard 36-inch community tanks. That's an awful lot of gravel to be washed!

Survey background

Until Project Urquhart began its work, we knew surprisingly little about the ecology



The Research Vessel *Calanus* sampling the fish of the open water by trawling.



IAN WISEFIELD

Arctic Charr — the most abundant fish in the open water.

of Loch Ness. The international literature, which holds the world's scientific knowledge, was largely restricted to accounts of the physics of water movements and the nutrients and microscopic plants, or *phytoplankton*, of its open water. Very little was known of the loch's fish life, other than that this huge lake was home to Arctic Charr (*Salvelinus alpinus*), Trout (*Salmo trutta*), Three-spined Sticklebacks (*Gasterosteus aculeatus*), Common Minnows (*Phoxinus phoxinus*) and Pike (*Esox lucius*), and that Atlantic Salmon (*Salmo salar*) and Eels (*Anguilla anguilla*) migrated between it and the sea.

Nevertheless, time and time again, the loch's fish life has been the subject of speculation, including the unlikely suggestion that huge numbers of Arctic Charr occur at depth offshore, where they are responsible for a 'scattering layer' often detected by echo sounders. Mysterious 'shoals' of fish have also been recorded by echo sounders on several independent occasions during the autumn. It has even been suggested that one or more huge Sturgeons live within its cold, dark waters. If true, this could be a biological finding to rank alongside the discovery of the sup-

posedly extinct Coelacanth alive and well off the coast of South Africa.

As mentioned above, the purpose of Project Urquhart is to discover what life is contained in this greatest body of fresh-water in Britain, and to bring together a co-ordinated programme of research to determine how it functions. This is to include, for the first time, a comprehensive investigation of the loch's food chain, from the nutrients and phytoplankton, through the microscopic animals, or *zooplankton*, and up to the fish populations. The results of this ambitious study will also ultimately be used to examine the theoretical possibility that a higher predator species exists in the loch.

There are also reasons of wider importance why we should understand a body of water like Loch Ness. To the fish biologist, it offers an increasingly rare opportunity to study fish life undisturbed by a fishery in a lake undisturbed by pollution.

To the environmental scientist, Loch Ness may be a particularly vigilant sentinel of environmental change. Around the world, scientists study the waters and sediments of lakes to reveal secrets of changes in local and global environments.

Preliminary studies at Loch Ness suggest that its impoverished waters are extremely sensitive to inputs from the surrounding land, which means that it holds a particularly detailed record of environmental change. Consequently, a further aim of Project Urquhart is to provide a detailed baseline set of environmental measurements that could be used by investigators of the next century to assess long-term changes in the loch and its environment.

The surveys

To an observer on the shore, lakes appear as featureless expanses of water. In reality, however, they are complex environments in which vital features vary across, along and down into the water.

One of the most important features is *thermal stratification*, in which, during the summer, the lake becomes separated into two parts, with an upper layer of warmer, sunlit water, or *epilimnion*, resting on a lower layer of cooler, dark water, or *hypolimnion*. A lake the size of Loch Ness also has its own underwater weather system driven by 'winds' of water currents, with day-to-day changes and seasonal cycles just as dramatic as those experienced above the surface.

In the summer of 1992, the Norwegian research vessel, *MV Simrad*, cruised the length of Loch Ness carrying Project Urquhart scientists making a preliminary study of 24 hours in the life of the lake. A scientific echo sounder, able both to count and measure the size of fish, sensed down into the loch's depths, while water from the surface was continuously pumped across a series of sensors to extract vital information.

At the same time, in a northern area of the loch, a support vessel from the Loch Ness and Morar Project carried scientists operating a second echo sounder and a Windermere Profiler, another piece of hi-tech equipment which sent back information on depth, temperature, dissolved oxygen, light level and pH to be logged directly on a computer.

The biological survey of Loch Ness began in earnest in the summer of 1993 when scientists spent the month of July working and living on the *Research Vessel Calanus* in a programme also supported by the *Research Vessel Sool Mara* and the Loch Ness and Morar Project. Almost 200 hours of intensive sampling were carried out during this period.

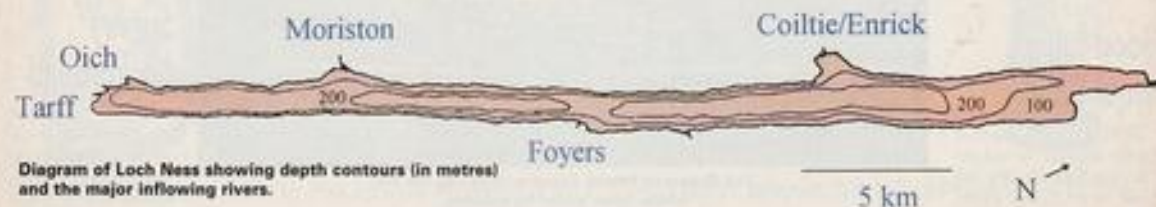


Diagram of Loch Ness showing depth contours (in metres) and the major inflowing rivers.

078/944/93

The *RV Calanus* carried some of the most sophisticated sampling devices and sensors ever used on a lake. A state-of-the-art echo sounder again studied the fish populations and an Undulating Oceanographic Recorder was 'blown' like an underwater kite up and down the loch's water column, constantly recording information on light levels, microscopic plants and animals.

Biological samples of microscopic animals were collected with a Longhurst Hardy Plankton Recorder, which usually monitors plankton in the sea, and for the first time ever, the fish life of the open water was systematically sampled using a trawl net. All fish were subsequently examined in detail in the laboratory to determine, among other things, their ages, growth rates and diets.

The *RV Seol Mara* was used with a second echo sounder in a preliminary investigation of the fish populations in the inshore regions and river mouths of the loch, where further studies were also made using a Windermere Profiler. Vessels of the Loch Ness and Morar Project undertook a study of water currents in the loch by monitoring the movements of a series of floats.

In the months that followed, some of the data collected using the above techniques were used to predict the fish population to be expected if Loch Ness 'behaves' like other lakes, which could then be compared with the observed fish population. In addition, information on the observed fish population was also used to predict the weight of predators which the population as a whole could be expected to support.

Preliminary findings

Baseline data have now been archived to provide a reference point for future generations of scientists. Although many samples collected during the intensive fieldwork remain to be processed and data analysis has yet to be completed, early findings have indicated that Loch Ness is more productive than first thought, and that it shows several unusual features. These are of such importance that initial assumptions about the food chain may have to be completely changed.

The land surrounding the northern end of Loch Ness is relatively more productive, and so the water here is slightly richer in nutrients and supports a slightly denser crop of phytoplankton. However, both surveys revealed that the next steps in the loch's presumed food chain, the



The water flea, *Daphnia*, is well known to aquarists and pondkeepers as a favoured food for fish, but why are they found deep in Loch Ness?

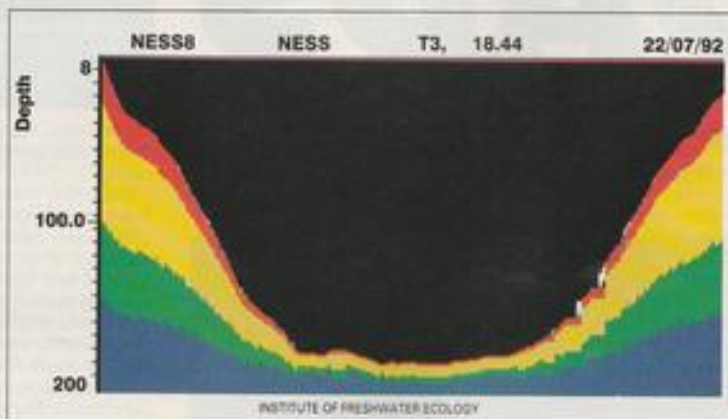
known as chironomids. Echo-sounding and video observations suggest that the latter animals are responsible for the 'scattering layer'.

The trawling produced a sample of almost two hundred fish from the epilimnion of the open water of the loch. Over 95% of these were Charr, with small numbers of Trout and one Stickleback. The Charr were between 1 and 10 years old, which is typical for an unfished population of this species. Growth was also comparable with rates observed elsewhere in Europe, although higher values have been recorded in other Scottish lochs.

As to be expected in a nutrient-poor or oligotrophic lake, the numbers of Charr recorded by echo soundings were extremely low, with averages of only 37 and 9 individuals per hectare in the open water and inshore areas, respectively, producing an overall population estimate of 181,500 individuals weighing 1,260kg (c2,780lb).

However, these estimates do not take into account hotspots of very localised but very high concentrations of fish, probably not Charr but Trout and Minnows, near the mouths of some of the loch's inflowing rivers, where up to 5,315 individuals weighing 95kg (205 lb) per hectare were recorded. So although most of Loch Ness is barren with respect to fish life, there are localised areas where fish are

as abundant as they are in far richer lakes.



Computer analysis of an echo-sounding transect across the loch.

zooplankton and fish, are more abundant towards the south.

It is not yet clear how these opposing patterns are produced, but it may be that deep water currents take the zooplankton away from the north and towards the south. Alternatively, it may be that the food chain of Loch Ness is very unusual and the zooplankton feed, not on the phytoplankton, but on material washed into the loch by the rivers of the southern areas. Like much about life in Loch Ness, at present, we simply do not know the answers to these questions.

The vertical distributions of phytoplankton and zooplankton are also unusual in Loch Ness. The most voracious forms of the latter group of microscopic animals, which include the familiar water flea, *Daphnia*, and its smaller relative, *Bosmina*, occur some distance below the lowest phytoplankton which, in other lakes, are their staple diet. Even the distribution of fish is somewhat unusual, with most occurring at a depth of between 20 and 30m (c65-100ft) in perpetual darkness. Here, Charr feed on certain types of zooplankton as expected, but also on surprisingly large numbers of insect larvae

Further studies

Because of the unusually high concentrations of fish near river mouths, further surveys in these areas are needed to provide the data for a comprehensive predator-prey analysis of Loch Ness. In the meantime, this has only been carried out for the observed Charr population of the open water, which turned out to be considerably less than that predicted on the basis of the concentration of nutrients.

The dynamics of the Loch Ness food chain are clearly different from those of other lakes, but just how and why are questions which cannot yet be answered.

The above findings are, indeed, preliminary and, like the early results of most scientific investigations, they have raised almost as many questions as they have answered. However, through Project Urquhart, significant and exciting progress has been made in our understanding of the life of Loch Ness. Further research promises to be just as rewarding.

▲

CAPTIVE CARE

Accommodation: These very aquatic Anurans should be maintained in water at a depth in which they can stand upright on their hind limbs. Catch and pick up these toads with the aid of a net. They are very slippery amphibians and can easily slide out of the hands and injure themselves if they fall to the ground.

Diet: Juveniles and adults eat earthworms, small pieces of lean beef and specially formulated pelleted foods.

Breeding: Amplexus is lumbar (inguinal). Fertilisation of eggs is external to the female's body. *Hymenochirus* have an elaborate courtship best described as 'aquatic acrobatics'.

Development of spawn: Rapid. Tadpoles emerge after 50 hours within a temperature range of 22° to 24°C (72° to 75°F).

amphibians should be removed into another tank to avoid cannibalism of the eggs and offspring. As the eggs (and newly hatched tadpoles) are particularly susceptible to temperature shock, they should not be moved.

The rate of development of fertile eggs is dependent on the temperature of the water. However, within the range of 22° to 24°C (72° to 75°F), development can best be described as 'rapid', *Xenopus* tadpoles emerging after about two days (50 hours) of the eggs being deposited by the female.

At first, the hatching tadpoles are usually inactive, unless the tank is knocked. They are yellowish-white in colour and remain in an upright position 'fixed' to the glass of the aquarium by mucus secreted from a cement gland near the mouth 'pit'. During this period of relative inactivity, the tadpoles are nourished by the remains of the egg-yolk in their abdomen. Once they have developed a functional mouth, tadpole activity increases as they begin to search for food, approximately two and a half days after hatching.

Tadpole growth

Xenopus tadpoles are herbivorous, feeding on microscopic algae suspended in the water. In fact, there is evidence to suggest that unless suitable tadpole food, including single-celled algae of the genus *Chlorella* are present in the water inhabited by the adult toads, these amphibians will not breed naturally. The tadpoles feed by filtering tiny plants from the water. Characteristically, they swim at an angle of approximately 45°, head pointing downwards, and develop a long tentacle on each side of the mouth.

After the tadpoles have grown to a length of between 17 and 22mm (approximately ¾ of an inch), a hind limb 'bud' develops on either side of the anal vent. The hind limbs grow rapidly, during

which time the front limbs break through the transparent skin behind the head.

The tadpoles remain transparent until they begin to metamorphose. At this stage, pigment develops in the skin and their tentacles shrivel. The time at which metamorphosis starts depends on a number of conditions, including the temperature of the water during development, the amount of available food, the frequency of water changes and the density at which tadpoles are maintained. In high-density situations, rate of development is slow because the tadpoles release inhibitors into the water.

At 22° to 24°C (72° to 75°F), *X. laevis* tadpoles usually complete their development into toadlets in 9 to 12 weeks. The young toads are carnivorous, feeding on tiny earthworms and fibres of lean beef.

Hymenochirus tadpoles are carnivorous from their very first meal, when they feed on tiny invertebrates. Initially, they can be offered rinsed Brine Shrimps (*Artemia*), then Water Fleas (*Daphnia*), mosquito larvae and *Chironomus* (midge) larvae.

Adult diet

Adult Clawed Toads feed on small earthworms but should **not** be offered the 'banded' red worms from compost heaps; these contain poisonous body fluids. Adult Clawed Toads will also eat small pieces of lean beef, but uneaten meat must be quickly removed from the water to prevent contamination.

Adult *X. laevis* are relatively large amphibians and readily take moving prey such as earthworms. They also grab the legs of other similar sized toads if these move nearby!

Therefore, it is advisable only to keep aquatic toads of the same species and of the same size in any one tank — a small *Hymenochirus*, for example, could easily be swallowed by a large *X. laevis*.

For the same reason, it is unwise to keep large aquatic toads and fish in the same aquarium. You never know when the stimulus of movement by a fish will trigger a feeding response by an amphibian!

Disease prevention

The water must be kept clean and changed regularly, otherwise the toads are prone to 'Red Leg'. This is a water-borne disease caused by rod-shaped bacteria (bacilli) called *Aeromonas hydrophila*.

The disease gets its name because one

AFRICAN CLAWED TOAD FACT FILE

Family: Pipidae — all members lack a tongue.

Genera: *Xenopus*, *Hymenochirus*, *Pseudhymenochirus*.

Species: 19 currently discovered and recognised — 14 *Xenopus*, 4 *Hymenochirus*, 1 *Pseudhymenochirus*.

Distribution: Throughout Africa, south of the Sahara desert. Absent from parts of East Africa, including regions of Angola.

Size: Largest species — *Xenopus laevis* — females can reach a snout to vent length of between 8 and 10cm (3¼ to 4 inches). Smallest species — *Hymenochirus boettgeri* — only grows to a maximum snout to vent length of 3cm (1¼ inches).

of the symptoms is a reddening or inflammation of the skin, particularly in the abdominal area and the muscular regions of the legs. Other symptoms include general sluggish behaviour of the amphibians, while their whole bodies eventually become swollen or oedematous. Clawed Toads seldom recover from this state of deterioration.

However, in the early stages of infection, aquatic toads can sometimes be cured if they are placed in clean tapwater in which a very few crystals of potassium permanganate (KMnO₄) have previously been dissolved. These crystals will dissolve to form a very pale purple-coloured solution — a deep purple solution is too concentrated and should not be used.

Carry out this treatment in a small 'hospital' tank, NOT in the aquarium with other amphibians. The 'patients' should be left in the treatment tank for two to four minutes. Repeat the treatment every two days until the skin infection has been cured. During this time, and for a month after the disappearance of their symptoms, keep the treated toads in a separate aquarium, isolated from healthy stock.

Inexpensive

African Clawed Toads are beautifully marked amphibians. They are also fascinating to maintain in captivity, yet they are relatively inexpensive to buy.

They are particularly suitable for the novice to start with and will almost certainly lead to the development of a life-long interest in herpetology.



The mating clasp (amplexus) in all Clawed Toads — this is the Dwarf Clawed Toad, *Hymenochirus boettgeri* — is inguinal (ie) around the waist of the female.