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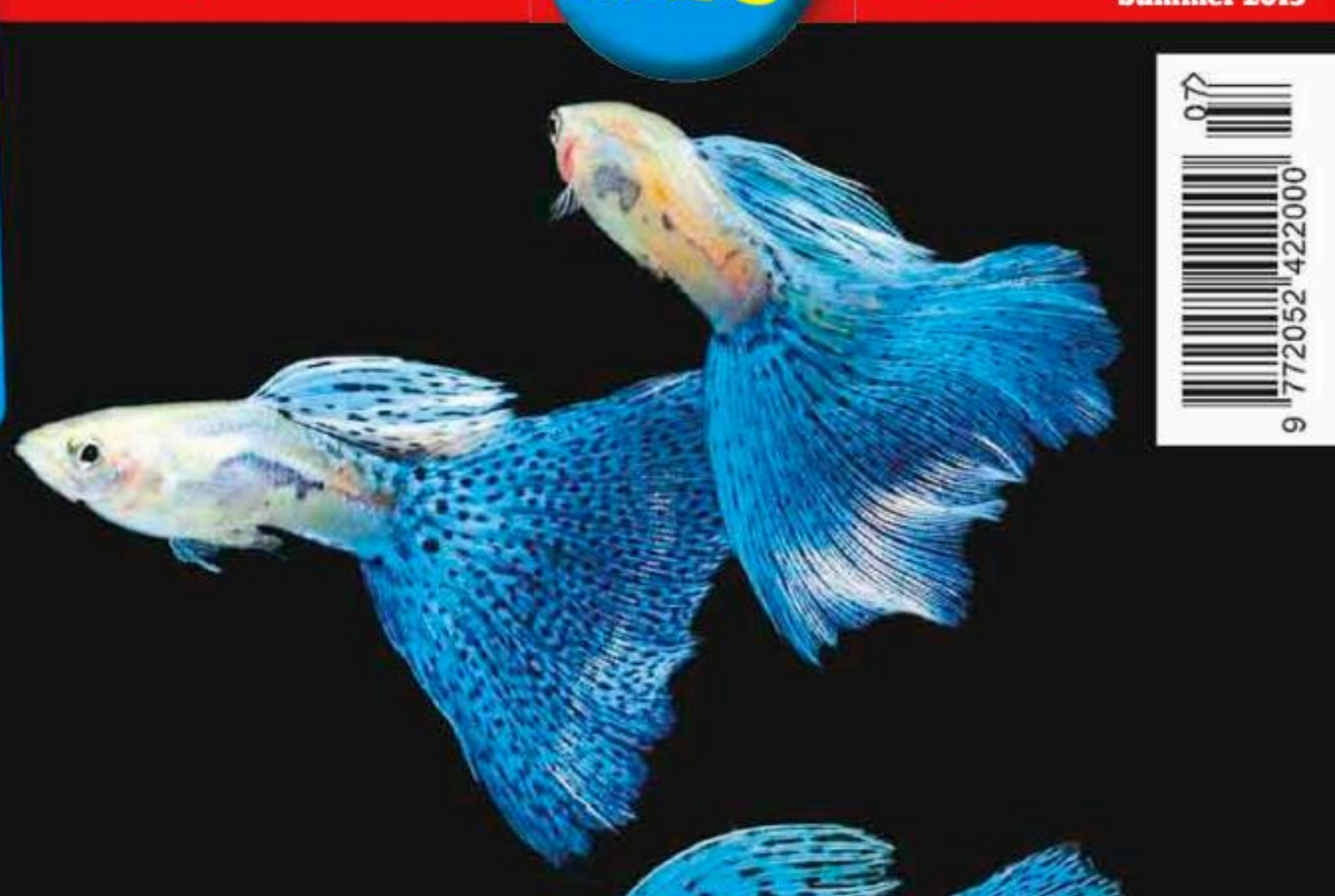

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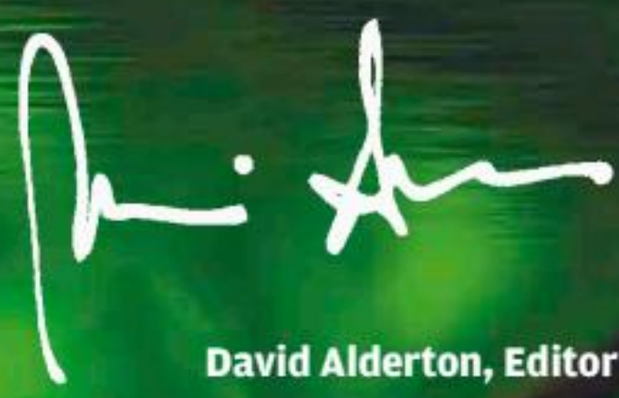
hello

And welcome to *Popular Fish Keeping!* I hope that you'll enjoy this first issue, and the very best of luck in our competition to win a fantastic biOrb tank. As you'll see, our focus is on fresh water fish keeping – both cold water and tropical, touching on other aquatic creatures too – and one of our key aims is to help newcomers. Too many people are dropping out of the hobby prematurely, because they cannot find the right advice when starting out.

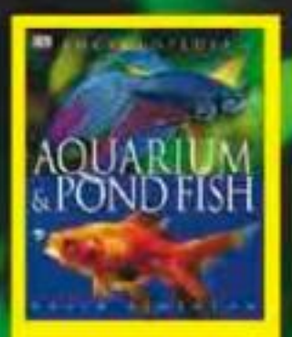
By concentrating exclusively on fresh water aquariums, we can devote all our space to this area of the hobby, rather than providing information on topics relating to the marine fish keeping for example, that may well have no significance whatsoever for you.

By way of an introduction, Kelsey Publishing Group produces the widest range of pet-related magazines in the UK, and you may already be familiar with some of our other titles such as *Practical Reptile Keeping* and *Cage and Aviary Birds*.

We've set up a great subscription offer for *Popular Fish Keeping* so that you can obtain a free aquarium filter. Don't miss this opportunity! We'll be publishing every two months, and our second issue will be available on August 16th. Meanwhile, if you've got any thoughts, comments or questions, please do get in touch with me.



David Alderton, Editor



David has kept fish for many years, and his books include the *Encyclopaedia of Aquarium & Pond Fish* (Dorling Kindersley, £16.99) - a comprehensive guide to the care of over 800 species.

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Keep up-to-date with events in the world of aquatics.

Share your views and opinions by Emailing us: pf.ed@kelsey.co.uk

Help fish and other wildlife in London's waterways

People are being invited to get to know their local river in a series of watery adventures, planned with the aim of improving the rivers of Lewisham, Greenwich and Bromley. These events, which run through until July 7, are part of the fifth annual 3RiversCleanUp. Vic Richardson, one of the organisers, explains: "This is a great opportunity for people to discover hidden green stretches of river on their doorstop, and play a direct role in protecting and improving them for the future."

Hundreds of volunteers are expected to take part in family-friendly, river based activities, which include walks, river dipping, nature walks and talks, invasive weed removal, litter picking, and habitat improvement events. Volunteers can also share information about invasive plant sightings and particular stretches of river that could benefit from more work.

The results of people's efforts are bringing real benefits to these localities. Back in 2011, an amazing discovery was made in the heart of London by the Environment Agency, which monitors wildlife populations in England.

Its scientists found evidence of a colony of seahorses in the River Thames during a routine fisheries survey at Greenwich. This is the first time that these rare creatures have been found so far up the Thames, and they have never previously been reported from this part of London.

ABOVE Clean-up work in progress. *PHOTO COURTESY 3RIVERSCLEANUP.*

Occurring in temperate and tropical waters

Although it is often assumed seahorses are confined to tropical seas, they have always been visitors to the coastal waters around the British Isles. Recent sightings suggest that there may be more permanent populations in areas around the UK and during 2008, they became fully protected under domestic wildlife legislation. A small number of individuals had previously been found in the River Thames, raising the possibility that the river could be supporting a colony of seahorses, but this had not been confirmed, nor had these fish ever been recorded so far up the river. The species that was discovered in the Thames during 2011 is the short-snouted seahorse (*Hippocampus hippocampus*). It is relatively rare in UK waters, mainly being found along the south coast, and can grow to around 15cm (6in) long.

Regular monitoring

The Environment Agency has carried out regular monitoring of the fish populations within the Thames Estuary since the late 1980s. This data has enabled scientists to gain a better understanding of the importance of the river as a nursery and breeding ground for a number of species of commercial and conservation importance.

Seahorses themselves are one of the few fish that mate for life after elaborate courtship rituals.

Emma Barton, Environment Agency Fisheries Officer said "The seahorse we found was only 5cm (2in) long, a juvenile, suggesting that they may be breeding nearby. This is a really good sign that seahorse populations are not only increasing, but spreading to locations where they haven't been seen before. This is a really exciting discovery.

"We hope that further improvements to water quality and habitat in the Thames will encourage more of these rare species to take up residence in the river. The young seahorse itself was released back there, and will hopefully breed in due course."

The young seahorse found in the River Thames. *PHOTO © ENVIRONMENT AGENCY / ENVIRONMENT AGENCY MEDIA TEAM.*

Further information

For the full calendar of events or for more information, see: www.3riverscleanup.co.uk/ or contact Jess Kyle on 020 8314 2119

Are you launching new aquatic products?
Want to let our readers know?
Drop us an email to: pf.ed@kelsey.co.uk

CoolControl is a simple but effective system.

Controlled cooling

The JBL CoolControl is equipped with a temperature sensor for the JBL Cooler, switching it off when the set temperature has been reached. It is easy to operate, with a dial being used to set the maximum temperature, while the control cable simply has to be plugged into the Cooler itself. The sensor will need to be placed in the tank. As soon as the set maximum temperature has been reached, the JBL CoolControl turns the Cooler on automatically, and will then disconnect the power supply again, as soon as the temperature drops below the set maximum temperature. The JBL Cooler and the JBL CoolControl are effective, reasonably priced alternatives to expensive cooling units for typical aquaria, where a maximum temperature reduction of no more than 4°C (7.2°F) is required.

TMC launches dedicated pond UV lamps

This is the time of year when goldfish owners often transfer their pets from an aquarium to an outdoor pond, but these can become rather murky with algae at this stage. The Tropical Marine Centre (TMC) has been the market leader in UV Pond Clarifiers for many years and now has just launched a range of ultraviolet (UV) lamps, aimed specifically at the replacement pond UV lamp market (rather than being a general UV lamp). These are branded "TMC Pond" and are high quality lamps, suitable for use in all brands of UV pond clarifiers. The range offers a choice of 4W, 6W, 8W and 16W lamps.

Why keep fish?

This seems a good question to start with, and we've asked Dick Mills, the President of the Federation of British Aquatic Societies, to provide the answer and guide you through the early stages, assuming that you are just about to start out in the hobby.

Small goldfish of all types will thrive in aquarium surroundings.

It's simple really. Fishkeeping is a relaxing pastime that is quiet, clean and unlikely to impinge too much on your daily lifestyle. It is literally a self-contained hobby, and the fish will not cause any disturbance.

Fish won't:

- take over your favourite armchair.
- bring home unwanted litters.
- need exercising late at night.
- make any noise.
- become a complication at holiday times.

Fish will:

- take kindly to aquarium life.
- generally adapt to the water that comes from the tap, provided that you add a water conditioner to it first.
- breed, despite the odd bit of negligence on your part.

Fish are:

- highly educational – you'll learn all about geography, mathematics, physics, chemistry, biology, genetics as a result of keeping them.
- an excellent teaching tool about the responsibility that comes with pet care.
- great examples to help answer those 'facts of life' questions that every parent has to face at one time or another!

Living quarters

- **Aquariums** – serve as living art. A fully furnished aquarium can brighten up any dull, normally lifeless corner of the house, providing an interesting focal point at the same time.

- **Aquarium equipment** – is dependable, easy to set up and inexpensive to operate. You can design your aquarium from separate components or buy a complete set-up including a furniture cabinet.

RIGHT There is a wide selection of different fish food now available. Check the use-by date on prepared foods like those shown here.

- **Aquarium fish** – With a choice of tropical or coldwater freshwater fish, you have a wide selection of different types of fish that will be suitable for this type of set-up.

An excellent selection of such fish is available at aquatic dealers around the country. Aquarium fish are commercially bred on a very wide scale, often long distances away from their native waters, thus dispelling conservation concerns.

There are numerous areas

In some tanks, the emphasis may be on aquascaping, rather than the fish.

within the hobby to explore. You could just as easily specialise in aquatic plants for example, with fish forming only a minor part of your aquarium's focus.

Other popular hobbies associated with fishkeeping are photography and painting; an opportunity for you to keep visual records of your aquarium set up, favourite species or even spawning sequences.

- **Maintenance** – A few minutes of simple maintenance each day, plus perhaps a couple of hours every fortnight or so is all that it takes to maintain most aquariums in optimum condition.

Costs

Although costs have to be considered, a modest-sized aquarium set – a 60cm (2ft) long tank, fully equipped would certainly provide change from £200.00.

Running costs are low – a tropical aquarium in a normally-heated house will not require vast amounts of electricity to heat the water, and ancillary equipment (in the guise of filters, lights, and air-pumps) is equally miserly in terms of power consumption.

Fish can be expensive if you want the most 'exotic' species, but the average, popular freshwater species are well within financial reach, as are most aquarium plants.

- **Feeding fish** – This presents few problems. A wide range of foods – in flake, tablet, granular or pelleted form, together with frozen or freeze-dried live foods - are now available. The appetites of fish are relatively small, and this is reflected in their feeding costs.

- **Further help** – A wealth of helpful advice is at hand from equipment and fish food manufacturers, local aquarium societies, and the Internet, where you can visit the Federation of British Aquatic Societies' website at www.fbas.co.uk for additional information as well.

- **The only real drawback?** – You won't discover this until it is too late, but it is the amount of time you will spend gazing into the aquarium's depths, and admiring the activities of its brilliantly coloured occupants.

Choosing the fish for your new tank is exciting.

So you've decided to take the plunge?

Here is a quick run-down on the basic requirements that all fish need – regardless of their type or species:

They have three vital needs, in terms of space, light and food. Obviously the first thing that you'll need is an aquarium, and it is important to have adequate space in the house to accommodate it.

Perversely, we'll look at the second thing first – the location where you intend to site the aquarium. It needs to be in an area where:

a) It's near an electrical power outlet.
b) It is not facing a window.
c) The occupants won't be disturbed by excessive vibrations, from door movements, a sound system or television noise.
d) There are no cold draughts, especially if you are keeping tropical fish.
e) It can be easily maintained.
f) Ideally, it will be close to your favourite armchair too!

CONTINUES ON THE NEXT PAGE »

"The appetites of fish are relatively small, and this is reflected in their feeding costs."

Be sure that your fish will not outgrow their aquarium when choosing them. Discus, as seen here, can grow quite large.

Once you can fulfil most of these requirements – or understand how to deal with the consequences if you can't quite manage all of them – you can progress on to the next stage, which is getting the tank. The size and proportions of the tank are all-important, and you should get the largest one you can afford (as long as it still fits in the place you have in mind for it).

The reason for this is not simply to impress anyone who may visit, but to provide the best environment for its ultimate occupants - the fish. The larger the volume of water, then the more stable that the conditions will be within the tank, or, putting it slightly differently, the longer the periods you can allow between essential maintenance, and the less you will need to worry about the fish! Of course, the shape (length and depth) can be left to your personal tastes to some degree, but you must choose an aquarium with a good surface area, so as to allow for efficient exchange of gases to occur at the water surface. Tall, column-shaped tanks may look spectacular, but they will be difficult to plant and maintain and, even more disappointingly, may not be able to house the number of fish you might have liked to keep.

Digressing for a moment, this fish number thing is not applicable right across all areas of the fishkeeping hobby. Just because you splash out (oops, sorry for that!) on a large tank doesn't mean you could keep 50 fish of whatever species you like in it. You can choose more fish, and will have a wider available choice too, if you opt for tropical rather than coldwater species.

The tank itself

Back to the tank selection then. You can buy a basic aquarium and fit it out yourself, or you can opt for what is sometimes described as a "plug 'n' go" set-up, which will contain all the basic components that you need. Always look for an aquarium that has the correct thickness of glass panels for its size. Water exerts a great pressure on to the glass and as the length of the tank increases, so does the tendency for the front and/or back glass panels to bulge outwards! This is the reason many 'long' tanks have cross bracing straps across the top to hold the glass panels in line. Most reputable aquatic dealers work to an approved OATA (Ornamental Aquatic Trade Association) code of practice which lays down exact specifications for glass thicknesses for new tanks but, should you tend to pick up second-hand tanks, then this is something you should look out for.

Many newcomers to the hobby are children, and they will be more than likely to be attracted to the mini-type of aquariums that are now quite widely available. Some of these are very skilfully mini-engineered right down to clip-on fluorescent lights and rather gaudy, brightly coloured lids and logos. Such units need particularly careful management because of their small size though, as I mentioned previously. As a starting point with this type of set-up, be sure to choose fish that will not outgrow their quarters.

Rockwork can add significantly to the weight of an aquarium.

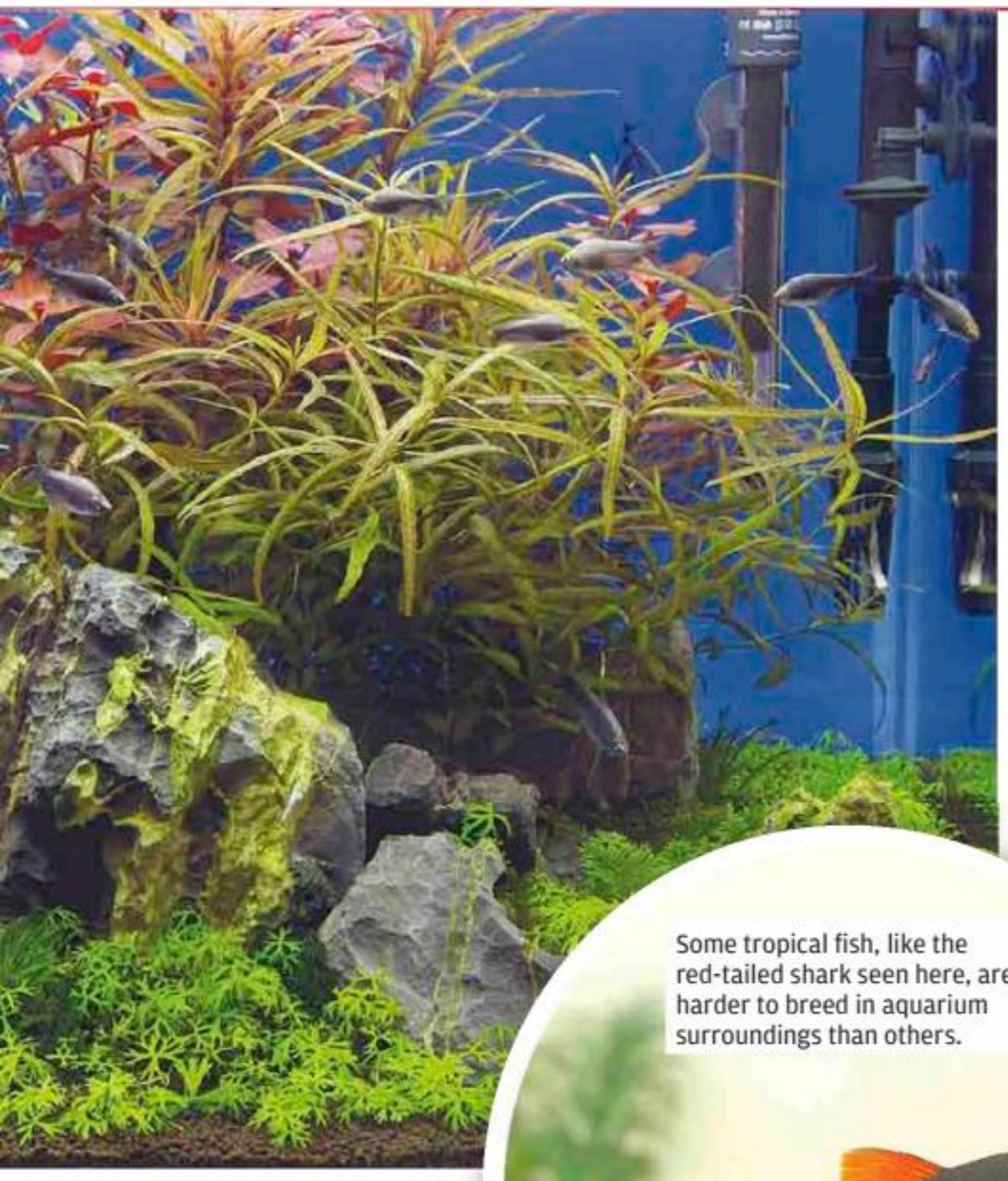
At the other end of the size (and cost!) scale, there is no denying that large 'hang it on the wall' tanks look impressive. Obviously these have a very narrow back to front dimension, and this in turn may effectively limit the surface area of the water, and so ultimately, the number of fish that you can keep in the tank.

It is recommended that the minimum size for an aquarium is around 45cm (18in) long by 25cm (10in) tall and 25cm (10in) wide. This will hold around 28 litres (6gal). Usually, the commercially available aquariums come in standard lengths of 60cm (2ft), 90cm (3ft) and 120cm (4ft) lengths, with the height dimensions being tailored to look aesthetically pleasing.

When it comes to design, this is an area where you are on your own, as one

"Always look for an aquarium that has the correct thickness of glass panels for its size."

A stylish glass tank with a supporting cabinet beneath.



person's Picasso is another's Rembrandt! The only thing that I would advise is be aware that there is a difference between glass and acrylic tanks. The latter material is increasingly being used for tank construction, and many of the resulting aquariums are quite spectacular.

Extruded acrylic tanks often have rounded corners which can give a distorted view of the fish but this aside, the real cause for attention is when it comes to cleaning the inside of the panels. What works well on glass may leave scratches on acrylic – with such damage being ideal for microscopic algae to colonise, turning these areas green. There are specific cleaning instructions and materials available for whichever type of tank you choose.

Finally, harking back to an earlier point, do remember that a fully furnished fish tank is likely to be heavy. Before you stagger in with your new aquarium therefore, do make sure the floor can support it adequately – especially if you live in an upstairs apartment! You may also wish to check that your floor is level, and if not, adjust the positioning of the support under the

Some tropical fish, like the red-tailed shark seen here, are harder to breed in aquarium surroundings than others.

aquarium to create this situation.

Vive le difference!

Faced with the prospect of keeping tropical fishes, there is no doubt as to what the main attraction is - their sheer visual beauty. Factors such as breeding, care difficulties, costs or even where to put the tank are all typically problems to be solved at a later date!

Encouraged by a frantic desire to own such a beautiful living picture in your own home, it is all too easy to jump to the wrong decisions at the outset, so here's some comparisons for you to think over before you finally decide what suits your requirements best.

How easy?

Most newcomers presume tropical fishkeeping is going to be 'too difficult and technical' compared with setting up a coldwater tank, but this is not necessarily the case. Basically, there is little difference, other than the fact you will not need to buy a heaterstat (a combined heater and thermostat unit) for coldwater fish.

Care is straightforward for most tropical species, with relatively few needing special conditions. The biggest bonus is that the majority of species are generally tolerant of gradual varying water conditions and are, extremes of size apart, usually compatible. This characteristic stems from the fact that whilst freshwater species may come from only a small area of water, these habitats are affected by seasonal changes in water quality, to which the fish have become naturally accustomed. The result is that these fish usually survive the very varying conditions under which they are kept by a novice fish keeper, provided that they were healthy when you acquired them!

Stocking densities

Here it has to be said that freshwater tropicals come out top, compared with coldwater fish, which tend to grow larger, so you can only keep fewer of them in your aquarium. Allow 75sq cm (12sq in) of water surface area per 2.5cm (1in) body length (excluding tail) of the fish. As an example, in a tank measuring 60x38x30cm (24x15x12in) you could keep around a maximum of 60cm (24in) of fish.

In neither case though should the maximum number of fish be put into the tank all at once, as the filtration system takes time to mature and reach its full capacity.

Aquatic plants

There is a very wide range of aquarium plants available for the tropical freshwater aquarium; you can even get incredibly realistic plastic replicas for use in tanks with herbivorous species. It is quite permissible to mix 'n' match both living and replica plants together, in order to create just the effect you want.

Equipment

Whilst both groups will need filtration and lighting, only tropical fish will require thermostatically controlled heating. For really luxuriant freshwater plant growth, extra lighting, together with carbon dioxide injection will be required. For those species that need special conditions, then items such as water softeners, nitrate removers and inert substrate materials may be necessary in order to maintain the water chemistry within the correct parameters, but this situation represents the exception rather than the rule.

Is breeding possible?

Tropical freshwater fish have been bred in home aquariums for years. A very large number of species are happy to oblige and there are diverse methods of reproduction too, notably livebearing and egg-laying fishes. Egg-laying species again divide further into different subgroups - egg-scattering, egg-depositing and mouth-brooding: in the latter two cases, varying degrees of parental care will be evident. Coldwater fish can also be bred very successfully in aquarium surroundings.

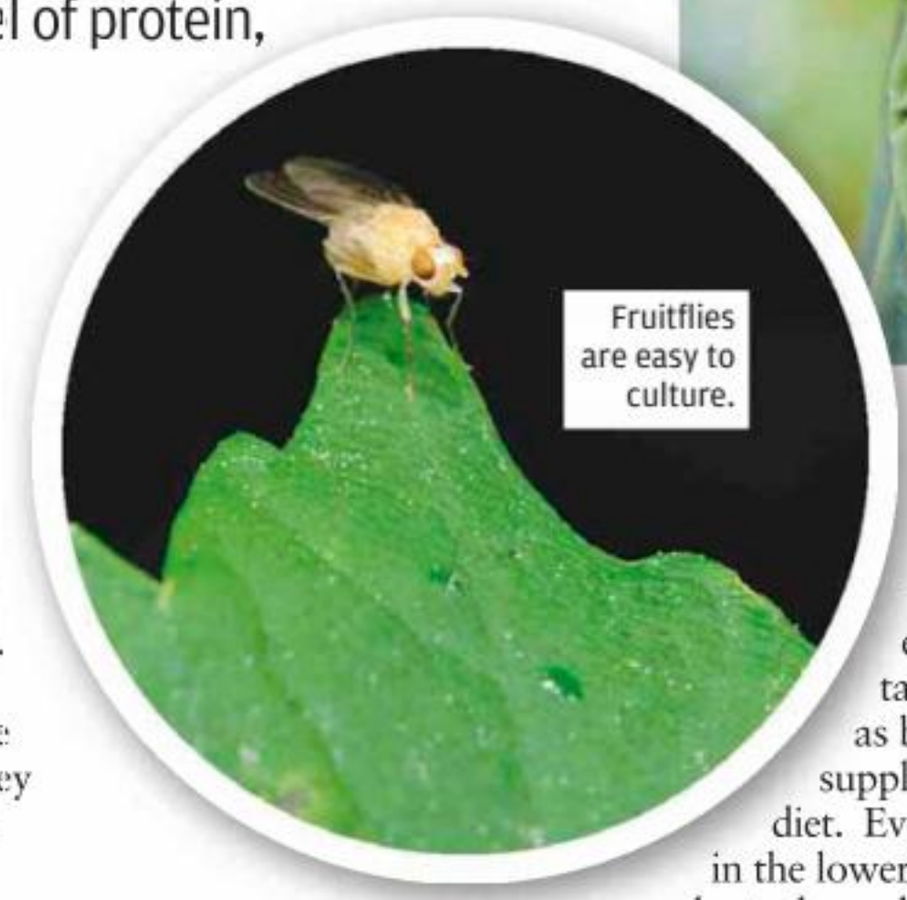
Outside support

There is a great deal of support in terms of societies for freshwater tropicals, including specialist groups catering for particular types of fish, and even individual species in some instances. In the case of coldwater fish, there are a smaller number of groups, largely focused perhaps unsurprisingly on goldfish. Now, armed with some basic facts, you simply need to decide which (or both) path(s) to take in order to enjoy your fishkeeping career. We wish you the very best of luck!

Live foods

In the wild, many freshwater fish prey on invertebrates. Compared with other types of food that most fish eat naturally, live foods contain a higher level of protein, writes Adam Drew.

Aphids shown here on a cabbage leaf.



Fruitflies are easy to culture.

This in turn means that live food can serve as a natural conditioner for breeding purposes, thanks to its protein content. Although you can obtain freeze-dried live foods, many fish instinctively prefer fresh or defrosted foods of this type.

The problem is that those of aquatic origins are potentially dangerous. They may have originated from water that is polluted, or contains harmful bacteria and fungal spores that could threaten your fish's health when introduced to the aquarium alongside the live food.

One answer can be to offer live foods that are not aquatic, but will still be eaten readily by the fish. At this time of year, you may find large congregations of greenfly or blackfly on garden plants such as roses and broad beans. These aphids will be greedily eaten by many smaller fish, especially species that normally lurk close to the water surface, seeking to snap up unwary insects.

You simply need a clean small paintbrush, and a container into which you can gently brush a supply of aphids. It will then be a matter of brushing them into the water for the fish. Only collect aphids in areas where you are certain that no chemicals treatments are used though.

More possibilities

Other forms of terrestrial live food that will be eaten readily by many fish include fruit flies (*Drosophila*). These can be purchased in starter cultures from live food suppliers advertising on eBay and elsewhere.

Tip them into a narrow by tall plastic container, with a banana skin or special fruit fly paste as food, keep warm, and before long, you are likely to be inundated with them! It helps if you can purchase a wingless strain, so that when you open the container's lid, they will not fly off around the room. Larger fish will appreciate curly-winged flies. This is a similar mutation that means these houseflies cannot escape. You simply need to tip them in small numbers into the aquarium, where the fish will gulp them down at the surface.

Live foods provide an excellent way to tame fish, as well as being a valuable supplement to their diet. Even those living in the lower reaches of the tank can be catered for, with earthworms, which are available in different sizes, being very appealing to many catfish.

Live food developments

An exciting new range of frozen foods intended for fish of all types has just been launched by Aquadip. These foods are supplied sealed within colourful blister packs, with 20 cubes to each pack.

The cubes are scored so that each one can be easily broken into two, in order to allow you to defrost a smaller quantity. This prevents any wastage, ensuring that such foods are economical to use, even if you have just have a single aquarium rather than a fish house full of tanks.

There are 35 different foods to choose from, ranging from staples such as daphnia to more exotic choices such as lobster eggs. Each has a detailed product analysis on the packaging, helping you to select the most appropriate for your fish, with colour coding also serving as a guide in this regard. For larger-scale users, there are also flat packs of these foods available in both 500g (1.1lb) and 1kg (2.2lb) packs as well.

Increased brine shrimp benefits

These tiny crustaceans, also sometimes referred to as artemia, are widely used as fish food, particularly when it comes to rearing fry. It was not easy to grow them through to adulthood in the first instance, but about 15 years ago, Aquadip devised a successful formula for this purpose that included Omega3. As a result of their on-going research, Aquadip has recent altered the formulation again, and has now added astaxanthin to the ingredients. Astaxanthin is a form of carotenoid pigment that can be passed from the brine shrimp to the fish, and absorbed into their bodies. This will help to improve their colouration, with shades of red in particular being very vivid. Immature brine shrimp are called *nauplii* in their larval form, with those from Aquadip already being enriched with fatty acids. Their small size and soft bodies mean that they have been a popular rearing food for aquarium fish over the course of many years, as they can be easily digested, and they also form a staple part of the diet of seahorses.

LEFT Aphids on a rose stem. These soft-bodied insects will be eaten by many fish.

BELOW Part of Aquadip's new range of frozen live foods.
PHOTO COURTESY OF AQUADIP.

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High quality live fish food: Enriched brine shrimp, Nauplii, Daphnia, Glassworm, Small Bloodworm, Large Bloodworm and Tubifex. Packed in bags, ready to sell.

Award winner!

Frozen fish food

Renewed packaging making our high quality food cubes even better! Full color blisters with round corners and small cubes in **35 different** flavours including colour-coded feeding guide. 500 gram and 1000 gram packaging also available and in stock.

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Roger's tropical aquarium trauma

Roger George hoped that his new tank of tropical fish would bring him some much-needed stress relief. However, following some initial poor advice, it had the opposite effect at first, as Caroline Impey reveals.

CAROLINE IMPEY
Aquarium writer

When Roger George's life became stressful, he thought that keeping fish might help him to relax. After all, what could be more therapeutic after a busy day at work than watching beautiful fish swimming around gracefully in their aquarium?

"I'd grown up with fish," explains Roger, 33. "My parents had a pond as well as a coldwater tank. I helped to look after these and I used to love watching the fish. I found them peaceful to be around, even back then as a child."

So, equipping himself with a large 180l (39.5gal) tank donated by his parents, Roger got to work setting up the perfect aquatic home. He decided to try his hand at tropical fish keeping. He didn't feel ready to take on marine fish and in any case, he liked many of the different species of tropical freshwater fish that he'd seen.

He took his time installing a heater, an internal filter, gravel, artificial plants and decorations for the fish to hide behind and swim through. Then he added the water and water treatments.

Starting too soon

"A week later, I went to a pet and aquatic store and asked them when I could begin adding the fish," says Roger, who works in a call centre and lives with his partner Palma in Easington Lane, Tyne and Wear. "I was a little surprised when they said I could start straightaway, but I had very limited knowledge then, and I trusted the staff there knew what was best."

So with feelings of eager anticipation, Roger chose some Guppies, platies, shrimps and a 'sucker' or plecostomus catfish.

"I put them in the tank and at first, it was wonderful," says Roger. "That evening, we sat for hours just watching them swimming around, investigating their new environment. I found them so calming. It was fantastic. I loved having them in my home."

Disaster strikes

But, just two days later, Roger walked into his living room to be greeted by a very different sight: all four of his Guppies were dead.

"I couldn't believe what I was seeing," recalls Roger. "One day they'd been swimming around quite happily, and then on the next, they're floating

One of Roger's Amano shrimps on a piece of bogwood.

Roger and his aquarium today.

Bolivian ram cichlid (*Mikrogeophagus altispinosus*).
PHOTO COURTESY CORPSE89.

– lifeless – at the top of the tank."

After that, things went from bad to worse. One by one, nearly all of the fish in his aquarium died.

"It was awful," admits Roger. "I found it really upsetting. To me, they weren't 'just fish'. They were living creatures and our pets. And they were all dying."

As he continued to lose his fish over the next couple of weeks, Roger became increasingly concerned and stressed, as he was unable to save them. What was he doing wrong? Why was this happening? What was he meant to do?

"Fish-keeping was supposed to help me to relax," says Roger. "Instead, it was creating even more stress in my life. I felt terrible – guilty, anxious and confused. I thought I'd done everything that I was meant to do and yet all my fish were dying. It was a very difficult time."

Seeking a solution

Desperate by now, Roger sought advice from books as well as from online forums. It was on a forum that he discovered that he was not alone. Many other people new to fishkeeping had apparently been given similar advice and were also experiencing the distress of dying fish.

"I realised that I'd been advised to use fish to cycle the tank," says Roger. "The shop must have known that those fish could easily become ill and die, but they didn't tell me. I was shocked. Fish are living creatures. How could this ever be ok?"

"In a new tank, there are simply not enough of the beneficial bacteria in the filtration system at first to break down the fishes' waste. This accumulates unchecked, and becomes an unseen killer. Everything seems ok at first, until the ammonia in the water reaches toxic levels for the fish and other creatures. Then they start dying," he explains. "And obviously, the more fish you have in the aquarium at this stage, then the worse the impact will be on them."

Safeguarding the fish

Gathering more advice from the forum, Roger realised that there were various ways to prepare the tank so that it was safe for the fish. This typically means using a product that introduces these beneficial bacteria to the aquarium – a process sometimes described as 'seeding the filter bed'.

The whole process typically takes 6-8 weeks, until the filter will be working effectively in a new tank. You need to be carrying out regular water checks throughout this period to see that everything is fine. Ultimately, the nitrogen cycle kicks in, and then the toxic ammonia will be broken down to less harmful nitrite.

It will be converted, again by bacteria in the water, to nitrate which plants will use as a fertiliser to support their growth. This is just what happens in nature, but you need to be very careful at first with a new aquarium.

It is normally recommended to introduce the fish slowly to the tank rather than putting them all in at once, so that the filter does not become overloaded. You need to be very careful about stocking levels in these early stages.

Roger also bought an external filter and realised that he should continue testing the quality of the water in his tank regularly. This will reveal any fall-off in water quality before it becomes fatal for the tank occupants. "I wish that I'd known all this before," says Roger regretfully. "It could have prevented the deaths of those poor fish and saved us a lot of heartache."

A new start

Gradually, however, Roger was brave enough to start adding fish to his tank again. And this time, he bought them from a different aquatic dealer with a much more knowledgeable staff. They also offered free testing of water samples.

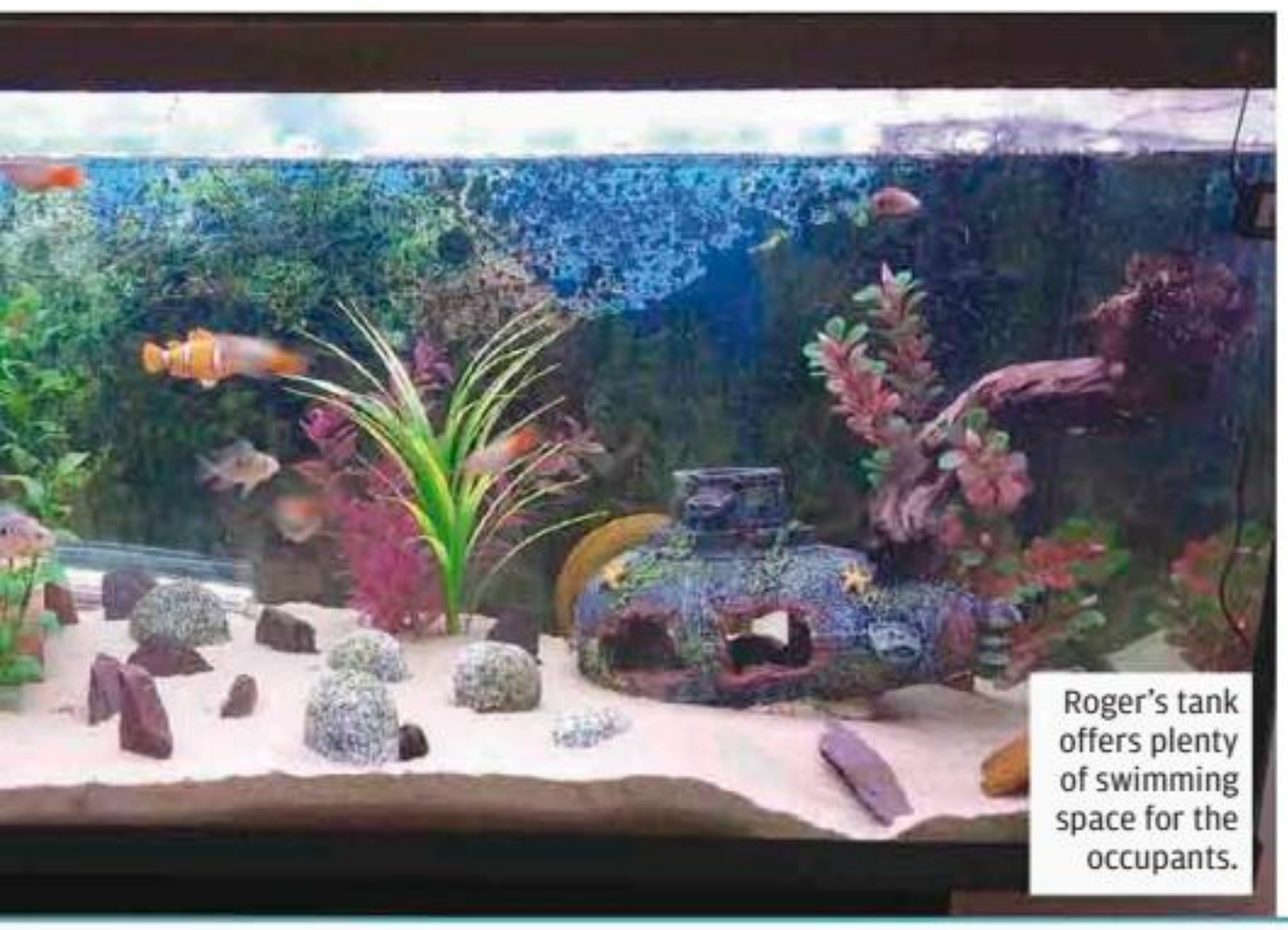
With a little trepidation, he added the first few fish. "To my relief, they didn't die," says Roger. "It took quite a few weeks but soon we had all the fish that we wanted and thankfully, they were all ok."

Now, eight months on, Roger is the proud owner of four Bolivian ram cichlids, eight platies, eight panda corydoras, one bristlenose plec, five zebra nerite snails,

Roger's Top fish keeping tip

"Read up before you start, get the biggest tank you can afford and chose an external filter"

"I absolutely love my fish. Having the tank now is everything that I'd hoped for and more..."

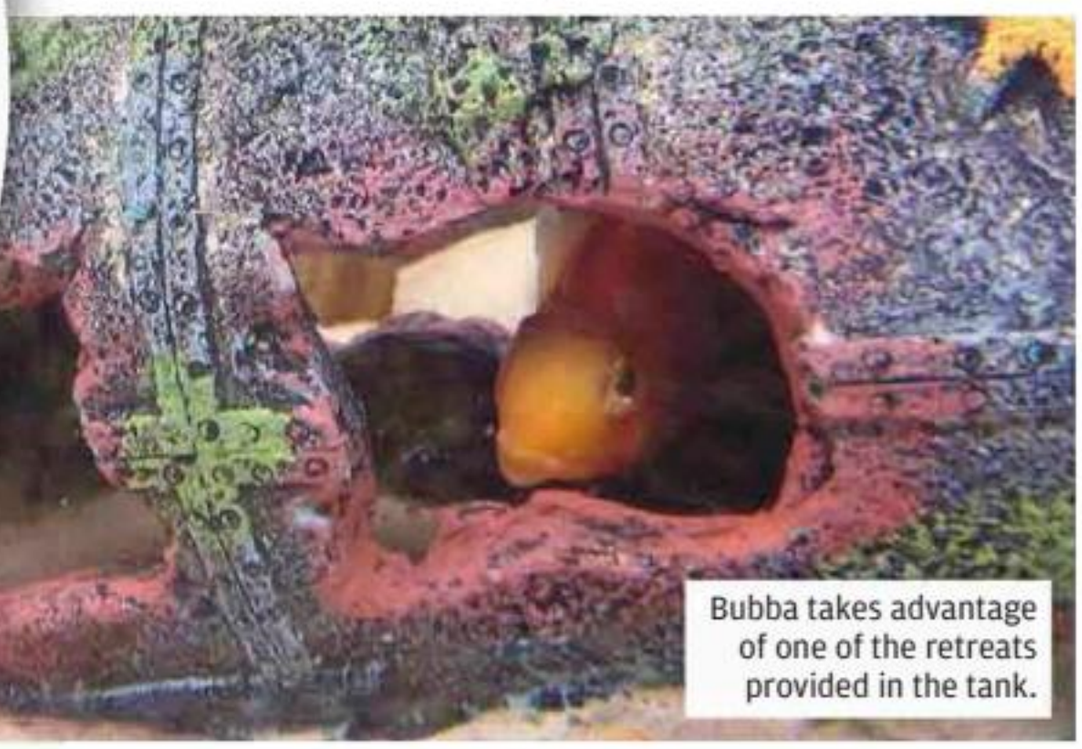


Roger's tank offers plenty of swimming space for the occupants.

CONTINUES ON THE NEXT PAGE»

A zebra nerite snail (*Neritina natalensis*), has striped patterning. These molluscs not only look attractive, but also help to control algal growth in the aquarium. *PHOTO COURTESY DRĀGŪS.*

What's in Roger's tank?



Bubba takes advantage of one of the retreats provided in the tank.

Panda corydoras (*Corydoras* species). These small catfish are so-named after their markings. They are an ideal choice for a community aquarium.

PHOTO COURTESY CHRONOTOPIAN.

Bristlenose plecs (*Ancistrus* species) are so-called because of the projections on their face. They appreciate pieces of bogwood in their tank.

PHOTO COURTESY SHUTTERSTOCK.COM

Parrotfish They should not be confused with the marine fish also known under this name, which belong to a completely different group.

PHOTO COURTESY SHUTTERSTOCK.COM

four Amano shrimp and a blood parrotfish called Bubba. They thrive together.

Roger's favourite

"I absolutely love my fish," says Roger. "Having the tank now is everything that I'd hoped for and more. I love going into the living room in the morning and they're all there at the front of the tank. I think it's completely wrong to suggest that fish have a two second memory because I know they recognise us.

"They each have their own personalities and we've been lucky that we've never had any fighting between them. It's a very peaceful tank and that gives me a sense of calm. I love coming home from work to see them and yes, we do talk to them all the time! They're better to watch than television. You find yourself sitting watching them for hours. They're just brilliant and the best stress-reliever there is!"

Roger admits that while he loves all his fish, he does have a favourite – Bubba. Not only is he one of the friendliest of the fish, but Bubba is also one of those that Roger often feeds by hand. He is always the first one to swim around Roger's fingers when he swishes the water.

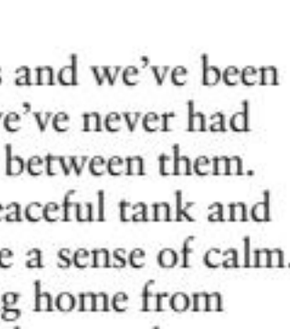
"Bubba is a real character," laughs Roger. "He's always at the front of the tank and when I go up to it, he'll often swim across the tank and look over at the drawer where I keep the food. He knows where it is! He's so funny. We love him."

Maintenance needs

Roger gets such great pleasure from his hobby that he doesn't regard the weekly water changes as a chore. Each week, he changes a quarter of the water in the tank using a siphon and five buckets. Then every month, he cleans the filter, while every other day, he feeds his fish on a wide variety of food.

"It takes about two hours to change the water but I never mind doing it because I know it's giving my fish the best environment to live in," says Roger. "That's my role as their owner. I've never had a problem with algae or anything like that. Maybe I've been lucky but I have also put a lot of effort into creating the best possible environment for them."

ROGER'S ADVICE



So what has he learned from his experiences, and what advice would he give to anyone thinking of setting up a tropical tank?

- "I'm no expert but what I would say is to read up before you start, get the biggest tank you can afford and chose an external filter, as these are generally more effective," says Roger.
- "I've thought a lot about what happened to us initially, and I've come to the conclusion that the hobby itself should really be called water keeping, not fish keeping! Get the water quality right and the fish will look after themselves."
- Roger found support and advice at www.fishkeeping.co.uk

Share your experiences

Would you like to feature in *Me and My Fish*? If looking after your coldwater or tropical fish means a lot to you, we'd love to hear from you! Perhaps caring for your fish has helped you through a stressful event? Or maybe you particularly value the friends you've made through your hobby, either on the forums or through a club?

Perhaps you show your fish or you might help to re-home unwanted fish? Do you suffer from a disability and enjoy overcoming the challenges it brings to looking after your tank? Whatever your story you can email us at pf.ed@kelsey.co.uk or write to us at our address on page 97.

A Burmese gem

Perhaps you've been out of the hobby for awhile, or are simply looking for new fish? If so, let us introduce you to some of the more unusual and striking freshwater species that have entered the hobby over recent years. Sue Jones reports.

One newcomer that has generated particular interest is the celestial pearl danio (*Danio margariatus*), also sometimes known as the galaxy rasbora (*Microrasbora* sp. 'Galaxy'). Even if the precise name of the species has been a subject for debate therefore, it is definitely a member of the family Cyprinidae, with recent studies confirming that it does belong in the *Danio* genus.

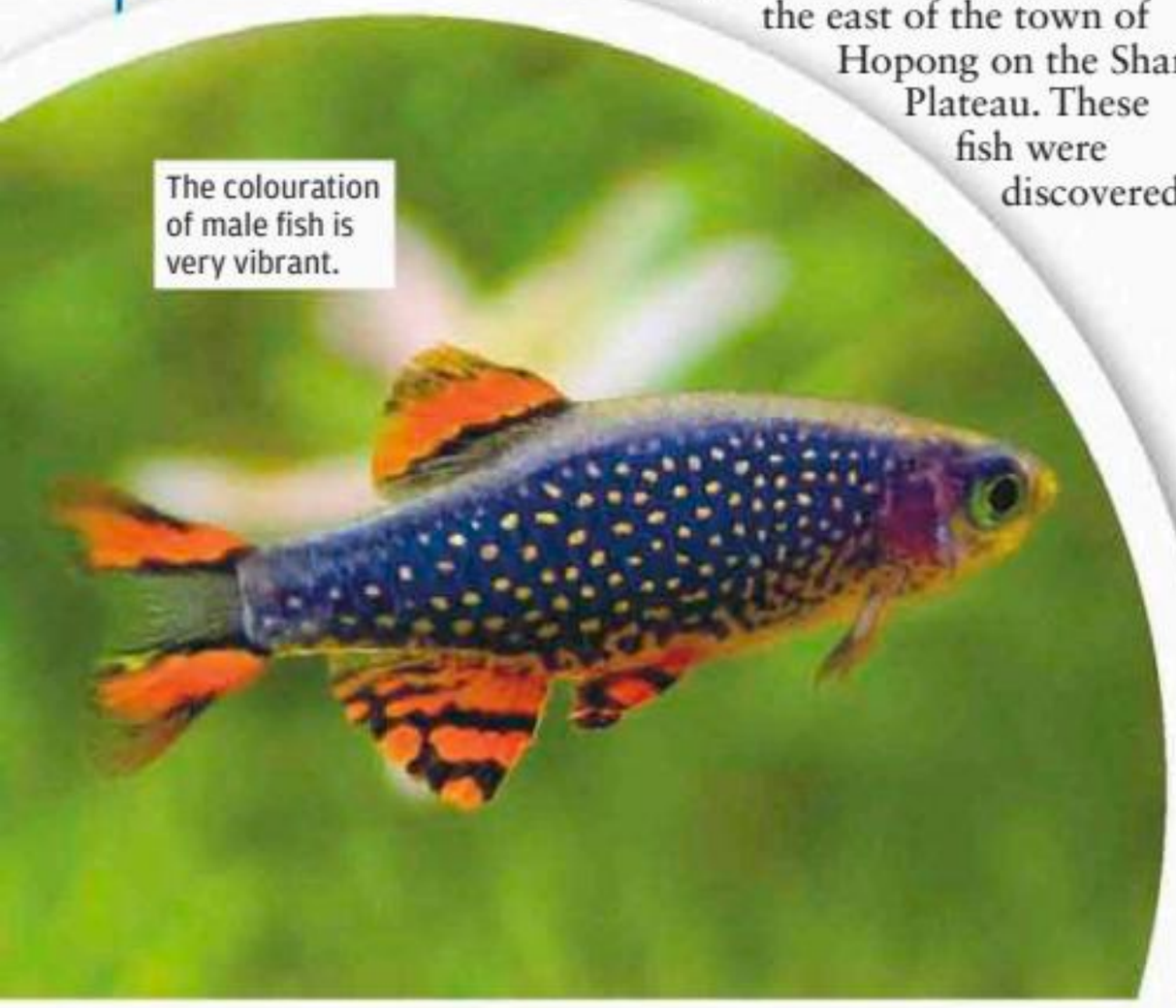
Origins

It was originally found seven years ago in the Asian country of Myanmar (formerly Burma), just to the east of the town of Hopong on the Shan Plateau. These fish were discovered in shallow ponds, in a small area of this relatively open, upland region.

There are relatively few species present alongside the celestial pearl danio in these stretches of water, of which only the dwarf snakehead (*Channa harcourtbutleri*) could be regarded as a potential predator. These danios, measuring just 2cm (0.75in), were known to the local people though, who caught them as food in spite of their small size.

Before long, celestial pearl danios also began to be sought after as aquarium fish, and soon collectors were out searching for this species, raising fears about its survival. Such concerns were thankfully misplaced though, and it soon became clear that if if there is a species of fish that is ideally suited to being captive-bred, then this is definitely it! Adult females of this species can spawn on a daily basis when conditions are suitable.

Sexing is straightforward, with mature males being more colourful than females. These fish are substrate spawners, although their eggs are not scattered around, as in the case of many related species. Instead, they tend to be hidden in vegetation. It is also now clear that these danios do not form true shoals, although they show best in aquarium surroundings in small groups. They will prove to be relatively inactive fish, and are not especially strong swimmers, probably reflecting the fact that they originate from ponds, rather than rivers.



The colouration of male fish is very vibrant.

Straightforward care needs

Celestial pearl danios are quite straightforward to look after in aquarium surroundings. Basically, medium hard water conditions, with a pH of 7 or just above will suit them well. They thrive at relatively low temperatures, reflecting their high altitude origins, with a water

DID YOU KNOW?

The town of Hopong is close to where the celestial pearl danio was found.

MAP COURTESY UWE DEDERING.

ABOVE Females are less brightly coloured. *PHOTO COURTESY MUMMYMONKEY.*

temperature between 21-24°C (70-75°F) suiting them well.

Be sure to include a number of plants, as these danios can be rather nervous in the open, and will settle better in these surroundings. They are quite unfussy about food, eating everything from flakes to micro pellets. Assorted small livefoods should be offered regularly too, with powdered freeze-dried krill enhancing their red colouration.

Breeding

Care needs to be taken when it comes to housing the sexes together, as more dominant males will chase and harry would-be rivals away from females, even inflicting injuries on them using their tiny sharp teeth. The females are very prolific indeed, and they may produce as many as 30 eggs a day!

The hatching period depends on the water temperature, typically varying between 3-5 days. The young fry are dark in colour at first, and can be quite slow to start swimming, remaining largely inert for as long as a week.

They then undergo a series of colour changes, becoming silvery before they then start to gain adult colouration between 9 -10 weeks of age. By just three months old, they will be fully grown and are likely to be starting to spawn for the first time.

In addition, there are colour variations between different strains, which may be an indication that their ancestors came from separate areas of water. The less typical form, where red colouration in the cases of males is replaced by orange, and the spots appear elongated rather than round, is attracting the attention of breeders keen to preserve these traits. Blue colouration in this case is also affected, being changed from a rich deep shade to a more olive one.

"Before long, collectors were out searching for this species"

There seems little doubt that this stunning fish, originating from a remote area of Myanmar, could ultimately become one of the most popular aquarium fish of all time. The question is – how many more species like the celestial pearl danio are out there, still awaiting discovery?

Maintaining water quality

Clean water is not necessarily safe, as dissolved chemicals from the waste matter produced by the tank occupants can build up here and prove deadly. So how can you prevent this situation from arising?

Airstone bubbles. Good aeration is important for biological filtration

In the wild, amphibians and reptiles may live in large expanses of water, whereas in their aquatic home, the volume of water accessible to them will be significantly reduced. Unsuitable water conditions can then give rise to skin and eye problems, and if uncorrected, they may lead rapidly to the premature death of the tank occupants - particularly amphibians, and the same applies with fish.

Natural control of water

Biological filtration is the natural process whereby organic waste is broken down, via what is known as the nitrogen cycle. Toxic ammonia from the breakdown of waste builds up in the water, but then beneficial bacteria in the water will convert this firstly to nitrite, and finally to less toxic nitrate. Testing systems, as sold for aquarium fish, enable you to keep a check on the water quality in set-ups housing aquatic frogs and reptiles.

Although an accumulation of nitrate can still be harmful to amphibians at a high concentration, it will be utilised by aquatic plants, serving as a fertiliser to encourage their growth. It therefore helps to maintain water quality by adding live aquatic plants to their enclosure. This may not be possible in all cases, as with African clawed toads (*Xenopus* species) because their swimming patterns tend to uproot any vegetation. But even the addition of floating plants may be beneficial, as

An African clawed frog in its natural habitat.

Red-eared terrapins need powerful filtration systems

they will utilise nitrate.

The simplest way of stimulating biological filtration is to fit an undergravel filter. As its name suggests, this needs to be located under the gravel on the base of the tank, and should cover the entire aquatic area.

The size of the particles is vital, because the aquarium water has to pass down through the gravel which acts as a filter bed. An undergravel filter therefore will not work effectively with a sand substrate, so choose pea gravel or larger. The gravel used needs to have a particle size of at least 3-4mm (one-eight of an inch).

The depth of the filter bed is also significant, and should be at least 5cm (2in) in depth, if it is to work successfully. By sloping the gravel towards the front of the tank, so you will be able to see any build-up of debris here and can siphon this out.

The other thing that is important is to seed the filter bed with a bacterial culture, to speed up the colonisation of the gravel by these beneficial bacteria. In a new set-up, it will take about eight weeks or so for an undergravel filter to become fully functional. More frequent water changes than usual will be needed through this period, to safeguard the health of the tank occupants.

For this type of filter, an air pump is required to force air through an airstone, creating a stream of bubbles in the uplift tube. Drawing water vertically into the tube from beneath the filter creates what is effectively a circulatory pump.

Maintaining this type of filter simply requires the regular use of a gravel cleaner, when carrying out a partial water change of perhaps 30% of the water every week or two. This will help to remove dirt that has been drawn down between the stones, and would otherwise ultimately reduce the undergravel filter's efficiency.

More powerful options

An undergravel filter is particularly useful in a tank catering for a pair of newts, where the waste output will be relatively low, but will not be an ideal choice for larger turtles. Different filtration methods, as well as alternative designs of filter are required in this case. Turtles produce a relatively large amount of solid waste, which may not be drawn down through an undergravel filter in any case.

TURN OVER FOR TOP TIPS ON WATER CARE »

Top tips to keep water safe

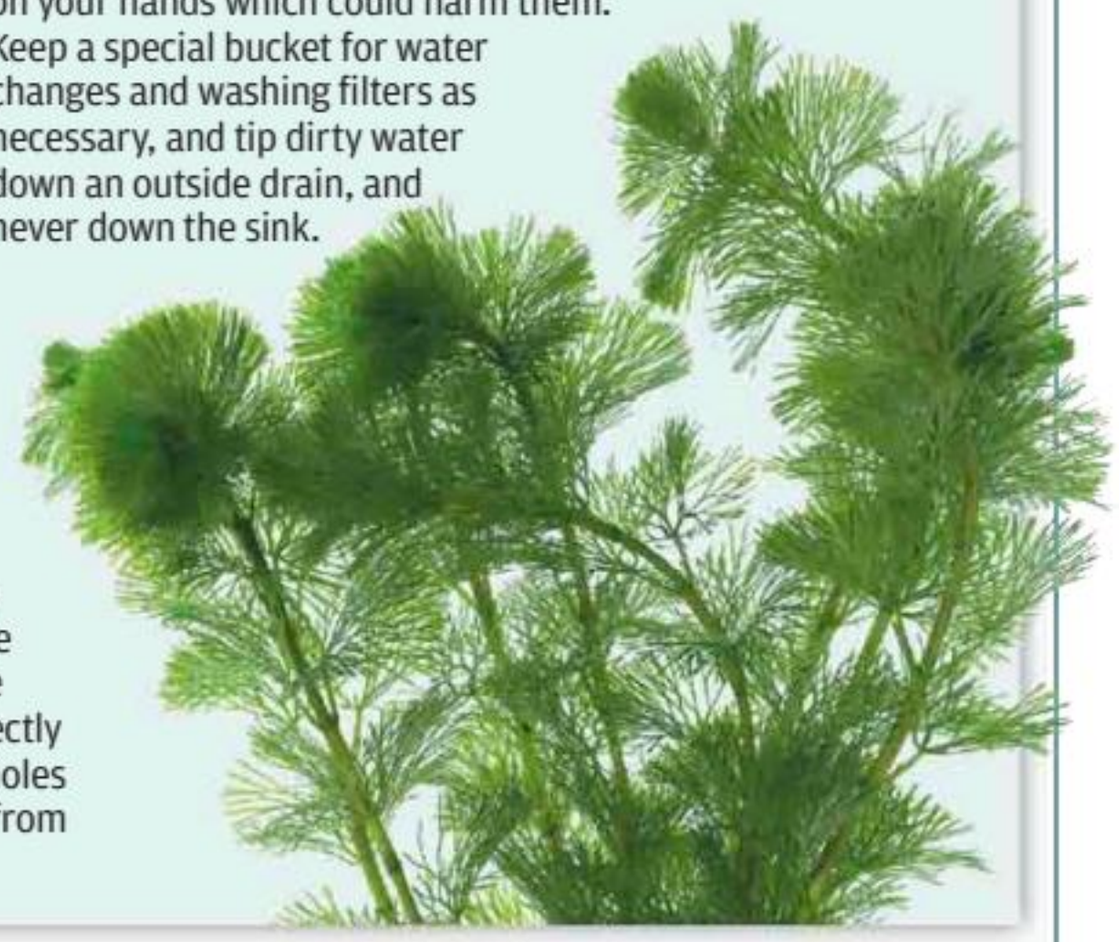
Lifestyle differences

Amphibians and reptiles occur in a wide range of different aquatic habitats. Yellow-bellied toads (*Bombina variegata*) are typically found in small, shallow areas of water, often little more than puddles. This means that they are relatively well-adapted to the build-up of waste matter here, compared with the Asian river toad (*Bufo asper*) for example, which inhabits much larger stretches of water where pollutants are rapidly flushed away. It will therefore be much more vulnerable to a build-up of waste in its quarters.

Hygiene concerns

Always wear gloves when servicing the quarters of your fish, amphibians or reptiles, both to protect you from any risk of infection and also the occupants, in case you have residues on your hands which could harm them.

Keep a special bucket for water changes and washing filters as necessary, and tip dirty water down an outside drain, and never down the sink.



Planting concerns

Beware about setting too many plants in pots in the gravel, as they will reduce the effectively filtration area, and once established, the roots of plants set directly into the gravel may start to block the holes in the undergravel filter, preventing it from working effectively.

Tadpoles must have gentle filtration only.

Mechanical filtration is more important in this case. Various materials including filter wool and foam are sold as mechanical filters, acting as sieves that are capable of trapping waste of this type.

Power filters are all-in-one units, which attach to the side of the aquatic area, using the suckers that form part of their design. A power filter should be sited in such a way that the output nozzle is at the water surface, generating a flow here, and assisting movement of the water around the tank.

Basic units draw in water and particulate waste matter in suspension, which passes upwards through the mechanical media. Some biological filtration also takes place here, as bacteria colonise the material here.

Every few weeks however, you will need to strip the filter down, because the debris building up on the filter medium will have comprised its efficiency, causing a noticeable slowing in the output of water from the unit. Changing the filter medium is also easy, but before buying a unit, check and compare the cost of replacements, because this can represent a significant outlay over a period of time. Foam can be washed off in a clean bucket of dechlorinated water and reused, whereas filter-wool products will need to be thrown away.

In addition to mechanical filtration, filters of this type may also include carbon, as part of the filter medium. This provides for so-called chemical filtration. Potentially harmful chemicals dissolved in the water are adsorbed, becoming bound with the molecules of carbon, and this also help to prevent the water from smelling.

Flow rate

The amount of water in the set-up determines the size of filter required. It is quite easy to work out the volume of water in the tank by multiplying the width, depth and length measurements for the aquatic area together, and then dividing by 1000, to provide the answer in litres. Choose a filter with a relatively high flow rate, as this means it will be drawing the water through the unit more frequently.

Further considerations

The height of the water in the set-up will also have an impact on the type of filter that can be used - large internal power filters are not suitable for shallow water. The power of the filter is also significant. Young tadpoles for example should only be housed in tanks where either an undergravel filter or a basic foam filter are incorporated, because neither of these are likely to endanger their health. A power filter, however, may drag tadpoles into the unit, with fatal consequences.

Water changes

Not everyone who keeps amphibians in the home relies on a filtration system to maintain water quality, especially where they are only or two individuals housed together. Instead, regular water changes can be the answer. Aquatic siphons, doubling up as gravel cleaners, are available for this purpose. They are equally useful to spot clean around an enclosure where rockwork can be a barrier to effective filtration, enabling debris to build up out-of-sight. This if overlooked, can result in a marked deterioration in water quality.

In many cases, it may only be a matter of carrying out a partial water change, as is normally the case with fish, instead of having to empty the whole tank. The water that has been removed should be replaced with fresh water at the same temperature. This must be treated with a water conditioner first, especially for amphibians, in order to remove harmful chlorine-based chemicals that will have been added to the water to kill potentially harmful microbes.

Lessening the load

In order to minimise the inevitable deterioration in water quality, the following steps will be helpful:-

1 Consider transferring turtles to a separate feeding tank.

2 Carry out partial water changes once or twice a week.

3 Remember water quality deteriorates most rapidly when the tank occupants are feeding well. Use test kits regularly for monitoring purposes.

4 Do not overfeed the tank occupants. Uneaten food of any type will rapidly pollute the water. Feed a little and often, matching your pet's appetite and minimising wastage of food.

External filters

Large set-ups will need an external filter, which is located outside the unit itself, often being concealed in the cabinet on which the tank may be resting. The filter media are likely to be more complex than in the case of an internal power filter. These units often have a range of materials present, through which the water passes. They can include ceramic granules, which help to support colonies of beneficial bacteria, contributing to biological filtration, as well as filter wool and carbon. Some of these external filters may be used with a spray bar, through which the water is returned to the tank. This acts rather like a shower, helping to move and oxygenate the water as it is returned to the tank.

Where to find...

Interpet
Test kits and filtration systems
www.interpet.co.uk

Tetra
Manufacture filtration systems
www.tetra-fish.com

Zoo Med
Produce specialist filters, water conditioners
www.zoomed.com

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A Plant Pro lamp in use.

Getting the best from today's lighting technology

With so many different lighting options now available, it can be very confusing when it comes to choosing which lamp or indeed lamps to buy for your aquarium. Here Ben Catley of Arcadia Aquatic explains what you need to consider.

An Original Tropical lamp in an ArcPod.

It is not just the choice of possibilities on offer that can create confusion. Aquarium lighting can unfortunately sometimes seem to be a very technical area, full of jargon and with limitless facts and figures, not to mention strange acronyms such as PAR lamps (with this abbreviation actually stands for a 'parabolic aluminised reflector' lamp!). But what you need to bear in mind is that aquarium lighting essentially serves two distinct purposes, and these will impact directly on your choice.

Firstly, it can ensure healthy plant growth, mimicking the beneficial effects of sunlight in this regard. The wavelengths of this light will correspond to those in nature, so that plants can utilise these in order to photosynthesise, producing energy for their growth. The other crucial aspect to aquarium lighting is, of course, so that you can see your fish in their true colours.

Lighting options

There are many type of lighting available now that will serve these purposes, but there is no single solution.

It may be that you have no live plants in your tank, preferring instead to include maintenance-free and very realistic plastic substitutes. On the other hand, you might keep blind cave fish for example, which typically only require very subdued lighting, replicating that in their subterranean world.

Historically, aquarium keepers have used fluorescent tubes in standard output T8 and now in High Output T5 forms, while metal halide systems, which are very high output light sources, have been favoured for larger aquariums. Things are changing fast though, and there is now a big push towards the development of LED (light-emitting diode) lighting, which is a topic that we will cover in detail in the next issue.

Fluorescent lighting can be in the form of a tube or a more compact light. As you will see looking at packaging of lamps, there can be quite significant variations between manufacturers in terms of the colour outputs of different lamps. As lighting specialists, Arcadia have researched plant growth and fish colouration for many years now, and this has helped us to develop a family of lamps that we believe not only provide excellent plant growth, but also show off the colours of fish in a way that not many other lamps can achieve.

To give you some insight into the subtleties of the process, we have chosen to use very expensive phosphors in the mix of our lamps. These serve to highlight colours and fluorescent patches on fish that would not be apparent otherwise. Furthermore, there are also very particular phosphors in this mix that will not just accelerate live plant growth but actually inhibit the growth of nuisance algae.

Rainbowfish under a Freshwater Lamp.

Meeting your needs

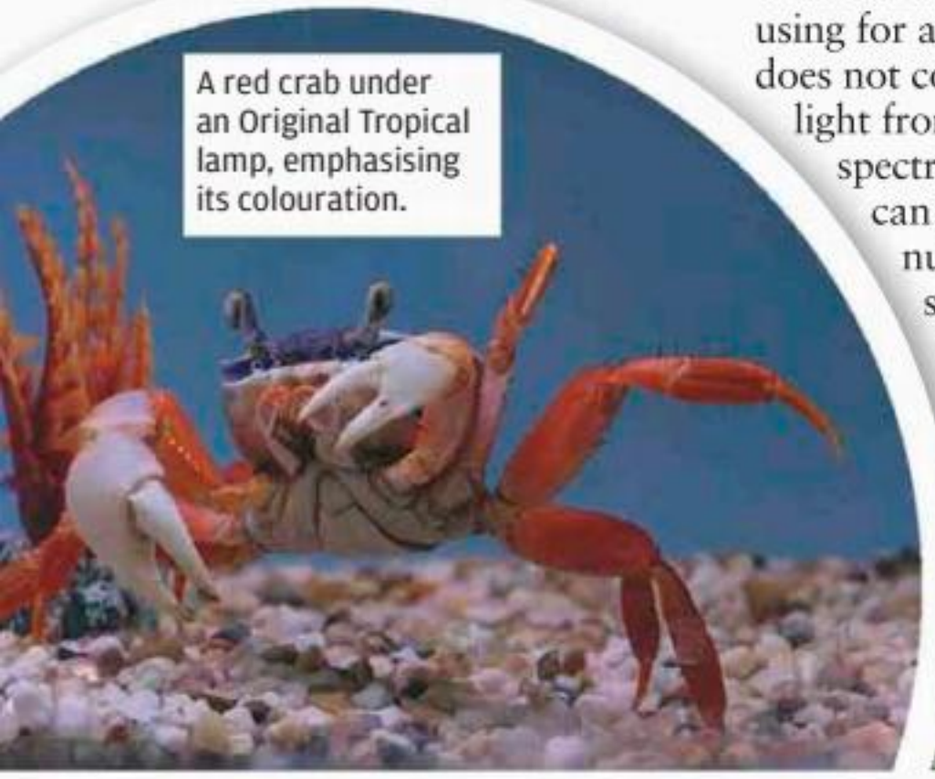
It is certainly not the

A T8 Freshwater Lamp over plants.

ALL ILLUSTRATIONS COURTESY ARCADIA AQUATIC.

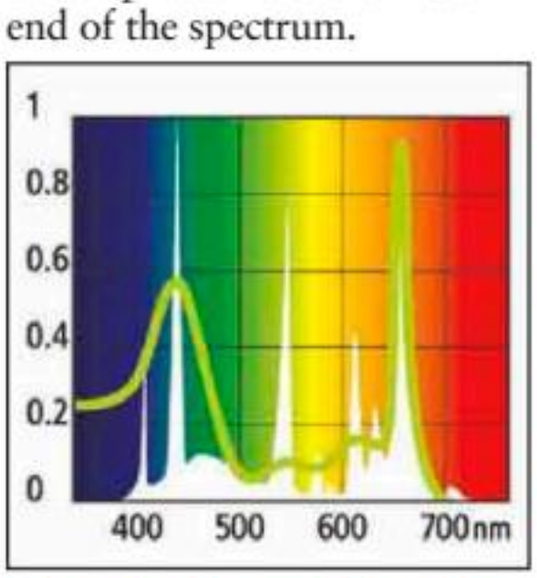
case that all lamps are the same and any one will do! If you have ever tried using a typical ordinary fluorescent lamp as sold in diy shops above your aquarium, you will soon notice the difference, compared with a genuine aquarium lamp. There will be a rapid increase in unwanted algae, and a decrease in the colour rendition of the fish as a whole using a household lamp.

So how do you make the right choice, in general terms? First of all, you need to consider what type of aquarium you have, and the species of fish that you are keeping. Do your fish contain lots of deep reds, blues and oranges in their colouration? If so, a pinker type of lamp would be the best choice by far. This part of the spectrum highlights the reds, blues and oranges and makes such fish stand out in the aquarium, so they will look more stunning. It is for this reason that most aquatic shops will use a lamp of this colour output over their more brightly coloured fish, so as to showcase them very effectively for their customers.



A red crab under an Original Tropical lamp, emphasising its colouration.

Arcadia's Original Tropical lamp is an example of a light of this type. The SPD (spectral power distribution) chart in the next column shows how the emphasis here is on red end of the spectrum.



A natural combination

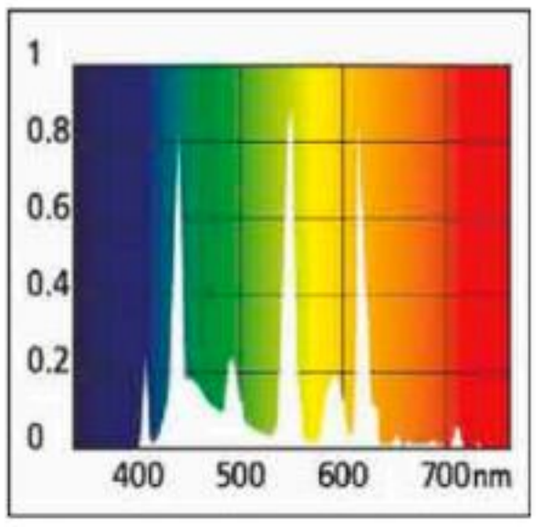
Yet what lamp would you choose If you have lots of green plants that need high quantities of light and would benefit from a clean, crisp light? You will want to show the natural colours of these fish and plants together in this case. The solution will be a bright, full spectrum lamp with a hint of green. This will provide great plant growth and will also help with the colour rendition of the plants, so they look good in the aquarium too.

You do need to be very careful though, so as to ensure that the lamp you are using for aquarium plants does not contain too much light from the blue part of spectrum though. This can otherwise cause nuisance algae to start spreading, and will significantly increase the amount of time that you need to spend maintaining your tank.

Getting the choice of lamp right is a very personal thing though, as we have found. Some aquarium owners like the deep tropical hue created by the Original Tropical Lamp whereas other keepers prefer the starker brilliance of the Freshwater Lamp, both of which are available in standard output T8 and now in the high output T5 version.

The SPD chart below for the Freshwater Lamp illustrates that the focus is on the green part of the spectrum, but still with peaks in the yellow/ orange, when compared with the Tropical Lamp.

Getting the choice of lamp

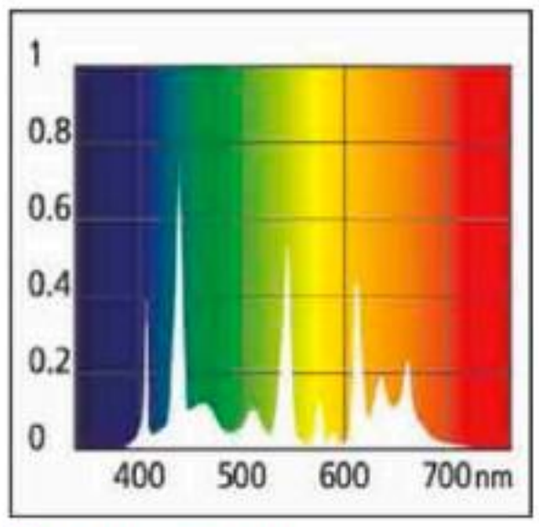


wrong will wash out the colours of your fish and can cause terrible algal problems in the aquarium. So what should you do when you are keeping both plants and fish together? You can select one of each type of lamp for your aquarium. There is an added advantage of having a pink light under these circumstances, should you have any red aquarium plants such as red ludwigia, simply because this will also highlight the colour of such plants, making them look really stunning too.

The best of both worlds!

If you are really keen on combining the very best of plant growth with the fantastic colours of fish,at the pink end of the spectrum, then in effect, you need a lamp that combines the outputs of both. Arcadia has achieved this in the form of a single, high output T5 lamp, called PlantPro. Many of the mainland European planted tank experts now rely on these lights to provide both the colour and intensity of light that are necessary to get the very best from their set-ups. Such lamps are commonly used as part of a group of lamps over high light requirement planted tanks.

As its SPD profile shows below, the Plant Pro is a broad-spectrum lamp that recreates daylight and so stimulates plant growth.



In summary

There are no hard and fast rules, but follow these simple guidelines and you and your family should be very pleased with the appearance of your aquarium for the life of the lamp. Remember that the phosphors inside of a lamp, which effectively control the light colour output, degrade over time. The longer that a lamp is used therefore, so the duller its appearance will become over time, even though it is still working.

Make sure that you change your lamps at the intervals recommended by the manufacturer. In the case of Arcadia lamps, they can be used safely for up to two years, depending on the type. You can find all this information on our website, and also sign up to receive an email when your light ultimately needs changing, so there is no need to worry that you might forget. Lamps need changing, even if they are still operating at the end of this period, in order to safeguard plant growth, quite apart from optimising the viewing experience of the aquarium.

Further information

To learn more about aquarium lighting, visit Arcadia's website at www.arcadia-aquatic.com


Crystal black bee shrimp .

Shrimp talk

The world of shrimps and small, beautifully planted desk top set-ups, accommodated in so-called 'nano tanks', is an area of the hobby that is growing very rapidly as present. Here expert Lucas Witte-Vermeulen of Sharnbrook Shrimp introduces this new branch of the hobby.

Q Why do you think shrimp have become so popular?

A The emergence of the "planted tank", with the emphasis on plants and design, rather than fish, has encouraged enthusiasts to source small creatures for these set-ups that will not dominate the aquascape. Shrimp like the Amano were originally introduced into such set-ups to clean the plants and keep the tank clear of algae. They were kept primarily for functional purposes, but now they have become the focus in many tanks.

With the advent of small nano tanks, which are not large enough for the majority of fish, so shrimp prove to be the ideal occupants. They are small, colourful and create little waste.

Q Are they straightforward to keep? Can many be kept in fresh water?

A They range from being very easy to keep at one extreme to being very challenging and suitable for the expert only. The cherry shrimp makes a great introduction to the hobby though. Its care is straightforward and it is adaptable to most conditions. In contrast, the higher grade crystal red bee shrimp and Taiwan bee shrimp are much more demanding to maintain successfully. There is a great choice of shrimp suitable for fresh water setups.


Blue jelly shrimp are beautifully coloured.

Q What attracted you to shrimp?

A My wife pointed out some red and white striped shrimp in a tiny 10l (2gal) tank in a local fish shop. I was instantly hooked on these crystal red bee shrimp, and it began from there.

Q Why did you decide to set up a business promoting them?

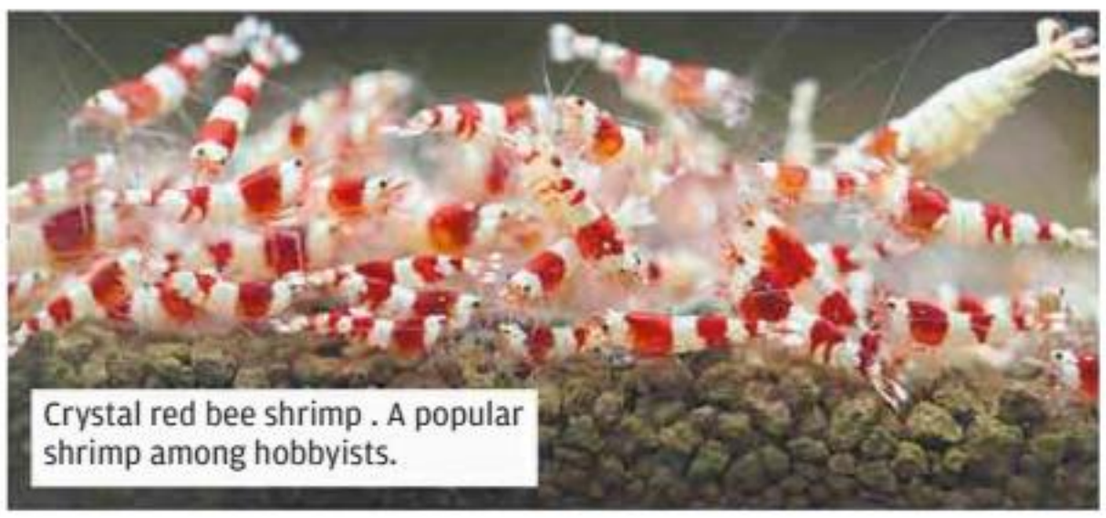
A I then had a large tank containing cherry shrimp that thrived, and after a few months, I had thousands of them. I began selling them on eBay and it started from there.

Q Do you need to have had experience with fish before keeping a shrimp set-up?

A No, I think shrimp keeping can be simpler, and there is less maintenance involved if you are interested in a few of the easy-to-keep,


Snow white bee shrimp.


Black Taiwan bee shrimp.


Crystal red bee shrimp . A popular shrimp among hobbyists.


A yellow shrimp, bordering on a canary yellow shade

colourful varieties like the cherry shrimp, or the yellow or orange shrimp.

Q Where do they come from, and how big can they grow?

A The most popular shrimp come from Asia, but new species are being found all the time. The most notable new and extremely colourful introductions to the hobby are currently originating from the island of Sulawesi in Indonesia.

Common ornamental freshwater shrimp range in size from about 2.5 cm (1in), in the case of the crystal red bee shrimp, up to the Cameroon fan shrimp, which can reach 15cm (6in). However, there are many more occurring in different shapes and sizes in-between!

Q Are there any that I could add to my aquarium?

A If a fish can fit something in its mouth, then it will. Shrimp are mostly quite shy and fish are highly active, and this conflict can cause stress to shrimp. I would advise having a shrimp-only tank. That being said though, Amano shrimp, which grow to about 7cm (2.8in), should be fine in a community tank as long as the fish are peaceful and non-aggressive.

Q Where did the interest in keeping ornamental shrimp originate?


The orange eyed blue tiger shrimp.

A In Japan. The most notable figure in the hobby is the famous aquascaper Takashi Amano. He introduced the Amano shrimp into his aquascape works of art and thus eventually into the mainstream. Another famous shrimp pioneer was Hisayasu Suzuki who bred the first crystal red bee shrimp, a mutation of the wild form that is predominantly brown and black.

Q Is it expensive to set up?

A Definitely not! You could find a well-made, small 15-30l (3-6gal) nano tank with a filter and light for around £50, and you don't even need a heater for most species. A few plants and shrimp could set you back a further £15 to £20 to start.

Q What type of people keep shrimp?

A Anyone who wants to include a part of nature in their home or office. You only have to worry when you are addicted like me, and shrimp tanks start to reproduce throughout your house!!

"You only have to worry when you are addicted like me, and shrimp tanks start to reproduce throughout your house!!"


Taiwan bee blue bolt.

Don't miss out!

Starting in our next issue, Lucas will be providing a detailed, step-by-step guide to setting up and maintaining your own shrimp collection. Meanwhile, check out the Sharnbrook Shrimp website at www.sharnbrookshrimp.co.uk

It helps to have friends in the world of fish!

In the case of fish, as with any other animal, being able to detect changes in their environment and pick up the slightest hint of danger is very important for their survival. Over recent years, it has become clear that in shoaling species, learning from other members of their group is a skill that many such fish have mastered with remarkable success. Behavioural scientist Dr Julia Mueller-Paul explains more about this ability.

Guppies have been shown to learn from each other's behaviour.

The benefits of this way of life are clear-cut of course, with several pairs of eyes providing greater environmental awareness. This allows all individuals in the group to track down food sources more easily, and become aware of possible predators at an earlier stage. Such skills greatly enhance the chances of survival, with this ability to learn from others being described as 'social learning'.

Despite being widespread, social learning is complex, and requires substantial cognitive abilities to understand the situation. Firstly, a fish needs to observe the behaviour of its companions in a shoal. Then it needs to interpret why another individual reacts in a certain way in a given situation.

Next, it has to understand how both the situation and the other fish's solution to the situation might affect its own circumstances and finally, it has to translate all this information into appropriate behaviour that might or might not involve copying the actions of its companion. Taking all of these steps into account, it becomes clear that even the brain of a fish, which might be physically very small, can have great processing power and capability.

There are several different ways in which social learning can be of help. Apart from the avoidance of predators and the acquisition of food, other benefits can include orientation and mate choice.

Recognising danger

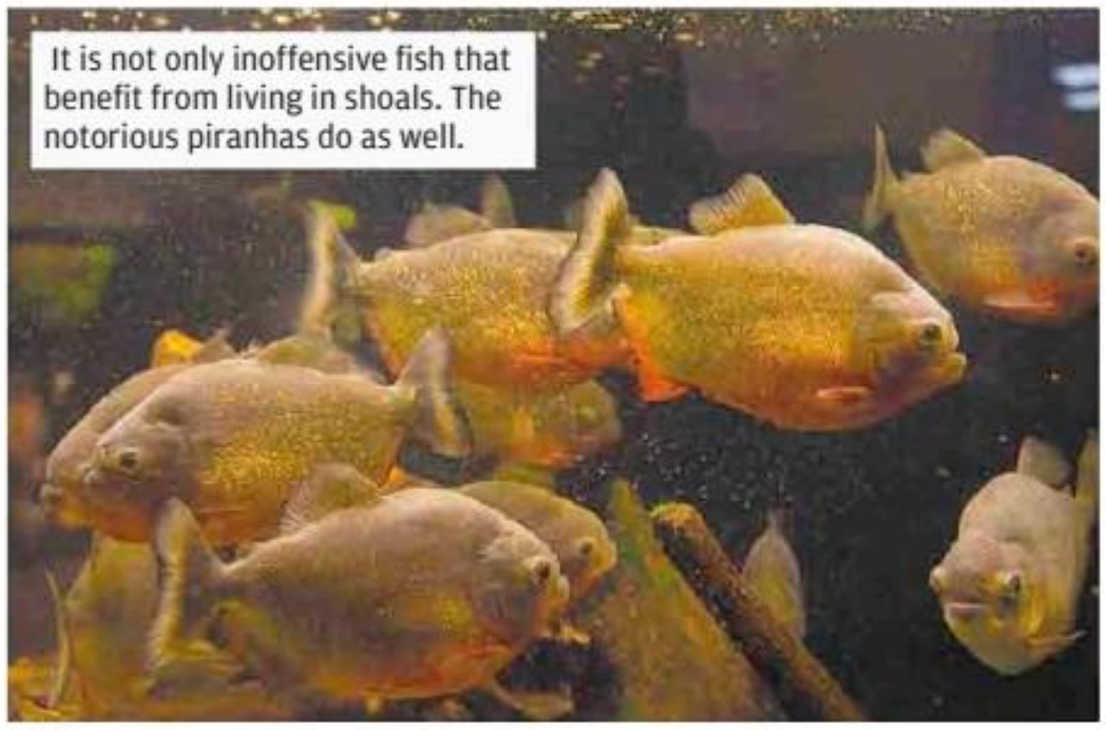
Learning to avoid predators is a risky business, and an individual is unlikely to get many chances to overcome these dangers by trial and error! Obviously, errors are very likely to be fatal, so learning from the reaction and fate of others is highly beneficial, making this a prime situation for social learning. Fish can learn about both the presence of a predator and the identity of a predator, should they have not encountered this particular threat previously.

Shoaling tends to offer an early warning with regards to potential danger, ensuring that members of the group have a greater chance of escaping than if they were on their own. Fish living in shoals have the unique possibility of learning from others via the extraordinarily fast communication that occurs within the shoal. This means that the need for avoidance can be communicated faster than a predator is likely to approach, maximising the opportunity for escaping the danger.

Scouting behaviour

While simply following the shoal away from a predator cannot be considered social learning, research has shown

"Errors are very likely to be fatal, so learning from the reaction and fate of others is highly beneficial..."



It is not only inoffensive fish that benefit from living in shoals. The notorious piranhas do as well.

Fish living in shoals have the benefit of an early-warning system against would-be predators like pike.

Minnows can learn to recognise danger of specific predators by their scent.

Young fish like these discus have to learn fast, in order to survive.

that young or inexperienced fish often acquire or refine their individual knowledge of predators by correctly interpreting their shoal mates' reaction to a situation.

Interestingly, some shoaling fish even send out scouts that will assess the level of danger expected from a specific predator. The threat level appears to be conveyed back to the shoal through the reaction of the scouts, thereby allowing the shoal to respond to this potential threat, even before the predator even attacks.

How the risk is communicated

Information about a predator can be transmitted via the release of a warning substance into the surrounding water or by visual signals. One study showed a flight response by shoaling fish that had observed a flight reaction of another shoal of the same species in a neighbouring tank when it was threatened by a predator.

Other investigations have reported similar flight responses of one species in reaction to the behaviour of another species. This means that making use of visually transmitted information about predators is not necessarily restricted to a particular species, as other vulnerable fish in the vicinity can pick up on this message too.

The important point in deciding when such reactions are lessons learnt is that the information about the danger is retained. Research has shown that minnows can learn to associate a previously unknown predator with danger when it is presented together with either a flight response or a chemical warning given by other minnows. This ability is also very useful for minnows in terms of learning to be cautious about

CONTINUES ON THE NEXT PAGE

A Siamese fighting fish in combative mood.

The more guppies there are in the group, so the easier it should be for them to find food.

A golden shiner. This cyprinid lives in large shoals and is widely-distributed throughout eastern parts of North America.

ARTWORK COURTESY DUANE RAVER/US FISH & WILDLIFE SERVICE.

dangerous habitats that might contain the scent of resident predators.

Plotting a safe path

In another study, guppies (*Poecilia reticulata*) were paired with previously trained demonstrators. The task was to escape from a model predator via one of two possible escape routes. The first demonstrator always used one route, the second always followed the other. While the demonstrators were present in their quarters, the fish followed them faithfully and thus learnt how to escape from the predator.

Later though, they were tested without the presence of the demonstrator and the results show that they were much more likely to escape successfully than fish that had not received previous demonstrations. Interestingly however, they did not necessarily follow the same escape route that their demonstrator had taken.

This suggests that the fish do not just copy a simple behaviour, but in fact, they actually learn about the means by which escape is possible. This is very useful as it ensures that they are more likely able to apply a similar problem-solving approach in different situations and locations, enhancing their survival skills accordingly.

Learning about food sources

In open waters, the discovery of new feeding grounds and foraging are much more likely to be achieved by shoaling, simply because the more fish that are present in an area, so the greater will be the possibility of encountering a suitable food source. Guppies, for example, forage more efficiently in direct proportion to the size of the shoal.

Once an individual has encountered a food source, this information is spread quickly through the shoal, and as the fish begins to eat, it will soon be joined by others in the group. This ability to communicate about food sources undoubtedly increases the likelihood of the survival of the shoal.

In more restricted areas with less visual access and more aquatic vegetation, smaller shoals can prove to be more successful, as they might be more flexible with respect to their travelling paths. However, shoal size is not the only important factor, as studies have revealed that guppies learn better from fish they know, rather than from unfamiliar companions.

Going against their instincts

Golden shiners (*Notemigonus crysoleucas*) usually spend the whole day in safe, shady areas but can be taught to wait for food in a brightly lit area, when always fed in that location at the same time of day. Shoals of inexperienced golden shiners could be trained to wait for food in the brightly lit area of their tank by just a few experienced individuals, going against their natural instincts. The greater the number of experienced individuals that were present, so the stronger was the effect, but even a single experienced golden shiner was able to train eleven inexperienced fish in this task.

Furthermore, it appears that fish that have the opportunity to observe others feeding on unfamiliar prey are more likely to accept this new food source. On the other hand, a group of fish are less likely to be drawn to new prey than in the case of an individual learning on its own. This means that a social influence can encourage as well as inhibit new behaviours, and once more demonstrates how aware many fish are of their shoal mates' actions.

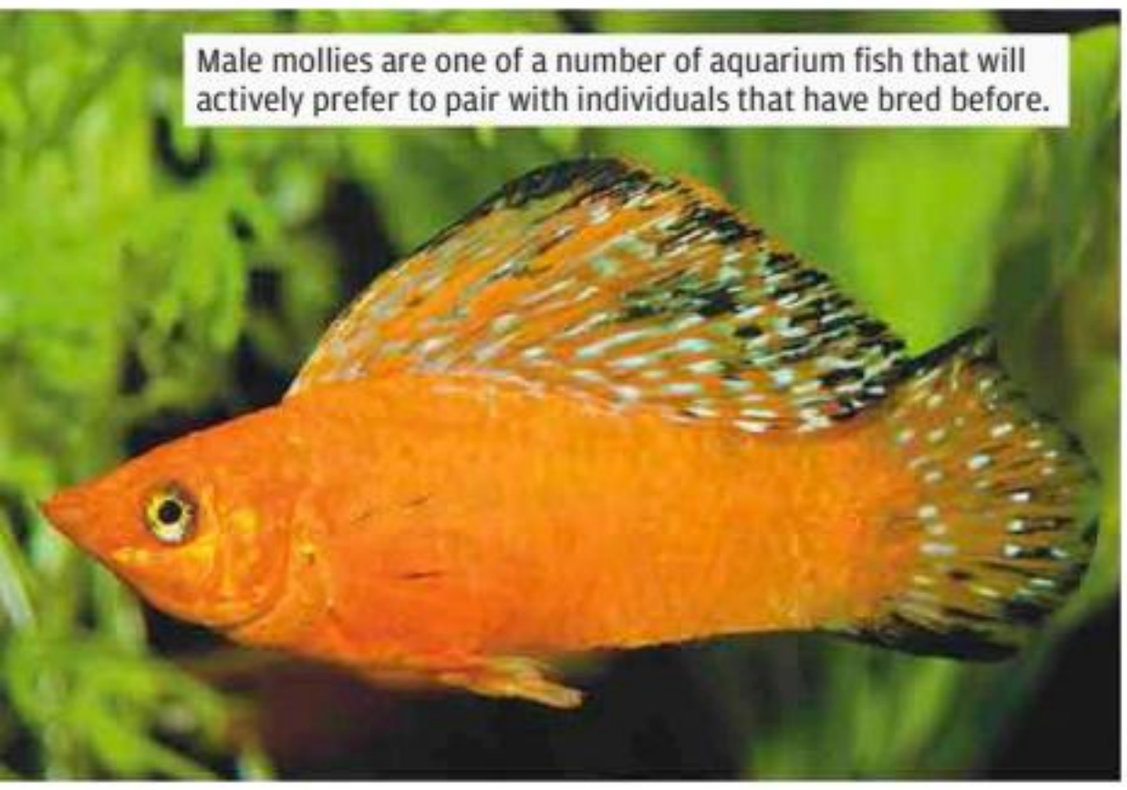
A striking experiment with European seabass (*Dicentrarchus labrax*) showed that individuals were able to learn to press a lever that released a food

"This ability to communicate about food sources undoubtedly increases the likelihood of the survival of the shoal"

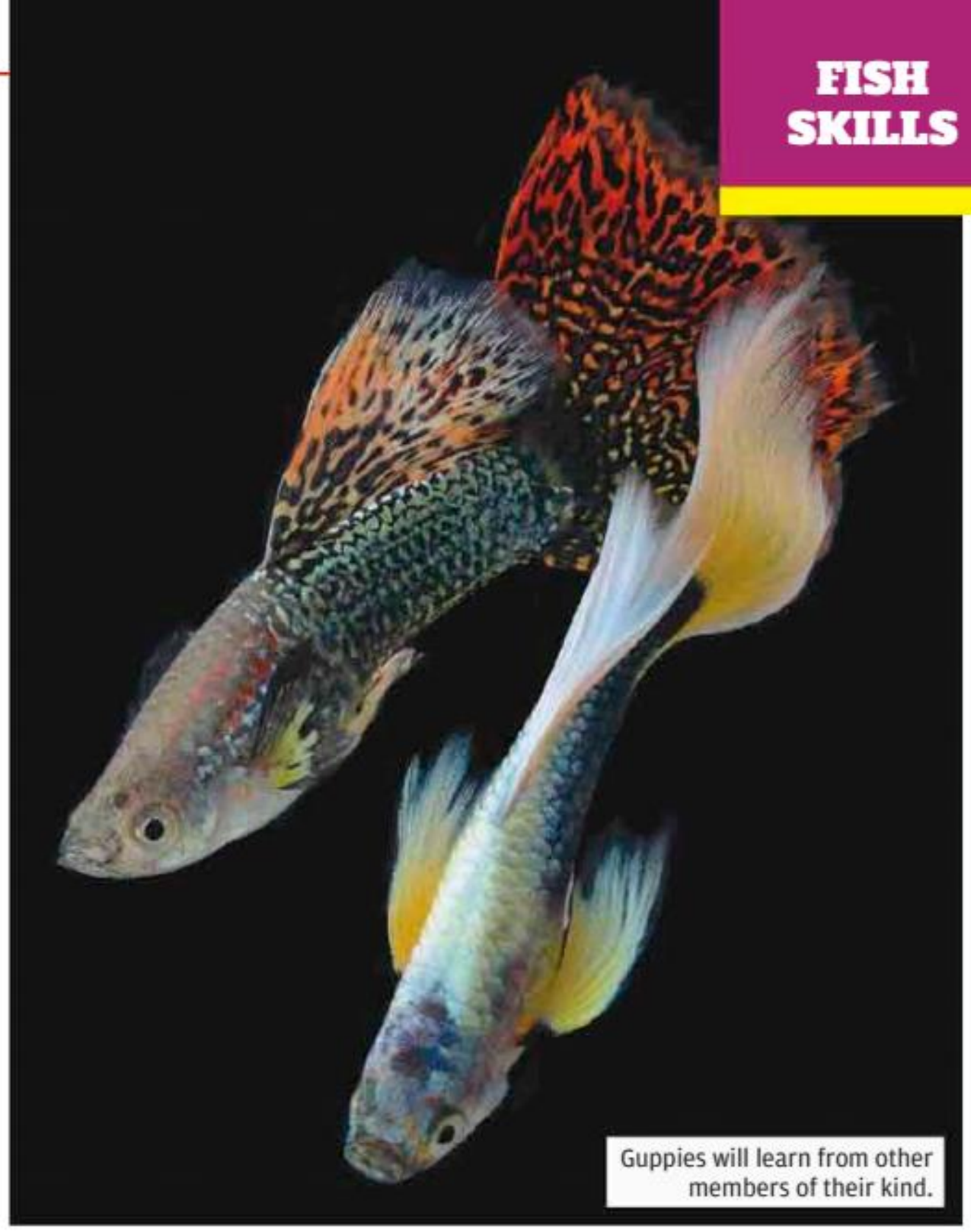
DID YOU KNOW?

In order to increase the chances of fish reared in captivity surviving when they are released into the wild, they need to be introduced to wild individuals, capable of alerting them to possible dangers.

European seabass could be taught to feed themselves using a mechanical device, simply by observation.



Male mollies are one of a number of aquarium fish that will actively prefer to pair with individuals that have bred before.



Guppies will learn from other members of their kind.

reward, simply by observing experienced individuals perform the task.

Orientation and navigation

Fish can also learn spatial orientation and navigation routes from others. This ability is very useful in finding the best paths from resting sites to feeding grounds. One study tested fish in their natural habitat. When some were displaced from one resting site to another, but had the chance to follow the resident fish to the feeding grounds, they were able to find their way by themselves within two days. However, this was not the case when there were no experienced fish present in the new location to guide them.

Another study provided inexperienced guppies with two possible routes to a feeding ground. They were then paired with an experienced demonstrator, which they shoaled with to arrive at the feeding location. After some time, the demonstrator was removed and the guppies confidently continued to follow the same path to the feeding ground that had been used by the demonstrator, despite the presence of another possible route. This means that they remembered the route rather than just blindly following the demonstrator.

Interestingly, the greater the number of experienced fish that were present and demonstrating the route, so the more faithful the guppies were to that original route. The effect was so strong that in another similar study, the fish chose a longer, less convenient route, simply because it was the one commonly used by their experienced shoal mates. This still proved to be the case if the guppies could clearly see the feeding ground, and had received individual training to use the more direct path.

Learning about mates and potential adversaries

Social learning can even be helpful when it comes to mating and conflicts with other fish. Male Siamese fighting fish (*Betta splendens*), as an example, are able to gather information about the combative strength of their potential adversaries by observing them fight amongst each other. Information obtained from such observations can later be used to decide how to fight against a particular individual – or if it will be better to avoid conflict.

But male fighting fish are not the only ones that pay attention to these fights. Females may also observe them and use them to evaluate the males as potential mates. Accordingly, studies have confirmed that male adversaries will adjust their behaviour during a fight, depending on the whether or not they are being observed from the sidelines. A female's presence gives rise to less aggressive behaviour and more sexual demonstrations.

Learning is, however, not restricted to observations of displays and outcomes of fights. Both male and female mollies, guppies, gobies, and Japanese rice fish (*Oryzias latipes*) have been observed to prefer mates that have already been selected by other fish. One study tested this phenomenon by letting a female guppy choose between two males, one of which she had observed interacting with another female, while the other had been on his own. Females reliably chose the male that had been preferred by the other female. This behaviour might suggest that female fish take the favourable opinion of other females as an indicator that a particular male is a worthy mate.

In conclusion

Learning socially from other fish is something that is observed regularly in shoaling fish. The ability itself can be both complex and demanding but the benefits are great, since they can often make the difference between life and death. This also has consequences for fish raised in hatcheries for later release into the wild.

Given the importance of learning socially from experienced fish, it is important to expose safely kept hatchery fish to individuals experienced in the dangers of the real world and provide simulations of such dangers before release, so that they have a more realistic chance of survival in the wild. All in all, however, it is probably fair to say that fish are much smarter than is popularly believed!

Business profile

Featuring The Aquatic Design Centre Ltd., located in London's West End.

Need an aquarium set-up for your film set? Or keen to make a corporate statement emphasising your green credentials with a stunning planted tank? Set designers, celebrities and the BBC are just some of the people who have employed the services of the Aquatic Design Centre for such purposes. The business, based in the heart of London, has gained an enviable reputation as the 'go to' name in this area, often being called upon to build aquariums from scratch.

Contact details

Where: 109 Great Portland Street, London W1W 6QG.
Opening times: Monday-Thursday 10am-8pm; Friday 10am-7pm; Saturday 10am-6pm and Sunday 11am-5pm.
Telephone: 020 7580 6764 (shop) and 020 7636 6388 (installations and maintenance).
E-contacts:
www.aquaticdesign.co.uk
Email: info@aquaticdesign.co.uk

Sound knowledge and advice

This is not just coincidence either, because the underlying strength unpinning all the different aspects of the Aquatic Design Centre's work is genuine knowledge. Every member of the shop staff is a fish keeper, and between them, they can discuss the hobby with you in no less than 10 languages, reflecting its international appeal. Shop manager Greg Czyrak started keeping fish himself as a boy in Poland, and is passionate about the hobby.

"Our aim here is to share our enthusiasm with our customers," he explains. "We are always very keen to help newcomers to the hobby, because we ourselves know how much enjoyment you can get out of it, especially if you have guidance to help you start off on the right lines.

"As an example, just recently, a man came in with his wife and bought an aquarium, although she was not very enthusiastic at first. Within three months though, they came back to buy another one, which she wanted for herself!"

What is available?

There is a massive selection not just of fish, but also aquatic plants to suit everyone from the beginner to the serious specialist. To give some idea of the scale of what you can expect if you visit, there are some 200 tanks housing tropical fish alone, with the premises extending over two floors.

"We have deliveries three time a week from all around the world, but particularly Asia, which is of course a major centre for aquarium fish breeding," explains Greg. "We also have two deliveries of plants weekly, and so if there is something in particular that you are looking for, we can probably source it for you."

A very wide selection of dry goods and aquariums are also kept in stock too, including the full biOrb range. ADA products are also proving good sellers, not least their Amazonia soil, which provides an excellent medium for plant growth, and can be recommended as a substrate for nanotanks. It makes the aquarium water slightly more acidic, lowering both pH and KH readings, while its physical properties mean that it will not cloud the water in the aquarium.

Trends

Greg has noticed that sales of nanotanks have grown significantly of late, along with demand for small fish that can be housed successfully in these surroundings, such various rasboras and small danios, not to mention certain killifish as well. "There's definitely a growing interest in shrimp too, although the UK is still lagging far behind in this area, compared with elsewhere in Europe. In Poland, keeping ornamental shrimp has become a massive hobby," Greg explains.

When it comes to the display field, mixed tanks of Malawian cichlids are very popular at present. Servicing such tanks is also significant, with the business employing some 30 engineers for this purpose, working full-time, five days a week, visiting both other businesses and homes.

"All these people are not only trained to a high level, but if necessary, they can call on additional support from our in-house team of experts who themselves have many years of experience, dealing with virtually every conceivable aquatic situation," adds Greg. "If you're in London, come and see what we have to offer. We're always pleased to talk fish!"

Getting there

By tube: the store and showroom are just five minutes from Oxford Circus (Victoria, Bakerloo, Central line) and Great Portland Street (Circle Line, Hammersmith and City, Metropolitan) underground stations.

By car: if you drive, there is metered parking outside the shop or it is free on Sundays.

On foot: from Oxford Circus underground, start walking east along Oxford Street towards Tottenham Court Road. The first road on the left is Great Portland Street, and as you walk up here, we are on the left hand side.

From Great Portland Street underground, walk south down Great Portland Street and you will see the shop on the right hand side here.

The Aquatic Design Centre

Invites you to an evening of shrimp on Saturday 6th July 2013 from 6pm

Have a drink & snack as you peruse our excellent range of colourful freshwater shrimp & shrimp related products. Ask our resident shrimp expert questions.

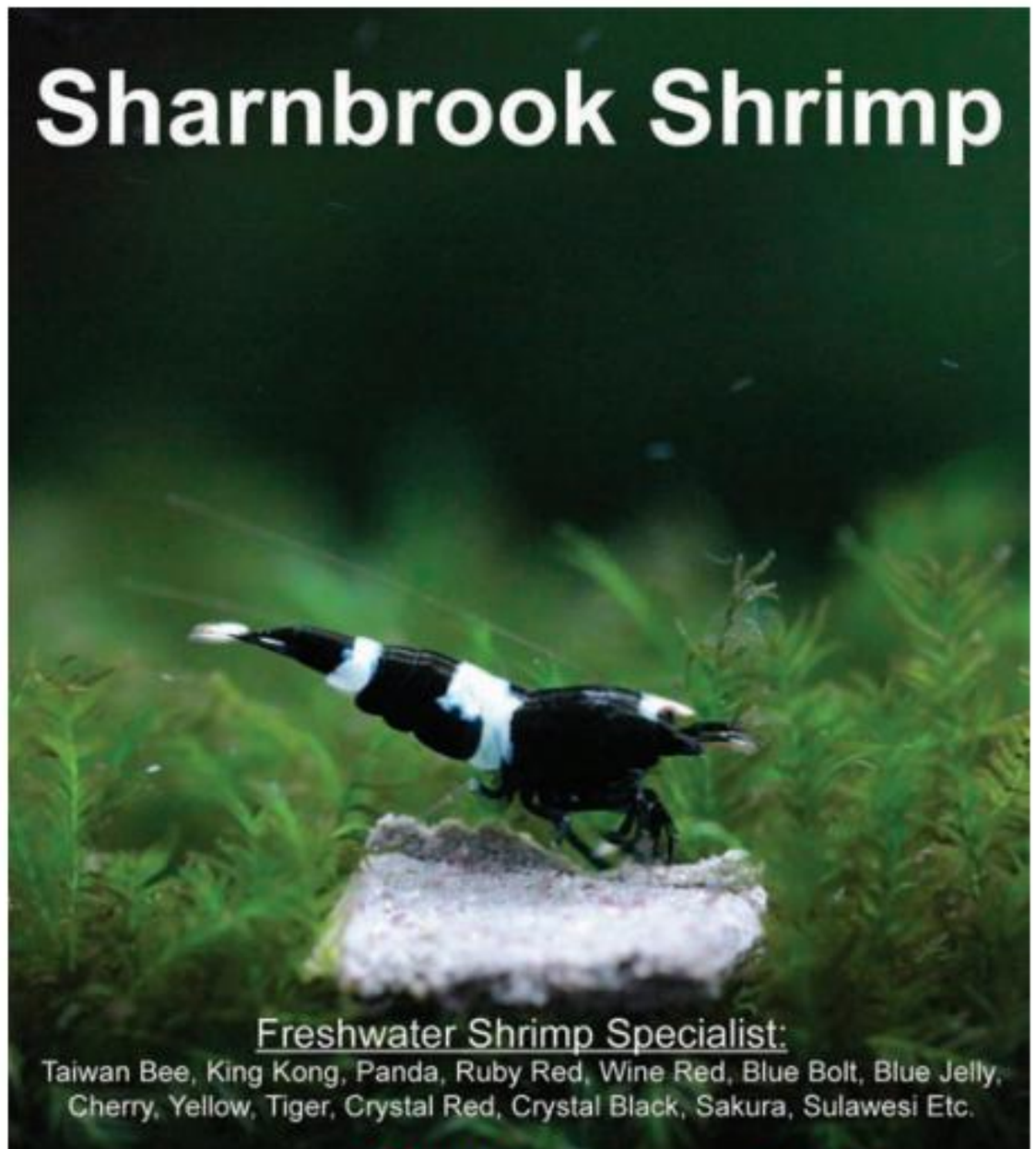
Some of the Shrimp Available:

Taiwan Bee Blue Bolt, King Kong, Panda, Ruby Red, Wine Red, Blue Jelly, Orange Eye Blue Tiger, Red Sakura, Cherry Shrimp, Yellow Shrimp, Orange Shrimp, Crystal Red Bee, Crystal Black Bee, Chocolate Sakura, Sulawesi Shrimp & others.
Including: Dennerle products, nano tanks, substrates, ADA Products, TMC Signature Series Tanks, Mosura Shrimp Food & more...

See you at: 109 Great Portland St, London W1W 6QG

Web: www.aquaticdesign.co.uk Tel: 020 7580 6764

Sharnbrook Shrimp



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At Aquatic Design we've been designing, carrying out aquarium installations and maintenance for over 25 years.

We work to the exacting standards demanded of architects, designers, film and TV industries, delivering on time and within budget.
We are the world's leading experts in aquatic design and our installations range from small to the large, from private homes to international headquarters.
If you have a project which requires an aquarium or pond installation please call us for free advice

Our Central London store has everything you need for any aquarium, be it freshwater community, planted aquascape, or marine. Our young, enthusiastic and knowledgeable team are ready to help out in 8 languages!
Come and browse over 350 tanks of marine and freshwater livestock.
We offer a huge range of fish, including rare and exclusive species, which are quarantined and dewormed prior to sale. All fish are sourced from responsible shippers with CITIES certificates where required.
Whatever your requirements we will be able to realize your vision, from beginners to expert aquarists.

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Talking plants

If you're setting up a new aquarium, then you will need to choose between either living plants or plastic substitutes, which are now often very realistic in appearance. The inclusion of living plants not only helps to create an attractive natural aquascape however, but it also improves the aquarium environment. Don Harper considers the possibilities.

Aquatic plants are part of the natural cycle. They convert the carbon dioxide produced by the fish to oxygen during daylight, by photosynthesis, and in addition, they use the nitrate that ultimately results from the breakdown of the waste resulting from the fish as a fertiliser. Aquaria without living plants are far more likely to be blighted by the growth of unsightly algae as a consequence, as this link in the ecosystem is broken.

The biggest range of aquarium plants is available by mail order, from specialist nurseries, but you can generally find a good selection in local aquatic stores as well. Here you can buy them straight from

It will take time for healthy plant growth to develop.

Java moss is an attractive and versatile aquarium plant. *PHOTO COURTESY BUCHLING AT THE GERMAN LANGUAGE WILKIPEDIA.*

A planting scheme needs to incorporate open areas, preferably at the front of the tank where the fish can swim easily.

of personal preference, but careful planning is important, so there will be no need to disturb the plants as they grow.

Planting schemes

As a general guide, taller plants should be situated at the back and around the sides of the tank, with one being used as a centre piece. By setting plants in small pots, so there is less risk of their roots blocking the slits of the undergravel filter, compromising its efficiency over time. The pots themselves can then be concealed by gravel.

Smaller plants can occupy the foreground, and some are suitable for growing over rocks and other tank décor, where they can be anchored in place. Although aquarium plants need little actual care, suitable lighting conditions will be essential if they are to thrive for any length of time in the aquarium. As with garden plants, so some aquatic plants need more light than others.

Inadequate or insufficient lighting remains the major cause of dieback of aquarium plants, which is a shame, because there are now very effective lamps available to maintain the optimum lighting conditions needed for their growth. (*See p24-25 of this issue* – Ed).

Choosing plants

One of the most versatile plants, whose growth cannot be replicated by plastic substitutes is Java moss *(Vesicularia dubyana)*. This originates from south-eastern Asia, ranging from parts of India eastwards, and including the island of Java. True Java moss will grow well either in an underwater setting, or it can be allowed to spread above the water-level as well, making it useful in a vivarium housing amphibians.

It spreads quite slowly, but its dense growth underwater provides a safe spawning ground for egg-laying species and also offers a retreat for young fry. A mass of Java moss can be easily be held in position on a piece of bogwood or rock by means of a rubber band, until it has established itself here.

Although Java moss prefers soft water, it is very adaptable in terms of its growing requirements. It is not a good idea to include it in a brightly lit part of the aquarium however, because here, algae will soon develop and choke the dense fronds. The only thing to do under these circumstances is to discard the plant and start again.

The pygmy chain sword plant (*Echinodorus tenellus*) is a good choice for the front of the aquarium. It has long been popular as an aquarium plant, being easy to cultivate in these surroundings. There can be variations in size however, between the different types. In general, they grow to no more than 5-7.5cm (2-3in) in height, although where these plants are crowded, their pattern of growth is more upright, so they appear taller.

Space out the plants in the foreground at the outset therefore, to create an attractive, low-growing and bright green array of vegetation here. In most

CONTINUES ON THE NEXT PAGE »

the water, and transfer them back to an aquarium environment with minimal delay. Their delicate foliage is easily damaged if it is allowed to dry out and so this can be the best option.

Rather than selecting individual plants, you may prefer to purchase a collection instead. These are intended for tanks of specific size, and take a lot of the guesswork out of what is required, provided that you have no strong preferences about the plants that you want.

It is always a good idea to wash the plants first in a solution containing a special aquarium disinfectant, to minimise the risk of introducing any diseases or parasites to the tank that would harm the fish. The way in which you arrange the plants in the aquarium is very much a matter

Popular Fish Keeping – Expert tips: Troubleshooting

Q Is it a good idea to add snails to my aquarium?

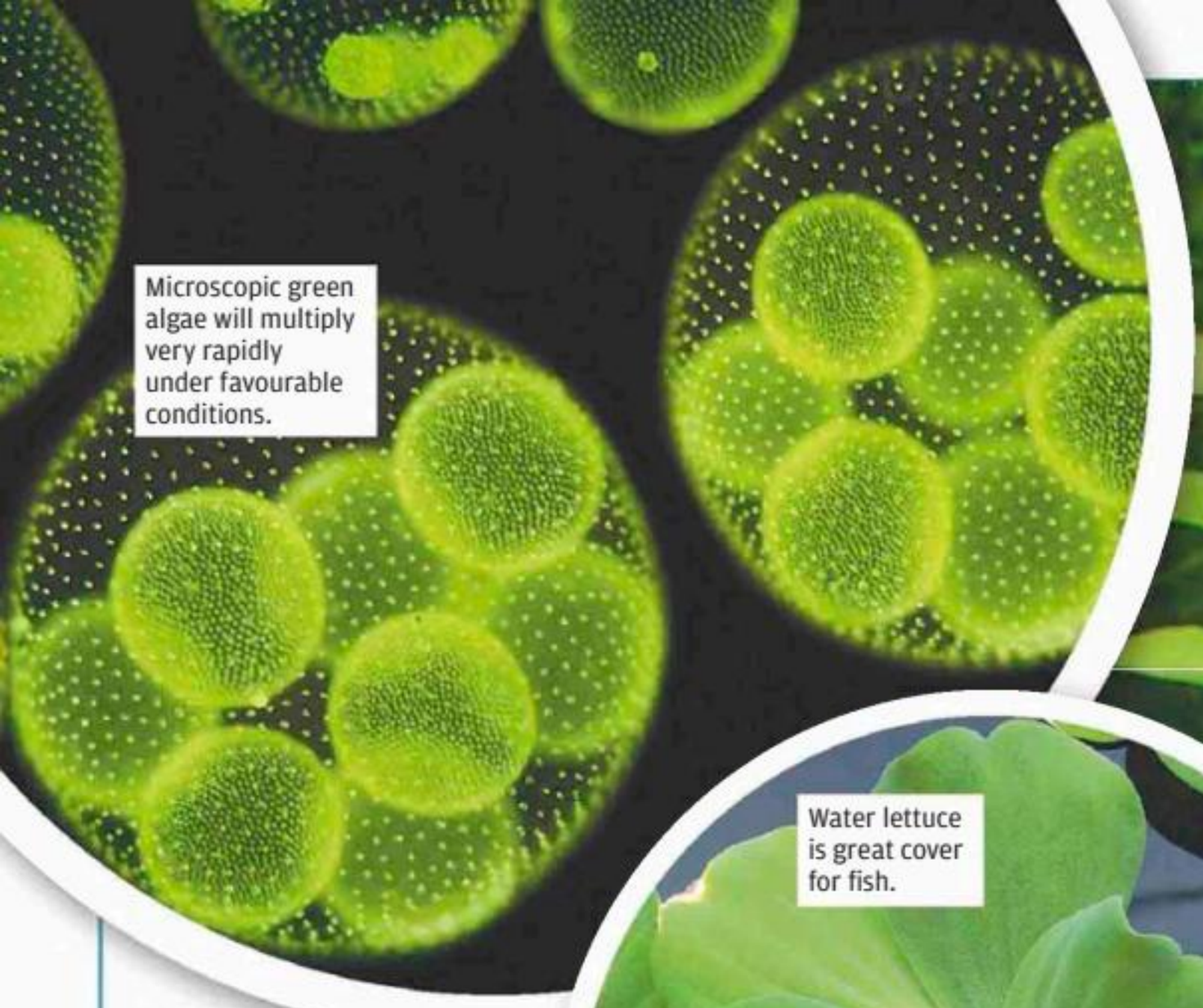
A Snails do add interest in these surroundings, and some are very attractive. But bear in mind that a number of species can reproduce very quickly under good conditions, and they may soon reach plague proportions.

Their appetite is likely to cause them to turn their attentions to aquarium plants, which may already have to cope with the attention of some of the fish as well. Since snails are hermaphrodite, with both sexes present in their bodies, so even if you have only two snails, they will both be laying fertile eggs.

Should you find that the tank is being over-run with snails, you can trap them quite easily using an inverted clean saucer, by placing fish food tablets or a piece of cucumber on the base at night. The snails will be attracted here to feed, and can be lifted out on the saucer in the morning.

On the other hand, if your aquarium contains freshwater pufferfish however, then it will probably be impossible to keep even a small number of snails alongside these fish, as they are likely to eat them.

Aquarium snails can lay huge numbers of eggs, so the aquarium can end up being overwhelmed by these molluscs.



Microscopic green algae will multiply very rapidly under favourable conditions.

Water lettuce is great cover for fish.

Dwarf hygrophilia often is a favourite of aquarium snails.

cases, pygmy chain sword plants dislike hard water, which makes them ideally suited to an Amazonian tank, featuring fish such as tetras.

Floating plants such as water lettuce (*Pistia stratiotes*) can be very valuable in the aquarium, offering the fish cover and also screening part of the water surface, creating suitably darkened areas for catfish and others which tend to avoid bright light. They are also favoured by fish that live close to the water surface., such as hatchetfish.

Water lettuce itself will not thrive without good artificial lighting in the aquarium, but it must not come into contact with the droplets of condensation on the cover glass, as with other floating plants. If water drips down persistently on to the plants, it will cause them to turn black and die off.

Under favourable conditions however, it will grow very rapidly, with small plants developing as offshoots on stolons connected to the adult plant, rather like strawberry runners. These stems rot way in due course, leaving the young plants on their own. As they grow, their white roots will turn black - this is quite normal, and not a sign of fungal attack.

Possible problems

Pests tend not to strike aquarium plants as readily as those in the ponds, but snails can prove to be a problem. Dwarf hygrophila (*Hygrophilia polysperma*) for example is normally a very easy aquatic plant to cultivate in aquarium surroundings, provided that there is not a large population of snails here. They are otherwise likely to strip the leaves in preference to almost other plants growing in the tank.

Cuttings need to be weighed down in groups, and should soon root and grow, to form a dense clump of plants. They can also be arranged in a line, to provide good cover at the back of the aquarium. Although very undemanding in terms of its own growing requirements, dwarf hygrophila will tend to turn the aquarium water more acidic.

Unfortunately however, it is not always possible to grow plants successfully, even under ideal conditions, because certain fish, notably large cichlids, will dig them up, while others may eat them. If you are a keen underwater gardener, you will need to choose your fish accordingly!

Also, bear in mind that most aquarium plants are of tropical origins, and so will not be suitable for cold water tanks. If you want a more varied selection, then combining some cold water plants with plastic representations of tropical plants is a possibility, even if

"Floating plants such as water lettuce (*Pistia stratiotes*) can be very valuable in the aquarium"

A common hatchetfish (*Gasteropelecus sternicla*). These fish require floating plants in their aquarium.

does not meet the approval of purists!

Getting the best from your plants

There has been a marked trend over recent years for those aquarists who are looking to create lush plant growth in their tanks to invest in carbon dioxide (CO_2) systems, such as the aquaGro system marketed by TMC. This reflects the fact that plants are expected to grow in a different way in the home aquarium compared with the way that they do in nature.

In their natural habitat, the vast majority of plants grow out above the water surface into the air, when they can access an unlimited amount of carbon dioxide from the atmosphere. Within the aquarium, however, they tend to be trapped below the water level, and so are not exposed to the same concentration of this gas, which they depend on as an energy source.

Aquatic plants need CO_2 passing over their leaves if they are to thrive, as part of the process of photosynthesis. As a result, the most effective method of dosing them with this gas has proved to be using a pressurised bottle and regulator, which is not the cheapest method, but will prove to be reliable. It ensures a consistent output of the gas into the water, ensuring a constant supply.

Some fish, such the flying fox, will assist in curbing algal growth naturally.

Algal growth

Not all plants are necessarily welcome in the aquarium though, with microscopic algae often discolouring the sides, and coating other surfaces, including rockwork. Algae may even colonise the leaves of aquarium plants, preventing them from photosynthesizing effect, so they die.

The problem is often worse in aquariums with plastic plants though, simply because the algae face no competition for the nitrate that results from the nitrogen cycle, when the fish's waste has been broken down. If you keep fish that naturally feed on algae, such as the flying fox (*Epalzeorhynchos kalopterus*), this may, however, not be a problem.

Snails too may help to control algae, although they are more inclined to target larger plants, favouring new growth in particular. Rather than having to strip the entire tank down though, there are algal cleaners that are available to clean the glass or acrylic areas of the tank. Be careful though, especially when using scrapers not to damage he surface, which will predispose to further algal growth in the future.

It has long been assumed that excessive lighting predisposes to this problem, but more recently, it has emerged that CO_2 levels may also be a significant factor, helping in the battle against algae. In the case of aquaria where CO_2 is being injected into the water, it is actually a lack of this gas that can be implicated as the main source of the problem.

Taking a CO_2 reading

It is possible to assess the dissolved CO_2 level in your aquarium very easily, by means of a drop check, which is included in TMC aquaGro range. The test is very simple to use, with the drop checker being filled with 4dKH water and three drops of the CO_2 reference solution. You then simply place the drop checker in the aquarium. The solution will change colour according to the level of diffused CO_2 gas that is present within the aquarium.

There are three options:-

- **Blue:** this indicates that the CO_2 level is sub-optimal, and the plants are not receiving sufficient CO_2 to encourage their growth.
- **Green:** No need to worry in this case, as this is optimum level to support good growth, with a reading of about 30 parts per million (ppm).
- **Yellow:** In this case the level of CO_2 is too high for fish and invertebrate life, but if you only have plants in the aquarium, they would grow very well!

WIN A FISH TANK

Competition time

Here's your chance to win one of our fantastic prizes, with three biOrbs on offer, courtesy of manufacturers Reef One Ltd. These acrylic aquariums have transformed the hobby, with their attractive, contemporary styling, and are suitable for a wide range of fish.

WIN A STYLISH biOrb® AQUARIUM

The biOrb LIFE range is intended for fancy goldfish or small temperate fish, but with the addition of a biOrb Heater Pack or Intelligent Heater, you can adapt it very easily to accommodate tropical species if you prefer. For an aquarium that oozes style, the biOrb LIFE 30 is nevertheless very practical. It's compact, making it easy to site and yet it has enough room inside to allow you to get creative with plants and décor.

Like all biorbs, the biOrb LIFE 30 uses special ceramic media to provide biological filtration, which offers a surface area equivalent to the size of a football pitch. Any excess waste is collected and held in a filter cartridge at the base of the biOrb. To maintain your biOrb LIFE, all you need to do is simply replace the filter cartridge every four weeks and change a third of the water.

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- biOrb LIFE 30 litre aquarium
- 12V Intelligent LED Light
- Ceramic media
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- Fish food
- Instructions

Dimensions

- Height and width: 41cm (16in)
- Depth: 23cm (9.5in)
- Weight when full: approximately 35kg (78lb)

FIRST PRIZE
biOrb LIFE 30 litre, with a (rrp) of £237.58

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You can find the entire biOrb range on Reef One's website at **www.biorb.co.uk**

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☐ Goldfish ☐ Cichlids ☐ Livebearers ☐ Catfish ☐ Labyrinth fish

☐ Characins (eg tetras) ☐ Tropical cyprinids (eg barbs, danios, rasboras).

I have the following number of fish in total: _____

I have been keeping fish for: _____ years

My favourite article in this issue is: _____

I also keep pond fish ☐ a marine aquarium ☐ (tick box if applicable)

Note: The judges' decision is final. No correspondence can be entered into. The names of winners and their respective prizes will be published in a future edition of *Popular Fish Keeping*. Winning entries will be drawn in reverse order, starting with the third prize.

☐ Tick box if you DO NOT wish to receive information from Kelsey Publishing and Reef One Ltd.

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SECOND PRIZE
biOrb CLASSIC 60 litre, with a (rrp) of £187.52

➤ You'll find the biOrb FLOW is a really easy aquarium to set up and maintain. Everything needed to set up your aquarium is included in the box. It uses the tried and tested biOrb filtration and also has a built-in LED light. It represents the latest addition to the biOrb family and is ideal for keeping small fish or shrimps, as well as being compact enough to place on your desk or in a small space around the home. The tank holds 15l (3.2gal) and weighs approximately 18kg (40lb) when full.

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THIRD PRIZE
biOrb FLOW 15 litre, with a (rrp) of £94.45

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Have Guppies: will travel

There can be more to fish keeping than just having a tank in your living room. Carl Stewart and Derrick Clayton are devoted Guppy breeders who take great pride in exhibiting their guppies at shows across the UK and Europe. Susie Kearley caught up with them to find out how they got started and to hear about how they became.

SUSIE KEARLEY
Aquarium writer

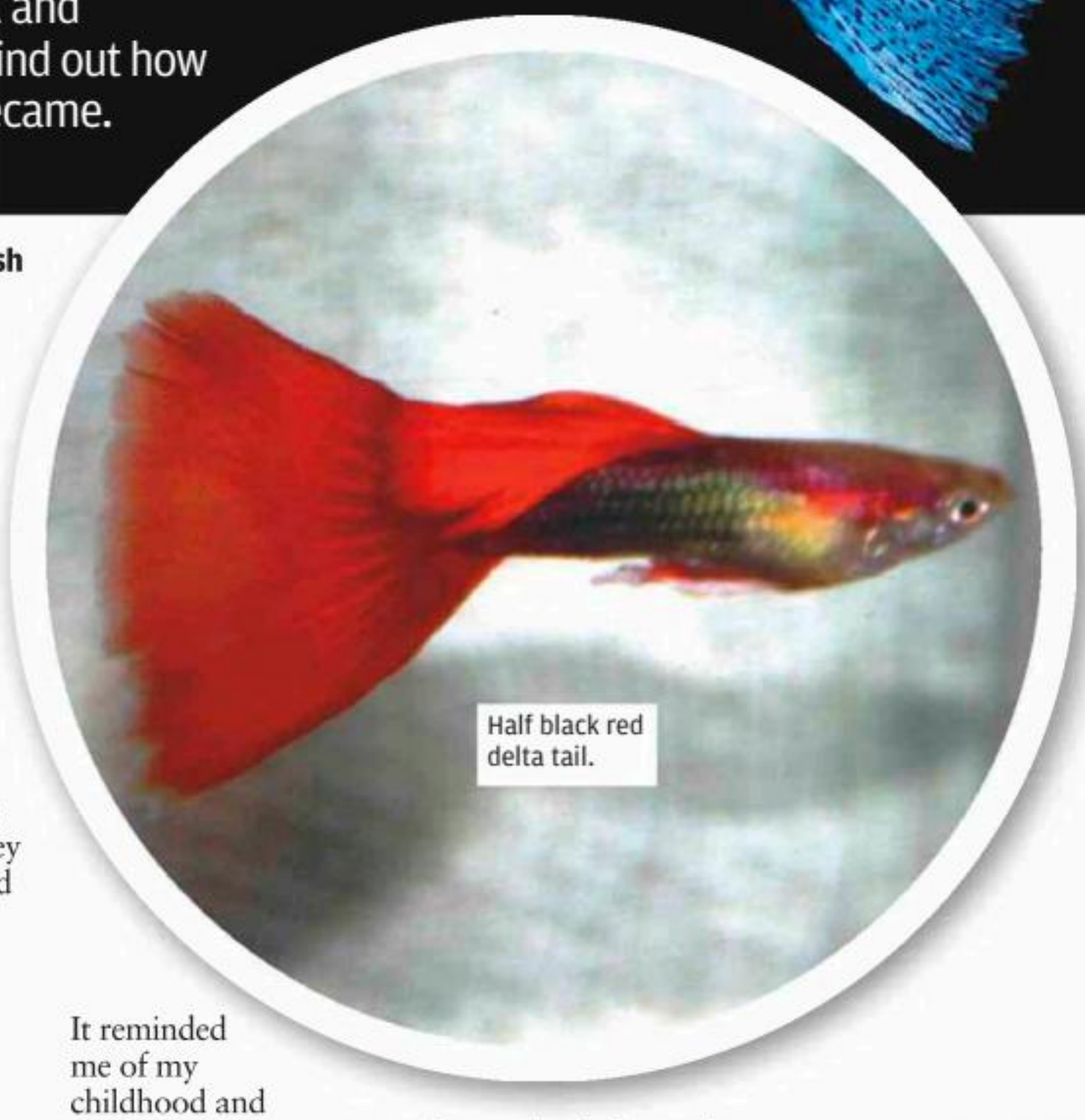
Below Carl with his certificate, having won Best in Show at York back in 2011.

Below Derrick Clayton, seen right, receives the 2010 International Show Winners' Shield from Jordan.

SK: What first drew you to fish keeping and what made you decide to breed Guppies?

Carl: "I was first attracted to keeping tropical fish when I was a young boy. I always wanted dogs, rabbits or something cuddly, but with my parents at work all day, I had to compromise - so I got my first tropical fish tank.

"Many years later, when I was married with children of my own, I found myself getting them an aquarium as well, but as they grew up, they developed other interests, and I was left with the fish tank.



Half black red delta tail.

It reminded me of my childhood and particularly my parents trying to catch baby Guppies to save them from being eaten by the adult fish!

"I then decided to breed tropical fish and started off with some fancy Guppies. These are effectively pedigree fish, bred to conform as closely as possible to a judging standard for show purposes, so that the different varieties can be distinguished by their consistent appearance.. It is up to the breeder to select the best male to pair with the right female. I started doing so, and have become fascinated by this process.

"Fancy Guppies are getting better and better every year. You can see many new and exciting colours emerging. Guppies of this type are also known as 'high breeds'

Carl and Derrick's Guppies

Carl's Best In Show Guppy, at the Kettering Show 2013

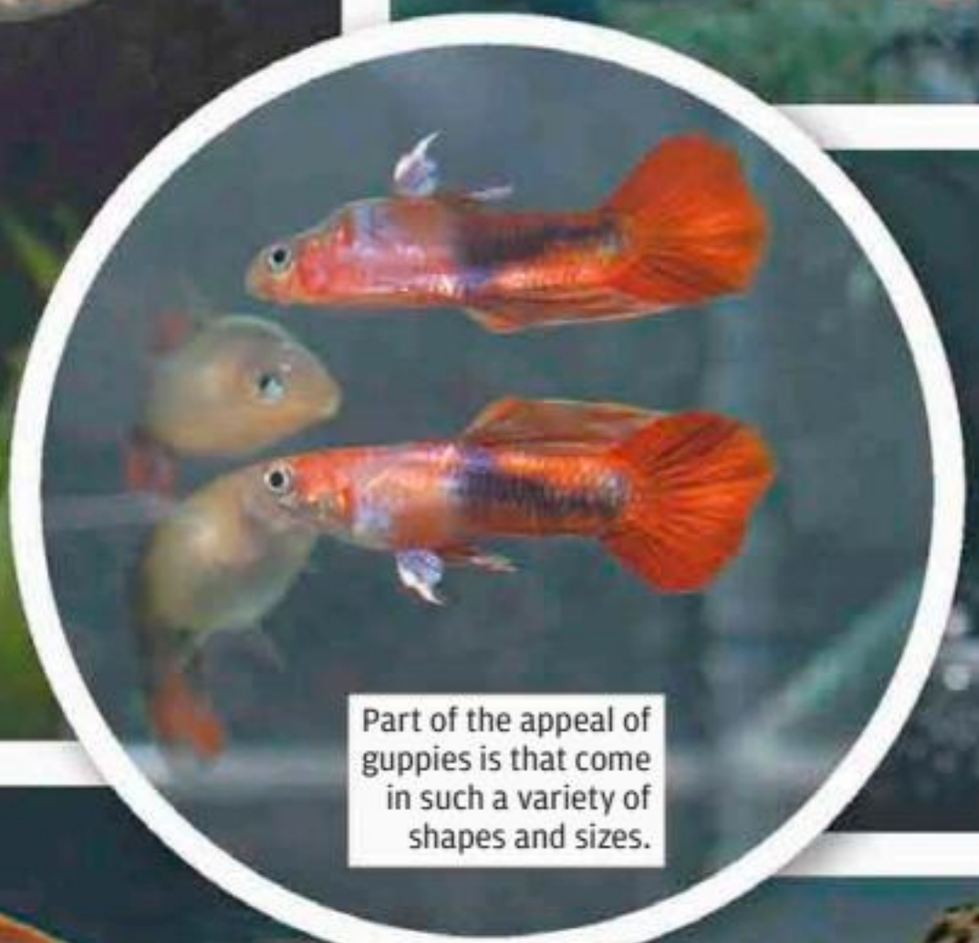
A superb albino Moscow blue delta tail.

A round tail pink Moscow.

A half black yellow delta tail.

A pair of blonde red round tails.

A pair of red spear tails.



Part of the appeal of guppies is that come in such a variety of shapes and sizes.

A female in great condition.

Red spade tail.

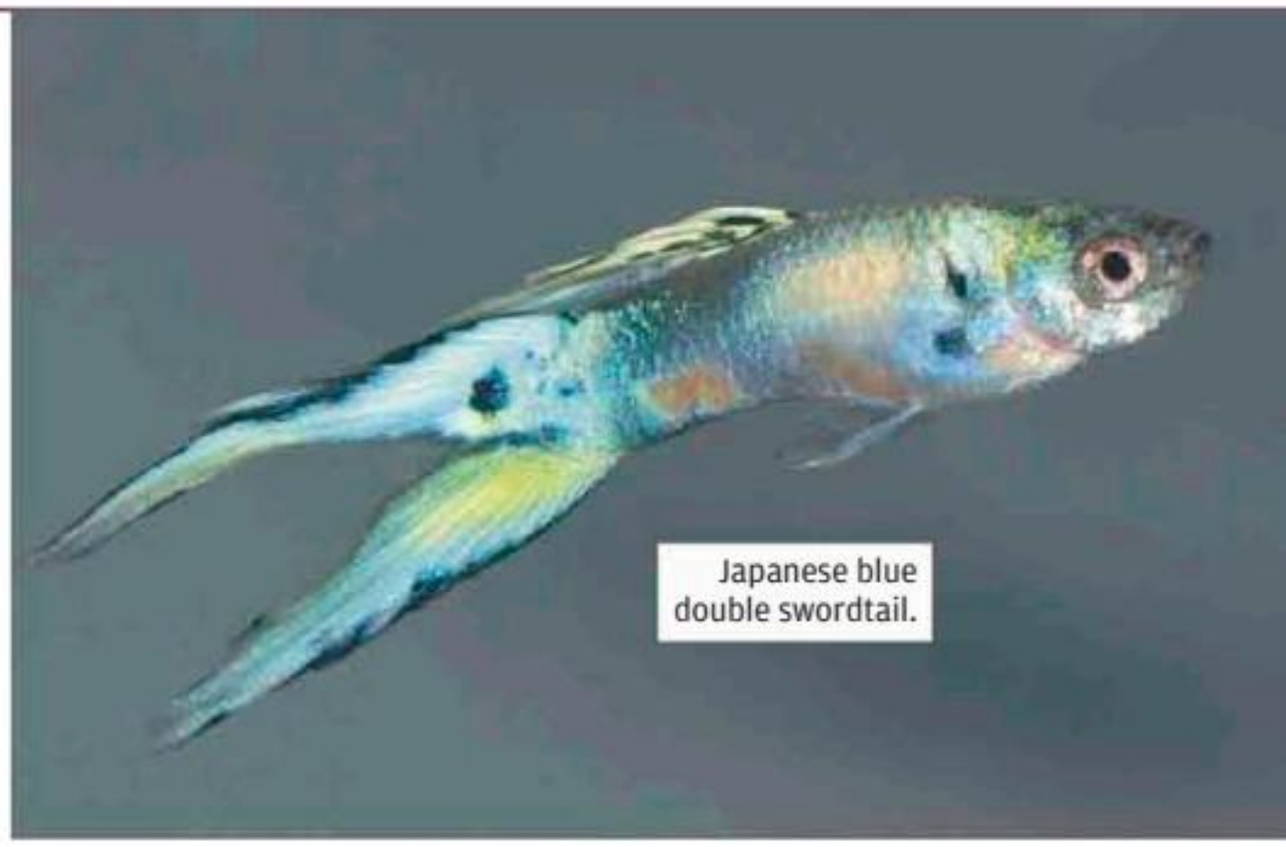
Snakeskin round tail.

TURN OVER TO UNDERSTAND GUPPY TYPES »

PHOTOGRAPHS COURTESY CARL STEWART & RALF LOCH

More show Guppies

Delta tail blonde red Japanese blue.



Japanese blue double swordtail.

PHOTOGRAPHS COURTESY CARL STEWART & RALF LOCH

Spade tail male.

A pair of spade tail guppies.

because you would never find them in the wild - they have been bred over many generations to develop the bloodlines to where they are now."

Derrick: "My interest in freshwater tropical fish keeping started while I was still at school in 1959. I had a tank in my parents' lounge that was fine until it sprung a leak! I was then banished from having any more tanks inside. So when the local scout troop obtained a new scout hut, I bought the old one for the timber, and transported it home on a wheelbarrow.

"I used it to build a shed about 2.4x1.8m (8x6ft), scrounged a few tanks and an old paraffin heater, and I was away. The local aquatic society was thriving and the help that I received from the older members was just great. It set me on my way!

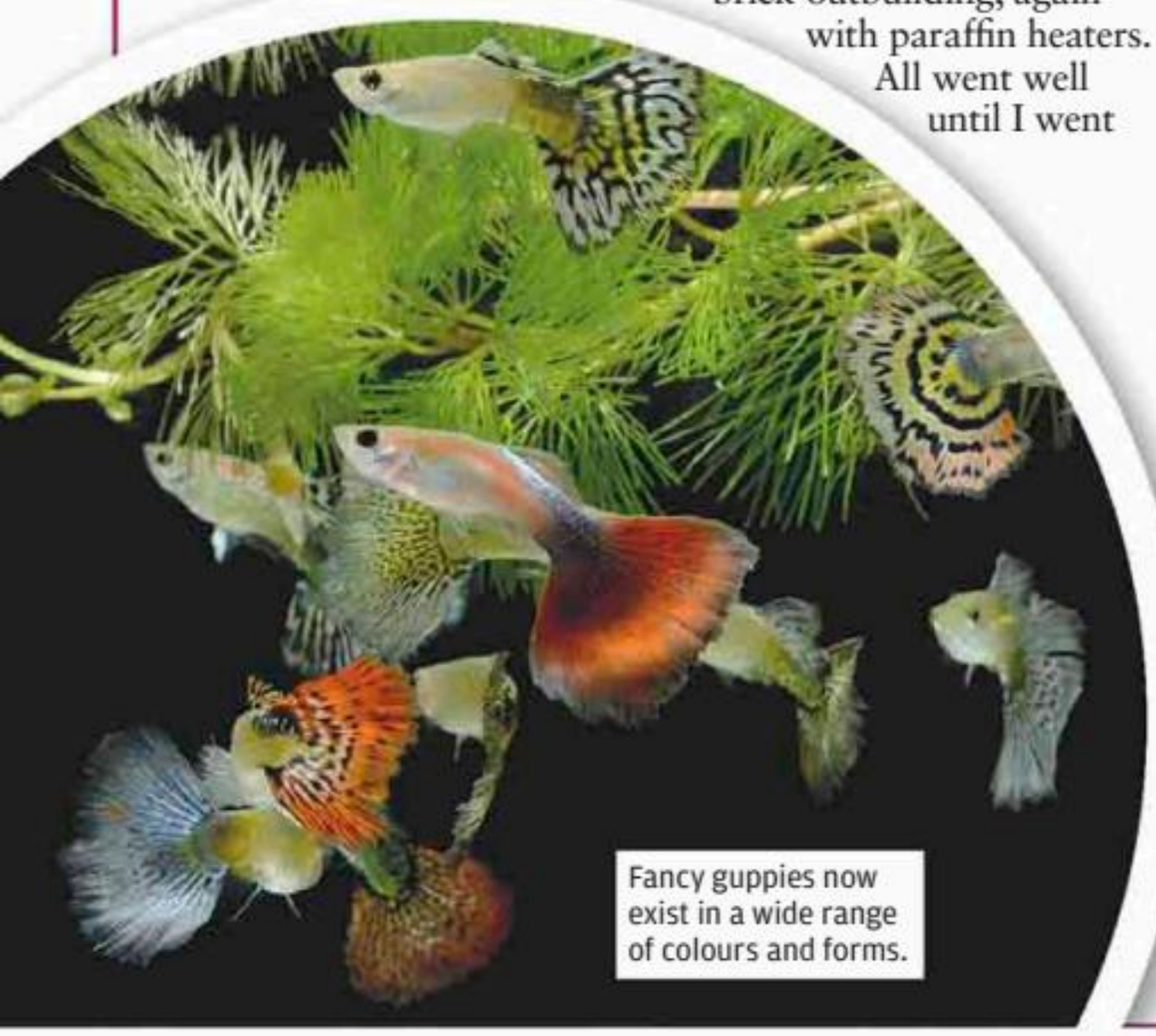
"Years later, having married and with a home of my own, I then set up my second fish house in a small brick outbuilding, again with paraffin heaters. All went well until I went on holiday and a neighbour, who had kindly volunteered to look after the fish house, managed to set it on fire! After that, I just kept a smaller number of fish in our home.

"So it all began about 50 years ago with all the common freshwater tropicals - tiger barbs, angelfish, gouramis, Siamese fighting fish and livebearers that were readily obtainable back then. I drifted in and out of the hobby over the years, eventually returning in 2005 with my current, small fish house. I keep a few ancistrus (bristle nose) catfish but otherwise, only fancy Guppies.

"Unlike most other freshwater tropical fish, you can develop your own strains and colours - it's not unlike cultivating roses! Establishing new strains can be a fast process too. With fancy Guppies, they breed so prolifically that you get several generations in one year."

Derrick's Top showing tips

"If you are interested in showing, make contact with other hobbyists, join the club and try to get to events"



Fancy guppies now exist in a wide range of colours and forms.

SK: Can you tell me about the history and development of fancy Guppies?

Carl: "I think this is really a question best addressed to our friend Derek Jordan, as he has made a particular study of this area."

Derek Jordan: "In 1866, John Guppy sent a small fish to London that he had collected from streams in Trinidad. Dr Albert Günther, a famous Anglo-German ichthyologist working at the British Museum then named the fish as *Giradinus guppyi*, in honour of Mr Guppy.

Everyone therefore assumes that John Guppy was the first person to discover and describe the wild Guppy, which bears his name. However, four years earlier, a Spaniard called De Filippi had found this fish on another Caribbean island, Barbados. He assumed it to be a new genus and species and named it *Lebistes poeciliodes* (*Lebistes* simply means 'a kind of fish').

Earlier still though, in 1857, an amateur German biologist called Julius Gollmer caught some of these fish in the Rio Guaire near Caracas in Venezuela, on the South American mainland. He sent some specimens preserved in

Question and answer session with international judge Harmann Magoschitz at the 2012 Fancy Guppy UK International Show.

A rare quiet moment at the event.

Dennis Babe, one of five judges at the 2012 Fancy Guppy UK International Show.

jars to the Imperial Prussian Academy of Science in Berlin.

The scientists there were not impressed, however, and they only gave him a small payment before placing the jars containing the specimens in the archives. It is only because these original specimens were overlooked that the Guppy is not known today as the Gollmer, as should have been the case as Julius Gollmer discovered it first!

The first recorded live Guppies to enter Europe were imported in December 1908 to Hamburg, Germany, by Carl Siggelkow. German hobbyists were so impressed with the reproductive rate of the Guppy that they nicknamed it the *millionenfisch* (translating as 'million fish').

The first fancy Guppy in today's terms that became widely available was the swordtail variant. Although swordtail guppies do occur in the wild, the double swordtail does not, and this variety, with sword-like extensions on the top and bottom of its caudal (tail) fin was initially recognised and developed around 1928.

The first International Guppy show was held some time later, during 1954, also in Germany. It attracted thousands of visitors as well as extensive radio and television coverage.

SK: What are the characteristics of fancy Guppies that impress judges?

Carl: Firstly, there are established judging standards laid down, and you have to breed your Guppies as close to the relevant standard as you can. The guppy has to be the right size and have the right shaped tail for its class. The dorsal fin also needs to be the correct shape and size, and the colouring needs to be clean and comply with the standard for that variety.

SK: Do you take them to shows?

Carl: Yes. There are Guppy shows all over Europe and they are split into two types. The first type is a trio show, which involves showing three males, judged against the standard. All the males have to be similar to each other in appearance. The second type is a pairs event, where you exhibit a matched male and female.

The Guppies are judged by five judges at the show, each of whom gives points for the Guppy's various characteristics, such as its size, shape, dorsal fin, tail, and overall vitality. When all the scores are in, the highest and lowest scores for each Guppy are omitted, leaving the three middle scores. Your average score is then calculated from these figures, and this is used to determine the winners.

I try to attend most of the Guppy shows in the UK and Europe. They provide a good opportunity to speak to other breeders, so I always find them very helpful and enjoyable. You can obtain answers to the many questions you may have, and you get to meet some fantastic people who share your interest. Many of the shows also provide the opportunity to obtain new breeding stock as well.

Derrick: I attend the UK Fancy Guppy League shows throughout the year. They are usually hosted by the local aquarist society. The final is our International Show. We have shows in Kettering, Sheffield and York. After the first leg, Carl is currently at

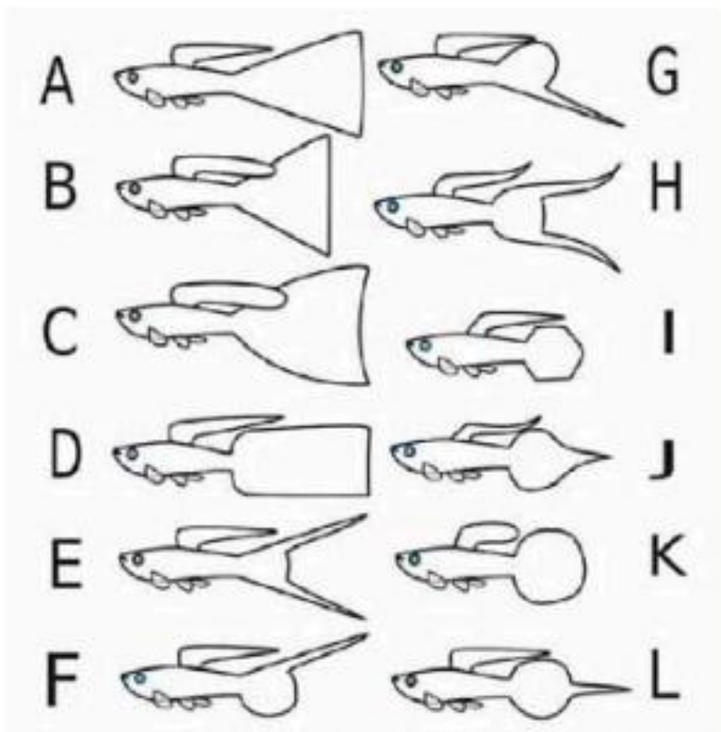
Guppy types

Recognised types of fancy Guppies can be bred in a host of different colours too.

Large strains:
A - Flag tail
B - Triangle tail
C - Fan tail
D - Veil tail

Sword strains:
E - Double sword
F - Upper sword
G - Lower sword
H - Lyre tail

Short strains:
I - Spade tail
J - Spear tail
K - Round tail
L - Pin tail



ARTWORK COURTESY LUCAS3. PD.

TURN OVER FOR THE PFK GUPPY FACT FILE »

the top of the league - but just wait!

SK: Do Guppies have any funny quirks?
Carl: Yes, they definitely do! The one that always makes me smile is when I go into the room where I keep all my tanks (just short of 100), and all of the guppies will come to the front for food. However, when my wife does the same thing, they head to the back of their tanks! They know the hand that feeds them!

SK: What is your proudest moment as a fish breeder/ keeper?
Carl: I have newborn fry on a regular basis but I still feel proud when I see them at only a few hours old. Another very proud moment for me was winning the Best in Show award for the first time.
Derrick: When I walk into the fish house and think every fish looks fit and well.

SK: What type of people buy from you?
Carl: People from many different backgrounds buy Guppies from me for all sorts of reasons. I was once even asked if I could supply some Guppies for table decorations for a wedding, but I declined. I was concerned for the health of the Guppies and all I could think was that some people might add things to the water such as alcohol, and endanger the fish.
Derrick: The people who buy from me are usually other hobbyists or beginners, especially those interested in showing their fish. I only have a small surplus, so I don't sell young in large numbers.

SK: What are your breeding tanks like?
Carl: My breeding tanks are basic, so I can keep a close watch on the well being of the fish. Set-ups of this type are also easier to maintain. There is no gravel on the bottom because I want to see if the Guppies are eating all the food I give them, and it enables me to monitor any leftovers. I include a clump of Java moss in the tanks to keep newly born fry safe if they are produced while I am at work. Each tank has two filters so that I can replace one while the other keeps working. The tanks are 25x25x45cm (10x10x18in) and each holds approximately 30l (6.5gal) of water.
Derrick: My tanks are small and bare-bottomed. The fish house is brick built and fully insulated, with racks either side and a door at each end. There are four tiers extending along each side, and six tanks in each row on one side (12l (2.6gal); 21l (4.6gal); 37l (8.1gal) and 53l (11.6gal) respectively), and four tanks in the rows on the other (12l (2.6gal), 18l (4gal), 33l (7.3gal) and 46l (10gal)).

SK: What would you say to someone thinking of breeding fish?
Carl: Do it and enjoy it. You will meet people with the same interests. But don't go into it thinking you will make a lot of money. You won't!!
Derrick: Read, read more, and take it slowly. With fish keeping, all the problems seem to be at the beginning. Also, if you're serious about showing, start with only one strain and don't be like a kid in a sweet shop, selecting one of everything!

SK: Any other thoughts?
Carl: I keep to a strict routine with my fish breeding. I think this is important. I have a semi automatic water change system and add 2l (0.4gal) of clean water every day to my tanks. I feed the Guppies three times a day, with the first feed being around 6am. I carry out a visual check on the fish in every tank at the same time.

I give the next feed as soon as I get home from work, at 4.30pm. Again, I carry out another check at this stage, to see all the fish appear healthy. Then at 6pm, I add the clean water and carry out the last feed at 8.30pm. The lights go out automatically at 9.30pm, so it is important to feed the fish at least half an hour beforehand.
Derrick: If you are interested in showing, make contact with other hobbyists, join the club and try to get to events. You will be made very welcome. From a welfare perspective, don't over-feed or over-crowd your fish, and ensure that you carry out partial water changes regularly.

SK: How can readers find out more?
Carl: I have recently become chairman of the Fancy Guppies UK club and I travel to tropical fish club meetings and give talks about show guppies around the country, so I may be at an event near you soon! Otherwise, the club's website is www.fancyguppies.co.uk It contains a lot of information for anyone wanting information information about Guppies - and caters for more experienced breeders and exhibitors too.

DID YOU KNOW?

The female Guppy is able to store sperm and so need only mate once to produce successive broods, at intervals of perhaps a month apart.

Popular Fish Keeping Guppy fact file

1 Size: Males grow to 2.5-3.5cm (1-1.4in); females are larger when adult, averaging 4-6cm (1.6-2.4in).

2 Water conditions: temperature range 20-27°C (68-81°F); prefers hard water and some breeders add a little aquarium salt to the tank water as well.

3 Housing: lives in groups, and tolerant by nature, although they will cannibalise their own young at first, especially if there is little cover in terms of plant growth in the aquarium.

4 Breeding: females produce broods of anywhere up to 50 young. These fish may themselves be mature by three months old.

5 Lifespan: Guppies can live for a year or so.

A male snakeskin delta tail.

Q&A

In each issue, our team of fish-keeping experts will be answering the questions that you want answered. **Why not email us with yours to pf.ed@kelsey.co.uk?**

A kissing gourami, showing its mouthparts.

Q Why do kissing gouramis kiss each other? Does it signify that I have a pair?

A It seems most likely that this strange kissing ritual has actually evolved as a way of settling disputes, without the fish having resorting to more aggressive behaviour, rather than as a sign of affection. It could be a trial of strength. Kissing gouramis (*Helostoma temminckii*) will anchor their fleshy lips together, until one breaks the contact.

You cannot sex these fish visually outside the breeding period - only when the female then swells with eggs can they be distinguished. There are two colours in existence - the natural grey form, and the more commonly kept rose-pink domesticated variety. These do not reflect a difference in gender.

Q Do fish actually sleep?

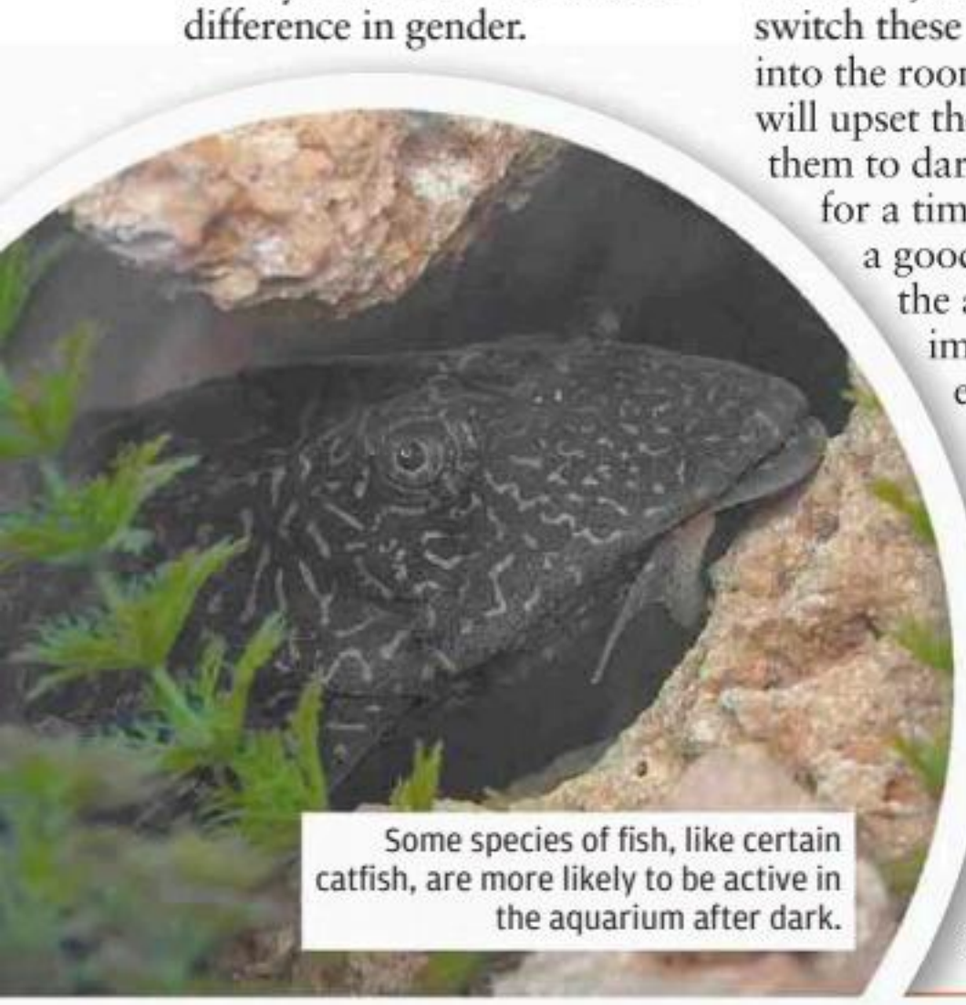
A There is no doubt that they undergo periods of inactivity, but they still have to be wary, even after dark. This is the time when nocturnal hunters such as certain catfish start to become active, seeking to catch their prey, which can include other fish.

The appearance of fish also alters after dark, with brightly coloured individuals often becoming much paler at this stage. This change in coloration can occur quite rapidly - within minutes of all the lights being switched off. It is quite normal and not a sign of ill health in most cases, as their normal coloration will soon reappear.

Do not position bright lights close to the aquarium therefore, because if you switch these on when coming into the room after dark, this will upset the fish, causing them to dart around wildly for a time. It is also not a good idea to turn on the aquarium lights immediately when entering a dark room. Rely on the main room lights at first, and wait for a few minutes, to allow the fish to adapt to this change in their environment.

Many aquarium fish do not like bright lights in any event, inhabiting fairly dark stretches of water. Suitable retreats, such as artificial caves and a well-planted area around the sides and back of the tank will help to give nervous fish of this type a greater sense of security, as well as floating plants placed on the water surface.

"This strange kissing evolved as a way of settling disputes"



Some species of fish, like certain catfish, are more likely to be active in the aquarium after dark.

Q We live in a rural area, and our electricity supply can sometimes be erratic, causing power failures. Our son has just set up a tropical fish aquarium - what should we do in the event of a power cut ?

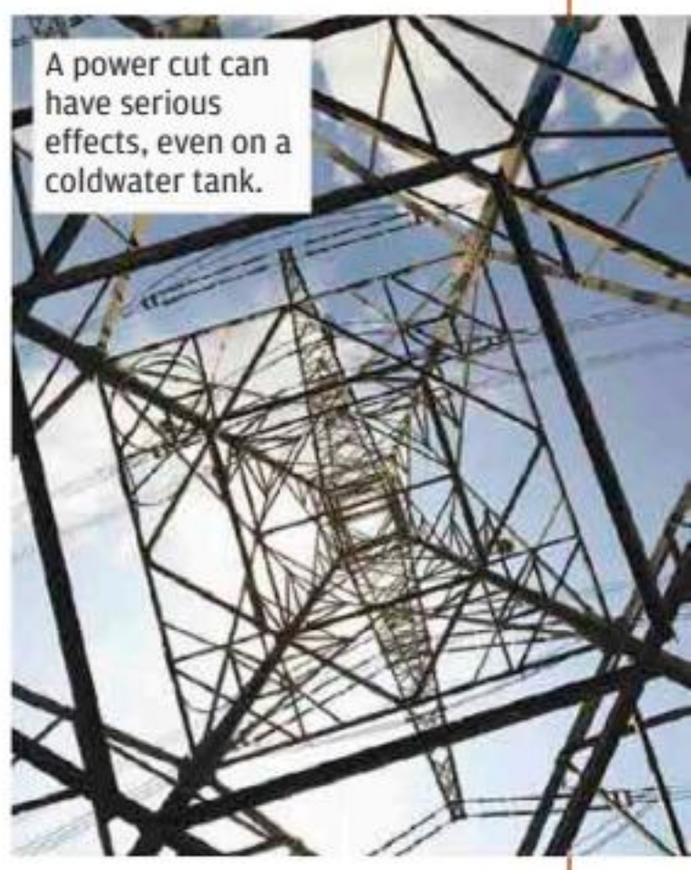
A When there is a loss of power, not only will the water temperature start to decline in the aquarium, but aeration of the water will cease. The biological efficiency of the filter will be compromised, and the lights will go off as well.

Perhaps surprisingly, the most serious long-term effects may be on the filter, but immediately, remove the electrical plugs from the sockets and cover the aquarium, so as to slow the rate of heat loss from the water. A thick blanket or even a duvet can be used for this purpose. Provided that the room itself is reasonably warm, then the temperature should only decline slowly, enabling the fish to adjust accordingly, and hopefully, before long, the power supply will be restored.

What to do afterwards

Start by removing the cover as it will be a fire hazard if it is left in place once the system is operating again. Then reconnect the power supply. The heaterstat will switch on, and the water will warm up slowly, minimising the stress on the fish. The other equipment such as the filter and lights should start working again too.

For a week or so afterwards, carry out more frequent water quality checks, particularly for ammonia and nitrite, to see how badly the beneficial bacteria in the filter have been affected. Be prepared to carry out more frequent water changes during this period if



A power cut can have serious effects, even on a coldwater tank.

levels have risen, ensuring that you have an adequate supply of water conditioner available for this purpose. It will also be worthwhile adding a beneficial bacterial culture to the filter. This should help to regenerate the bacterial population here more rapidly than leaving the existing bacteria to do so on their own.

Try to avoid stressing the fish, and do not feed them immediately, as they are unlikely to eat straightaway if the water temperature has dipped, and any uneaten food will simply pollute the water. Watch for stress-linked problems in the fish, notably fungus, and be prepared to treat this without delay. Hopefully though, they should be fine, especially if they are well-established in their surroundings.

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Scorchers for your tank!

Chinese fire-bellied newt on land

RIGHT Make sure your aquarium has a fitted hood because they can be talented escape artists

It is not just fish that will thrive in aquarium surroundings, but you can also keep a variety of reptiles and amphibians too, using similar equipment. Here Greg Jennings profiles the ever-popular fire-bellied newts.

These attractive amphibians have been kept as pets for many years, partly because they are very easy to maintain, even if you have never kept newts of any kind before. Provided that you have an aquarium, along with a suitable hood because they can prove to be talented escape artists, then you are well on the way to meeting their needs. Fire-bellied newts can be kept at room temperature without any additional heating, and they are very straightforward and inexpensive to feed.

There are two separate species that you may encounter, with the smaller form being the Chinese fire-bellied newt (*C. orientalis*), which grows to a maximum size of about 10cm (2.5in). It has black upperparts and contrasting orangish-red underparts broken by variable black markings. This contrasts with the relatively large Japanese species (*Cynops pyrrhogaster*), which can grow to a length of about 12.5cm (5in) overall, and is often very similar in colouration.

Apart from this difference in the size of adults though, the Chinese form has a smoother body, with less prominent parotid glands behind the head. Furthermore, the tip of its tail is not so sharply pointed as that of its Japanese relative, being rounded in appearance.

Japanese fire-bellied newts are more variable in terms of colouration. Their upperparts can range from dark brown to black, while their underparts are typically fiery red, with variable black patterning evident here, which allows individuals to be distinguished quite easily. Sometimes, their reddish coloration may be more extensive, or mixed with white dots. Six distinct races are recognised, varying in terms of size and other features, including the patterning on their underparts.

Housing

Both species need similar care, and are largely aquatic by nature. A partitioned tank, affording an easily accessible dry area of land, is ideal. This divider can be put in place very easily at one end, using a piece of glass or perspex, taking up no more than a third of the area and allowing for a water level of 22.5cm (9in).

Use special silicone aquarium sealant to anchor the barrier in place. Don't use a general diy sealant, as this is likely to contain harmful chemicals, and amphibians, with their sensitive skins, are particularly vulnerable to any pollutants in their water. Fill the area behind the barrier snugly with a

Breeding these newts in a home aquarium is quite feasible.
PHOTO COURTESY YATTON

polystyrene block, so as not to add significantly to the weight of the tank. Place a good layer of sphagnum moss on top, and add a retreat, as available from reptile stores, or even a piece of cork bark that the newts can hide under when they are out of the water. You also need to be sure that they can move easily in and out of the water, by carefully placed rockwork, and also that the top of the barrier is not sharp, as this could injure their delicate skin.In the aquatic section, put an undergravel filter in place, just as you would in an aquarium, and add well-washed gravel on top. You can include some underwater decor for the newts, such as pieces of bogwood, but plants may be uprooted. Just as with fish, be sure to use only tap water that has been conditioned with an appropriate water conditioner, so as to remove the chlorine-based chemicals that will be present.

Avoid housing these newts alongside fish though, as they could choose to eat them. Furthermore, like most amphibians, these newts can produce skin toxins too. Catch them with a fish net when necessary, and avoid handling them directly.

Lighting is not essential, and should not be bright in any event, but particularly if you have plants growing in the newts' quarters, then a suitable aquarium lamp should be incorporated beneath the hood. Just as with an aquarium, you can also add a backdrop to the tank, so as to enhance the natural effect when you look in from the front.

Be careful as to where you position the newts' quarters too. Never chose a location in front of a window, where the sun will cause the temperature in the tank to rise rapidly on a hot day to a potentially fatal level.

Feeding and care

It is now very easy not just to feed your newts, but also to make sure that they are receiving a balanced diet, thanks to the availability of special pellets for them, made by the likes of ZooMed and Tetra. You use these in a very similar way to fish food, offering small amounts regularly, every day or so for young newts when they are in the water, and two to three times a week for adults.

With a tub of food costing around £3-4 or so, this means that keeping newts is very inexpensive, as it should last for many months. I do augment these pellets with offerings from Tetra's Delica range, particularly their bloodworm, to give some variety in their diet, but this is not essential. Years ago, before such foods were available, I used live tubifex and daphnia, but it always worried me about introducing parasites and disease with this type of diet. A partial water change every week or so is to be recommended, and the water can be changed completely every month. Fire-bellied newts are very healthy creatures, rarely falling ill and can live for well over a decade.

"Fire-bellied newts are very straightforward and inexpensive"

Breeding

Both species of fire-bellied newt can also be bred quite easily in aquarium surroundings, spawning repeatedly when conditions are favourable. Lowering the temperature in their quarters for a couple of months over the winter, when they frequently spend more time on land, should stimulate breeding activity in the spring. This is then the time that these newts can be sexed most easily.

The male develops an enlarged cloaca at the base of the tail, which will be visible as a swelling. Males are also likely to appear thinner at this stage, as the females swell with eggs, and they may temporarily become a browner colour too.

The male fire-bellied newt fans his tail repeatedly as part of his display, and produces a package of sperm, known as a spermatophore, which the female takes into her body to fertilise her eggs. She will diligently lay each of her eggs separately on the underside of water plants such as Canadian pondweed (*Elodea canadensis*), folding the leaves over to conceal their presence. Mature females may produce as many as 200 eggs during the breeding period.

Rearing

It is safest to hatch the eggs in a separate aquarium, with the tadpoles emerging about three weeks later. Tiny water creatures will serve as a first food, with fry foods as sold for fish being useful at this stage. These can be augmented with flake food as sold for fish. Always powder the flakes to dust by rolling them through your fingers, reducing them down to a dust, so as to make them easier for the tadpoles to eat.

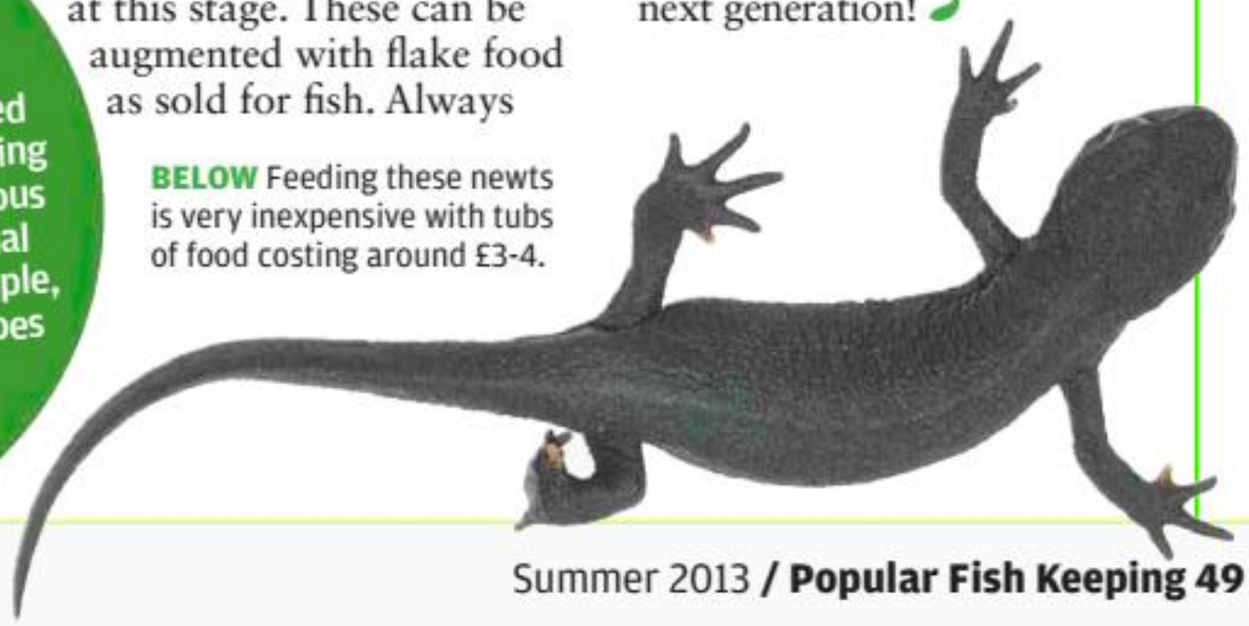
The young newts will emerge on to land about 3-5 months later, with their gills reducing in size and then disappearing beforehand. They need low stones, so they can rest at the surface at this stage. It is also important to ensure they can move easily between the aquatic and land areas of their enclosure, with damp sphagnum moss being a good substrate here in which they can hide.

Young fire-bellied newts will hunt small invertebrates when on land, such as whiteworms, aphids and also small calciworms, which can be recommended for their high calcium level. Calciworms can be purchased via mail order, with suppliers often advertising on eBay, and they should last for several weeks if kept cool.

Dust all livefoods with a vitamin and mineral powder, and place these in a small container, to make them more accessible for the young newts. They will spend more time on land at first. It is important to keep the moss moist, by means of regular spraying using dechlorinated water. At about two years of age, the young newts will themselves be approaching maturity, and you can then think in terms of rearing the next generation!

DID YOU KNOW?

Scientists are studying fire-bellied newts because they display amazing powers of regeneration, like various other amphibians. If an individual loses toes or even a foot for example, then provided that the wound does not become infected, the missing area will regenerate.



BELOW Feeding these newts is very inexpensive with tubs of food costing around £3-4.

FISH FOCUS

Tetra

Purple cichlid
Pelvicachromis pulcher

Also popularly known as kribensis, this beautiful cichlid is found in slow-flowing rivers in the west African country of Nigeria, sometimes even being encountered in the Niger Delta in brackish water. Adult fish can be sexed quite easily, with the male, as shown here, having longer, flowing fins and being larger overall. Kribensis will be easy to keep in a well-planted tank, with some open space for swimming. They are generally peaceful by nature, unlike many cichlids.

Pairs develop a strong bond, and have a fascinating breeding cycle. Provide a clean, upturned ceramic flowerpot partly buried in the substrate for this purpose, having conditioned the fish by increasing the amount of live food in their diet. As the time for spawning approaches, so the female's belly becomes a deep cherry red.

She will deposit up to 300 eggs on the roof of the flowerpot, and remains there, fanning them with water, while the male guards the surrounding area, driving away potential intruders.

The fry are likely to hatch in a couple of days or so, and then, after absorbing the remains of their yolk sacs, the young cichlids will emerge and start swimming in a shoal, watched over closely by their parents. They will be chaperoned back to their flowerpot cave every night at first. Finely powdered flake and brine shrimp can be used as rearing foods for them.

Key info:

Grows to: 10cm (4in)
Water chemistry: soft (50-100mg/l); acid-neutral (pH 6.5-7)
Water temperature: 26-28°C (79-82°F)

"This beautiful cichlid is found in slow-flowing rivers in the west African country of Nigeria"

AQUARIUM FAVOURITE

I can still remember pressing my nose against the warm glass to see this little fish, only about 5cm (2in) in length, darting about the tank, until finally it came up to the surface to breathe. It impressed me so much, and as a child, it seemed to me like an underwater firework going off.

My fish is the betta!

No other freshwater fish possesses such a warrior-like reputation as the Siamese fighting fish, entwined with both poetic grace and stunning beauty. Christian Castille discusses one of his particular aquarium favourites.

Fish keeping has always been a very important part of my life. I now have an entire room and outbuilding dedicated just to my fish, and for me, this is a fantastic hobby. Whether it is a tank full of neon tetras or a huge aquarium housing a massive red-tailed catfish, I find watching and looking after them incredibly relaxing.

The initial encounter

As a kid, I grew up with fish – there were koi in our pond, and a tropical aquarium in the living room. My brother and I used to breed goldfish and guppies, and then one day when I was around eight years old, we were looking at aquatic amphibians for a tank when we saw something flash past our eyes. It was like a bolt of electricity, rather like a shooting star, making me wonder whether I'd actually seen it.

BELOW Females can appear rather drab in comparison to males.

Predominantly white-bodied individuals with coloured fins have been bred.

"The exotic appearance of these fish meant that I expected them to be very difficult to breed, but I was completely wrong."

A stunning buttercup yellow individual.

LEFT Scales of a male Siamese fighting fish in close-up.

The label on the tank read 'Fighting fish'. I asked the man how much it was, and I was even more surprised to discovered that it only worked out at about £4.20, which struck me as cheap, considering that just the week before, we'd bought four red-clawed crabs that had cost us £5 each! My brother and I chose two fighting fish – a blue one and a red one. The owner of the shop remarked that if we thought these were spectacular, we should come back the following week and see the males. I simply assumed that he meant they were different colours, but obviously, with a promise like that, we'd be returning then!

We put the females into a 50l (11gal) tank and they settled well with the tetras and shrimp that I had in there. I bought a single, stunning male the following week as advised by the shopkeeper, and introduced it into my tank with the females. The exotic appearance of these fish meant that I expected them to be

CONTINUES ON THE NEXT PAGE

very difficult to breed, making this an area for the specialist, but I was completely wrong. They bred for me without any special conditioning at all.

I knew then that this species was going to be a big part of my life as a fish keeper. In fact, I have now kept them consistently for over 20 years, and intend to carry on doing so. They still exert a fascinating magnetism for me.

Background briefing

Although sometimes called the betta, this species is only one member of the genus *Betta*, which currently consists of around 77 species, many of which have only been described quite recently, although to my eye, none is as beautiful as the Siamese fighting fish.

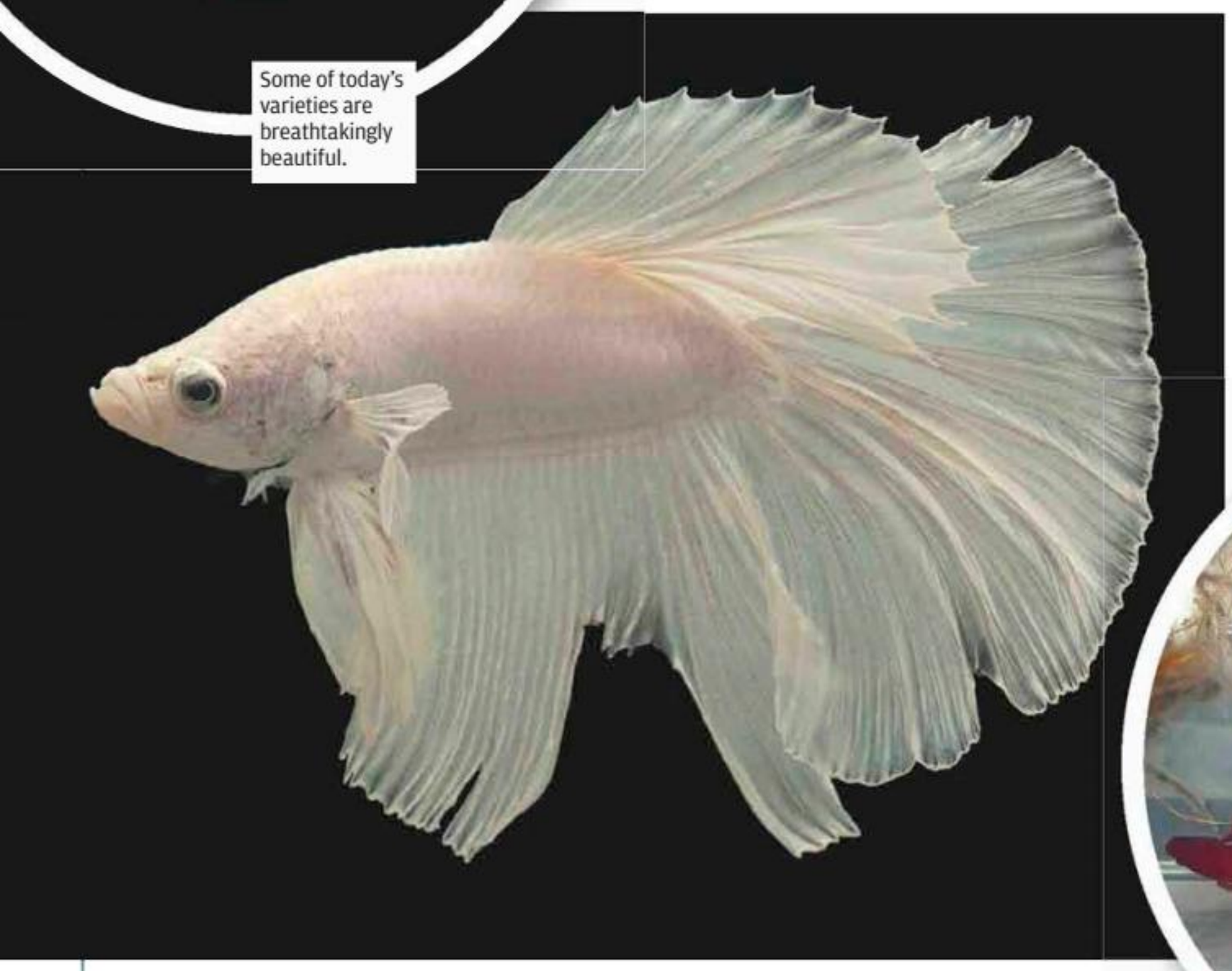
The first species of *Betta* recognised by science was documented by two French zoologists, called Achille Valenciennes and Georges Cuvier, back in 1846. Even today though, *Betta* species are still being discovered. Over the past decade, 22 new species alone have been described for the first time, with the latest being identified just this year. Christened *Betta dennisyongi*, it was found by Dr Heok Hui Tan, a scientist who has now described an impressive 27 members of this genus.

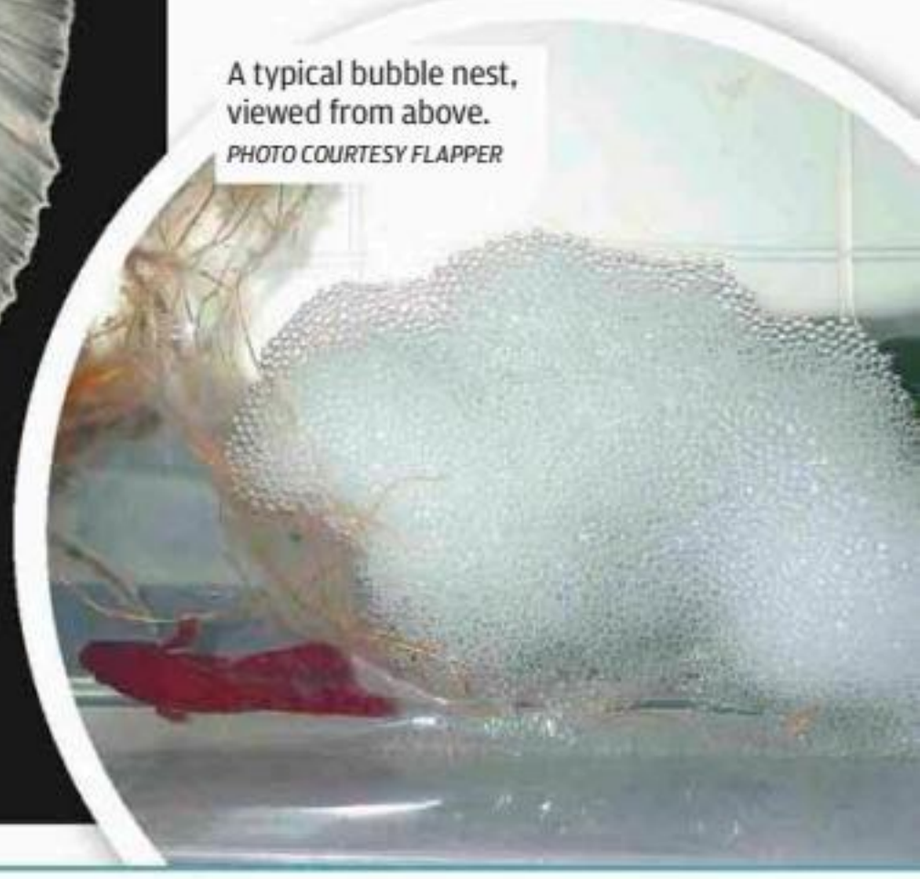
The Siamese fighting fish – rather appropriately in my view! – is known to science as *Betta splendens*. There are literally hundreds of websites, societies and clubs set up in tribute to this fish, each of which provide their own unique twist on how the relationship between this species and people was forged.

"Even a fish that was seriously injured yet prepared to display its fighting spirit could emerge victorious"

Siamese fighting fish can be kept with unrelated species.

Some of today's varieties are breathtakingly beautiful.





A typical bubble nest, viewed from above.
PHOTO COURTESY FLAPPER

Origins of domestication

What we do know with certainty is that these fish were first kept for fighting purposes well over 600 years ago, in the days of the Sukothai Empire in the vicinity of modern day Thailand. Farmers working in the paddy fields would collect these fish and use the males to fight, placing them together. Before long, people were betting on the outcome of such contests, and soon the first ever organisation dedicated to these fish, literally called the 'fish fighting club', was established.

In those days, the fish were generally collected from the wild, and they were small and dull in colour, being very different in appearance when compared with those seen today. Interestingly, while males will defend their territory to the death, fights in the wild are very rare, as the fish recognise the boundaries.

When the water level in the paddy fields was low, however, the farmers noticed how when they trod in puddles of water, displacing the fish into other puddles, so brutal fights would then take place. By the 1700s, they realised fish that won these fighting competitions could pass on their strengths on to offspring, and so careful breeding and the development of recognised bloodlines began to take place.

At the same time, though, farm workers would occasionally find vividly coloured males, and even individuals with fins that appeared more elaborate than normal. They would sell these to breeders, although such fish were not popular for fighting purposes. Instead, these more attractive ornamental forms were kept in people's homes, as they believed to bring good luck and prosperity to the family.

The truth about combat

The description of *Betta* is derived from that of the warrior tribe known as the Bettah. It is a common myth that these fish will fight to the death; in fact, it is extremely rare for a fish to die while fighting. However, they commonly die from their injuries afterwards, as the result of infections.

Winners of such fights were traditionally decided by the willingness of a fish to continue fighting. Even a fish that was seriously injured yet prepared to display its fighting spirit could emerge victorious, although obviously, the chances were that this would be its last ever fight.

How they became known in the West

The popularity of bouts between these fish grew through the 1700s, and by the 1800s, this form of combat was deemed so popular by the Siam Government that the King of Siam issued permits for them, as a means of cashing in on this pastime. King Ang Duong became very interested in these fish though, to the point that he kept and bred them himself.

Dr Theodore Cantor, a herpetologist studying sea turtles for the British East India Company, met with the king, who instructed that one of these prized fish should be given to him as a gift. In 1849, Cantor, unaware that the species had been described in France three years earlier, therefore named the fish as *Macropodus pugnax*. He died some 10 years later, but the clarity of his original drawings revealed where its true relationships lay, and it was ultimately reclassified.

By the 1870s, these fish were starting to be kept in many European countries, at the stage when tropical aquarium keeping was beginning to develop as a hobby. They gained a reputation for being quite docile, provided, of course, that the males were not kept together, but at that stage, they were still very dull in appearance, compared with today's strains.

This was to change though, starting in 1909, when a shipment of Siamese fighting fish arrived in America for the first time. During the following year, a British ichthylogist called Charles Regan was in America carrying out extensive work on fish systematics when he saw some fish being offered for sale that were described as "Siamese fighting fish" yet they clearly differed in some ways from the established scientific description.

He obtained a few to study, and noted they were bubble nest builders, although Cantor had described them as mouth brooders. It eventually turned out that Cantor had been given the wrong species in Thailand!

It wasn't until Regan discovered this error, thanks to his visit to the pet shop, that he was able to correct the situation. Cantor's fish was reclassified as *Betta pugnax*, and Regan then named the Siamese fighting

CONTINUES ON THE NEXT PAGE »

DID YOU KNOW?

The difference in the breeding habits of bettas reflects the environment in which they live. Siamese fighting fish are found in still areas of water with no currents. These would otherwise destroy their delicate bubble nest. Mouth brooders occur in areas where water currents are more powerful, and so it is believed that they collect their eggs, to prevent these from being swept away.

Female Siamese fighting fish under her bubblenest

Newly-hatched fry, visible by their tiny tails, being guarded by the male.

"I enjoy keeping these fish greatly, and I even import them now and again but I'm not a massive fan of all these different mutations"

fish as *Betta splendens*, ending the confusion between them.

A new marketing strategy!

By the early 1900s, Siamese fighting fish were suffering because of their name, because it suggested they were unsuitable for community aquaria, which were then becoming very popular. As a result, dealers changed their name, and starting calling them the Jewel of the Orient. This led to a rapid change-around, and their popularity soared, to the extent that they then became the centerpiece of many aquariums. Over the years, more colours and fin shapes were developed, and their genetics became better understood. It was these vivid colours and mesmerising fin changes that allowed these bettas to be perceived as highly prized living works of art, being bred for their looks rather than their aggression. Their traditional name resurfaced during the 1970s, by which time, they were so well-known in the aquarium hobby that there was no need to disguise their origins by this stage. New fin mutations such as crown tails and half moons emerged, to maintain interest in the group, and today, virtually every aquarist store around the world stocks these beautiful and yet still potentially feisty fish.

Yellow and silver combinations are less commonly-seen.

Labyrinth organs

One of the many fascinating things about these fish is that they possess what is described as a labyrinth organ close to each of their gills, behind their eyes. These allow them to breathe atmospheric air, which is important for their survival, because in the wild, they are often inhabit shallow and poorly oxygenated waters. When necessary therefore, this adaptation simply allows them to come up to the water's surface and gulp down air.

The labyrinth organ is formed by blood vessels that are associated with the epibranchial bone within the first gill arch. The oxygen can diffuse straight into the blood here, after being gulped into the mouth.

Eyesight

You can see the way that a male Siamese fighting fish retains its aggressive instincts, simply by placing a mirror outside its tank. These fish do not have binocular vision, where there is an area of overlap between what each eye sees, allowing the brain to compute distance and detail of the image more accurately. As a result, they are thus inclined to fight their reflection, believing it to be a potential rival.

Where do they originate from?

The true distribution of the ancestors of today's domesticated Siamese fighting fish is unclear, and will

Note the upturned mouth, indicating these fish are surface-feeders.

probably never be known with certainty. This is because of the way that these fish were traded and moved between localities over the course of past centuries.

It is generally believed that the species originated in the vicinity of modern-day Thailand (which was formerly the kingdom of Siam). Its natural range was probably centred on the Mekong delta in south-east Asia, with its distribution extending through Myanmar (formerly Burma), Laos and Cambodia.

Introduction to the varieties

The popularity of these fish in today's hobby comes down to their colours, as well as the variation in fin type. Around the world, there are shows rather like Crufts, dedicated just to these bettas, as well as numerous societies and even private clubs, not to mention conventions and a wide range of publications devoted to them. There are noted breeders too, such as Guy Delaval, who helped to produce the half-moons, right through to Sarawut Angkunanuwat with his orange Dalmatians.

I enjoy keeping these fish greatly, and I even import them now and again, but it may surprise you to know that I'm not a massive fan of all these different mutations. I actually prefer the rather plain females, in comparison with the more elaborate finned males, and I like to breed veiltails, which tend to be the most common variety. They have longer fins than usual, and a non-symmetrical caudal fin.

The shortfin is the most traditional form, often referred to under the name of *plakat*. These are probably the closest variant today to the original Siamese fighter, with far less elaborate fins than seen in other varieties, although they can bred in a correspondingly wide range of colours.

Half-moons have a caudal fin in the shape of a D, with the tail being well-defined on this basis. More extreme variants on this theme are the over half-moon, where the tail extends over more than 180 degrees, plus the so-called rose tail, which is a half-moon with more highly developed fins, which can create an overall effect like that of a rose. At the other extreme, delta tails are similar, but have a less extensive tail than half-moons.

Comb tails have fins that are effectively split, like the teeth of a comb, with the crown tail being similar, displaying a highly developed caudal fin, which can look rather like a crown. This variety is also known as the fringe tail. Among the other forms that you may see are double tails, as well as spade tails and round tails, plus the unusual elephant ear, with its long fins said to resemble elephantine ears.

Starting out

Something you will notice with these fish if you purchase them from a pet supplier is that females tend to be kept communally whereas males are often housed in small containers. This applies particularly in Asia. Initially, it might be assumed that this is cruel, but much depends

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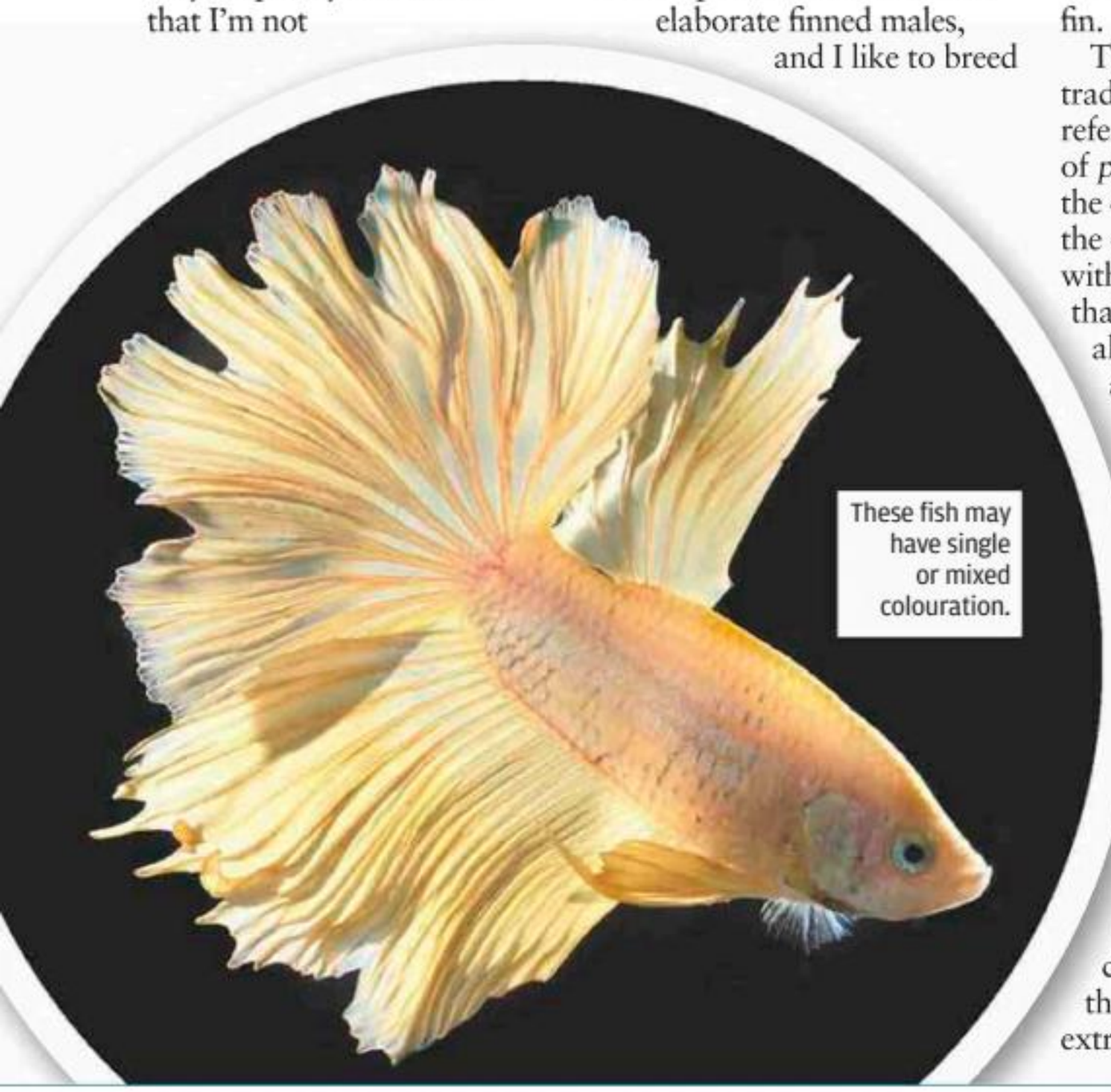

These fish may have single or mixed colouration.

Popular Fish Keeping Expert tips

Key set-up statistics


LEFT Bettas can breathe atmospheric air directly from the water's surface.

- Most living rooms and other localities in the home where you may choose to locate a tank will be in the 20°C range (the upper part of the 70°F scale), and you may find that a heaterstat is not required. I remember reading some years ago about a study involving guppies where, when they were kept at lower temperatures, so they lived longer, which I think is interesting – are we overheating some of our aquarium fish?

- Anyway, I have found that my Siamese fighting fish will thrive, even though they are not in a heated home. It is warm enough in these surroundings for them to breed consistently and rear their fry. Generally, it is advised to aim for a water temperature of between 26-28°C (78-83°F).

- Set up the tank in the usual fashion, bearing in mind that as always, it will take time for the filtration system to become fully functional. You need to aim for a pH reading of between 6.5-8.0, with a water hardness (°dH) reading from 5-19.

on how the fish are being maintained.

In the wild, these bettas frequently inhabit small stretches of water, so this way of keeping them is a good reflection of how they would live in the wild. However, many of the small tanks have no filtration or oxygenation and even though Siamese fighting fish can breath atmospheric air, they still produce the same waste as other fish and this can pollute these smaller quarters more quickly.

These bettas will very happily swim in large bodies of water if you allow them. For me, I have tried keeping them both ways, and I did notice an impact on their lifespan. I have found that in 40l (9gal) tanks or larger, they would only live for about two years, which is regarded as their typical lifespan, but in my much smaller home-made tanks, with filters attached to maintain water quality, they could live for almost five years.

Others may disagree but for me, I enjoy having all my fish thriving for as long as possible, so I now keep them this way. I have also found that despite males having long fins, it is actually the females that are less suited to communal tanks, perhaps because they seem to be much quicker and this attracts other fish to nip at their fins. Much does depend though upon which other fish are present – tiger barbs for example can be a particular problem when it comes to fin-nipping in a community aquarium.

LEFT Not all Siamese fighting fish are brightly-coloured. There are blackish strains too.

Suitable for everyone!

I would not consider myself a betta specialist, but I have evolved my way of looking after these fish. Not that this is rocket science – in fact, keeping Siamese fighting fish is incredibly easy, even if you've never kept fish before.

Don't be put off by their exotic beauty. Remember that over 600 years ago in their homeland, they were being kept successfully by doing nothing more than carrying out regular water changes.

While plain tanks will suit their needs, attractively planted aquaria will also work extremely well for them. They frequent the upper level within a tank, but you will sometimes observe them heading down lower in search of food.

It is difficult to generalise about the size for a community aquarium for these fish, because it depends very much on the other occupants, the tank décor, if it is planted and so on. But generally, even smaller fish tanks can accommodate at least one Siamese fighting fish, irrespective of its gender.

Generally speaking, I think it is a matter of using your commonsense: females will agree well with each other, a male will breed with a female, and remember that two males will fight. If in doubt about the suitability of your set-up, ask at a local knowledgeable aquarist shop where they have bettas available.

Set-up

Gravel is a must for these fish, but don't make the mistake of choosing the brightest that you can buy, thinking that this will complement your fish's colour. The reverse is actually very much the case, because a bright substrate will usually detract from their colour. Always aim for as dull a substrate as possible therefore.

Filtration is important, but this will be influenced by how you keep your fish. Power filters offer a reliable and cheap option, but are not recommended if you are trying to breed these bettas, as they will disturb the bubble nest.

Most cheap tanks come with a basic sponge filter, which will do the job, provided that as always,

Their fins will be vulnerable to fungus if damaged.

ABOVE Shimmering colours typify these fish.

you monitor water quality carefully and carry out partial water changes regularly. This type of filtration, which does not cause a current, is ideal for breeding tanks too.

As in the case of other tropical species, a heaterstat is always recommended, to maintain the water temperature. However, this is something that I have had many debates about, especially as in the early days of betta keeping in Europe, there were no effective heaters available. I think this is why they became so popular, because these fish are undoubtedly adaptable.

If you have a fish house in an outbuilding or shed, then yes, heating is a must, and this also applies if you are keeping Siamese fighting fish with other tropical species that need warm water conditions in order to thrive.

Feeding

This aspect of their care is particularly important, as they are voracious eaters and require a high protein diet. Formulated fish foods today are well-balanced, containing all the minerals, vitamins, proteins and carbohydrates needed for general aquarium use, but you may want to seek out one of the specialist betta foods, available from the likes of Tetra and Hikari. Alternatively, I'd recommend choosing a high protein general food.

Live food is ideal, as this forms a significant part of their food intake in the wild, but you need to have access to an uncontaminated supply. I have set up a range of water butts outside that I allow to fill with rainwater, so that insects can breed there. I then catch their larvae and add these to my tanks as food for the fish.

Even if you live in a flat and have just a roof area or similar open space, you can do something similar, which will benefit your fish, particularly in the summer. Live food is a valuable breeding conditioner for bettas generally.

Many people advise feeding Siamese fighting fish in small amounts, up to four times a day. Personally, I feel this is excessive and I feed mine once a day. I've never encountered any issues as a result, although they can often snack on live food during the day.

Breeding

This is something that will naturally happen on its own, but if you wish to be successful, then you will need to invest in some equipment. This species is a bubble nest builder – but some other members of the *Betta* genus are mouth brooders, sweeping up their eggs and keeping them in their mouths until the fry hatch.

Living in still waters with relatively low oxygen levels means that using a floating bubble nest has advantages. It is created by the male, who literally blows the bubbles using his saliva. The eggs float at the surface, where oxygen enters the water, and the pair spawn beneath the nest, so the eggs as close as possible to this site. Afterwards, the male retrieves any that were missed, and moves them under this floatation device.

The spawning process

I have to admit that once again, I don't follow the recommended guidelines of introducing a pair together to a spawning tank. Instead, I always place the male in the tank initially, allowing him to create the bubble nest first. If nothing happens, which is often the case, I then place the females in alongside him.

I always add several females to lessen the pressure of courtship, as a male is likely to be very aggressive towards a single female. Once a nest has been created, the male will court the female and a very vivid display will take place.

When she is ready to accept him, he will wrap up around her almost like a constrictor snake, and actually squeezes the eggs out of her onto his anal fin, before fertilising them. This is often referred to as the spawning embrace.

After spawning

A typical spawning session lasts for between 2-5 hours. After this, the female should be removed and placed in a hospital tank where she can rest on her own, as mating is brutal and her fins may be torn and damaged.

You do not want these damaged areas to become infected with fungus. I've always used a small amount of tonic salt to help with healing and raise the water temperature slightly as well, but there is also a choice of suitable treatments available from aquarist shops too. The male will look after the nest and guard it. He will return any eggs that fall out, and then they will start to hatch some two days later. A single spawning may result in as many as 300 fry. Up to a day and a half later after hatching, the young fish will have absorbed their yolk sacs and will emerge from their egg cases.

Rearing

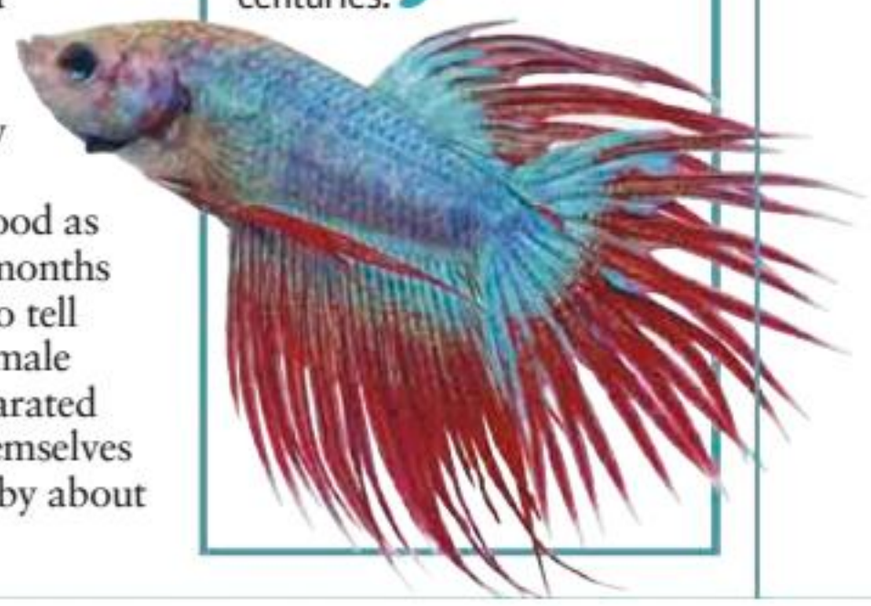
At this stage, you will want to remove the male and try to divide the fry into smaller groups, so they should feed better. This also allows you to monitor them more effectively, and it reduces the competition for food between the fish.

A wide range of suitable rearing foods is now available, including formulated dry foods, but be very careful not to overfeed the young fish, as this will impact rapidly on the water quality, endangering their health. You can also use live food such as infusoria cultures. I like to use a range of both, and gradually change their diet as they grow bigger, until they are feeding on the same food as their parents. By 3-4 months old, you will be able to tell the genders, with the male fish needing to be separated by this stage. They themselves will be ready to mate by about eight months old.

LEFT The elegance of a Siamese fighting fish when seen from above.

In summary

This is the way that I keep and breed my fish, but if you want to start out with them, bear in mind there is a huge amount of information available, so before you acquire your fish, do your research and read as much as possible about them. You can then gradually evolve a method that suits you. Siamese fighting fish are straightforward to keep, and inexpensive too. There is something about watching them that is very calming, as they swim around in their quarters. With their rich cultural ancestry, they also still represent the essence of their Oriental past. ppppppastextending back over the course of centuries.



Flying Guppies, cichlid brains and giants of the Amazon

A round-up of some of the latest amazing findings about freshwater fish from around the world, by Victoria Welch.

Zebra mbunas engage in a territorial dispute.

One of the best-known of all aquarium fish, the Trinidadian guppy (*Poecilia reticulata*), is a colourful species that thrives in groups and is generally easy to keep – provided that you remember one rule. This little fish has a fondness for leaping out of its tank, often with disastrous results.

Whilst the solution to this behaviour is simple – and available in the form of a tank lid – the reason that these fish jump in the first place has long been a mystery. Guppy-jumping frequently does not seem to be caused by an obvious cue, such as a perceived threat from a bigger companion in the aquarium, and furthermore, guppies will jump regardless of whether they are housed on their own or in schools.

Dolphins are believed to jump out of the water regularly for different reason, compared with guppies.

However, biologists Daphne Soares and Hilary Bierman of The University of Maryland believe they may now have found an explanation. In a recent study published in the journal PLOS ONE, the scientists used high speed video to record over forty jumps made by nine different male guppies, before analysing the movement of the fish, on a frame-by-frame basis.

As well as measuring the speed of the guppies in the water and mid-air, Soares and Bierman documented their movement before and during each leap, so they could compile an "anatomy of a guppy jump". In the process, the scientists discovered that just before leaping, guppies were able to reach a maximum speed of 128cm/sec (50in/sec) in water and, whilst airborne, they flew at an impressive maximum speed of 150cm/sec (59in/sec), although the maximum jump was just over 6cm (2.3in) out of the water.

The guppies were able to reach these high speeds because they prefaced each jump by first slowly reversing, using only their pectoral fins, before moving forward with "fast body thrusts". Next, the fish contracted their bodies to bend themselves into a strong 'C' shape in one direction, before springing from the water, straightening up and then bending themselves in the opposite direction, flailing from side to side as they propelled themselves through the air.

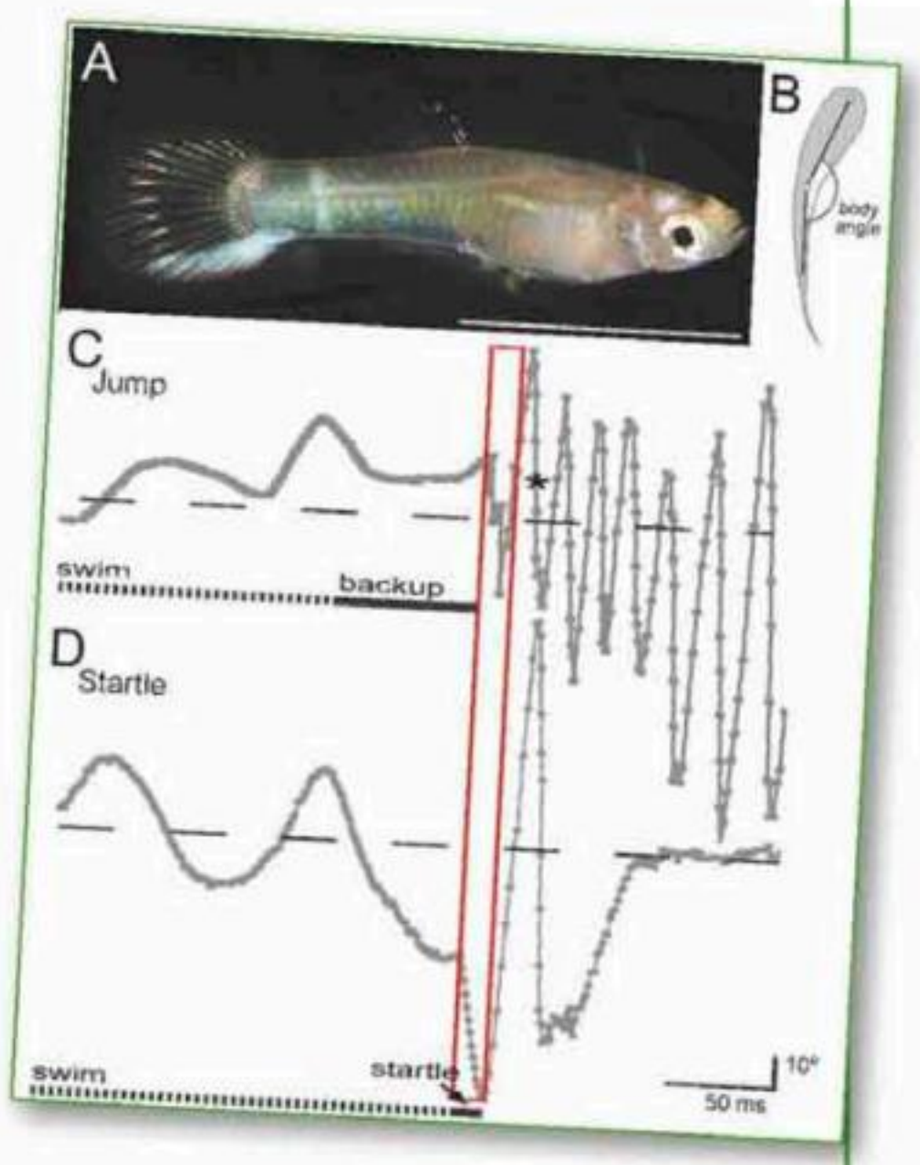
Unlike archer fish and arowanas, which are known to jump in order to catch prey, or dolphins and squid, which are thought to use jumping as a mean of conserving energy when cruising long distances, Soares and Bierman suggest that guppies may use aerial jumping as a means of

The guppies' jumping behaviour is thought to be linked to their environment.

Young utaka cichlids – the species often popularly called the redfin hap (*Copadicohromis borleyi*). Brain development shapes their behaviour. *PHOTOGRAPH COURTESY CALILASSEIA.*

Above Mbuna cichlids display very territorial behaviour patterns, for reasons that are now becoming better understood. These are *Melanochromis cyaneorhabdos* (Maingano). *PHOTO COURTESY DR DAVID MIDGLEY, OF FISH OWNED BY MR. GLENN BARRETT.*

Right A summary of the recordings of the study, with regard to the body angle of the fish. Note also how the dorsal fin shape of the wild guppy is far less evolved than is often the case with those kept in aquarium surroundings today. *ILLUSTRATION COURTESY DAPHNE SOARES & HILARY S. BIERMAN / PLOS ONE JOURNAL, VOLUME 8, ISSUE 4.*



This photo of a diver hand-feeding an arapaima in an aquarium revealed how large these fish can grow.

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DID YOU KNOW?

A living example of an arapaima can be seen at a public aquarium in the Ukrainian city of Sebastapol.

PHOTO COURTESY GEORGE CHERNILEVSKY.

dispersal.

Since the native environment of the Trinidadian guppy consists of freshwater streams that are divided by waterfalls, so the scientists suggest that the fish may have evolved this leaping behaviour because it permits them to colonise areas that would otherwise be inaccessible to them. Guppies, it is thought, may escape high rates of attacks by predators when in lowland streams by jumping in this way to quieter upland streams - literally leaping away from danger.

More incredible insights into cichlid diversity

If guppies are one of the most popular aquarium fish from the Americas, surely Lake Malawi's cichlids must be Africa's equivalent? Colourful and active by nature, these cichlids are endlessly fascinating to biologists, as well as hobbyists, with new species described every year. Historically, much scientific interest in cichlids related to the sheer number of species found and to what they can tell us about evolution in general (and the formation of new species in particular).

However, more recently, various groups of scientists have begun examining cichlid brain development. One use of this research is purely zoological, seeking to explain the very different behaviours found in various cichlid species, and seeing if this relates to alterations in brain anatomy. Another potential use of these studies, however, is to understand early processes in cichlid brain development that also occur in humans. Since problems in early human brain development have been linked to autism and schizophrenia, scientists in the field hope that their work on cichlids might help in future to contribute to a better understanding of the causes of these human brain disorders.

During the late 1990s, a team of biologists managed to explain certain aspects of cichlid behaviour in terms of the anatomical structure of the brains of these fish. For example, Lake Malawi's so-called "mbuna" (rock-dwelling) cichlid species are known to be strongly territorial and somewhat aggressive in the wild, as in aquariums.

By contrast, the "utaka" (sand-dwelling) cichlid species from the same area are less confrontational and territorial. These contrasting behaviours were found to reflect differences in the size of various areas of the cichlids' brains, such as the enlarged telencephalon (cerebrum) in

"One tropical fish that is unlikely to be coming to your local aquarist store anytime soon is the arapaima"

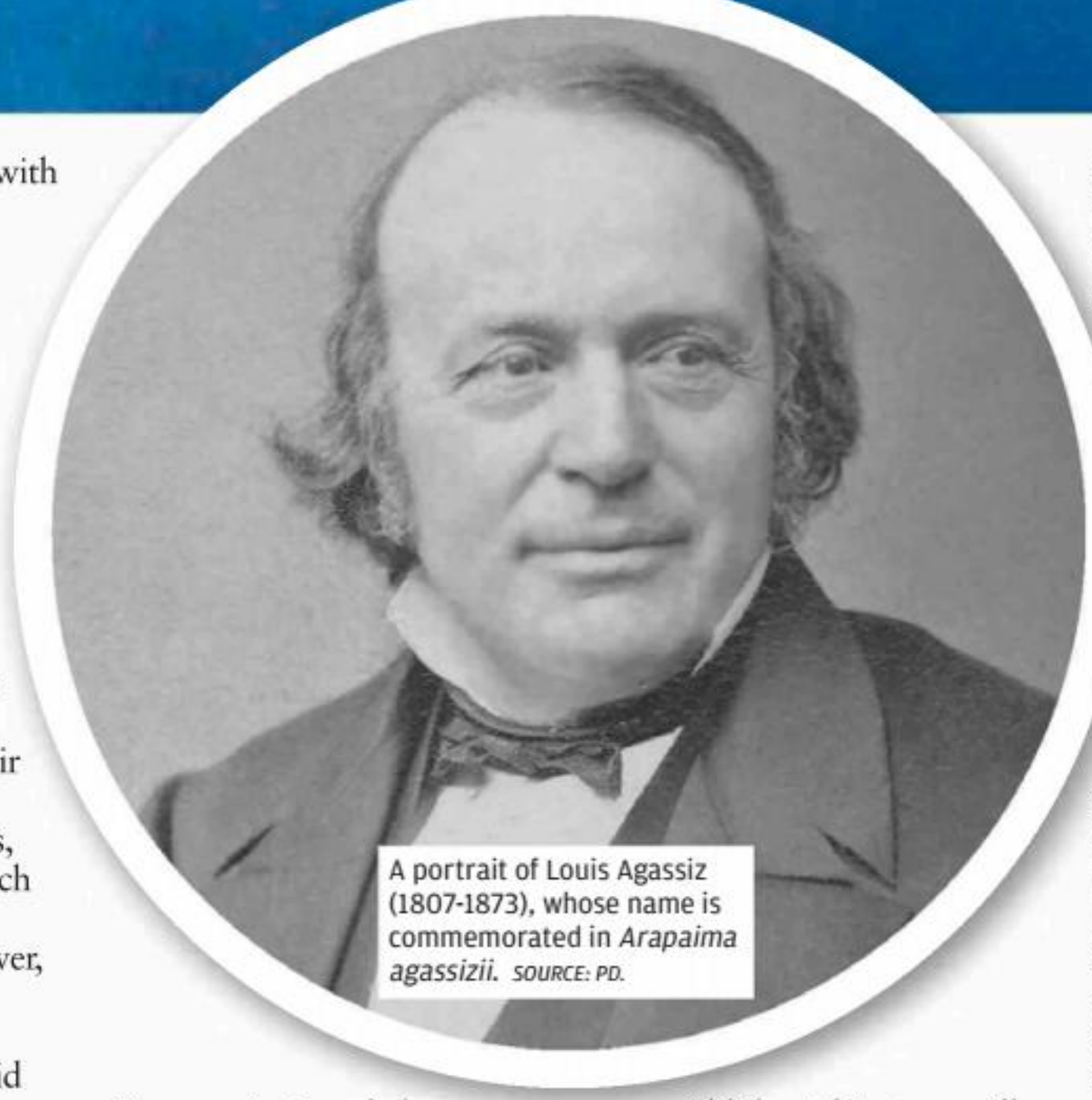
Right Prof Donald Stewart of the SUNY College of Environmental Science and Forestry examines an arapaima skeleton. *PHOTO COURTESY PROF DONALD STEWART.*

the mbuna fish compared with their utaka relatives.

Likewise, the mbuna cichlids (which generally eat algae from the vicinity of the lake bed) had a bigger olfactory bulb in the brain, to assist their sense of smell and comparatively smaller eyes, compared with many of the utaka species. The utaka, which use acute vision to capture small prey, had a greater optic tectrum region in their brains, to assist them with processing of visual images, and so helping them to catch their prey.

So far, so logical... however, scientists were puzzled, because even though the significantly different cichlid brain structures were known to be correlated with markedly divergent behaviours, the two groups of fish had very similar DNA profiles. If their genetic codes (genomes) were so similar, they wondered, how could such different brains arise?

The recent study published in the journal *Nature Communications* helps to solve this riddle. It shows that mbuna and utaka cichlid brains are very sensitive to specific chemical signals during their development. The scientists found that the precise timing of exposure, as well as the balance and quantities of these specific chemicals in the brains of the cichlids at this stage will affect their ultimate brain structure.



A portrait of Louis Agassiz (1807-1873), whose name is commemorated in *Arapaima agassizii*. SOURCE: PD.

According to the findings by J.B. Sylvester and colleagues, two chemicals in particular – named "Hh" and "Wnt" – appear to cause the very marked developmental differences in mbuna and utaka brains and, therefore, the contrasts in behaviour between these two groups of cichlids. Both types of fish possess these chemicals, but the pattern and timing of the release of these chemicals during brain development varies between them, giving rise to notably different results in each group as a result.

A rediscovered river monster

One tropical fish that is unlikely to be coming to your local aquarist store anytime soon is the arapaima. These giants can grow to 3m (10ft) in length and weigh as much as 200kg (440lb). In spite of ranking amongst the world's largest freshwater fish, the arapaima is also one of South America's most distinctive creatures, yet remarkably little is known about it and its relatives.

For some 144 years, conventional wisdom has decreed that there was only one species of arapaima,

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known as *Arapaima gigas*, and that the other three described "species" were, in fact, just variants. That view has now finally been challenged and overturned in a scientific paper by Professor Donald Stewart of the State University of New York. Prof Stewart undertook some of his extensive studies of arapaima samples in museums around the world, before "re-describing" one of the four historic species of arapaima, known as Agassizi's arapaima (*A. agassizii)*, in the journal *Copeia*.

In what is planned to be the first of several related papers on the *Arapaima* genus, Prof Stewart explains in detail how the re-described species differs from the one currently accepted species in the genus, *A. gigas*, and how it also differs from the other two former species within the genus. The newly re-described species is unlike its relatives in several features – it has more maxillary teeth, more dentary teeth and smaller orbital bones compared with *A. gigas* individuals of similar size. Prof Stewart also notes that the newly re-described species has a markedly greater spacing between its caudal fin and its dorsal and anal fins than any of the other three types of known arapaima.

Taxonomists ordinarily resolve debates over what is and is not a species by examining the original example of the creature in question, known as the type specimen, in the vaults of whichever museum hosts the sample. In this case, though, the work was hampered by the fact that the original fish, collected during the 19th century, had been deposited in Munich's State Zoological Museum and destroyed in the Second World War. Prof Stewart therefore had to consult detailed original sketches made when A. agassizii was first discovered and compare these with samples of the other sorts of arapaima in the world's museums.

Right Research into early drawings of arapaimas helped to confirm that more than one species existed.

Below Arapaimas have long been a popular target for fishermen, as shown by the portrait on this stamp from British Guiana (now Guyana). These fish are often harpooned when they surface to breathe.

"What is remarkable is that this fish was not re-discovered swimming in the Amazon but, rather, on the pages of a monograph from 1829 that described its anatomy in great detail," he explains.

"In a sense, this forgotten fish has been hiding in plain sight but that monograph is so rare that it now resides only in rare book collections of a few large museums. I was truly surprised to discover drawings that revealed a fish very different from what we consider a typical arapaima."

The arapaima described in the monograph had been collected in about 1819 from the Brazilian Amazon, and carried to Munich in Germany as a dried skeleton. There the Swiss biologist Louis Agassiz, who was just beginning his career, before later becoming a professor of zoology at Harvard University, supervised a technical illustrator in drawing the complete skeleton in great detail. At that time, however, he gave the scientific name of *Sudis gigas* to the fish portrayed in the drawings.

"To this day, we do not know the precise locality where the fish was collected because the German scientist who collected it died before indicating where he found it, and nobody has found a second specimen," Prof Stewart says. "So, all that exists about the status of *A. agassizii* is the original drawings of its bones."

Even today, much of the apparently rare fish's story remains a mystery, and it is unknown if it still exists in the wild. "Scientists have had the impression that *Arapaima* is a single species for such a long time that they have been slow to collect new specimens. There are still vast areas of Amazon basin where no specimens of *Arapaima* have been collected for study. Their large size also makes them difficult to manage in the field and expensive to store in a museum," adds Prof Stewart.

"In a sense, this forgotten fish has been hiding in plain sight"

Since the only recorded example of *A. agassizii* was documented long ago, the pressing questions now include how many wild Agassiz's arapaimas still exist in the Amazon, are they endangered or did this species cease to exist in the real world, at about the same time that it vanished from the world of taxonomy? These are all questions that Prof Stewart and his team hope that they will be able to answer in due course.

Popular Fish Keeping Information point

PHOTO COURTESY AVIHAI LEVY

● Victoria Welch is a science writer and lecturer in scientific communication. Her website can be found at www.victoriawelch.com

● "Aerial jumping in the Trinidadian Guppy (*Poecilia reticulata*)" by Daphne Soares and Hilary S. Bierman was published in *PLOS ONE*, Volume 8, Issue 4, e61617, April 2013, and the manuscript is available online at http://tinyurl.com/pzbqqtp

● "Competing signals drive telencephalon diversity" by J. B. Sylvester, C. A. Rich, C. Yi, J. N. Peres, C. Houart and J. T. Streelman was published as article 1745 in *Nature Communications*, Volume 4, on 23rd April 2013, the abstract is online at http://tinyurl.com/o8dl7cb

● "Microhabitat use trophic patterns and evolution of brain structure in African cichlids" by R. Huber, M. J. van Staaden, L. F. Kaufman and K. F. Liem was published in *Brain, Behaviour and Ecology*, Volume 50 (3), pages 167-182, (1997), and the abstract is online at http://tinyurl.com/na4eufx

● "Re-description of Arapaima agassizii (Valenciennes), a Rare Fish from Brazil (Osteoglossomorpha: Osteoglossidae)" by Donald J. Stewart was published in *Copeia* 2013, Number 1, pages 38-51; the abstract is available online at http://tinyurl.com/pggvwog

AT A GLANCE

Great fish keeping advice from the Popular Fish Keeping team

These are three-striped corydoras (*Corydoras trilineatus*).

Find out about Corydoras Catfish in just 5 minutes

Ideal for
Feline allergy sufferers, forced to consider an alternative pet. Useful also as therapy for those scarred by watching television programmes about monstrous killer catfish, as corydoras are cute, attractive and small.

Cost
Typically £1.50-£5.00 or more, depending on the variety.

Lifespan
Between 5-10 years on average, although the oldest recorded individual was 27 years old on its demise.

Space requirements
Not a great deal, as they only grow to about 7.5cm (3in), with the tiny pygmy corydoras being just 2.5cm (1in) long. Quite at home in a typical aquarium, measuring from 52cm (20in) in length.

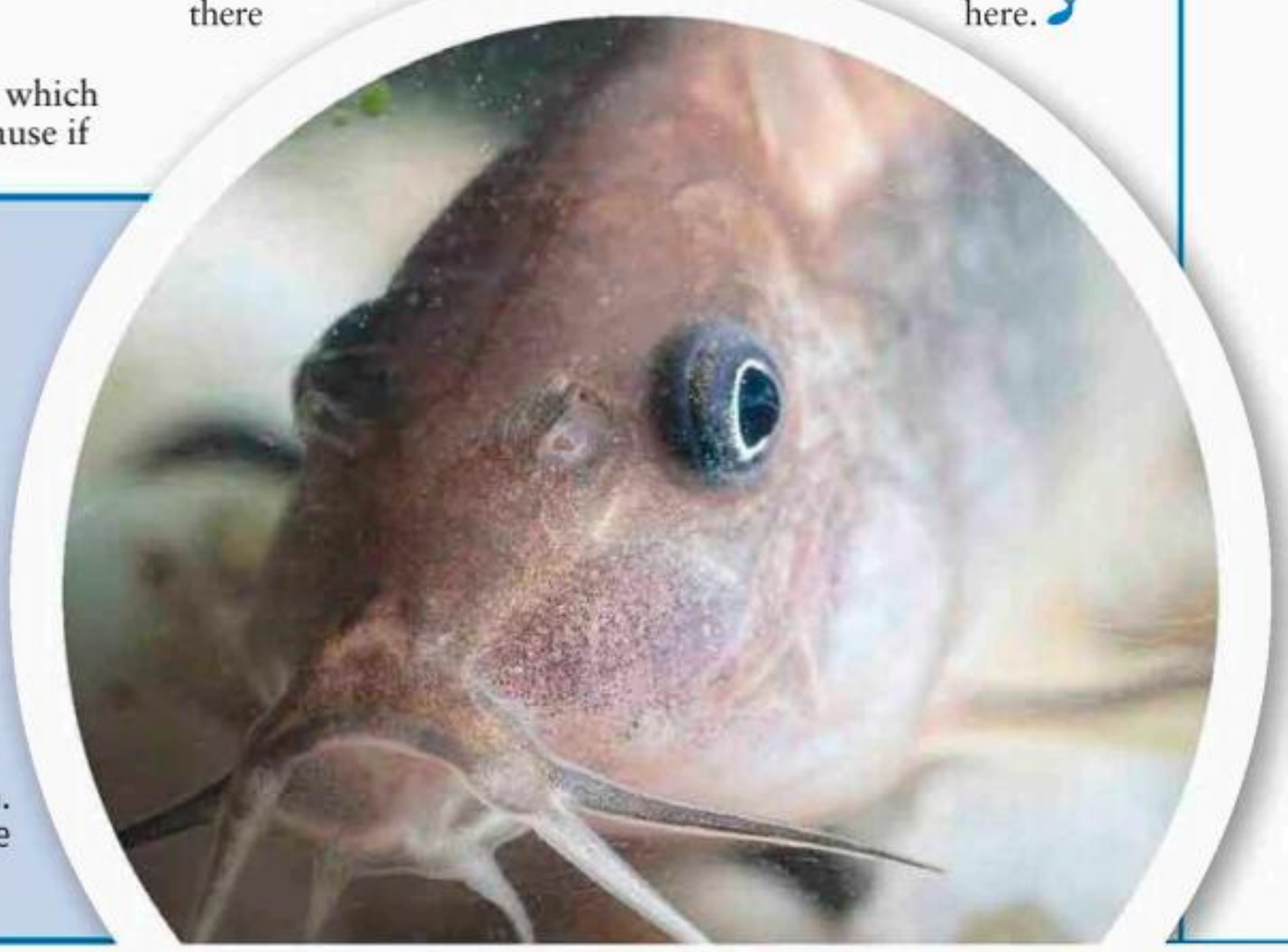
Care requirements
Usually kept alongside other non-aggressive fish from South America, as part of a community aquarium, spending much of their time near the base here. Corydoras need a water temperature between 22-26°C (72-78°F), preferring soft, acidic water conditions but they are reasonably adaptable. They should be fed sinking foods such as special catfish pellets that will reach them on the floor of the aquarium. Retreats created by rockwork and bogwood are required, although these catfish are active during the day, unlike many of their relatives, and quite conspicuous.

Temperament
Agree well together, which is a good thing, because if you hope to breed them, there is no easy way of distinguishing the sexes. Females only become more rotund just before laying, when they swell up with eggs. Social and not aggressive towards other fish. Tend to do better in small groups.

Varieties
No-one actually knows exactly how many there are, as new species are still being discovered, but over 140 are presently recognised. Don't expect bright colours, as the majority of corydoras are fairly subdued in appearance, with their patterning consisting of dark spots or stripes on a pale background. Rabaut's corydoras (*Corydoras rabauti*) is something of an exception, with its orange body colour and a black stripe on each side of the body. You are most likely to see the bronze corydoras (*C. aeneus*) (of which there is also a pure white albino variety with reddish eyes) though, plus the peppered (*C. paleatus*) and panda corydoras (*C. panda*).

History
The famous naturalist Charles Darwin discovered the peppered corydoras during his voyage on HMS Beagle between 1831-1836. Corydoras catfish were amongst the first tropical fish to be bred in Europe, with the earliest recorded success being achieved by a Parisian enthusiast called Pière Carbonier in 1878.

Likely illnesses
Infection of their underparts, caused by lying on dirty gravel, is a potential health problem. Easily preventable though, when you use a gravel cleaner every couple of weeks or so, in order to freshen up the aquarium substrate and remove organic matter that has accumulated here.



Did you know?
The projections or barbels around a catfish's mouth are said to resemble a cat's whiskers in appearance. Corydoras have very short, rather stubby barbels, so it is not really true in their case. These projections do still have a sensory role though, helping the fish to find food in murky surroundings.

Corydoras live in waters where the oxygen level can be very low. Since they could not be certain of extracting enough oxygen from the water passing over their gills therefore, so they developed the ability to breathe atmospheric air directly, unlike most fish.

They shoot up like a rocket at intervals to the surface of the water, take a gulp and then dive back down again. The air passes through to their hind gut, from where the oxygen then diffuses into the bloodstream.

A blue diamond discus watches over its young.

Persuading your fish to breed

One of the most satisfying aspects of keeping tropical fish has to be breeding them – whether intentionally or even by accident, as can sometimes happen, writes Paul Donovan. The feeling of excitement when you see little fish swimming about in the tank is always there, no matter how many time you experience it.

Some fish are relatively easy to breed, with common livebearers such as guppies doing what comes naturally, whereas other species may require a lot more input and perseverance on your part. Nevertheless, successfully breeding a species about which little is documented can bring a particular sense of achievement.

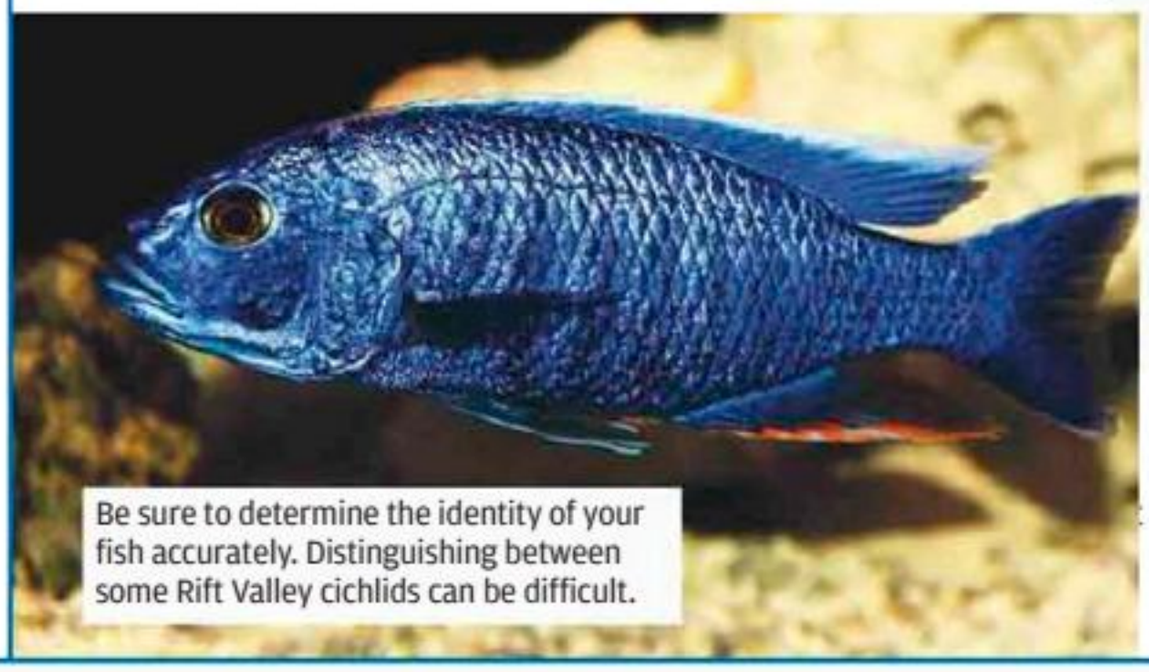
Choosing breeding stock

The selection of suitable breeding stock is perhaps the most important aspect of this process. When starting out, aim to acquire fish that are healthy, showing no signs of deformities or abnormalities, and are ideally unrelated, so as to minimise the rish of any hereditary weaknesses.

A crescent-tail. One of the ornamental domesticated strains of molly developed by breeders.

Even if you are seeking to breed exhibition strains of fish, be sure to concentrate on obtaining the most vigorous individuals. Hopefully then, the parent fish will display good colouration and body shape, passing on these traits to their offspring which will themselves be healthy.

Sometimes though, in any brood, you will get the



Be sure to determine the identity of your fish accurately. Distinguishing between some Rift Valley cichlids can be difficult.

A pair of guppies. The larger female is on the left.

"Nevertheless, successfully breeding a species about which little is documented can bring a particular sense of achievement"

occasional individual that is malformed in some way, and will have to be humanely destroyed. This happens in the wild too, with such individuals rapidly falling victim to predators. It is not usually a concern – more worrying, as far as the vigour of the strain is concerned, will be a marked fall-off in the number of fry being produced.

Never be tempted to experiment and interbreed closely-related species, as although you may obtain offspring, you will end up with hybrids that are not just likely to be sterile, but for which there will be little demand, particular from fellow breeders.

It is worth bearing in mind that particularly in the case of certain species of cichlid, a female of one species can easily resemble that of another. It may sound obvious, but if in doubt, do seek the advice of an experienced hobbyist or shop,

Popular Fish Keeping – Expert help with... top rearing tips

Once your fish have spawned, you will then have the task of rearing the fry. At first, the young have a yolk sac from which they derive nourishment, both in the egg and for a short period afterwards. This will provide them with enough food to sustain them for a period after hatching, during which they will remain inert.

Only once the yolk sac has been fully absorbed will the fry then begin to swim in search for food. This is usually provided in the form of finely crushed flake food, or appropriately-sized live foods, such as brine shrimp.

It is important that the water is maintained in tip-top condition, as the fry are very susceptible to any fall-off in water quality. Feed them little and often, so as to prevent any build-up of uneaten food which will pollute the water. Only use a gentle filtration system, such as a foam filter, in order to safeguard the fry.

Also, ensure when carrying out water changes that the replacement water is not just the same in terms of its chemistry, but that it is also at the same temperature, because otherwise, a marked variation in temperature could easily kill the young fish.

Brine shrimp (*Artemia*) – seen here highly magnified – are a popular rearing food for young fry.

Young fish are tiny at first, and can be hard to observe. There is one young cichlid just visible here, swimming across in front of the top leaf.

TURN OVER FOR MORE BREEDING INFO »

DID YOU KNOW?

The subtle but stunning colouration of lemon tetras will only become apparent iwhen water quality is good.. A dark substrate helps too.

Tetras are most likely to breeding when kept in shoals. These are lemon tetras (*Hyphessobrycon pulchripinnis*).

should you be uncertain about the identity of a particular individual. You can easily email or text some photos for this purpose.

Some people recommend obtaining stock from several retailers. The reason for this is that they may source their fish from different breeders or wholesalers, and by mixing these individuals together will help eliminate the risk of inbreeding of siblings to parents, or mating brothers to sisters.

Choosing fish of the correct age is also important.

Some fish, like these angelfish (*Pterophyllum scalare*) appear to need to learn parenting skills, with their early breeding attempts often ending in failure.

Individuals that are still immature may be harder to sex, but at least you can be fairly certain of their age, whereas this may not be the case if you buy older fish, whose breeding prowess may be declining.

Sexing fish

This is not as difficult a task as it may sound, as many fish show signs of sexual dimorphism. By this, I mean that males and females can be distinguished by external features such as shape, colour and variations in fin shape.

In most cases, males are more colourful with ornate fins, but these difference may not be so clear in the case of young fish. Many of the livebearers such as mollies and cichlids are prime examples of groups where sexual dimorphism is commonplace.

This doesn't apply in all cases though, making it much harder to recognise pairs. This may not matter so much, though, if the fish are compatible and live in a shoal. You should be able to distinguish between the sexes when the females are ready to spawn, as they will swell in size with their eggs, and the males will be in close attendence, often nudging at their flanks. The genital papilla (a small fleshy tube behind the anus) may be evident at this stage too, with its shape differing between the sexes in some cases.

Just because you have a pair of fish, and have identified a male and female though, placing them together does not automatically guarantee that they will breed. Some pairs prove incompatible, particularly in the case of certain cichlids, such as discus. This is why proven pairs can sell for a premium. But before reaching this conclusion though, you will need to eliminate other causes.

It is also important to bear in mind that the first attempts at parenthood in the case of these and other cichlids, including angelfish may often end in failure. They may even end up eating their fry, but be patient, and hopefully, once they have started spawning, you will be successful in the future, particularly if you leave the fish alone as much as possible during this period.

CONTINUES ON THE NEXT PAGE »

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Seasonally flooded rainforest increases the habitat available for fish at certain times of the year and this may encourage breeding.

Torrential rain in the tropics effectively freshens up water, and can serve as a breeding trigger.

In some cases, it is necessary to keep the fish in groups, in order to encourage successful breeding. Keeping a pair on their own in effective isolation is likely to end in failure.

Furthermore, it is often not usually a simple matter of just putting males and females together and waiting for a positive outcome. You need to be proactive and observant, and find the keys that activates the breeding process. In order to breed fish successfully, it is important to understand as much as possible about the biology of the species that you hope to breed, and what are often described as breeding triggers.

Conditioning breeding stock

The first step in the process is known as conditioning, and tends to mimic what occurs in the wild, when environmental conditions become more favourable, increasing the likelihood that the fish will be able to breed successfully. As a result of these changes, if all goes well in the aquarium, then the females will become ripe with eggs, and the males produce milt (sperm) in order to fertilise them in due course.

It is easy to think that seasonal changes only occur outside the tropics, but you'd be wrong! In the Amazon region for example, there can be massive shifts in the water level through the year, linked with rainfall, and when the water level has risen, so this often acts as a breeding trigger.

These factors are often interlinked in the wild, so that a period of rainfall will effectively alter the water chemistry too, by flushing out pollutants that have accumulated in the water. Food is also likely to become more readily available at this stage, as aquatic insects start to multiply rapidly.

Do not be afraid to experiment within reason thereforefore, in order to encourage your fish to spawn successfully. A partial water change, combined with raising or lowering the water temperature by 2°C (3.6°F) can be helpful. Many fish also respond well to being given an increased amount of livefood in their diet. The key starting point needs to be to replicate the natural conditions under which the fish not only live but also spawn in the wild.

Determining what are the precise triggers can be a matter of trial and error, but if one thing does not work, then try something else. Replace dry

There are now species-specific diets for a variety of fish, including discus. These can be helpful, in terms of breeding conditioning.

Breeding factors

Factors that are likely to play a part in breeding conditioning, depending on the species and its natural habitat, may include:

1 Changes in water chemistry
2 The onset of rain
3 Changes in temperature
4 Availability of food (or certain types of it)
5 Changes in light exposure (the photoperiod)
6 Alterations in atmospheric pressure

foods with live foods; increase the water temperature and then drop it or try the reverse; and carry out more frequent water changes.

If something proves unsuccessful, then do not be afraid of trying something else. Although the majority of common aquarium fish have been bred in aquarium surroundings over many generations, they still retain the spawning instincts of their wild ancestors.

Try and research more about the location, habitats, and seasonal climate of the country from which the fish originate therefore. All this information is now just a few clicks of a mouse away on the internet. With a bit of background research, you can not only prioritise the changes that are most likely to work, but should also be rewarded by a successful spawning in due course.

By far the most essential aspect towards bringing aquarium fish into breeding condition is to ensure they are healthy, and this is only achieved by feeding them a high quality, nutritionally balanced diet. Supplement a diet based on flake or pellets with live foods such as bloodworm and tubifex, brine shrimp.

There is no need to risk the health of the fish by giving them live worms either – there are safe, prepared alternatives now widely-available. I've had good results using Tetra's Delica range, where the food is in a nutrient-enriched jelly, and can be fed to the fish straight from the sachet.

Expert tips Troubleshooting advice

In spite of your best efforts, you may struggle to achieve success, particularly with more unusual species about which relatively little is documented. The reasons as to why fish refuse to breed are many and various. However, some of the more common causes include:

- The fact that you may not have a pair; believe it or not, it is possible to have a shoal of fish and still end up with all of them being the same sex!
- The individuals may be too young, and have not reached sexual maturity yet.
- On the other hand, they may be too old and have passed their breeding phase.
- The individual may be sterile – it could be a hybrid. This can easily happen with certain cichlids, such as parrot fish, which are usually but not always sterile.
- Water conditions are not suitable for breeding purposes.
- A trigger mechanism, like a increase or decrease in water temperature may be required.
- There may be insufficient surfaces upon which to spawn.
- There may be too many individuals in the tank, thus creating a stressful environment.
- The illumination in the tank may be too dark, or too light.
- The fish may become stressed by routine maintenance. Keep invasive work to the minimum, by setting up everything in advance as far as possible.

Spawning may actually have occurred without your knowledge, with the fish eating their eggs or young.

Spectacular they may be, but parrot fish are usually sterile, being a hybrid form of cichlid.

Stimulating breeding

If all attempts to breed your fish still result in disappointment, and you have tried a wide range of the above conditioning factors, one thing you can do is to add another male into the tank. His arrival will usually strengthen the bond between the original pair and may inspire them to spawn successfully. However, this should only be attempted in a set-up with plenty of hiding places, where the introduced male can seek refuge from the possible harassment that he may be subjected too.

In many cases of course, you will need a separate spawning tank, in order to safeguard the eggs and any resulting fry from being eaten by the adult fish. It is a good idea to transfer the fish here at a time when you can supervise them – over a weekend for example, especially if you intend to introduce a newcomer. The fish should all be removed after spawning takes place.

Reproduction in the majority of fishes occurs through external fertilisation. In other words, as the female produces her eggs, the male will release his milt (sperm) at the same time. In order to ensure that fertilisation occurs in the aquatic environment, where currents are significant, both males and females must produce significant amounts of eggs and milt. This is essential because only if the sex cells come into contact will fry result from the spawning.

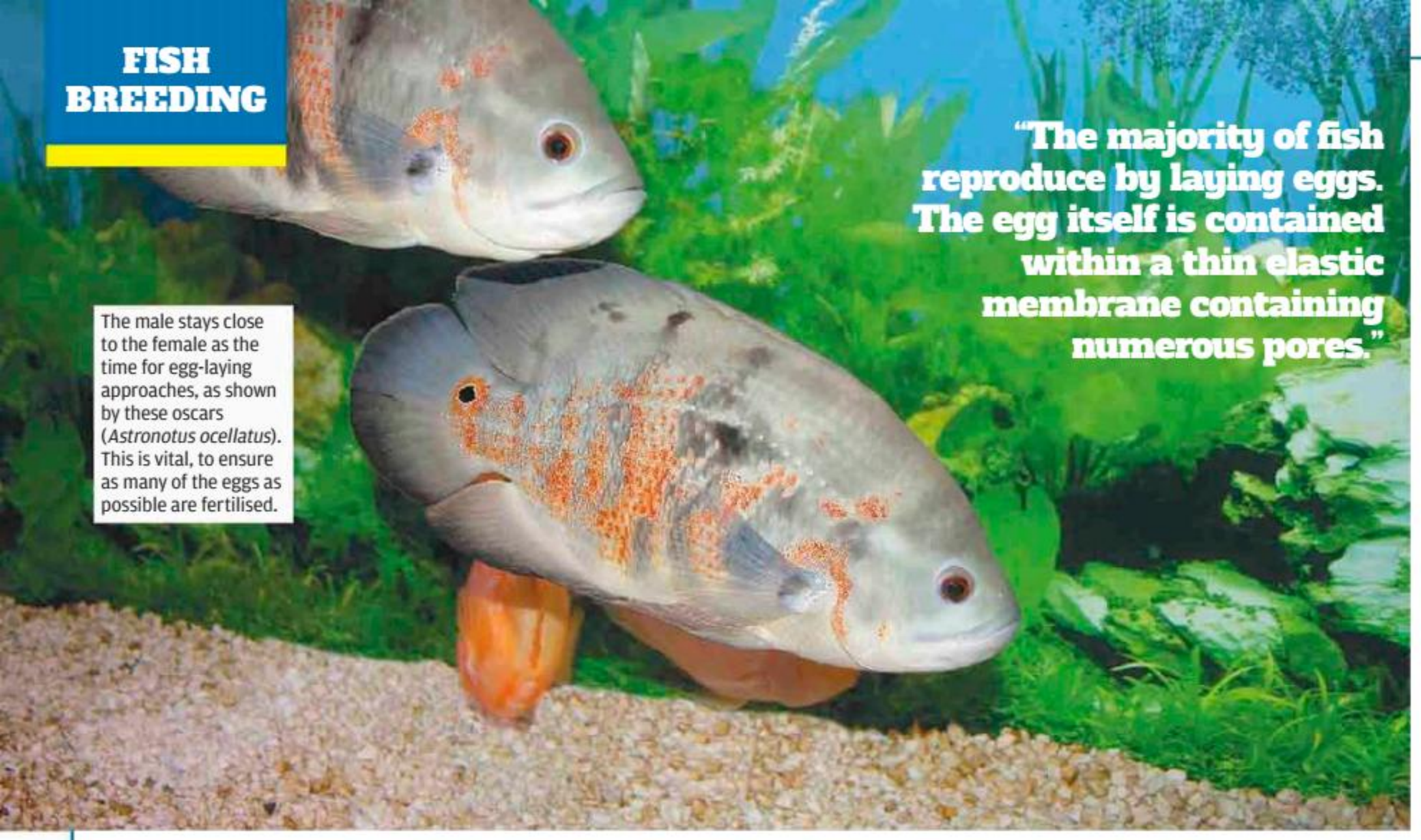
This can vary from one spawning to the next; sexual maturity, relating to the age of the individuals is important, as those at either end of their reproductive lives will be less prolific. A typical spawning may result in hundreds of eggs being produced, of which only a tiny handful of fry would normally survive in the wild.

Preparing the stage

There are numerous ways in which the spawning tank can be set up, and much will depend on the way the fish spawn. Some deposit their eggs on broad-leaved plants or require a flat surface such as a piece of slate on which to lay their eggs, while others dig shallow pits in the substrate over which they stand guard. There are also bubble-nest builders which make a foam-like nest at the water's surface. A number of species adopt a more casual approach, allowing their eggs to drop into the substrate where they are at the mercy of predators.

A word of warning though, as fish breeding can be very addictive, and in no time at all your entire house can be taken over with aquaria containing baby fish! That is why devoted breeders end up with fish houses in their gardens if they have the space, or give over an entire room

CONTINUES ON THE NEXT PAGE



"The majority of fish reproduce by laying eggs. The egg itself is contained within a thin elastic membrane containing numerous pores."

The male stays close to the female as the time for egg-laying approaches, as shown by these oscars (*Astronotus ocellatus*). This is vital, to ensure as many of the eggs as possible are fertilised.

indoors to their hobby. But it is only through the dedication of aquarists that many fish breedings have taken place. Keeping detailed notes on water quality, temperature and similar parameters all lead us to understand what triggers breeding behaviour.

Fertilisation occurs when the egg is penetrated by a single sperm. It finds its way into the body of the egg through a small opening in the membrane called the micropyle. If the sperm does not unite with an egg, it will die within a few minutes. Fertilisation of a single egg by multiple spermatozoa does occur, but is thought to be restricted to sharks.

With species capable of internal fertilisation, such as livebearers, the sperm introduced into the female's body are capable of living for several weeks, or even months. A single mating can be enough to produce a number of broods, freeing the female from the need to mate on each occasion that she produces young.

This is significant because if you purchase guppies, mollies or other livebearers from a shop where both sexes are being housed together, and you then select a pair of these fish in the hope of breeding them, the chances are that at least some of the resulting offspring will not be related to the male that you bought, but rather, to a previous tank companion. Breeders to whom the bloodline is important will keep young females on their own together, so they can be certain of the parentage of their offspring in due course.

The majority of fish reproduce by laying eggs. The egg itself is contained within a thin elastic membrane containing numerous pores. This means that when it is released, water will be absorbed by the egg and it begins to swell. In a number of species, the egg may be coated in a sticky secretion, so it will adhere to tank décor or even the glass. In the wild, this prevents the currents from carrying the eggs well away from the natural range of the fish, perhaps into less favourable surroundings.

Beneath the egg's outer membrane is another membrane containing the germinal disc, which eventually develops into an embryo upon fertilisation. It also contains a food store, the yolk, on which the developing embryo derives its nourishment.

Depending on the species, a healthy egg may take on a transparent, glossy, white, green or yellowish colour. In contrast, a dead egg appears greyish-white in colour and quickly develops fungal growth. Dead eggs must be removed without delay if possible, so as to avoid the fungus spreading to other healthy eggs and infecting them. A pipette can be useful for this purpose.

BELOW South American cichlids belonging to the genus *Bujurquina* will spawn on rocks as shown here, but others dig into the substrate. You need to discover your fish's breeding habits.

Barbs like the green barb (*Puntius semifasciolatus*) seen here are egg-scatterers. Females simply release their eggs, with spawning normally occurring in the early morning.

A final thought

Fish breeding is an exciting aspect of the hobby, but it can be challenging. It is a good idea to build up your level of experience, and be prepared for disappointments, and try to analyse what has gone wrong.

Above all, do not become disillusioned, because as is often said, perseverance is the name of the game and ultimately, you will hopefully be successful with your chosen species!

Puzzle page

See if you can solve the puzzles here! You can find all the answers on page 98.

GONE FISHING

We have hidden nine of the listed words below - up, down, diagonally, back and forth - along straight lines in the grid. Which one has gone missing?

AQUARIUM
FILTRATION
FOOD
GRAVEL
HEATER
LIGHTING
NETS
PLANTS
PUMP
ROCKS

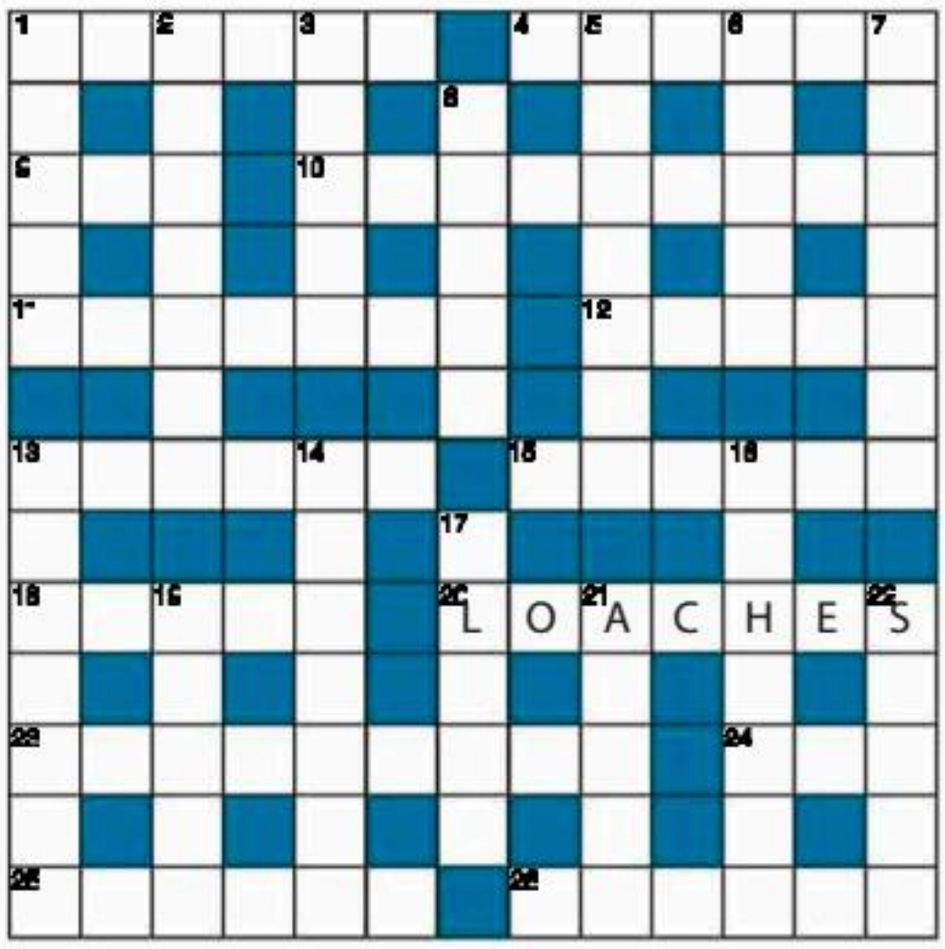
PUZZLE IT OUT

ACROSS

1 ****** (6)
4 Lacking the means or capacity (to) (6)
9 Tree's lifeblood (3)
10 Device used to clock times of runners (9)
11 Kingdom, realm (7)
12 Electronic computer message (1-4)
13 Oily fat (6)
15 Stops, comes to an end (6)
18 ***** (5)
20 LOACHES
23 Garden grass-cutting machine (9)
24 High, looping tennis shot (3)
25 Make certain of (6)
26 Veer suddenly to the side (6)

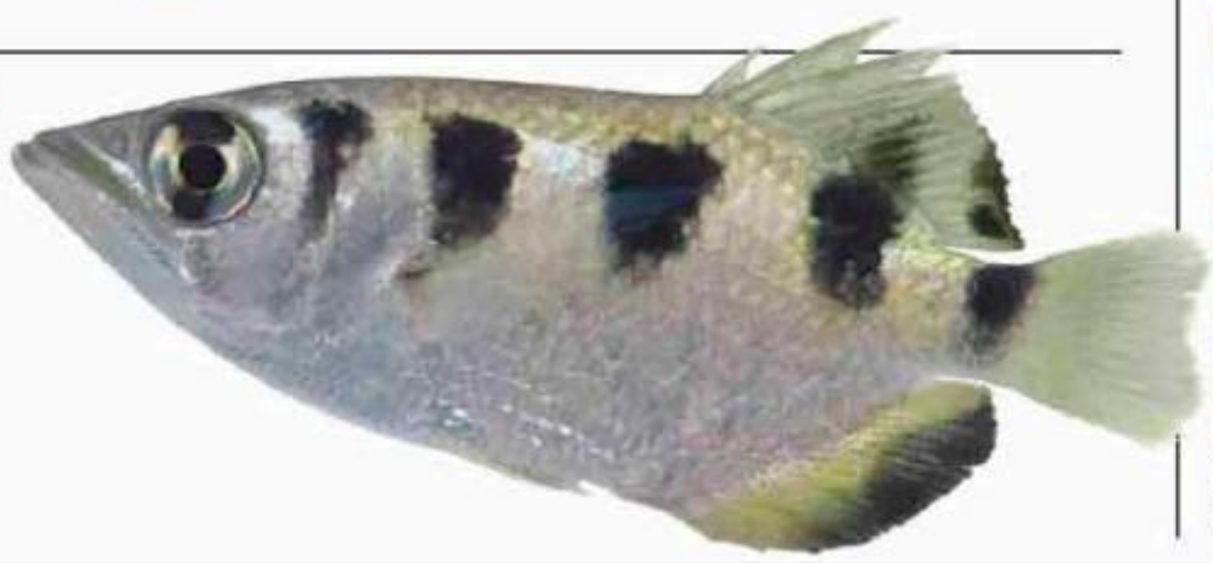
DOWN

1 Fundamental (5)
2 Eighth planet from the sun (7)
3 Useful resource or strength (5)
5 Not anywhere (7)
6 ***** (5)
7 Breathes out (7)
8 Japan's capital city (5)
13 Small. fleet-footed antelope (7)
14 Stumble nervously over one's words (7)
16 Distinguished academic or student (7)
17 ***** (5)
19 Crown green game (5)
21 Archer's missile (5)
22 Stout cavalry sword (5)



ID PARADE

Can you identify this fish?



WHICH FISH IS THIS?

Pictured below are close-ups of five different fish. Can you tell what they are?

A moving experience

With the housing market picking up, more of us are likely to be on the move again soon. Just imagine it though. After perhaps years of patient work, your aquarium is looking great, with the fish and plants thriving, and then suddenly, you are faced with having to strip it down. Here expert fish keeper Dick Mills provides practical advice to ensure that all goes well when you find yourself in this situation.

Don't panic, as with a little thought (and some forward-planning), things can be achieved without too much stress either for you or the fish. Of course, with tropical fish, it is better that any such transfers should be done in summer months, but we can't all choose the ideal time for everything, can we?

A number of problems, and a variety of solutions, will present themselves when faced with moving an aquarum to a new home. Will the water conditions there be the same as the fish are currently used to? Is any forward acclimatisation possible? Could any access to the new home - in advance of moving day - be negotiated in order to set up a new tank in advance or, conversely, could the fish be left at the old address for a short time and then collected at a later date? Alternatively, if you are a member of the local aquarist society, perhaps a

Aquarium plants will need careful handling, as well as the fish themselves, to ensure they continue to thrive after a move.

Dick Mills in his day job as a sound engineer. *COURTESY KEVIN DAVIS*

Before departure

1 Switch off and disconnect the power (above) to the aquarium - then by the time you've carried out the following steps, the heater is likely to have cooled down sufficiently to be handled safely.

2 Catch the fish (right) and place them in suitable transportation containers. Polystyrene boxes serve as excellent insulated containers and actually hold water, although it may be better to line these with heavy duty plastic bags for the fish unless you are certain that they are clean. Tape the lid on securely. If the weather is hot, then a battery-operated air pump will assist with aeration.

3 Remove the plants and place them in wet newspaper before sealing them in large plastic bags. Placing the plastic bags in another rigid container will prevent the plants being crushed or bent. Label the box as "Plants", to avoid any confusion amid the chaos. They will need to be returned to the water as soon as soon as possible.

4 Lift out the rockwork. Try to remember the layout, or better still, take some snaps with a mobile phone (top right), as this will help you to recreate things as they were, once you are at your new home.

5 Take out the hardware. Store fragile heater/thermostat (heaterstat) units in boxes lined with crumpled newspaper, bubble-wrap or some other form of protective padding. Make a note of thermostat control knob position, or tape it in place to prevent it becoming altered during transit. Clearly mark this container as "Fragile".

6 Fluorescent lamps can remain in the hood, but be very careful when handling the hood, as the starter gear is heavy and it can easily slip out of your grasp and damage anything (like the tank!) that is nearby. Also, take extra care when handling wet cover-glasses.

7 If the journey is short, then keep any external filters full of water (right). All you need to do is just connect the outlet and inlet hoses together for safe transportation. Internal power filters should be removed from their suction cups and slipped complete into plastic bags and sealed. Undergravel units can be left in place if the tank is small enough to lift complete with the substrate; don't disconnect uplift tube(s) though, as you'll never reconnect them again through the substrate without a lot of stress, trouble and a gravel-filled filter-plate!

Take photos of your tank's layout before leaving

8 Make sure to pack any electrical distribution extension leads.

9 Drain down the water to the level of the substrate, keeping as much water as possible in the extra containers. If the tank is large, then it will need to be emptied of substrate which, again, will need containers for transportation. Builders' plastic bags - as used for rubble disposal - are tough enough to handle the weight of wet substrates but don't overload them, because they can split.

10 Transfer the aquarium once it has been stripped down on to a suitable board for lifting evenly – don't trust the glass shelving to support the weight of the aquarium!

11 Dismantle the aquarium stand if possible for flat packing, keeping the screws and bolts in a handy bag taped to part of the stand. Don't forget the slab of polystyrene to go under the tank on re-assembly.

fellow fish keeper might have spare tank space in which your collection could be temporarily stored until a new home is established for it? Until you sit down and logically think through the possibilities though, you could be in for a very hectic and worrying time!

Of course, nobody moves house instantaneously and there is usually a reasonably long period of time between taking the decision to move and the actually transference of belongings. Within this period, it should be possible to reduce the collection in terms of the numbers of fish (or tanks!) to some degree. This, at least, will minimise the work involved. The fact still remains that eventually though, the deed will have to be done, so what is the best way of tackling it?

What you need to do

This can be best summed up by slightly amending the

TURN OVER FOR STEP-BY-STEP ARRIVAL TIPS »

Popular Fish KEEPING Step-by-step

1 Assemble the stand and place the tank in position, checking that it is level.

2 Replace the substrate (if previously removed) and then add the rockwork and hardware.

3 Refill the tank with all the transported water and replant it.

4 Switch on the power, re-start the filters and allow the tank to get up to its normal temperature before re-introducing the fish. Don't forget to float the fish in their bags in the tank as per usual, so as to allow water temperatures to equalise, before releasing them back into the aquarium (right).

5 Use the transportation water in which the fish were moved to top up the tank, only adding 'new' water as a last resort, and then only after treating it with a conditioning agent before use.

6 Have a cup of tea! Then go back and get the rest of the family and furniture .....

On arrival

When it comes to moving fish, time is definitely of the essence, and a helping hand is always useful. Ideally, although this is not always possible, aim to move the aquarium first, ahead of the rest of the household furniture and set it up at your new home in advance. Most domestic-sized aquariums, together with their hardware, can be fitted into the back of the average-sized car and a quick single journey is preferable rather than being kept at your old address until the last thing on moving day.

Most people will want to move the aquarium themselves, rather than risk it in the removal van. It is always worth checking your household insurance in advance, for cover for accidental breakage and/or the loss of fish under these circumstances though.

Top moving tip

"Bear in mind that water is heavy so don't stock up with containers that you will not be able to lift easily once they are full!"

words of a popular song - *Always take the weather with you* . Basically, it is important to take as much of the tank water in which the fish are being kept as possible, when you move. This will cause them less stress and should give a basis from which you can gradually adjust their water conditions, should this become absolutely necessary.

Collect a supply of sealable plastic containers for this purpose, but bear in mind that water is heavy so don't stock up with containers that you will not be able to lift easily once they are full! Large paint buckets with lids are ideal for carrying fish and water, but make sure the containers are clean and have no chemical residues whatsoever, or re-line them with large, heavy duty plastic bags. During mid-winter moves, you should also wrap the containers in blankets to conserve heat.

Rather than totally strip down the aquarium, if the journey is relatively short, it may be possible to simply drain the tank of water after removing fish, plants, rocks and fragile hardware, and transfer the tank and substrate as one item. This is feasible for tanks up to 60cm (2ft) long, but with tanks that are larger than this, there is a significantly increased risk of cracking the base glass and/or giving yourself a rupture!

Keep a close watch on the fish to ensure that all is well after the move.

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Capturing a jewel: the pearl gourami

Fish-keeping is acknowledged to be one of the most relaxing of all hobbies, but why not expand your interest with another equally relaxing pastime, and start painting pictures of your favourite fish?

You might think that you don't have any artistic talent, but in this unique step-by-step guide, professional wildlife artist and fish keeper Ben Waddams reveals the secrets that will allow you to come up with impressive portraits.

You don't simply have to hang a painting on the wall these days either – there are many other possibilities too. Why not photograph or scan your favourite, and use it as an avatar, if you join any of the fish keeping forums for example? You could also convert it into cards too, or even upload it to create your very own personalised T-shirt?

Ben loves to paint, write and photograph wildlife

Ben's choice

In the world of tropical fish, the pearl gourami (*Trichopodus leerii*) is surely one of the prettiest species of all – at least in my view! But it is not all about beauty. The black mark extending down the sides of the body serves as an effective predator avoidance system, by running through the fish's real eyes at the head, with more conspicuous false eyes present near the tail. Any would-be predator seeking to attack the gourami could easily end up focusing on its tail, rather than its vulnerable head.

But of course, this black line is not the only striking thing about these gouramis. Their colouration consists of reds and yellows, not to mention blues and greens, and in my opinion, this variation in colour makes them a great subject to select for a painting. So if you're inspired to portray this popular gourami in this way, let me show you how it can be done.

Ben painting a rhino at The Destinations Holiday and Travel Show held at he NEC Birmingham back in 2010

HOW BEN CREATED HIS MASTERPIECE

MAIN PHOTO BY DMITRO2009 / WWW.SHUTTERSTOCK.COM
ALL ARTWORK PHOTOS BY THE AUTHOR

1 As with all my paintings, I like to keep things easy and simple. All you will need to get started is a small selection of acrylic paints – blue, brown, red, yellow ochre, lemon yellow, green and white. You'll probably also need three or four different brushes, ranging from medium and flat to small and pointy.

Find an old plate to use as a palette, a pencil and something suitable as a water pot where you can rinse your brushes. Lastly, you'll need a 'canvas'. In this case though, I'm not using a canvas as such, but a small piece of hardboard, available very cheaply from any DIY store, and I'll be painting on the smooth side.

Ben's Top painting tip

"Don't try and paint every scale of a fish or every frond of weed. Instead, have some fun with the paintbrush and play about with the tip, the sides, the sharp edge and other parts – don't be afraid to experiment!"

2 I've got a photograph of my chosen gourami in its tank. This gives me the details that I'll need, but I'm starting the picture by creating the background first, before starting to paint the fish.

I have used a flat brush here, and mixed together green, blue, brown and white paints to create a dark background, while also creating the suggestion here that light is coming from above. This is important because you need a light source, and in water, it is almost always coming through the layers of water from the light above. The actual angle of the light may vary though. Here, it's coming in at an angle across the painting.

3 Using the same medium flat brush that I used to create the background, I'm now mixing a luminous green paint on my palette. The fluorescent lamps that we all use in our aquariums make the weeds glow with a lovely rich tone. Here I've used my green along with some brown for the shadier areas to the left, and a touch of lemon yellow for the lighter areas on the right. It's not the same as the photo, but that doesn't matter! The painting is not intended to be a copy of the photo – in fact, you can paint your fish swimming around, without using a photograph, although it will be harder to pick up on the detail.

4 I'm continuing to add greenery to form the background here. Can you see how that bluish-brown and white background continues to suggest beams of light from the top right? I've tried to give an illusion of a bit of depth by loosely brushing on some duller greens in the background. The lightest and most detailed parts of a scene are always toward the front, so I've added some yellow, green and white to the front bits of weed.

TURN OVER TO SEE BEN'S PAINTING »

5 Once the paint has dried (you can use a hairdryer carefully to speed up the process if you can't wait!), the next step will be to draw on the gourami. You can do this by creating a very faint grid on your photo and an identical grid on the board and then transferring it, to give the dimensions and outline of the fish, or you can measure it out slowly and carefully, drawing it on here in pencil in either case. Although we're not trying to create an exact replica of the photo, it is still important to get your fish drawn correctly in place, so take your time. When I'm happy, I then 'seal' the pencil lines with a watered down wash of brown. Once this dries, it will mean that I can't accidentally rub off my pencil lines.

6 There's no right or wrong way to start – I thought I'd begin with the orange. Most of the gourami is covered in different degrees of orange. For the dirtier areas I mix red with yellow ochre, brown and even a bit of green; for the lighter areas, I use a combination of red and lemon. lemonyellow.

Ben's Top painting tip

"Don't worry about your plants showing through. Fish fins are slightly transparent and you would be able to see through them in real life, as is evident in photo 6."

7 I've continued with my oranges, browns and yellows, using the photo as a constant guide. Keep checking that you've got it just right. Here I'm using a smaller brush, and I don't think I'll need to use another one because it's the perfect size. If I splay the bristles out, I can cover a larger area, while if I turn it on its side, it is possible to create a thin line (for example, the gourami's long 'feeler') and when I want to create dots, I can do that with the tip of the same brush.I can do that with the tip of the same brush.

Ben's Top painting tip

"Because the tank and the background are green, if that green shows through the fish a little bit here and there, it will help to 'place' the fish within the environment."

8 I am adding more orange colouration here, with some parts being clean and bright, while the others are dirty. The darker areas extend around the gills and the pectoral fin. The black pattern is made using a mixture of blue, red and brown paints. I don't like using black – you never see it in the natural world!

See Ben's latest work...

Discover what he is working on at his website, **http://waddams.webs.com** You can buy his paintings online here as well, including the one created for this article. Ben is also willing to undertake commissions too. Contact him for details through his website.

Your prized fish...

Why not email us a copy of your painting of your fish, to **pf.ed@kelsey.co.uk**? We'll aim to include a few in our next issue, and send out a small prize to the one that Ben thinks looks most appealing!

9 Here I am using the same brush with a lighter mixture. There is a bit of blue and white now being applied to the orange paint to show the light hitting the fish from above. I will also add a little bit of white to create the spots in the final step.

Ben's Top painting tip

"You don't want to paint the gourami in a green environment without putting a little bit of green in (or letting it shine through), or it will look like you've stuck the fish on to the board!".

10 Now you can see I've used the slightly blue mixture to paint the fins in, and put some light on the top of the fish's head and the back. I've nearly finished now, with the last stage being to add the spots, and this will then transform it from being an orange fish into a pearl gourami! I'm careful with the eye here too. I'm still using the same brush - I've only needed to use two for this entire painting as it has turned out - and I put little pinpoints of light and dark in the eye, following the photo.

BEN'S FINISHED PAINTING

11 I've added all the spots on now, along with a small amount of the blue-white colouration to the back and tips of the fins. I'm really happy with this study. I can just imagine the gourami floating gently in the tank, with the weeds swaying slowly behind and the light filtering down from above. Try it yourself – it really isn't that difficult! Just remember to experiment and have fun.

BELOW Seneye has developed solutions which allow fish keepers to understand what happens inside their aquarium by monitoring key water parameters.

How technology helps

Fish keeping has been transformed over recent years, as technological advances have led to the introduction of ever more sophisticated products, which can be of great benefit to both hobbyists and their fish.

LEFT The Seneye Home System.

Here we focus on the Seneye Home System, which should give you considerable peace of mind, whatever type of fresh water aquarium fish you keep. It is a broad-based aquarium monitoring system that covers all the key parameters to ensure that the occupants are not exposed to any serious shifts in their environment.

No longer will it be necessary to use water test kits, which can sometimes be fiddly, quite apart from relatively costly to use, and only give a snapshot of the water chemistry at any stage. Seneye provides round-the-clock monitoring, seven days a week, 365 days a year.

It is not only there to alert you to the risk of so-called 'New Tank Syndrome', when ammonia levels can rise suddenly and dramatically to dangerous levels, but it can also warn you about filter crashes that can have a similar, devastating impact on the creatures in the tank. It is usually impossible to spot any indications of early onset in either case, until the fish start displaying symptoms, by which time it will be too late to prevent the problem, and losses will be almost inevitable.

ABOVE The Seneye Home System's monitoring results on a PC screen.

On the move

The unit is very simple to operate, as all you need to do is place it in the aquarium, where it can be fixed unobtrusively to the sides with plastic suckers. It comes with a USB connection, enabling the results to be uploaded to a Windows PC. This transfer can even be carried out by WiFi if you prefer. A range of options

emphasise the flexibility of this unit still further, such as a USB extender, for example, or a micro travel power adapter, should you be travelling some distance to collect fish, and want the reassurance of knowing that all is well on the journey home.

Worries about failing lights, a broken heater or even a leak can be assuaged by the fact that this unit will alert you at an early stage, even if you are not at home. You can be notified directly by email or an SMS (text) message, should there be a problem.

Data collection

The information gathered is logged as well, so that you have a historic record of the water conditions in your aquarium. This data can be very useful for breeding attempts with less common species.

It allows the conditions that led to spawning, for example, to be precisely and accurately recorded for future reference. This monitoring also provides the opportunity to adjust these variables if things did not go to plan. You can also obtain predictions of future changes in water chemistry that can effectively serve as an early warning system for potential problems ahead.

Access and use

The system will operate through a Cloud platform, and this means that you can access the results via any internet-enabled device at any time, anywhere in the world, provided that you have access to an internet connection. This too can be very valuable. You may be thinking of obtaining new fish, for example, and want to discover if they will be suitable for your existing set-up. With Seneye, you have the option to access this information on your mobile, and discuss it with a retailer in the shop. Everything has been developed to make the system as simple as possible to operate, which will be particularly welcome if you are not especially techno-literate. In fact, there is even a very informative range of 11 "how to" videos available, explaining all aspects of how to set up and use Seneye.

"Seneye provides round-the-clock monitoring, 365 days a year"

Costs

With all these possibilities, quite apart from the collection of the data, you might be expecting Seneye to be expensive. But in fact, the Home unit retails for just £69.98, with the Seneye+ costing a further £18 for three months. (There is also a specific Reef option, priced at £99.98 and a dedicated Pond version, selling for £89.98, but this Home unit will work in these situations too if required). The Seneye+ includes the disposable Seneye slide, e-mail alerts, automatic online graphing and personalised advice. Activating Seneye+ is straightforward and the disposable slide removes the need for recalibration (and the cost of recalibration chemicals), in addition to improving the accuracy of the results.

WHAT SENEYE DOES

- **TEMPERATURE**
  Constantly monitors water temperature, alerting you if the heater fails.
- **FREE AMMONIA**
  Will detect the presence of highly toxic free ammonia (NHÐ) at very low levels, warning you of any significant shift so you can protect the fish from dying as the result of ammonia poisoning.
- **pH**
  Will monitor pH levels between 6.4 and 9, and detects changes. This range is ideal for most aquarium fish.
- **TOTAL LIGHT**
  Checks the light output over the course of the day and again notifies you if lights fail.
- **WATER LEVEL**
  Only operates in water, and will detect and warn you about leakage.

LEFT Instead of sticking Seneye to the side of your tank you can buy this float to put it in

5 WAYS TO LINK UP SENEYE AT HOME OR OUTDOORS

1. instant uploads

2. wireless instant uploads

3. internal data log

4. internal data log with powered hub

5. the seneye active extender can be used indoor or outdoor in conjunction with any of the uses above

Further information

Seneye's website is at www.seneye.com
See the videos about Seneye online at http://vimeo.com/seneye/videos/search:How%20To/sort:newest

Practical Reptile Keeping

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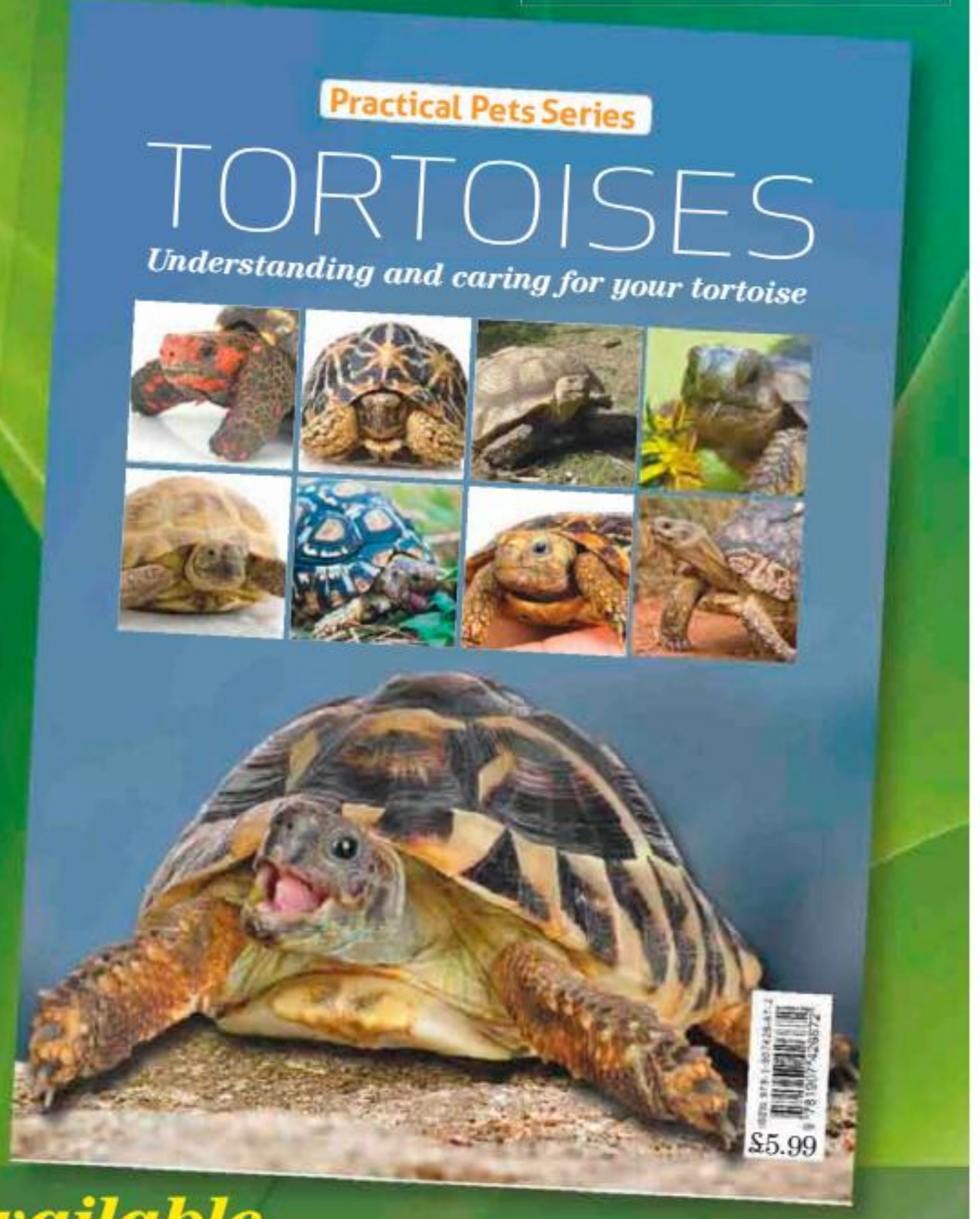

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Snakes has in-depth profiles of popular snake groups, including **corn snakes**, **hognoses**, **ball pythons**, **carpet pythons**, **green tree pythons**, **boas** and many others, along with detailed information about their care and breeding, plus general guidance about starting out with this group of reptiles. ***Snakes*** is illustrated throughout with stunning colour photography and draws on the expertise of *Practical Reptile Keeping's* contributors.

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The development of the discus

Discus rank as one of most striking of all tropical aquarium fish, but just what is it about these members of the cichlid family that inspire such enthusiasm on the part of fish-keepers, and have led to people literally risking their lives to acquire them?

Originating from the Amazon basin, discus have been highly prized right from the early days of tropical fish keeping, when technological advances made it possible to maintain heated aquaria for the first time during the early years of the 20th century. Herbert Haertel, who ran one of the world's first tropical fish shops in the German city of Dresden before the outbreak of the First World War in 1914, is credited with being the first person to bring these beautiful fish to Europe. He travelled across the Atlantic by boat to New York, in order to acquire what he described as "blue angelfish", because of their blue streaking and flattened body shape.

A remarkable discovery

This form is now referred to as the brown discus, because of its background body colour. Haertel's discus survived the journey back to Germany in good health, and then spawned soon after their arrival. Unfortunately

Discus habitat in northern South America.

Discus varieties

The narrow body shape of the discus is seen here.

Thanks to their shape, discus can weave easily between aquatic plants.

Pigeon blood discus - a variety of Asiatic origin.

Some discus lack markings.

The patterning on today's strains of domesticated discus often stands out.

though, the initial technique that Haertel used to hatch the eggs, based on his experience with angelfish, was doomed to failure. He finally managed to hatch discus eggs in soft water, but then the fry refused all the usual fish foods.

Undeterred, Haertel set up a large clay pipe in their aquarium where the adult fish could spawn undisturbed. The pair emerged only once their eggs had hatched, enabling Haertel to be the first person to observe one of the most remarkable sights in the animal kingdom.

Once they were free-swimming, he noticed how the young discus were nourished by their parents, nibbling at the sides of their bodies and consuming mucus here, before they became old

TURN OVER FOR TOP TIPS ON DISCUS CARE »

DID YOU KNOW?

It is now thought that the so-called "discus milk", which the young nibble from the sides of their parents, may contains antibodies, helping to protect them from infections at this early age.

enough to eat other foods. On this memorable occasion, Haertel raised 32 young discus successfully, and so pioneered the way for others to breed these fish.

Local variants

Within the Amazon basin, it was soon clear that a number of local colour variants of discus awaited discovered. Fabulous blue discus from the upper Amazon region were first recorded by Harold Schultz. He tried to bring some back to the civilisation but ran into serious problems on the return trip, and ended up having to eat his highly-prized fish instead, in order to survive.

The area where he found himself was very dangerous. Schultz was almost killed in a battle between local Indian tribes, and also ended up being ravaged by malaria. Finally, however, in November 1959, his determination paid off. He succeeded in obtaining three more of these magnificent fish, and was able to get them back to Germany, where again, they spawned successfully. Others had also fallen under the spell of the discus by this stage, including Dr Herbert Axelrod, the pioneering aquatic publisher who founded the company still known as TFH - with these letters standing for *Tropical Fish Hobbyist*. A regular visitor to the Amazon in his younger years, Dr Axelrod caught pure blue discus, of which the best-coloured individuals were soon being christened as 'royal blues'.

Specific strains

In Florida, the next stage in the discus story was soon to unfold, through the efforts of a breeder called Jack Wattley. He was responsible for developing a renowned strain of turquoise-coloured fish and now the emphasis became focused on producing discus with brighter colours.

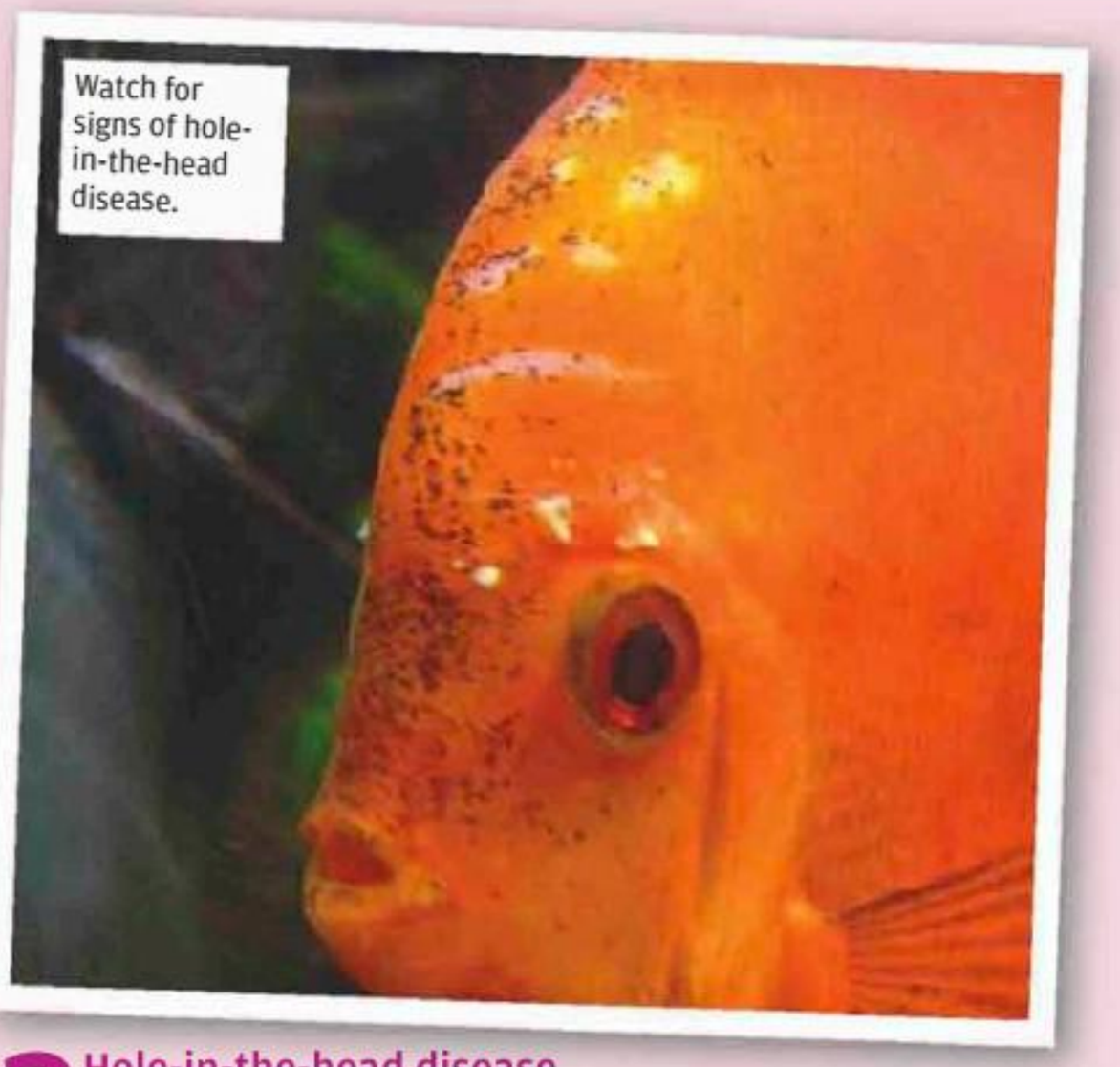
Popular Fish Keeping Expert tips — Fish care, buying and breeding advice for beginners

1 Care

Adult discus can reach a size of 13-20cm (5-8in) long when adult. They need to be kept in a correspondingly large aquarium, which should be at least 91cm (36in) long, and relatively deep - probably 45cm (18in), taking account of the height of these fish. There must be a spacious swimming area for the fish, with bigger plants generally confined to the rear and sides of the aquarium.

Discus are social by nature, and can be kept in small groups together, although breeding pairs are usually housed on their own. Maintaining the correct water chemistry is vital to keeping these fish in good health.

Feeding in contrast presents no problems. Prepared diets are quite satisfactory, with specialist foods for discus being available, although various livefoods such as small worms and crustaceans often help to stimulate breeding behaviour.



Watch for signs of hole-in-the-head disease.

2 Hole-in-the-head disease

Discus are vulnerable to this parasitic illness, so check fish carefully for early signs, prior to purchase. The affected area, typically in the vicinity of the forehead, becomes pale at first and then ulcerates. The cause is a microscopic parasite known as *Hexamita*. Treatment is possible - ask a fish vet for advice - but the chances are that individuals that do recover will be permanently scarred.

3 Breeding

Once discus are sexually mature, when they reach about 10cm (4in) long, so it is possible to sex them, although this is not easy. Seen in profile, the head of the female is more rounded than that of the male, whose head in contrast appears

Key aquarium stats
Temperature: 24-29°C (74-84°F)
Water chemistry: Soft (50-100mg/l) and acidic (pH6)

Top Troubleshooting Tip

A young pair of breeding discus may simply eat their first few clutches of eggs. Do not worry too much, be patient and leave the pair in peace, and ultimately, they should breed successfully.

Wattley's strain, which has now been maintained for many generations, has since become famous around the world among discus enthusiasts. Since then, other rare colour forms have emerged from localities in the wild. A discus with red colouration predominating on its flanks was obtained from the Rio (= River) Icana in 1979, and this passed into the care of a German breeder, Dr. Schmidt-Focke.

It proved to be a female and soon bred. Schmidt-Focke was able to show that it was possible to transfer this colouration from one generation to the next, confirming that it was a genuine colour form rather than an aberration caused by the fish's diet.

Other red discus have since emerged from other localities in South America, with this colour now having been successfully incorporated into various breeding strains, and intensified in appearance as well.

Green discus have also contributed to today's breeding programmes, although they are regarded as a separate species. Recent studies having shown that there are actually three distinct species of discus in the wild, with today's ornamental strains being derived from cross-breeding between them.

Although there is still widescale breeding of discus both in the USA and Europe, the centre for commercial breeding has now shifted to Asia, and especially Singapore.

Discus are the most commonly-kept aquarium fish there, and are bred in large numbers. New, vibrant red forms, such as the rather grotesquely named pigeon blood discus, have been created as a result.

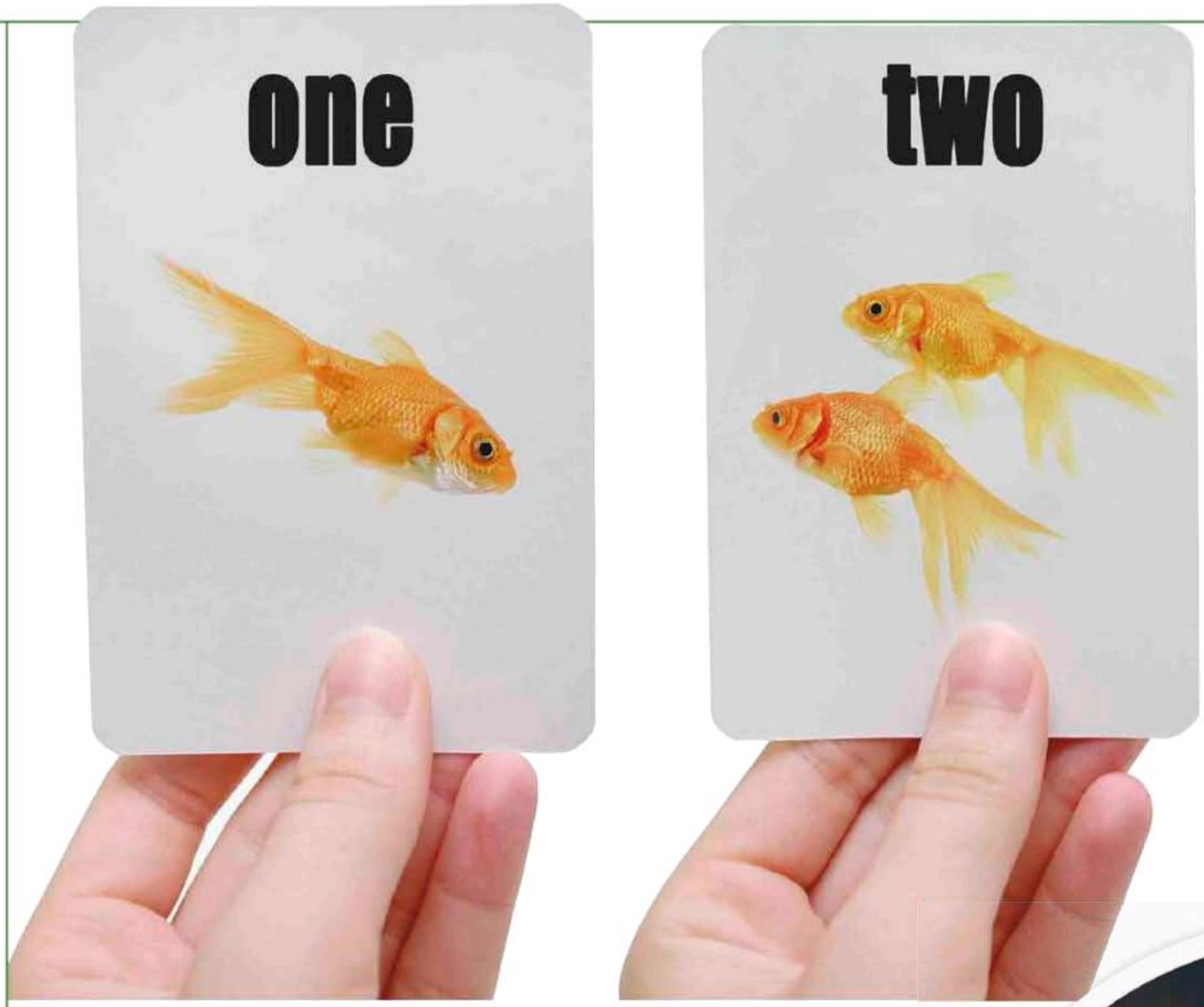
Today's discus are now far more colourful than their wild ancestors, as a result of selective breeding over many generations. The appeal of discus does not just stem from their colouration, however, but also their graceful shape, their friendly nature and the fascination of observing their breeding behaviour in aquarium surroundings.

slightly humped. Also, look behind the long thin pelvic fins and you will see that the genital opening of male Discus is relatively narrow and also triangular, rather than rectangular like that of females.

A pair will spawn either on a broad leaf or, more likely, on rockwork such as a piece of slate provided in their aquarium. They will clean the site very carefully first, and the female will typically lay 200-400 eggs here. These will then take about two days to hatch, and the young fish or 'fry' remain inert at first for a similar period, absorbing their yolk sac into their bodies before becoming free swimming. Throughout this time, their parents watch over them, and the young fish will soon be observed feeding on their flanks. Gradually, they become independent and should be transferred to another aquarium where they will have plenty of space to grow.

In summary

Today, you do not need to spend a fortune to enjoy discus, as reasonably priced fish are stocked by most aquatic stores. Even so, they rank as being among the more expensive tropical fish, particularly if you are seeking mature, breeding pairs of one of the rarer varieties. On the other hand, it can be much more fun to buy small discus which are significantly cheaper, and grow these on yourself into breeding stock. They are relatively long-lived fish as well, having a potential life expectancy of 10 years or more.



Can fish count?

Counting and numerical concepts may appear to be something intrinsically human and related to language, but over recent decades, research on human babies has found that language is not needed to understand numbers. Other studies have shown that some mammalian and bird species are capable of understanding and utilising numbers, but what about fish? Animal behaviourist Dr Julia Mueller-Paul examines the evidence.

Two distinct numerical concepts have been highlighted by animal cognition studies, suggesting that quantities are processed in one of two ways. It appears that small numbers are tracked by keeping score of individual items or fellow creatures. This way of processing numbers is precise but requires significant powers of memory for this purpose. As a result, animals are generally only able to track up to three or four items at a time.

This limited ability is, of course, not especially useful in a natural setting, as fish shoals are often significantly bigger. When it comes to the processing of larger numbers however, there is evidence of a second system that addresses this situation.

It operates by relying on differences in the ratio between two sets of numbers, rather than the absolute numbers that make up each set. This means that a fish might be able to distinguish between a set of four individuals compared with eight, but not a group of seven in contrast to eight. This way of distinguishing quantities is imprecise and somewhat vague but, in turn, it requires less active memory involvement and can also be quickly applied in real-life situations.

Strength in numbers

It is well known that shoaling fish prefer to join larger shoals compared with smaller ones. This suggests that some concept of numeracy is present is fish, but this might be related to overall mass rather than actual numbers. In order to establish the exact way in which fish count members of different shoals, a study was therefore carried out involving mosquito fish (*Gambusia holbrooki*). If


Water temperature can affect the counting ability of angelfish

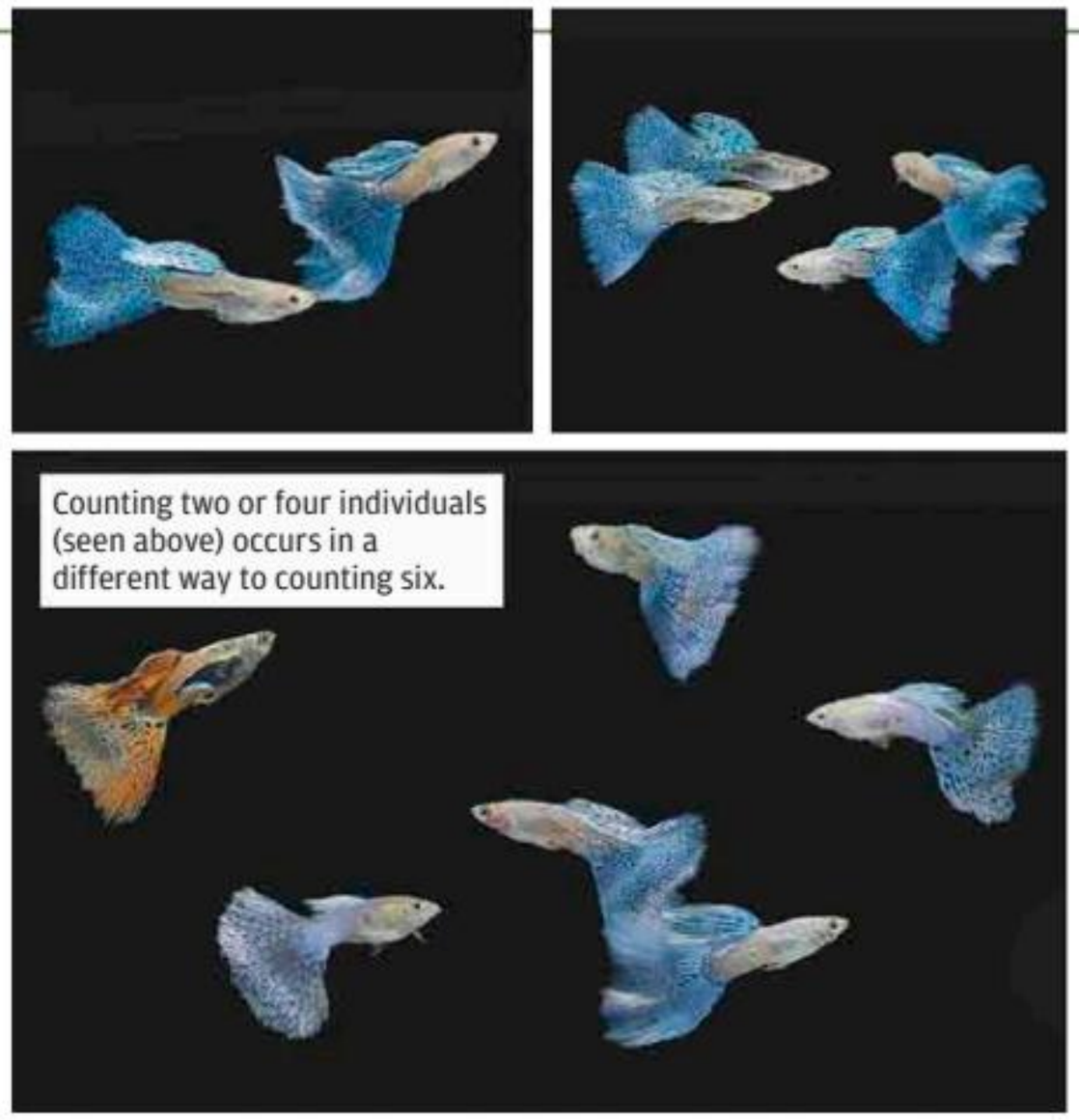
harassed by a male, female mosquito fish tend to join the largest available shoal in an attempt to escape the undesired suitor.

When given the choice between shoals of two versus three, and three versus four fish, so the females consistently joined the larger group. This shows that they were able to distinguish between shoal size, even though it varied by only one individual.

Matching a baby's ability

However, when shoals comprised of more than four individuals were established, but still only varying by one individual (such as four versus five, and five versus six) the mosquito fish were then unable to make the distinction. This suggests that they were using the same exact counting mechanism that has been found in other animals when it comes to distinguishing small numbers.

Their counting ability seemed to reach up to four items and then broke down. This is quite impressive considering that the number four represents the same cut-off point that has been observed in rhesus monkeys and babies up to a year old.



Counting two or four individuals (seen above) occurs in a different way to counting six.

A significant ratio

Further investigations presented mosquito fish with larger sets of numbers, and the ratio between the sets was altered. So for example, the fish were required to choose between a shoal of eight fish and another made up of 16 individuals, and others comprised of 12 and 16 fish.

When confronted by these situations, it turned out that they could only distinguish between the size of the shoal if the larger group contained at least double the number of fish compared with the smaller shoal. This shows that when interpreting larger sets of numbers, it is actually the ratio between the two numbers, rather than the totals that were important.

The fish were even able to make accurate judgements when deciding between shoal sizes as big as one hundred versus two hundred fish. This again shows that mosquito fish count in a manner very similar to that of many mammals.

The count-off: guppies versus university students

In an unusual study comparing the numerical abilities of guppies (*Poecilia reticulata*) with those of university students, the same cut-off point of four was found. Both the fish and the students were able to distinguish between sets without the reverting to the use of a ratio when four or less numbers were involved, but the system changed above this figure, with the ratio then being significant.

Interestingly, guppies have difficulty discriminating between quantities that span the border between the precise, small-scale system and the vague, large quantity ratio estimation. So, discriminating three from five items can actually be more difficult for guppies than distinguishing between three and four items.

The quantity judgements of fish are, of course, not perfect and they can be influenced for example by factors such as different activity levels within two shoals. When activity levels within two shoals of angelfish (*Pterophyllum scalare*) were artificially manipulated by varying the water temperature, the fish clearly had trouble using the estimating system for large quantities, but their small-scale counting ability was unaffected.

Size matters

It appears that such results could also be influenced by the overall space occupied by each set. So if a small shoal of fish contains many very large individuals, and the larger shoal contains many very small specimens, the fish can then become confused and their decisions are less precise.

To check whether fish are able to use numbers by themselves when no such external cues are provided, a further study was designed. This time, the mosquito fish had to discriminate between sets of two versus three geometric shapes.

By carefully designing the objects, the experimenters were able to ensure that non-numerical indicators such as the overall surface area occupied by the objects did not vary between the two groups. The only way that the fish could distinguish between the sets was by the total number of objects contained within them.

The results in this case showed that the fish could perform this task very well, and confirmed that they are truly able to count, rather than just distinguishing between larger and small areas. We now know that they can therefore compete in these mathematical stakes with primates such as monkeys, human infants and even university students!

RIGHT A pair of eastern mosquito fish (*Gambusia holbrooki*), a relative of the guppy. David this image was sourced through Shutterstock as one provided was poor quality and were not 'real' fish

Favourite aquarium fish that escaped science's net

A neon tetra in close-up.

Today, they rank among the most familiar and popular of all tropical freshwater aquarium fish – but what else do the neon tetra, cardinal tetra, Siamese fighting fish and Jack Dempsey cichlid all have in common? Amazingly, as revealed here, little more – and in some cases far less - than a century ago, not one of these species was even known to science!

A dazzling find

The year was 1936, and the location was the Rio Putumayo, one of the mighty Amazon River's innumerable tributaries. Here, a French explorer and fish collector named Auguste Rabaut was canoeing when he looked down and noticed a school of tiny but very beautiful fish clearly visible near the surface of the water.

Scooping up some of them in his hands, he observed that despite being predominantly grey and silver in colour, with just the rear lower region of the flanks a contrasting red, each of these fish was rendered instantly eye-catching by virtue of the horizontal iridescent stripe that ran along the upper flank region. This continually flickered from blue to green when viewed at different angles, glowing just like a fluorescent strip of neon lighting.

Delighted by his discovery, Rabaut collected several live specimens, some of which were sent to France, and others reached the John G. Shield Aquarium in Chicago (transported in style via the Hindenberg zeppelin airship, no less!). Upon close examination, they proved to be a species of tetra, belonging to the characin family, but one that was previously unknown to science. Later that same year, this stunning small fish was formally described, and, in honour of the celebrated American aquarist William T. Innes, it was officially christened *Hyphessobrycon innesi*. Subsequently moved to a different genus, it then became *Paracheirodon innesi*,

Keep these tetras in shoals.

Key info:

Grows to: 2.5cm (1in).
Water chemistry: Soft and slightly acidic.
Disposition: Peaceful

Red colouration predominates in the case of the cardinal tetra.

The stunning beauty of cardinal tetras is shown here.

but the English name that it was given has never changed – the neon tetra.

Moreover, its dazzling striped appearance attracted such attention that the neon tetra soon became greatly sought-after by aquarists. Initially, it was so much in demand in the hobby that single individuals would sell for more than a typical month's wages at that time.

It proved difficult to breed at first though, and many ardent collectors travelled far and wide seeking this species in its Amazon homeland. Some struck lucky and made fortunes. One German collector returned home with more than two thousand neon tetras, captured at the mouth of the River Nanay just inside Peru, with the assistance of the Javaro Indians.

The range of this species is now known to extend from eastern Peru and southeastern Colombia to western parts of Brazil. Its requirement for breeding in aquaria were ultimately discovered though, and today, these beautiful are bred worldwide in their millions, and can be seen in virtually all aquarist shops, being readily available to all.

LEFT A cardinal tetra – one of the most beautiful of all freshwater aquarium fish. *PHOTO COURTESY AXEL ROUVIN.*

A religious parallel

Just 20 years after the neon tetra obtained scientific recognition, ichthyological history virtually repeated itself, courtesy of the discovery of a close relative that is now known as the cardinal tetra. This fish shares the neon tetra's glowing 'electric' strip along its upper flanks (in a somewhat wider form), but is even more colourful.

Whereas in the neon tetra, only the rear lower flank is red, the whole of the lower flank is red in this species. Corresponding to the colour of a cardinal's robes, this therefore explains its common name. It is also slightly larger than the neon tetra and is sometimes dubbed the red neon tetra.

The cardinal tetra was initially discovered within various forest pools in the upper waters of the Rio Negro, but was later found in the Orinoco's tributaries too. Like the neon tetra, it soon became a very popular aquarium species.

When formally described in 1956, it was originally named *Hyphessobrycon cardinalis*. During a subsequent reclassification, however, it was renamed *Cheirodon* (and then *Paracheirodon*) *axelrodi*, in honour of another eminent American fish expert called Dr Herbert R. Axelrod. In aquarium surroundings, the cardinal tetra has similar requirements to the neon tetra, and should be kept in small groups.

Key info:

Grows to: 5cm (2in).
Water chemistry: Soft and acidic.
Disposition: Peaceful shoaler.

TURN OVER FOR MORE FISH MYSTERIES »

The black neon tetra is more subdued in colouration than its more colourful cousins.
PHOTO COURTESY LUKI86

Other gems are discovered

During 1963, another popular aquarium species closely related to the two tetras discussed above was formally described – the green or blue neon tetra (*Paracheirodon simulans*). Smaller, slimmer but more fluorescent than the neon tetra, this species is native to the upper Orinoco and Rio Negro.

Also popular but rather different in appearance is the black neon tetra (*Hyphessobrycon herbertaxelrodi*). Officially recognised in 1961, it lacks the characteristic 'electric' stripe of the other three species documented here, sporting instead only a plain white stripe above a black one. It occurs further south, being native to southern Brazil's Paraguay basin.

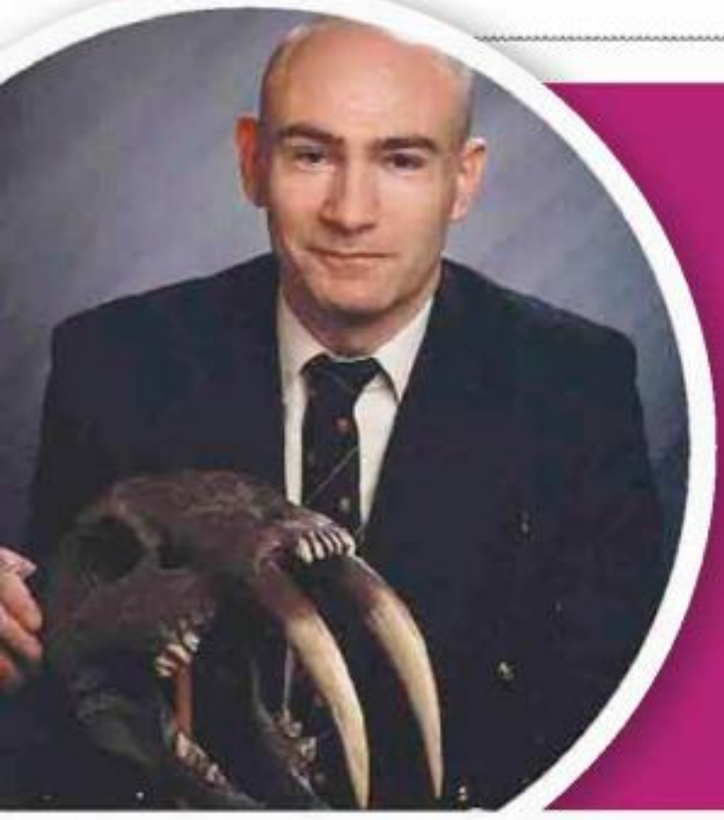
ABOVE The green neon tetra - not a colour form, but a different species.
PHOTO COURTESY SASCHA BIEDERMANN.

Resembling the cardinal tetra in size, its colouration is more subdued, and it prefers darker surroundings as well, which can be achieved by adding some more floating water plants in the aquarium.

Key info:

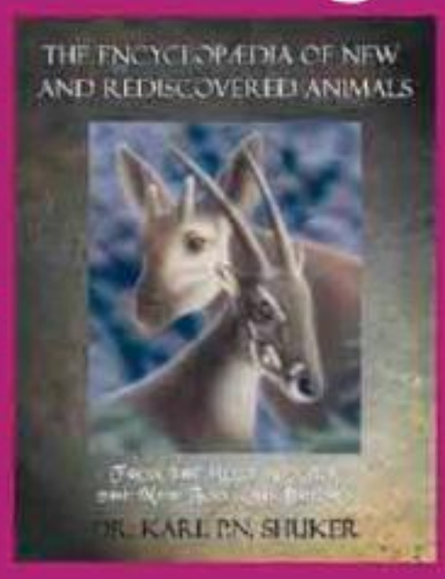
GREEN TETRA NEON
Grows to: 2.5cm (1in).
Water chemistry: Soft and acidic.
Disposition: Peaceful shoaler.

BLACK TETRA NEON
Grows to: 5cm (2in).
Water chemistry: Soft and acidic.
Disposition: Peaceful shoaler.



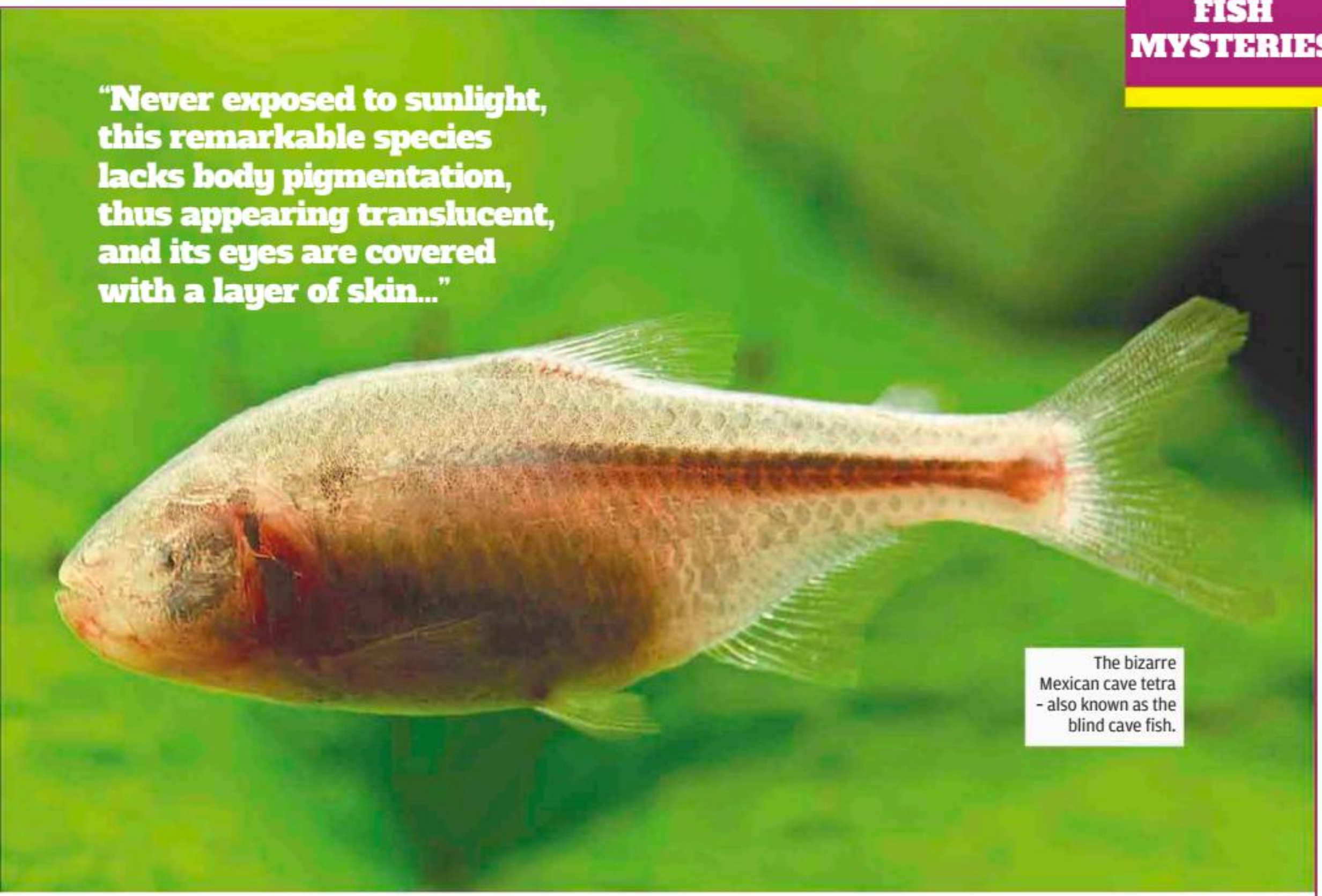
Read up on more fish mysteries

Expert in new species
Dr Karl Shuker BSc PhD FRES FZS is a zoologist, author and broadcaster who is pre-eminent in the field of both newly-discovered species and cryptozoology – the study of animals whose existence is not proven. Read his regular column in each issue, delving into the mysteries surrounding the discovery of various freshwater fish.



A great read
Karl's latest book - *The Encyclopaedia of New and Rediscovered Animals* (Coachwhip Publications: Landisville, 2012) extends to 370 pages long and is packed throughout with rare colour and b/w photographs. It costs £24.95, is available in hardback from Amazon and can also be ordered through all good bookshops.

"Never exposed to sunlight, this remarkable species lacks body pigmentation, thus appearing translucent, and its eyes are covered with a layer of skin..."



The bizarre Mexican cave tetra – also known as the blind cave fish.

Loss of eyesight

An even more distinctive tetra is the Mexican cave tetra or blind cave fish (*Astyanax* (formerly *Anoptichthys*) *jordani*), which was named in honour of its finder, Basil Jordan. He first recorded it from Mexico's Cueva Chica in 1936, where these fish spend their whole lives in darkness.

Never exposed to sunlight, this remarkable species lacks body pigmentation, thus appearing translucent, and its eyes are covered with a layer of skin, although tests have demonstrated that they can still detect violet, indigo, and blue light.

It appears that the ancestors of this fish became trapped in their subterranean world many thousands of years ago. In common with other cave-dwelling creatures living in pitch-black surroundings, they lost their natural pigmentation, as well as their eyesight.

Yet if housed with other fish with normal vision, blind cave fish are at no serious disadvantage when it comes to locating food, thanks to their highly developed sensory system that allows them to detect vibrations in the water. This helps to ensure they do not swim into underwater obstructions in their environment either.

They still betray one indicator of their ancestral past at an early stage in life though. These tetras, like all the other fish featured here, are egg-layers and when the young fry hatch, their eyes appear normal. As these fish grow, however, skin extends over their eyes, obscuring them.

Their care is similar to that of other tetras, but they prefer a rather dark set-up, without plants – although you can create a striking aquascape here with a creative choice of rocks. Slate is very effective in these surroundings, but as with all rockwork, make sure that it is firmly supported in the tank.

Blind cave fish are social by nature, and before long, you may notice that some individuals have become more swollen in appearance, and are attracting the interest of other members of the group. These are females that will soon be ready to spawn.

Such is the amazing ability of these fish to find edible items that they will seek out eggs and eat them, so you will need to prepare a special spawning tank, removing the fish immediately afterwards so they cannot consume their eggs.

On account of its strange and rather eerie form, the Mexican cave tetra has become very popular among fish fanciers, especially in the USA. Indeed, it is probable that there are more specimens that have been bred for household aquaria nowadays than there are in this species' native Mexican cave stream.

The blind cave fish is categorised by the IUCN as Vulnerable in the wild, being clearly at risk from any habitat disturbance. Meanwhile, its ordinary relatives, swimming in adjacent rivers in Mexico, are very rarely seen in aquarium circles.

The sensory lateral line, running down the centre of the fish's body, helping it to navigate safely and find food is clearly apparent under the pale skin.

Key info:

Grows to: 10cm (4in).
Water chemistry: Neutral and relatively hard.
Disposition: Shoaler – may nip the trailing fins of companion fish.

TURN OVER FOR MORE FISH MYSTERIES »

Amazing colours and fin variants have emerged in the case of male fighting fish, as shown by these two individuals. Females have a much more subdued appearance. *PHOTO COURTESY PD.*

Siamese fighting fish

Betta (aptly meaning 'warrior') is a genus that currently contains more than 60 species. Remarkably, more than 40 of these have only been formally described and named since 1990! None of them, however, is better known than *Betta splendens*, simply referred either as the betta or Siamese fighting fish. It is therefore surprising, not to say ironic, that this particular species should have such a convoluted history of discovery and belated scientific recognition.

Known in its native Asia for centuries, especially in Thailand (formerly Siam) and the Malayan peninsula, males of this species are highly territorial. They will spar very aggressively against each another until one retreats.

These fish were originally collected centuries ago for use in piscean competitions equivalent to cock fighting – pitting one male against another and betting upon which one would emerge the victor. So popular were such bouts that by the mid-1800s, the King of Siam had formally licensed them, and he himself had become an ardent collector of these fish.

The king gifted a specimen to a Danish medical scientist called Dr Theodor Cantor, who formally described the species in 1859. Unfortunately, however, the species' name that he chose, *B. pugnax*, had already been allocated to a related species, the Malayan fighting fish. For over half a century, there was confusion as to the Siamese fighting fish's precise taxonomic identity. Finally, however, in 1909, this situation was finally rectified when British ichthyologist (= fish zoologist) Charles Tate Regan renamed it *Betta splendens*.

"The King of Siam had become an ardent collector of these fish..."

He also described two additional, related species that same year - the banded fighting fish (*B. fasciata*) and the Bornean fighting fish (*B. taeniata)*. These are both rarely encountered, however, in fish-keeping circles, appealing essentially to specialist breeders.

Nowadays, selective breeding has yielded male Siamese fighting fishes with far more flamboyant fins and colours than those of their wild ancestors. But place two males together, and instantly the fop will still become the fighter – even when one of them is in reality nothing more than the other's reflection in a mirror! They must always be kept separate.

Key info:

Grows to: 7.5cm (3in).
Water chemistry: Hard and neutral.
Disposition: Males are highly aggressive.

The fish named after a boxer likes rocky areas in its tank where it can retreat.

Named after a boxer

If *Betta splendens* is the Siamese fighting fish, then by virtue of its geographical locality and the male's pugnacious territorial behaviour, this popular species of cichlid really should have been called the Amazonian boxing fish. Instead, it was given the name of one of the early 20th century's most celebrated boxing personalities – the world heavyweight champion, Jack Dempsey.

Formally described in 1903, also by Charles Tate Regan, the Jack Dempsey cichlid is native to Mexico and Honduras. Here it inhabits bogs and other warm, slow-moving swampy areas of water, as well as rivers, canals and drainage ditches. It can also be encountered in parts of the USA, Australia, and Thailand as an introduced species.

ABOVE The markings of the Jack Dempsey cichlid do vary, even in the case of the same species. *PHOTOS BY PD (PROFILE SHOT) AND ZHYLA.*

Most famous for its aggressive behaviour, if one male Jack Dempsey enters the territory of another, particularly during the breeding season, the two will circle each another and raise their fins to make themselves appear bigger and more ferocious. If neither fish concedes, they begin to 'spar', butting each other with their jaws in a manner that has all the appearance of a genuine boxing match!

Nonetheless, it is a largely ritualistic bout, because these fish rarely inflict serious injuries when they fight. Instead, the conflict usually comes to an end with the territory's owner simply chasing away the intruder - rather than with a straight knockout!

Until very recently, only a single species of Jack Dempsey was thought to exist, and it was known formally as *Cichlasoma biocellatum*. During 2007, however, two new species were recognised, and a new genus, Rocio, was created to house all three of them, with the original Jack Dempsey being renamed as *Rocio octofasciata*.

The two new species are the bejewelled Jack Dempsey (*Rocio gemmata)*, native to Mexico's Yucatán Peninsula; and the Ocotal Jack Dempsey *(Rocio ocotal)*, native to Mexico's Lake Ocotal. In addition, there is a blue mutant morph of the original species, called the electric blue Jack Dempsey, which is also smaller and has gained a reputation for being less aggressive than the normal, wild type version.

Key info:

Grows to: 20cm (8in).
Water chemistry: Relatively hard and acidic.
Disposition: Territorial and aggressive.

DID YOU KNOW?

The Yucatán Peninsula is home to the bejeweled Jack Dempsey cichlid.

MAP COURTESY FRESHENEESZ.

What of the future?

The progression from highly sought-after novelties to aquarium megastars, as demonstrated by all of the species documented in this article, could quite easily happen again. After all, many new species of fish are still being discovered by science each year. So who knows? Some of today's newcomers could well become tomorrow's best-known and most popular aquarium species!

Next issue

September/October edition on sale 16 August

Fish Doctor

Want to know more about fish health? Then don't miss our new regular column.

YOUR TOP FIVE

We all have our favourites, but which fish would you always want to keep and recommend to others, and why? A leading fish keeper reveals his choices.

GREEN IS THE COLOUR!

We delve deeper into the world of planted aquariums, and how to maintain them.

Puzzle page

FISH BITS Can you identify these five fish from these different parts of their bodies?

1.Cardinal tetra 2.Angelfish 3. Swordtail 4. Boeseman's rainbow fish 5. Oscar

PUZZLE IT OUT SOLUTION

Across: 1 Bengal, 4 Unable, 9 Sap, 10 Stopwatch, 11 Country, 12 E-mail, 13 Grease, 15 Ceases, 18 Zebra, 20 LOACHES, 23 Lawnmower, 24 Lob, 25 Ensure, 26 Swerve. **Down:** 1 Basic, 2 Neptune, 3 Asset, 5 Nowhere, 6 Botia, 7 Exhales, 8 Tokyo, 13 Gazelle, 14 Stammer, 16 Scholar, 17 Clown, 19 Bowls, 21 Arrow, 22 Sabre.

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