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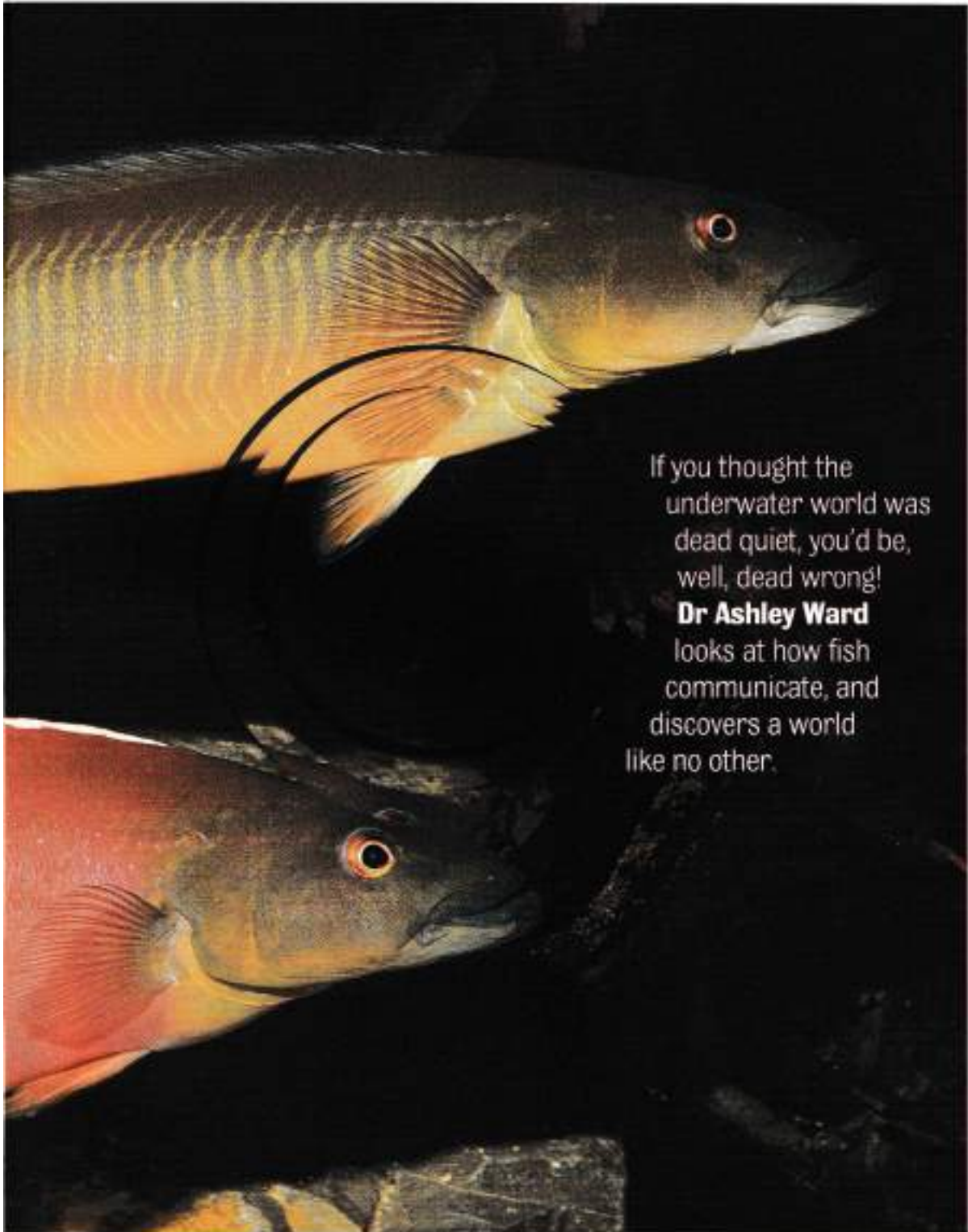
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Not a single sound?

MP & C Perchard / iStockphoto.com



If you thought the underwater world was dead quiet, you'd be, well, dead wrong! **Dr Ashley Ward** looks at how fish communicate, and discovers a world like no other.

It's a noisy world that we live in. We are continuously bombarded with all kinds of information from different sources.

Everyone, it seems, is trying to tell us something. While the environment that fish occupy appears to lack such continual hubbub, signals are constantly being transmitted and received. Fish are able to communicate using every imaginable sense, and some that we can't begin to imagine.

The brilliant colours of many of our familiar aquarium fishes are the means by which they signal to one another. Communicating visually allows a large amount of information to be transmitted rapidly. But visual communication has its limitations.

As the depth of water increases, large parts of the light spectrum are absorbed. If you cut yourself underwater, your blood looks green. This is because the red part of the spectrum is the first to be absorbed, so fish living beyond the first few of metres of the surface do not tend to use red pigments. Interestingly, many deep-sea fishes are red simply because it makes them virtually invisible!

Vision is also of limited use when rivers are in full spate or after a storm at sea and at low light levels, particularly at night.

So how else can fish communicate? Olfaction and gustation, better known as smell and taste, allow fish to communicate chemically. The ability of fishes to detect signals in this way far exceeds our own. Some species, such as eels and salmon which use smell to navigate, out-do even bloodhounds in their abilities to detect chemicals at incredibly low concentrations.

Fish use this ability to communicate; each produces pheromones which can be detected by other individuals and which convey a whole range of information from what species and sex a fish is, right up to whether or not they are related and what they have been eating! The importance of chemical communication differs according to the species. In nocturnal species and cave fish, it is enormously important.

Despite what Jacques Cousteau said about the underwater world being silent, fish use sound to communicate. Many cichlids, including Angelfish and Cornix, make noises when threatened. Clownfish have a small repertoire of noises. One sound is produced during territorial interactions, another during direct aggression and yet another to indicate submission.

And almost 100 years ago, behavioural research scientists



showed that bullhead catfish could be trained to emerge from hiding at the sound of a whistle!

Sixth sense

But some species of fish have another sense - one which is completely alien to us. Such fish are able to detect and, in some cases, produce electrical fields.

All animals produce a small amount of electricity during the normal communication within the body. Some species have developed this further. They use this electric 'sixth sense' to detect prey, communicate with one another and to deter predators.

Mormyrids, such as the Elephant-nosed fish, live in murky environments where eyesight is of limited use, and many species are nocturnal. Research has shown that such fish

can use their electrical discharges to communicate with one another. Each fish produces an electrical signal which has both species-specific component and even individual characteristics. Other electric fishes are able to detect this and thereby gain information about other fish in the vicinity.

Electric fishes also indicate their moods in this way - electrical impulses of different sizes are used to indicate aggression and passivity!

What drives all these different means of communication? Why is it so important for fish to get their message across? There are a variety of reasons: they may need to convey





information to potential mates, to their offspring, to rivals, and even to their predators. The way in which they communicate differs according to the context.

Many fish species use colour to attract mates, such as the brilliance of the male guppy acts to attract females. Guppies tend to breed pretty much all year round, but other species 'switch on' their special breeding colours only during the reproductive season. The really intense colours on show at these times signal to potential mates.

Many male cyprinids, such as Koi and goldfish, signal their readiness to spawn by developing tubercles around the head and gill areas. Male sticklebacks develop an incredibly bright red throat and become highly sensitive to anything red nearby. Males in one laboratory famously had to be moved to a different aquarium because they would frantically 'attack' a red post office van that arrived each morning with the mail and which the sticklebacks were able to see through a window!

Damselfish have intricate courtship displays that rely on swimming displays and a panoply of different sounds. The noises produced by a territory-holding male include one advertising his presence to passing

females and a ringing sound which is thought to encourage a female to spawn once she arrives at his territory!

In species that provide parental care, the intense colours at breeding time have additional uses. The bands on the flanks of Convict cichlids become especially pronounced then. Not only do these signal a readiness to spawn, but subsequently they signal to others a high level of aggression and an investment in brood defence. What's more, the dark bands and the ventral colours that females develop provide a signal to the fry to remain close.

Fish also signal potential rivals and competitors. Because strength is closely correlated to size, they tend to use behavioural signals which exaggerate their size. These include turning flank-on to a rival and spreading the fins as far as possible or head-on by spreading the gill covers to make the head seem huge!

But if a signal is to have any value it must be honest. If an individual signals 'I'm strong, back off!' but can't back this up, then the signal will rapidly be exposed as a bluff and won't achieve what it is meant to, which is to prevent potentially costly escalations into conflicts.

Visual display signals are therefore often backed up with secondary signals which directly indicate strength. For example, flank-on displays may be joined with a stiff wave of the body where the

PREVIOUS PAGE: Like cichlids, like this cracking pair of adult *Goniistius* sp. 'Kings I' are ambush predators and attack at lightning speed.

LEFT: False eye spots, like on this butterflyfish, confuse potential aggressors and give it a better chance of survival.

BELOW: The rear end of this Marine betta, *Colloproctus atrovirens*, is said to mimic the head end of a moray eel. From a certain angle, in a certain light...



MPH, C. Perkinson / ianastudio.com

ABOVE: Tetras will flick their pectoral fins rapidly to indicate to a predator that it has a reduced chance of making a kill.

signaling fish pushes a pressure wave of water towards its rival. The rival can then assess the strength of the other fish based on the strength of that pressure wave.

Talking with the enemy

Fish also need to communicate with potential predators. Ambush predators, such as pike cichlids, rely on the element of surprise to capture their victims. Their prey in the wild, guppies, let the cichlids know that they have been spotted by swimming right up to them. This may sound like an odd thing to do but, crucially, prey fish that do this avoid what is known as the 'attack cone' – the area in front of the nose of the cichlid.

Glowlight tetras signal their predators to let them know that they have been seen. To do this, they produce a highly stereotypical signal which involves the tetra rapidly flicking its pectoral fins. This tells the predator that it has been rumbled and that its chances of making a kill are greatly reduced.

Some members of the carp family release a chemical that attracts predators when they are attacked. If a minnow's skin is grazed or cut by a predatory fish, cells in the damaged area release a substance known as Schreckstoff. This chemical actually attracts nearby predators. Although this seems to be a strange thing to do, in the ensuing competition and confusion, the prey fish can escape!

Fish also give out misleading signals. Manne butterflyfish have a fake eye-spot towards the rear of their bodies. This has two likely functions. Firstly, a quick glance at this large eye-spot may fool predators into thinking that the

“Glowlight tetras signal to their predator that it has been rumbled.”

butterflyfish is larger than thought and too big to swallow - fish are known to judge the size of other individuals based on the size of their eyes in some cases.

Secondly, when predators (or rivals) do attack, they tend to go for the head area as it guarantees a quick kill. The eye-spot draws attacks to the less vulnerable rear of the body and thus the butterflyfish has a greater chance of surviving an encounter.

Keeping it together

Fish in shoals communicate constantly with one another. X-ray tetras, for example, use the dark bar on their dorsal fin to flag to other shoal members. Researchers were able to show the value of this by obscuring this dark bar. When this was done, the shoal quickly lost its tight formation. The characteristic flicking of Scissor-tails is also thought to be a means of communication helping to maintain shoal cohesion.

Shoaling fish also use their other senses to choose which fish to shoal with. They use their sense of smell to detect whether or not nearby

individuals belong to the same species and the lateral line is involved in keeping individuals in shoals moving synchronously. Researchers found that when the lateral line was not functioning, individuals could not co-ordinate their movements with the rest of the shoal.

But fish are also capable of making finer distinctions between one another than simply which species an individual belongs to. They can also discriminate whether or not they are swimming with their kin. Rainbowfish are able to determine which fish are their siblings and even their half-sibs. It seems that they achieve it in a similar way to salmon which make the same kinds of distinctions on the basis of what is known as the major histocompatibility (MHC) genotype.

Each individual animal, humans included, has a particular MHC, a complex of genes which are involved in conferring immunity to disease. The interesting thing about this complex of genes is firstly that, like fingerprints, they are pretty much unique to each individual but, secondly, the MHC genotypes of related individuals are more similar than a random sample.

The MHC complex that an individual has also gives it a faint but characteristic smell, and it is on the basis of this smell that salmon are known to make distinctions.

Why do fish need to know whether they are related to one another? One reason is to avoid inbreeding. Another is that for fish, like us, blood is thicker than water - I'll be covering this in more detail in a forthcoming article.

Fish are not only able to tell to whom they are related but also what they have recently been eating, the chemical composition of the water that another individual has been living in, the competitive ability of strangers and whether or not a particular individual has co-operated with them in the past.

The fishkeeper can also interpret the fishes' language. For example, a change in behaviour such as an increase in aggression often indicates that there are eggs being guarded somewhere, as can a simple intensification of colour.

A loss of colour can indicate that the fish is under stress. Folded fins and 'shimmying' are usually a sign of poor health. Being able to interpret these signals provides a means by which fishkeepers can optimise conditions for his fish. By 'listening' to what they have to 'say', we can learn a great deal more about what's going on in the fishes' world!

News ▶

The latest events in the fishkeeping world and dates for your diary.

On the PFK website this month...

Is next month's poll we're looking at dealers and the advice they give. Does your retailer offer enough advice as the fish he sells? Or, would they let you buy a Red-tailed catfish for a community tank? Maybe you've got an excellent dealer who gives you all the information you need, or even refuses to sell you fish unless you've read up on their requirements yourself. Let us know your thoughts and you could win some of the fishkeeping equipment that's filtering our office.

Looking for an article on breeding Corydoras but can't remember which issue it was covered in? You can use the PFK website to access our database of articles and contents pages to help you find the magazine you're after. If you don't have that issue, you can order one from our back issues service.

www.practicalfishkeeping.co.uk

More water authorities add chloramine to tapwater

A number of water authorities will be using chloramines instead of chlorine to disinfect tapwater.

Chloramines, which are toxic to fish, invertebrates and beneficial filter bacteria, are harder to remove from tapwater than chlorine. Already, more than 10% of the UK's tapwater supply contains added chloramines.

The move aims to improve the potability and health aspects of tapwater. Chlorine quickly leaves the water as a gas, so it needs to be dosed at high levels to ensure that it is still present at an effective concentration by the time it reaches customers many miles from the treatment works.

Chlorine may also react with organic molecules in the water to produce potentially carcinogenic trihalomethanes (THMs). THMs are more of a problem where the water has high natural levels of organic materials, such as Scotland.

Compared to chlorine, chloramines are much more stable. However,



By Scott Haver / iStockphoto.com

chloramine can persist in the water for several weeks, even when strongly aerated.

The use of chloramines isn't new - Thames Water first reported their use in 1934. However, chloramination is on the rise across the UK, with Scottish Water commencing chloramination for parts of its catchment.

In order to find out what your water authority adds to your tapwater, you will need to call them.

However, even if your authority says it does not

add chloramine, it could be present anyway - small quantities of ammonia, certain organic nitrogen compounds such as amino acids and nitrogen heterocyclic aromatics can allow chloramines to form. A free water analysis report from your water authority will show if this is the case.

According to the Scottish Centre for Infection and Environmental Health, there is currently no UK standard for an acceptable level of chloramines in water. However, the

World Health Organisation (WHO) recommends a maximum of 3 mg/l, and typical levels in UK tapwater are reportedly around 0.2-2.0 mg/l.

For the fishkeeper, detecting chloramine in tap or aquarium water is likely to prove difficult as there are no commercial test kits to establish its presence, although some colorimetric kits do apparently exist outside the aquarium industry.

Unlike chlorine, chloramine can't be removed by boiling, leaving the water to stand, aeration, or spraying it into the aquarium or pond.

However, it can be removed using activated carbon and zeolite. Some RO units will remove it, when equipped with carbon filters. The easiest way is to use a chemical water conditioner.

Using a standard dechlorinator could lead to small quantities of ammonia being added. There are currently only a handful of products that remove both chloramine and ammonia.

These are Kent Ammonia Detox and API Ammo-Lock 2.

▶ **Fish fact:** If *Finding Nemo* was true-to-life, by the time Nemo wa



Native carp under serious threat

The tough, naïve Crucian carp could be going the way of the red squirrel. And its nemesis is... the goldfish.

According to an Environment Agency report, illegally introduced goldfish could be a serious threat to our Crucians.

The Crucian carp, *Carassius carassius*, is a close relative of the goldfish, *Carassius auratus*, and it's possible for the two species to produce fertile hybrid offspring.

Fish geneticists from Hull University examined the DNA of a number of Crucian carp populations to determine the level of

contamination through hybridisation.

The Environment Agency believes that the genetic make-up of some British Crucians has already been damaged through goldfish hybridisation. Not only that, but the goldfish are also posing a threat by competing for food and living space.

Environment Agency Fisheries Officer Phil Bolton said: "The Crucian carp is a fish that should have no problem thriving in the British Isles. It is hardy and adaptable.

"But man's interference has tipped the balance in favour of goldfish. Crucian carp are already suffering

from habitat loss and introduced disease. This new research has revealed that the presence of introduced goldfish and common carp has led to interbreeding and hybridisation in wild populations.

"Our research shows cause for major ecological concern because not only are the offspring capable of out-competing Crucian carp, but they are also capable of reproducing and further interbreeding with pure stocks. Native Crucian carp could be wiped out as a result.

"It is a serious biodiversity issue because what is happening is not natural evolution, but the hand of man."

'Dracula' fish pops up in Ireland

An unusual deep-water fangtooth fish, normally found off the Falkland Islands, was caught near Irish waters.

The black fish has large fangs on the mouth and tongue, and can see in the dark. Before you start thinking of vampires and Dracula, this fish measures 18cm/4" and feeds only on zooplankton.

It was caught at a depth of nearly 1220m/4000ft some 200 miles off the south-west coast of Ireland and was sent to the Dingle Ocean World aquarium in Co Kerry.

According to iWales, the fangs and the location where it was caught have earned the aquatic visitor the name of Dracula.

LEFT: If your water authority is adding chloramine, we advise you to use a dechlorinator that removes both chloramine and ammonia.

BELOW: Fish are intelligent, cunning, manipulative and cultured. Try telling us fishkeepers something we didn't know!

Zebra shark lays eggs

One of the London Aquarium's Zebra sharks has recently surprised staff by laying 10 eggs.

It's not yet known whether the eggs are fertile, or were actually conceived within the aquarium.

The shark has been with the aquarium for two years and may have stored sperm in her uterus.

The eggs have been removed from the Pacific tank in which they were laid and are being kept in an isolation tank.

Who's the cleverest then?

Contrary to popular belief, fish are intelligent, cunning, manipulative and cultured.

Writing in the journal *Fish and Fisheries*, biologists Calum Brown, Kevin Laland and Jens Krause said fish were, in fact, highly intelligent.

They said: "Gone (or at least obsolete) is the image of fish as drudging and dim-witted pea-brains, driven largely by 'instinct', with what little behavioural flexibility they possess being severely hampered by an infamous 'three-second memory'.

"Now, fish are regarded as steeped in social intelligence, pursuing Machiavellian strategies

of manipulation, punishment and reconciliation, exhibiting stable cultural traditions, and co-operating to inspect predators and catch food."

The scientists added: "Although it may seem extraordinary to those comfortably used to pre-judging animal intelligence on the basis of brain volume, in some cognitive domains, fishes can even be favourably compared to non-human primates."

Maybe there should be a fish panel in the next 'Test the Nation' IQ competition.



reunited with his Dad, his Dad would have turned into a Mum.

News

More than meets the eye...

FAR RIGHT: Flushing your fish is not a good way to set them free...

RIGHT: Scientists have discovered that octopuses have erectile tissues.

BELOW: If you've got a shark that's rapidly outgrowing its aquarium, contact your local Sea Life Centre which might be able to offer it a home.

New method of raising marine fry

Ever fancied putting difficult-to-keep coral-pong-feeding butterflies in your reef tank? Easier-raising marine fish could make it possible. In essence, post-larval fry are harvested from the reef and reared in captivity. The method, developed by AquaFish Technology, was commended by the International Coral Reefs Initiative.

In the wild, 90% of larvae fall prey to predation. By collecting them at this stage, hundreds are saved. The method also allows for the captive rearing of species such as butterfly fish, groupers and triggerfish.

The program was launched in 1999 in the French Polynesia. That year, 25,000 aquarium fish were exported to France. Another farm opened last year and fish have now been offered to the American market.

Species that were farmed showed promising growth rates. They were also successfully weaned onto prepared food. They adapted well to aquarium conditions and were less sensitive to stress than wild-caught individuals.

We think it's also likely to allow some other species to breed in captivity. Since many marine fishes are hermaphroditic, if you were able to purchase them at very small sizes, you could theoretically get a guaranteed pair!

At a recent trade show in the UK, a tank of fish captive-raised using the method was on display on the Underworld Products stand. For more details, see www.aqua-fish.com.

first we were told that sticklebacks get irritated by soft porn (PFK August), now scientists say that octopuses can get erections.

According to a paper published in the journal *Nature*, octopuses are the first soft-bodied organisms to have been found to have erectile tissues.

Scientists studying *Octopus bimaculatus* noticed that an inflatable structure called the ligula, which sits at the tip of the mating arm of the male octopus, is normally small and hard to see.

However, when aroused, the organ becomes erect and much more visible.

The researchers believe

the structure has remarkably similarities to mammalian penises and clitorises.

Male octopuses produce a packet of sperm and insert it into their mate using this specialised arm.

When all goes according to plan, the ligula is deployed inside the female, obscuring its function and size. It might help to transfer sperm, or it might scrub out the sperm of previous mates.



Sea Life start shark amnesty



Do you have any sharks that have outgrown your tank? If you have, you might soon be able to rehome them at your local Sea Life Centre. No questions asked!

It may sound bizarre but the Sea Life network has already taken into care a number of tropical sharks needing new homes, from both private owners and struggling small-scale public aquariums.

"Fast experience suggests there could be numerous home aquarium enthusiasts around the UK trying to look after sharks that they probably acquired as youngsters and which may now have outgrown their welcome," said Sea Life biologist Rob Hicks.

"We've had everything from various members of the carpet shark family, most no bigger than a couple of feet, to an eight-foot long nurse shark that had spent years in the back of a Birmingham aquarist shop."

Hunstanton Sea Life and Marine Sanctuary, one of eight Sea Life attractions around the UK, is to convert its ocean display - currently housing North Sea creatures - into a special refuge for any sharks handed in.

"Home aquarists are generally pretty well informed these days and don't make the mistake of taking in potential tank busters as often as they used to," said Rob.

"There are probably a

lot still around, though, that have become a burden to their owners, and we'd rather they handed them in to us than disposed of them in any more drastic fashion."

The amnesty applies only to genuine sharks and not any of the assorted freshwater fish that happen to have the word 'shark' somewhere in their name.

"And we'd prefer a phone call before anything's handed over," said Rob, "just to ensure the nearest Sea Life centre has holding space in its quarantine facility."

Sharks collected before the end of the year will also go to Sea Life's main collection centre at Weymouth Sea Life Park before transferring to the newly adapted Hunstanton facility next spring.

"Hunstanton will be the logical home for them, as it already has a strong sanctuary element with resident otters and penguins and a busy seal rescue and rehabilitation facility."



Saving Nemo

Alexander Gould, the nine-year-old actor who plays the voice of Nemo in Disney's *Finding Nemo*, is helping two conservation organisations get across their message to youngsters that flushing your fish down the loo is not a good way to set them free.

The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and the Marine Aquarium Council (MAC) launched the initiative following the deaths of hundreds of fish in the USA caused by young fishkeepers attempting to liberate their pets by flushing them down the toilet.

The animated film, which shows how the young clownfish Nemo was separated from his father after being caught by a diver and placed in an

aquarium in a dental surgery, includes scenes of the fish being released into the wild via a spit basin.

In the USA, the film caused an increase in the sales of marine fish by as much as 20%. Animal welfare groups in the UK have warned cinema-goers not to buy clownfish after watching the film.

Clownfish, which sell for around £10 each in the UK, need large, well-equipped aquariums and are not the ideal fish for newcomers to fishkeeping. MAC's President, Paul Holthuis, warned cinema-goers to think carefully before committing to a marine aquarium.

"*Finding Nemo* is a very engaging film, and parents who already have aquariums need to explain to their children that the fish will not survive if they are flushed.

"We also urge parents whose children are

inspired by the film to start a saltwater tank to think carefully before buying tropical marine fish for their children."

The launch of *Finding Nemo* in the UK coincided with the release of the UNEP-WCMC report, *Ocean to Aquarium: The Global Trade in Marine Ornamentals*, which uses industry data to highlight problems in the trade and makes suggestions for the protection of marine organisms.

The report emphasised the importance of the marine aquarium trade in placing a value on natural resources.

If someone you know is thinking of setting up a tank to keep a Nemo, please point them in the direction of the PFK website, where we've put some tips for beginners.

www.practicalfishkeeping.co.uk/nemo

Spotted!

► An enormous shark, about 5.4m/18' long, was sighted off the Devon coast. It was attacking a shoal of mackerel. Experts believe it may be a Mako shark or even a Great white.

► Venomous lionfishes, *Pterois* sp., were found living on the coast of North

Carolina, North America. The lionfish are generally found in Indo-Pacific waters. It is thought they may have escaped from a Florida fish farm or even introduced with ballast water in ships travelling to the area from the Far East.

► Ten new fish species were discovered recently in Venezuela.

► Ocean sunfish, *Mola mola*, are appearing in

large numbers off the Welsh coast. The massive pelagic fish, which are found in warmer waters, sometimes appear around the British coast when sea temperatures rise. Adult sunfish can reach 3m/10'.

► A colony of large fish-eating spiders, usually only found in East Anglia, has been discovered living in Wales. The Fen raft spiders eat small fish and tadpoles.

Diary dates

NOVEMBER 5

- Kirkcaldy Aquarist Society meets at 19:21 Junction Road, Kirkcaldy, Fife, Scotland. For info contact John Reid on 01738 854688 or Joe Graham on 01392 782864 after 18:00; email joeg@graham040.freeserve.co.uk

NOVEMBER 10

- Kirkcaldy Aquarist Society meets at 19:21 Junction Road, Kirkcaldy, Fife, Scotland. For further info contact John Reid on 01738 854688 or Joe Graham on 01392 782864 after 18:00 or email joeg@graham040.freeserve.co.uk

NOVEMBER 14

- Basingstoke & GAS club meeting of the Water Street Club, Basingstoke. AGM & Gaffin by Chris Ralph. Meeting starts at 8.15pm. For further details, contact Arthur Marshall on 01256 475751 or Paul Dean on 01189 781461.

NOVEMBER 16

- Silk and Lace Fishkeeping Auction, Erewington Community Centre, Hereford Road, Brinnington, Stockport. Auction of fish and fishkeeping equipment starts at noon. Booking is of 100 starts at 10.30am. For further details or to pre-book your lot, call Dave on 0116 955 1635 or Ken on 01602 627582, or email fish.auction@ntlworld.com

NOVEMBER 18

- ADAS Convention & Open Show with extended outdoor closes, being held at the Buckland Community Centre, Malins Road, Portsmouth. As well as the show there will be a lecture by Brian Welch and an auction of fish and aquatic goods. For further details contact the show manager Paul Corbett at The Orchard, Redony Lane, Galcombe, Isle of Wight, PO20 3EF. Tel: 01885 731246 or e-mail suppyg85@btinternet.com

NOVEMBER 17

- Kirkcaldy Aquarist Society meets at 19:21 Junction Road, Kirkcaldy, Fife, Scotland. For further info contact John Reid on 01738 854688 or Joe Graham on 01392 782864 after 18:00 or email joeg@graham040.freeserve.co.uk

NOVEMBER 21

- Greater Manchester Ornith Society auction at Littleborough Conservative Club, Pool Street, Littleborough, Greater Manchester, G66L. British and dry goods only. Booking in 11.30am-1pm. Auction starts 1.15pm. All lots to be pre-booked by November 15. Alan Waterfield 01706 945555 or Bob Barnes (chairman) 01284 767375

NOVEMBER 23

- Association of Aquarists AGM & SOCIETY auction, being held at the Kemphall Village Hall, Park Lane, Basingstoke, Hampshire. For further details please contact Sue Bungay-Petrie on 001 251 2511 or Arthur Marshall on 01256 475751 or via scalesnt@btinternet.com

NOVEMBER 24

- Kirkcaldy Aquarist Society meets at 19:21 Junction Road, Kirkcaldy, Fife, Scotland. For further info please contact John Reid on 01738 854688 or Joe Graham on 01392 782864 after 18:00 or email joeg@graham040.freeserve.co.uk

DECEMBER 13

- Basingstoke & GAS club meeting of the Water Street Club, Basingstoke. Christmas social meeting starts at 8.15pm. For further details please contact Arthur Marshall on 01256 475751 or Paul Dean on 01189 781461.

The people's poll

How clever are your fish?

Does your fish recognise you and react to you? Can it differentiate between shapes and colours? Can it get the conundrum on Countdown?

So your fish are not super geniuses, but the bulk of you (close to 70%) certainly think that they are moderately clever. Just over a quarter of you are convinced your fishy friends are super intelligent.

When it comes to the Stephen Hawking of fishes, that accolade must surely go to the fancy goldfish of Mena Macneil. One in particular, she says, appears super smart.

She says: "His name is Jelly bubble and every day he will sit in my hand - yes, sit! He knows that he will only get breakfast if he sits there first. When he does, he swims back out and waits eagerly for his food."

Her other fish have also adopted a routine at water change time. "Every time they sit in the corner of the tank where the filters are, out of the way. After the water is added, they come out and go about their business again, surely proof that fish have

memory, knowledge of time and understanding of routine."

Others who say their fish are super intelligent talk of how their fish seem to know when it is time for a feed.

David Newton has a Nile puffer fish, *Tetraodon lineatus*. "I truly believe that he not only knows who I am, but when he will be fed. I feed him only on certain days. He will always, on those evenings, be a lot more active."

"He also seems to be able to tell the difference between myself and others as he will only come to the surface when I open the lid."

David's fish also seems to demonstrate a sense of humour. "He spits water at me with good aim for attention if I tease him a little with the food!"

Some may argue that reacting in anticipation of food could be a form of conditioning. However, readers such as Barry Chignell believe intelligence is dependent on the species of fish.

"I have an Oscar," he says, "that if not fed at the right time or is annoyed will lay on his side and not eat for about an hour. After this time he will fit about the tank like a lunatic grabbing the now soggy food."

"Then I have four angelfish that haven't a clue. One thinks he is a catfish and will only eat once it has sunk."

"I also think that if fish are kept in groups such as Clown loach, they elect a 'thinker' and the others follow what he does. Plecs seem to possess great intelligence as they remember where sinking pellets will be at a certain time and often appear there just before feeding."

James Lewis says his fish are moderately clever. He put some Bronze corydoras into a community tank, which included a pair of Keyhole cichlids. The cichlids discovered a taste for the catfish pellets, but obviously were not impressed with having to search for them. Within three days, they were following the corys around until they found the food and then simply stole it off them.

He also points out that his fish seem to show a good sense of their surroundings. "I feed my community tank when it gets dark. The fish were soon far more active and responsive to me in the evenings than they were at any other time of the day. As the nights have started to get earlier, the fish have been getting more active earlier."

Mike O'Sullivan questions the use of the term 'clever'. "Clever implies a problem-solving ability of some description, but fish definitely have long- and short-term memory."

"For example, my

Discus always congregate in the corner of their tank next to my chair, but only if I sit there. They will also splash for food and attention, but again, only for me. They also recognise the frozen food container, as soon as it comes into the room, they go nuts."

This form of association has also been witnessed by Christopher Osborn. As soon as he returns home from school, his freshwater tropical fish are at the glass trying to get his attention.

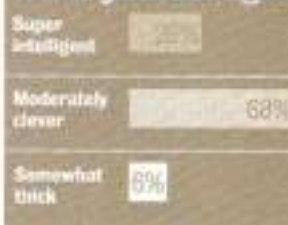
He also argues that fish have to be intelligent otherwise they would not survive in the wild!

Along the same lines, Tony Allan asks: "Have you ever tried catching one? In a tank or in the wild? They know all the moves to avoid the net, and it's not just speed they use!"

Next month's poll

Does your local retailer provide enough information on its livestock? When you buy new stock, does your local tell you all you need to know and advise you on what works and what won't? Worse still, were you given wrong information and ended up with a disaster on your hands? We want to hear your views and stories, and if we print your comments in the magazine, we'll send you some stuff.

What you thought...



www.practicalfishkeeping.co.uk/thepeoplespoll



Making a statement

With bright colours, these rams are both easy to maintain and breed. What more could you want?

Lee Newman reports on the characterful Venezuelan and Bolivian rams.

Few South American dwarf cichlids have captured the hearts and minds of so many fishkeepers like the 'rams'. Since their introduction to the hobby, both the Venezuelan ram *Mikrogeophagus ramirezi* and the Bolivian ram *M. altispinosus* have enjoyed unflinching popularity. Their bright colours, modest size and interesting behaviour complement their ease of maintenance and breeding, making them a hit with fishkeepers of all levels.

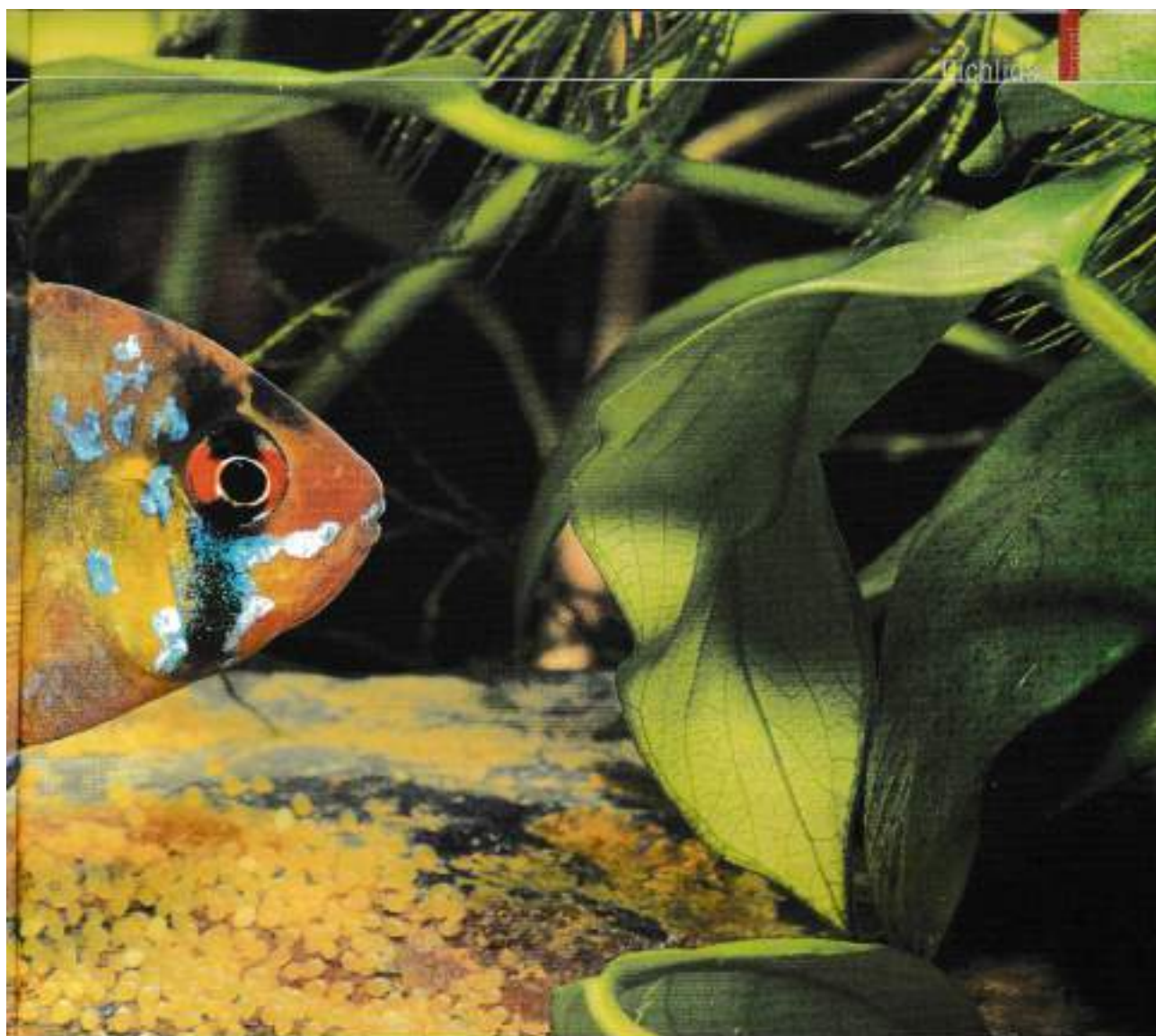
First described as *Apistogramma*, then as 'butterfly cichlids' in the genus *Papichromis*, the debate is

not yet over. Despite this, they are delightful little cichlids – irrespective of the genus they may end up in.

Venezuelan ram

Originally described as *Apistogramma ramirezi* in 1948, this character comes from the llanos in Colombia and Venezuela in the Orinoco drainage. Llanos (yá'nos) is a Spanish-American term for the prairie-like region in northern South America with an elevation no higher than 100m/330' above sea level.

During the dry season of November to April, the equatorial sun turns the vegetation brown and



brittle. Yet during the rainy season, much of the area is inundated.

According to Mayland and Bork (1997), *Mikrogeophagus ramirezi* is found in shallow, exposed pools, often surrounded by palms. Water temperature is usually around 30°C/86°F, while pH can vary from 5.5 to 7.5. Hardness is usually low. Plants such as *Nymphaea*, *Cabomba* and *Heteranthera* are sometimes found along with *Micropoecilia picta* and *Apatogramma boegneri*.

The *M. ramirezi* offered for sale in the trade are mostly produced on tropical fish farms in Asia. However, wild fish are still being imported with significant regularity.

Commercially produced fish are usually full-coloured sub-adult or adult, whereas wild-caught specimens tend to be juveniles with little colour.

Most rams, regardless of their origin, tend to need therapeutic treatment when introduced to the

home tank. I suspect many dealers and hobbyists suffer significant losses in newly arrived rams.

Affected fish begin to breathe very heavily. They then refuse food and hang listlessly in the water column. If untreated, they will die within a few days. I've tried to isolate the organism responsible, but have so far been unable to make a diagnosis.

If detected early, it can be treated using metronidazole, but this is only available on prescription in the UK.

Now while this seems to resolve the heavy breathing, it appears to stress the rams causing a type of lymphocystis. Fortunately, with large (more than three-quarters) water changes every five to seven days, the white, cauliflower-like growths will disappear within a few weeks. After such treatment, the fish often prove to be relatively hardy.

M. ramirezi is easy to sex: males are larger with longer fins,

particularly the ventral fins, and lack any blue spangled scales in the dark lateral blotch. Conversely, females are smaller with shorter bodies and fins. They have blue spangled scales inside the dark lateral blotch.

Be aware that in many cases, the cultured forms that show up in the dealers' tanks are usually male. This is probably due to using hormones that enhance colour and sex reverse any females in the population.

Like many dwarf cichlid species, *M. ramirezi* is a good choice for a community aquarium. However, wild-caught fish tend to be more shy than their commercially produced counterparts. Given enough room and suitable aquascaping, the most you should see are harmless squabbles over territory.

A 60cm/24" tank can comfortably house a pair. For each additional pair, add another 30cm/12" to the length. As these rams are pit

ABOVE: Part of the appeal of South American rams lies in their unique, vibrant colour. This is the Venezuelan ram, or *M. ramirezi*.

MPA/C. Pineda/ISTOCKPHOTO.COM

RIGHT: The female Bolivian ram will lay between 125 and 300 eggs.

BELOW RIGHT: The male Bolivian ram, *M. altispinosus*. Note their high, spiny dorsal fin.



"During the brood care period, the yellowish body colour, black eye

Is it spelt *Mikrogeophagus* or *Microgeophagus*?

In 1911, Hasemi described *Crenicoma altispinosus* which was later moved (along with *Aracostis*) to the genus *Apistogramma* by Kullander in 1977. Myers and Harry described *Apistogramma ramirezi* in 1948.

However, it was clear that the Venezuelan ram was not an *Apistogramma* and it was therefore moved to the new genus, *Mikrogeophagus*, by Frey in 1957.

According to Kullander, Frey's description was not done in accordance with the rules of the nomenclature code and was thus deemed invalid.

To complicate the matter further, in a multi-authored book edited by A. Scholtz and S. Christensen in 1968, the name *Mikrogeophagus* was used.

Note the spelling with a 'k'. I'd argue that the European authors simply translated the name using a spelling that would be familiar to their readers.

Later, Axelrod (1971b) described the breeding behaviour of the Venezuelan ram and suggested it be placed in *Mikrogeophagus* — he also suggested *Pseudopapistogramma* in the same description.

In 1974, Hoedeman suggested *Pseudogeophagus* and in 1975, in a book by A. Scholtz and S. Christensen, the name *Papilochromis* was used, suggestive of the name 'Butterfly cichlid', commonly used for the Venezuelan ram. Neither of the names were presented within the rules of the International Code of Zoological Nomenclature and were not accepted.

Then in 1977, Kullander published a description of the genus *Papilochromis* and placed the ram in it. The debate then started as to which name had precedence and was valid. Kullander eventually conceded to recognising *Mikrogeophagus*, but it was the A. Scholtz and S. Christensen 1968 version with a 'K' not with a 'k'!

I'd suggest that those interested should keep an eye on the literature, as I'm sure that the debate is not over yet!



diggers, always use fine sand or gravel as substrate. Aquatic plants, wood and small stones can provide cover, territory markers and spawning sites.

Water of low hardness appears to be a requirement for successful spawning and an acceptable hatch rate in the eggs. As a general rule, with increasing water hardness, the hatch rate decreases. Conversely, a better hatch rate is seen as the pH decreases.

High water temperature often triggers reproductive behaviour, but this also requires high water quality. Regular filter maintenance and 75% water changes every 10 to 14 days should be the norm.

In captivity, *M. ramirezi* is easily fed. I feed mine flake food, frozen bloodworms and brine shrimp, live *Daphnia* and a homemade mix made up of equal parts frozen krill (*Euphausia superba*) and frozen green peas. As with any small cichlid, I try to feed several small meals throughout the day.

If kept under suitable condition *M. ramirezi* spawns readily. In most cases, it starts with the largest male establishing a territory from which other fish are chased, including females! It usually assumes a head-down, fins-erect posture when confronting potential opponents. Other males with territories will respond in a similar manner.



LEFT: Courting *M. altispinosus* couple. Heightened colours are a good indication.

stripe and black lateral blotch of the parents becomes intense"

Disputes usually do not escalate to physical contact.

As soon as a female becomes ripe, as seen by a darkening of the red-violet abdomen colour, the male begins to court, rather than chase, her. If she accepts the male, the pair will defend the territory together and prepare a spawning site. This includes excavating several pits all within close proximity to the site that will initially receive the eggs.

Some rams opt for a hard object in the aquarium, such as a small stone, on which to place their eggs, while others excavate a pit in the sand. Regardless, it is the female who primarily prepares the site.

When the site has been cleaned (or the pit dug) to her satisfaction, she begins to deposit eggs. The male, although primarily concerned with keeping intruders at bay, will periodically fertilise the eggs.

Spawning lasts for 45-60 minutes in which the female will have deposited 100-300 light grey eggs. These are often covered with a fine layer of sand. At this point the male may chase the female from the spawning site and in many cases, he tends the eggs and larvae.

The eggs are tended on the spawning site for 36-48 hours, depending on the water temperature. They are then carefully picked up by the male and moved to one of the previously dug pits. After this, they are usually transferred several times

from one pit to another. This could be an attempt to elude would-be predators that might detect a wriggling brood that stays in one place for too long.

When the fry are free-swimming, offer them a live food smaller than newly hatched *Artemia*, such as cultured infusoria or rotifers.

If you wish to raise only a few fry, placing some in a well-established planted aquarium will provide enough nourishment for the first few days. Add newly hatched *Artemia* naupli to the diet after three or four days. Once they are feeding on this, they are easy to rear. A 30-50% water change every other day, combined with regular filter cleanings, will maintain acceptable water quality.

M. ramirezii is often described as being difficult to maintain and breed successfully. While this applies to many of those produced commercially, wild-caught fish, once purged of their parasites, are often easy to maintain and breed.

Bolivian ram

This was originally described as *Chenichia altispinosa*, then placed in the genus *Papilochromis* (Gulander 1977). The Bolivian ram, as it is commonly called, has become a popular dwarf cichlid for the home aquarium. The name 'altispinosus' refers to the high, spiny dorsal fin.



'Two-spot' altispinosus

There is a second form of the Bolivian ram altispinosus, one with not only a lateral blotch but also a large blotch on the caudal peduncle.

It also differs from *M. altispinosus* in that the body colour is a mottled dark pattern over a base colour of silver below and green above.

This form is generally referred to as the 'Two-spot' altispinosus. It is rarely imported and as far as I know, there have not been any published reports of its captive spawning. According to Mayland and Bork (1997), it is found in the Brazilian Mato Grosso, near the Bolivian border.

I've only had limited experience with this species, but have found it to be very shy and unresponsive to the husbandry procedures described for *M. altispinosus*.

Perhaps I was sent inferior fish, or maybe it has different requirements to the *M. altispinosus* usually offered in the aquarium trade.

NOTE:
M. ramirezi
may need
treatment
when first
introduced to
the tank.

According to Meyland and Bork (1997), *M. altipinnosus* is found in the Rio Mamore drainage system in Bolivia and Brazil. It mainly inhabits shallow pools where water temperatures average 27°C/80°F with a carbonate hardness of less than 100mg/l and a pH of 7.6. Not surprisingly, *M. altipinnosus* is a readily accommodated cichlid in the home aquarium.

Those offered for sale are usually bred on fish farms - wild-caught fish are rare in the trade. Dealers often sell sub-adult fish in which the males are not yet showing their brilliant colours or caudal fin extensions. For the fishkeeper, this makes sexing rather difficult. The best way around this problem is to buy several fish of different sizes to ensure both sexes are represented.

After a few months, the sex should be apparent. Males tend to be larger, up to 10cm/4", and are more slender. Both sexes sport dramatic red extensions from the upper and lower caudal fin rays, though the female is to a lesser extent. Males also have somewhat longer dorsal and anal fins.

M. altipinnosus does not share the Venezuelan ram's need for very soft water or high temperatures, and is reasonably adaptable to pH values outside those recorded in its habitat. Otherwise, follow the husbandry of the Venezuelan ram.

Again, it too needs regular, large water changes - the young, in particular, are known to die en masse from exposure to elevated nitrate values. Feed as the Venezuelan ram, but do make sure the particles of food are small enough to be easily eaten.

It should only take a couple of months before the fish become sexually dimorphic and reproductively active. In the aquarium, the Bolivian ram is a bi-parental, substrate-brooder; generally placing its eggs on a hard platform in the open. The male becomes very active, chasing and displaying to females.

After a few weeks, the male will pair with a female and start to court her while still chasing other females. Courtship behaviour consists of reciprocal lateral displays and mouthing rocks in the courtship area. After several days, the pair starts to clean and remove sand from around a rock. At this point, the male becomes increasingly aggressive towards other rams and keeps them from the spawning site.

Spawning site preparation often includes some pit digging and cleaning of the surface that will receive the eggs. Usually a



depression is dug around the rock or piece of wood. At later stages, the female's breeding tube can be seen.

Within several hours after the extension of the tube, the pair starts to spawn. She lays a line of five to seven light grey eggs on the site. The male quickly moves in behind to fertilise them. Spawning typically lasts for about 60 minutes, resulting in a circular plaque of about 125-300 eggs, depending on the age and size of the female.

The female now takes up station over the eggs and fans them with strong movements of her pectoral fin. While she tends the spawn, the male defends the territory. He also frequently relieves the female of her duties, but only for 5-10 seconds at a time.

The eggs hatch in two to three days, depending on temperature and usually with assistance from the female. Once hatched, the female moves the larvae, by mouth, into a previously dug depression beside the spawning site. The larvae are free-swimming in four or five days.

During the brood care period, the yellowish body colour, black eye stripe and black lateral blotch of the parents becomes inane. While the

pair continue to feed during the spawning cycle, the female does not leave the brood for very long.

In a community tank, the parents are not particularly efficient at defending the mobile fry. To ensure their survival, remove some of the brood to a separate tank. It is often a good idea to leave the pair in the community tank with a few fry to ensure pair bond stability.

Fry can be started on newly hatched Artemia, with prepared and frozen foods added as they grow. I once lost an entire brood to nitrate toxicity before realising their sensitivity to it, so carry out 30-50% water changes every other day and regular filter cleanings.

After several months they begin to show the adult colour pattern. The young fish can usually be sexed at about 4cm (1 1/2"), which is about five months old. They will also begin breeding at this size!

While not as popular as *M. ramirezi*, *M. altipinnosus* has a lot to recommend it. It seems a bit harder and easier to spawn than the Venezuelan ram, and typical of *Mikrogeophagus*, is colourful, has a lively disposition and exhibits interesting behaviour.

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Cover your bottom

For that touch of luxury, you can't beat good, old-fashioned thick-pile carpets. Recreate that look in the tank with plants like moss and liverwort, suggests **Peter Bradley**.

Glossary

Thallus - Body of a primitive plant that is not divided into leaves, stem and roots but consists of more or less uniform tissue.

TIP: A lush-green tank bed looks the treat.

Funny thing, carpeting. You only really notice it when things go wrong (such as when the dog has brought in half the mud from a rugby pitch). In the aquarium, you can create the illusion of carpeting. And anyone who has been inspired by Takashi Amano's books will want to have lawns of *Riccia*. However, *Riccia*, a lovely liverwort, is actually a floating plant so even when tied, it will try to free itself and rise to the surface.

Most floating plants obtain CO₂ from the air. If you observe *Riccia*, some of the thallus actually break the surface - they are, in fact, breathing, so it seems cruel to tie it down and let it struggle for precious CO₂. However, if you use CO₂ injection, it grows vigorously and the thallus sparkle with pearls of oxygen, showing it is photosynthesising.

Riccia tolerates most water, is happy in cooler conditions, and will take some shade. It then replicates

at a rate of knots. At one time I thought there was a Japanese variety with long thallus and a short European species. However, I now think it is a question of how it is grown. If grown out of water, it has a short, stubby thallus, but when grown in water, it has a longer, thinner thallus. They are wonderful plants for breeding livebearers or bubblerest builders.

There has recently been a new liverwort, originally called *Peltia* but now renamed *Monosolenium tenerum*. It is extremely rare in the wild and has only been found in small colonies in India, Taiwan and Japan. However, I suspect some varieties are found in other parts of the world, including South America. It is a true living fossil, the *Ginkgo biloba* of the aquatic world, and has become very popular.

Its main advantage over *Riccia* is that it sinks. This makes it far better for carpeting and, given good light and CO₂, will spread rapidly. It can



PHOTOGRAPH BY PETER BRADLEY

take a range of water conditions and temperatures, from 5°C to 30°C.

Another wonderful plant is Java moss. It grows underwater in the wild and will anchor itself to lava rock or rodowool. It also adheres to hessian and cork. It is used when breeding killifish - I use copious amounts to catch the eggs of egg-scattering fish such as White Cloud Mountain minnows.

It is easy to grow and thrives in similar conditions to those of *Riccia*. It also does well in low light levels or shade. I have clumps of it growing in



▶ Adding carbon dioxide will help your 'carpet' grow faster.



▶ Lay your plant on a rock and hold in place using a hairnet.



▶ CO₂ can be pumped into the container in a number of ways.



glass jars on a north-facing windowsill. Grown this way it has shorter leaves but soon adapts again to underwater conditions.

The variety called Christmas Tree moss is well worth searching for.

Propagation

To grow liverwort and mosses on lava rock, you will need hairnets, a good light source (daylight is fine) and a source of CO₂.

Take clumps of Riccia or Java moss and lay this on the rock. Pull

the hairnet over tightly to hold it in place, then tie it underneath the rock and trim. (Hairnets have one advantage in that they stretch, yet still hold the plant in place.)

If you want to speed up the process, add CO₂. For instance, you can top up the container with sparkling mineral water. Never try this if you have livestock - the concentration of CO₂ in mineral water is dangerously high. Even one cup in a 100 l/22 gal. tank would asphyxiate all the fish as I discovered to my horror... a quick 50% water

change revived them just in time!

I have also had excellent results with the Sander Floromat, a belljar method. I put the rock with the Riccia tied in place and within a few days of adding CO₂, it grew well!

I then used an improved CO₂ injection - the Dupla chemical system using yeast fermentation. The kit comes with a small pump and venturi sucks the CO₂ from the yeast mixture into the tank.

Follow these tips and in about four weeks, you should be able to produce beautifully carpeted rocks.

GREEN LINE AQUATIC PLANTS



PLANT OF THE MONTH

Litorea/Jagittaria paxillata

Supplied as 1cm/2" plants (code 4167) or aquaria lot chunks (code 7187). Widely used in the foreground. Very undemanding. Found all over North and South USA, Australia and New Zealand. I can also supply the narrow leaf form in pots (code P781).

ANDY GREEN'S TIP OF THE MONTH

Bind over little strips of lead like U tacks to hold the plants down on to the substrate. It can be trained to run on sand or beer wood and rocks - or I can supply them ready done on matting.

GIVEAWAY

We have five sets of plants to give away, each containing five clumps of *Litorea* and 10 other foreground plants plus a medium sized bag of Pro-Rock 1cm/1oz. Send your name and address to: **Plants Dept, PFK, Bretton Court, Bretton, Peterborough, PE3 8EJ** before

December 5. We'll send a set of plants to the first five names drawn. All entrants will receive a Green Line catalogue. See rear of inside back cover.

GREEN LINE

Tel: 01438 56488
Fax: 01438 56481
www.aquaplants.eu.com



▶ Hairnet holds the plant in place, yet allows it to grow through.



▶ Within about four weeks, the plant should cover the rock.



▶ The finished product - you can't even see the hairnet any more.



Coming soon, to a tank near you...

What developments can the marine hobby expect in the next few years? US expert

Mike Paletta gets out his crystal ball...



The past few years have seen some enormous advances in the marine hobby. There have been improvements both in the methods of collection and shipping of fish and corals, and also in their breeding and propagation. We've seen new methods of filtration, with the emphasis very strongly on as natural an approach as possible. And manufacturers have made great strides with the equipment we use.

So what does the future hold? Here are the areas in which I expect to see further improvements and progress being made.

Lighting

Providing light with adequate intensities, proper colour balance, high efficiency and low heat output is high on the list for those keeping reef tanks. While better reflectors and higher colour temperatures provided by metal halide lamps have produced somewhat improved lighting, the optimum lighting method has yet to be realised.

There are some new methods on the horizon that may meet these goals: some are just starting to make it to the market,

others are still a few years away.

The first of these has been around for a couple of years and is being used by more and more hobbyists in different applications. This system uses what are called T5 fluorescent tubes; they look like thinner standard fluorescent tubes and use a specially designed reflector.

This system, when engineered properly, is designed so that all the light produced by the bulbs reaches the tank either directly or is reflected into the tank. The reflector from better manufacturers is so well designed that virtually none of the light is reflected back through the bulbs themselves, which otherwise would reduce the intensity.

This system is reportedly so efficient that four tubes produce as much light as a 250W metal halide lamp while using 40% less energy. In addition, the bulbs are now manufactured in a variety of colour temperatures from 6500K to 20,000K.

In the two tanks I have seen using these lights, the intensity and colours appeared to be a hybrid between a moderate wattage metal halide system and a fluorescent system. The tanks were quite appealing to look at while the corals exhibited rapid growth and good overall health. I expect these systems will be one of the

standards for lighting reef tanks in the near future.

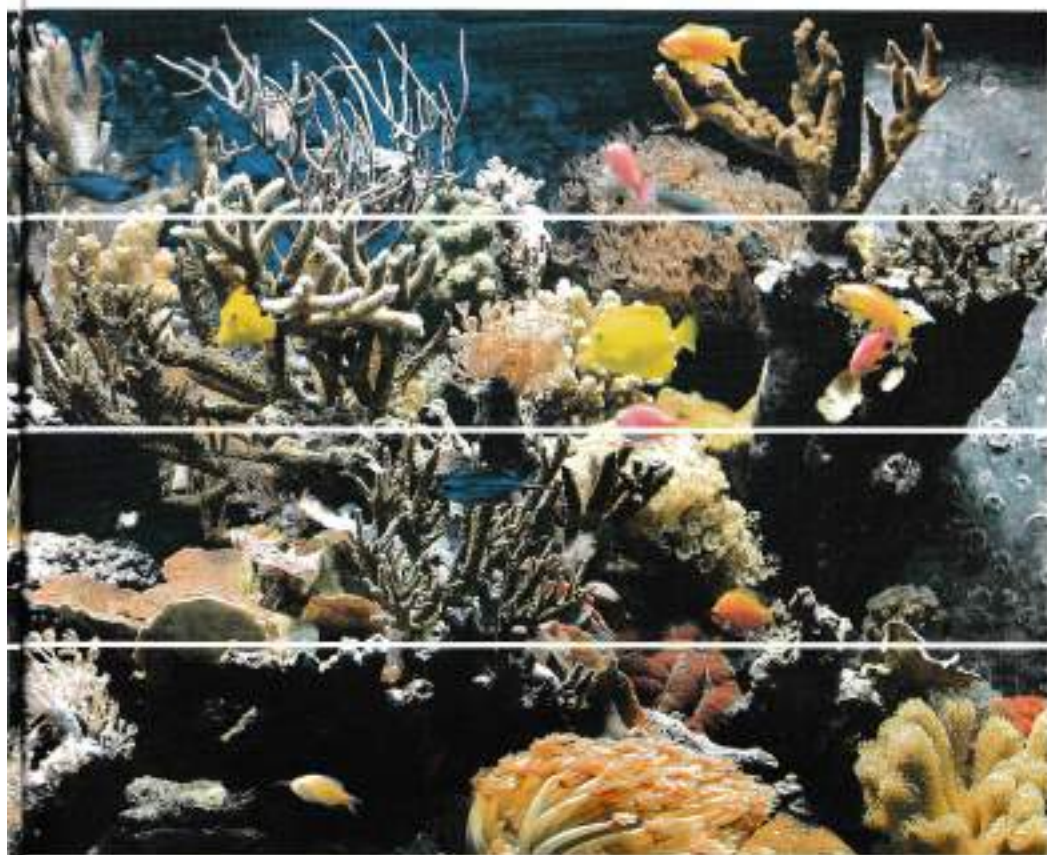
Another lighting method was discussed by Charles DeBeek at the Marine Aquarium Conference of North America five years ago and in an article by Richard Harker two years ago.

In this method, sulphur is irradiated with a microwave generator. The light produced then flows across a tube that illuminates the area underneath. The advantages of this system are that it produces virtually no heat and the tube generator is supposed to last at least three years. This system was initially designed to use tubes that were at least 2.4m/8' in length, but the lengths have now been reduced to shorter and more useful sizes.

The light produced by this system, which is comparable to that of having four 400W metal halide lamps, has a low colour temperature of 4500-5000°K. However, it is possible to bring the colour temperature up by using light filters. By adding blue and purple filters, you could have the light reaching the tank approximate to that of 10 or 20K metal halide lamps.

With these problems overcome, the biggest hurdle remains the high initial cost and the reliability of the





Computers

These control our lights and water pumps, and measure pH, temperature and ORP. But in future they could also measure nitrate and phosphate, compare levels before and after feeding or when the flow rate through the phosphate reactor or denitrator has changed, making finger losses or algae blooms a thing of the past. While we tend to attribute these to a single event, they more than likely to build up over time, so constant monitoring should make prevention much easier. Computers will allow for additions of trace elements as and when needed, rather than exposing the corals to a large quantity in a short period followed by another period where little or none is present.

generator and tube. The cost of this system only makes it practical if it lasts at least three years.

Unfortunately, the units have not lasted more than six months to date, and much of the research and development has been put on hold.

There is another method of lighting which is still a few years away, but when available will probably make all the others obsolete. It will use light emitting diodes (LEDs) to generate the light and promises a source that produces virtually no heat, will never need to be replaced and can be placed wherever the light is desired.

Unfortunately, LED technology at present does not produce light with enough intensity or a high enough colour temperature to be useful to illuminate a reef tank. Also, these lights are on the expensive side at the moment.

However, over the next five years these technological shortcomings should be overcome and this method for lighting reef aquaria should become widespread and very useful within the hobby.

Nutrient removal

Just as lighting needs to be more efficient, so do the means for removing unwanted nutrients.

While the widespread use of protein skimming has dramatically improved water quality, there will be continued advancements.

The future will see improved skimmer design. They will be smaller, more efficient and easier to adjust and maintain. This improved efficiency and ease of use is already present in some skimmers like Deftec, which are widely used.

Better understanding of what is being removed should allow future skimmer designs to remove the undesirable compounds while leaving more of the desirable elements and plankton alone. If the removal of plankton by the skimmer can be reduced or eliminated, then the increased use of refugia on tanks with skimmers will also probably increase at an even faster rate than is occurring today.

The positive attributes of this set-up including plankton and microfauna production, slow release

of trace elements and the benefit of nutrient removal make this addition to a protein skimmer an interesting aspect of future reef tanks.

Allowing more plankton to remain in the water while removing waste products and other unwanted materials will also allow for better success with filter feeders and non-photosynthetic corals.

Technology will also be improved to remove problem compounds like nitrate and phosphate, especially with the use of resins. This is already occurring to some degree with compounds like Rowaphos, which is the most efficient means I've found for removing phosphate and some heavy metals. A method that may allow for using it more efficiently has recently been developed using a modified fluidised bed filter.

In the future, even more efficient means or compounds will be employed. In terms of nitrate removal, the means used so far have included deep sand beds, col denitrators or anaerobic chambers. These require close monitoring and heavy maintenance to ensure their

ability. **Inventing the wheel changed the world forever. Could something similar happen in the marine hobby?**

LEFT: Self-dimming T3 lighting from D & D Aquarium Solutions.

RIGHT: Better understanding of nutrition is bound to improve the colour of fish and make more difficult fish like *Anthias* easier to keep.



By Jeremy Van Hook, courtesy David Sully

Coral and fish propagation

Taking fewer fish and corals from the reef will be one of the biggest changes to come. There are now several commercial facilities breeding fish for the industry. Initially these facilities focused on the easiest and most desirable fish such as clownfish, gobies and pseudochromis.

With improvements in breeding, rearing and finding adequate first foods, success with more difficult species is beginning such as with Flame angels and *Goniichthys* angels. As a result, species that command higher prices like deepwater angelfish and some species of seahorses, wrasses and anthias could become available more often.

Some enterprises are beginning to use a different methodology, harvesting large quantities of fertilised eggs or fry from the reef and then raising the spawn commercially (see News pages 10-13). This approach allows for the propagation of more diverse species including butterflies and groupers and the fish can be raised on commercially prepared foods.

When raised in this way, fish like coral eating butterflies can also be kept in reef tanks as they have not developed a taste for coral polyps. As this process develops, more species will be successfully raised. The extra benefit will be that the fish will probably remain healthy longer as they will feed readily on commercially available food.

Coral propagation is also taking giant steps forward. Several facilities now take cuttings or frags from wild colonies, mount them on small pieces of substrate and allow them to grow to marketable size in the wild. This not only reduces stress on the reef by reducing the need to take mother colonies, but also employs locals and increases the ability of the reef to renew itself.

Numerous small facilities that propagate the most brightly coloured or rare stony and soft corals are now in place. As a result, a rare colour morph of a coral that only a short time ago would only be available to a single individual may now be in the tanks of dozens of hobbyists due to these small-scale entrepreneurs. When done properly, even small frags can grow into healthy colonies

not breaking down and producing disastrous results.

However, the use of sulphur beads as a medium for culturing nitrate-consuming bacteria has become available. Once the methodology becomes better understood and established, their use will be common.

Calcium reactors

Calcium reactors will improve with more efficient use of CO_2 and better utilisation of the calcareous media. As a result, the media will not turn into mush and then need to be thrown out before it can be used up. It will also be phosphate free. Since these reactors will be so efficient they won't need to run constantly, so to keep systems at constant levels, future monitors will not only show calcium and alkalinity levels but will also turn reactors on and off as needed. This will also increase the stability and availability of two of the more critical compounds for maximum coral growth.

The study of trace elements will also hopefully expand so that we will have a much better understanding of what and how much of each trace element is optimum for coral health growth and colouration.

Water movement within our systems will also be much improved. Unlike current systems which typically employ strong laminar flow over relatively small areas, these new systems will employ stronger, more widespread flow that will also be

more random. This will allow for better distribution of trace elements, oxygen and plankton, help reduce pests that adhere to our corals, and also reduce detritus accumulation.

Nutrition

Only recently has the feeding of corals and other inverts been undertaken on a wide scale. However, as far as I am aware, no real studies have been done in captive systems to identify which foods and in what quantity optimises coral growth. As more foods are developed or cultivated, and as more hobbyists and companies gain experience with these foods, more information should become available as to the best way to feed and what foods will produce the best healthy growth and colour in corals.

As this occurs, it is also likely that a wider variety of foods, both live and prepared, will become available. In addition, it's possible that the means to feeding inverts on a slow, more gradual basis rather than once a day will become available. This should further enhance growth and the health of our corals and make it possible to keep some of the more difficult filter-feeding inverts as well.

Understanding the nutritional requirements of fish will also improve, meaning that some fish that are difficult, if not impossible, to keep - like anthias, coral-eating butterflies and some of the angels - will be common in future systems.

Ask the Experts

Got a query or a fishkeeping problem? PFK's expert team of fishkeepers is on hand to help.

TROPICAL LETTER OF THE MONTH



THE BENDER OF THE MONTH LETTER OF THE MONTH was a TetraBio M40 internal aquarium power filter (200-600 lph). The TetraBio M40 is suitable for tanks up to 60 l. The Tetra range of internal power filters are quiet, reliable and easy to maintain.

Was it *really* fish TB?

Q About three months ago, I added three 5cm/2" Veiltail angels to my 90cm/36" Amazon set-up. They were fine for about two months, but then I noticed that the smallest had developed a large, bright red ulcer on its side. When it didn't heal by itself, I went to see my local retailer who diagnosed fish TB.

He said that all my fish would now have the disease. He said the Angelfish only showed signs because it was the smallest and would have been picked on by the others. This stress worsened the disease, resulting in the external symptom becoming apparent.

I euthanased it but am now anxious to know whether fish TB can be transferred to humans, and if the rest of my fish will go down with the disease. They all seem healthy and active

at the moment.

Also, how do I get rid of the brown tint caused by putting unsoaked bogwood into the tank?

IAN HILL, IGHTHAM

A First of all, it is not possible to diagnose fish TB from external signs alone. Instead, a dead specimen needs to be examined internally by an expert and special lab tests, using stains, are needed to confirm whether TB bacteria are really present.

The red ulcer could have been due to other bacteria. We shall never know.

Even if your fish had TB, the disease is not highly infectious and the others are likely to escape it. But be aware that an underlying water quality problem can make fish prone to TB and other bacterial problems, as can stress.

It is really important to point out that fish TB is

not the same as human tuberculosis (the type that causes lung and bone disease). I researched human TB and other human mycobacteria for five years, so I know this to be the case.

The human form of fish TB typically affects the lower hands, is not life-threatening, is very rare and can be treated with antibiotics, so there is no need for alarm.

However, always take sensible precautions when handling fish (or any pet): never immerse your hands in the water if you have cuts, wash your hands after coming into contact with aquarium water or fish, and never prime a siphon tube by sucking!

As for removing bogwood tannins from the water, the best product in my experience is Bio-cham zorb (a mix of activated carbon and resin) from API. **PETER BURGESS**



Sponsored by Tetra - experts in fish health





If fish go down with what you think might be fish TB, only a vet or fish health professional can give you an accurate diagnosis.

YOUR TROPICAL EXPERTS

Write to us using the form at the end of the Ask the Experts section or send an email to us at questions@practicalfishkeeping.co.uk and we'll forward your query to the right expert. Please note that we cannot offer a quicker service for email queries as every question is answered in turn and each one has to make its way to the top of the pile. Photos include a stamped address, envelope for all letters sent by post.

PLANTS
PETER BANLEY
 has had years of experience with just one species.

HEALTH
 by **PETER BRADSHAW** of the Aquarist Advisory Service is an expert on fish diseases.

DIAGNOSIS
RICHARD HARRISON of What Aquarist Needs is well known for his knowledge of fish health.

DIAGNOSIS & TREATMENT
JOHN PENNIE is a highly experienced fish breeder and expert on freshwater fish.

CATFISH
CHRIS PALM is a catfish expert. He's Chairman of the International Aquarist.

ADVANCED
ANDREW SMITH is the featured Aquarist in Great Britain, in a project on freshwater species for Tetra.

TERRARIUM
 by **DAVID COO** of the Tetra Club has a vast amount of knowledge on terrariums.



TIPS FROM THE EXPERTS

A few bags of Daphnia will quickly clean green water and is a wonderful biological filter. Please note this only works when there are no fish present.

PETER BRADLEY

Keep an eye out for the nippers

A My 60 x 38 x 30cm (24" x 15" x 12") community tank contains two Blue gouramis, a male Siamese fighter, various small tetras and catfish. If I added two female fighters, would the male become aggressive towards the other fishes?

MAX TRAVIS, BRISTOL

A Given the size of your tank, you seem to be approaching maximum stocking level. Blue gouramis are quite large fish and I suggest you keep an eye out for them

Male fighters aren't that aggressive to other fish - it's usually the other way round...



Copyright: iStockphoto.com / gettyimages.com

becoming spiteful to the other inmates. If you do choose to add a couple of female fighters, then initially the male will either become aggressive or pose and posture at them.

He will turn aggressive towards the other fish only

when he starts to build a bubble nest, although most of this will be directed at the female with which he spawns.

Male fighters are not that aggressive to other fishes - it is often the other way around.

You don't have any notorious fin-nippers in your tank at the moment, but even innocent-looking Cardinal tetras can have a sly peck at the flowing fins of male fighters when the fancy takes them.

ANDREW SMITH



Botia siamensis

Which fish will decimate snails?

A I should like to know how to rid my 180 l./ 40 gal. community tank of snails. I was told Clown loaches would do the job, but last time I tried them, they kept getting whitespot. Are there other snail-eating fishes?

UDAY SHARDMA, LONDON

A Snails are a real problem in the hobby,

particularly the conical-shelled Asian mud snails which burrow into the substrate.

Clown loaches do a great job, but once they grow larger than a couple of inches, they tend to become less effective at removing these little pests as their mouths grow too big to pick them off.

A better choice would be the Candy loach, *Botia striata*, or its close relative

the Chain loach, *B. siamensis*, neither of which attain the same size as the Clown loach.

Other possible species include small doradids such as *Amblydoras* species from South America. There is no need to rid your tank entirely of snails as in small numbers they perform a useful service in eating small, leftover food particles.

RICHARD HARDWICKE

Infanticide among Angels

A My Angelfish breed in the community tank, but free-swimming young disappear after about three days. Why? I also need to find whiteworm cultures.

WILLIAM MCCRAIGEN, BELFAST

A Either the tank inmates are eating the young, or the parents are frustrated trying to guard them and are themselves eating the brood as they think the chances of survival are slim. Give the breeding pair their own tank.

Whiteworm cultures are becoming harder to find. You could try either Tommy Topsoil (01422 831112) or Mr Collins (01262 675264).

JOHN RUNDLE



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Fish with a sting in the tail

I have a well-established 2.4m x 60 x 60 cm/8' x 2' x 2' Discus tank and would like to know if I could keep freshwater stingrays in with these fishes. I also have some *Corydoras* and L-number plecs.

ANDREW LEWIS,
THE HAGUE

A Stingrays will live in a Discus tank when they are young, around the 10-15cm/4-6" discus, happily feeding on small foods such as bloodworm and mysis shrimp.

The problem arises when they become established and put on some serious growth. At this time their diet changes to larger things such as small fishes, which they skilfully trap under their wings.

I have seen a 15cm/6" *Potamorhynchus leopoldi* trying to eat a similarly sized *Uaru* cichlid, clamping it to the substrate for several minutes before releasing it. The victim was removed and made a full recovery, apart from some damaged scales.

The most suitable stingray species to consider are *P. laticeps* and *P. reticulata*, as these tend to be more agreeable with smaller fishes, although anything *Corydoras*-sized would have to go – for both parties' sake, as these catfishes could stick in a ray's throat.

I suggest you set up a species tank and discover just how amazing these fishes really are.

RICHARD HARDWICK

Thinking big – maybe too big!

I should like to set up a tank to house an arowana. I know they grow quite large, but are some species more manageable than others – and could you recommend some suitable tankmates?

LIAM WALSH, LONDON

A All arowanas grow extremely large. For example, the Silver arowana, *Osteoglossum bicirrhosum*, will make at least 75cm/30" in captivity with its close cousin the Black arowana, *O. ferox*, not far behind. The Australian arowanas

of the genus *Sclerorhynchus*, notably *S. jardini* and *S. leichardti*, rarely grow much more than 60cm/24" in captivity, but are highly-aggressive towards their own kind as well as to other fish.

Asia has its Dragonfish – *S. formosus*. These are very highly priced and CITES-protected, so they come with a certificate and are micro-chipped. The Asian arowana is a very heavy, deep-bodied fish which can attain 90cm/36" if given the room.

Other members of the family include the largest

freshwater fish in the world, *Arapaima gigas*, and the African arowana *Heterotis niloticus*. These species are seldom seen and are not suitable for anything other than public aquaria.

These ancient fishes can live for more than 40 years and need tanks at least 2.4m x 76cm x 60cm/8' x 30" x 24" (1130 l/250 gal.) plus to move around.

Food consists of whole fish, mussels, cockles, floating high-protein sticks, and locusts from a reptile outlet. Think hard before you buy!

RICHARD HARDWICK

All Arowana grow extremely large and therefore require suitably large aquaria.



How frequently should I feed?

My tropical community fish appear to be constantly hungry, however many times a day they are fed. Would one daily feed be enough, or would that mean they starved?

JANET DRAPER, SWINTON

A In the wild, non-predatory fishes spend most of their day searching for food, and therefore many species have evolved a relatively small stomach. This is why healthy fishes appear to be constantly hungry, even when frequently fed. I would aim to give

yours at least two meals a day, but only ever as much as they can eat in a few minutes. Always leave them a little hungry. That way, they will digest the food more fully and produce less waste, meaning there is less work for the biological filter.

JASON SCOTT

TIPS FROM THE EXPERTS

Algae-eater

The Siamese flying fox, *Crossocheilus siamensis*, is one of the best choices for algae control in aquaria. These fish will tackle even the stubborn hair or brown-tufted types which grow on plants. The problem is, these fish are seldom seen and some dealers unwittingly add all the machinery common flying fox as the real thing in the Siamese flying fox, the black body stripes extend into the tail. It grows to 12-18cm/4 1/2-6" and can be kept in small groups without too much territorial aggression. It's not difficult to keep. Aim for water parameters of pH 7, GH 6-10° and temperature 24-28°C/75-70°F.

TIPS FROM THE EXPERTS

To remove small particles of debris or dirt from difficult planted areas, use a plastic turkey baster. You can remove debris with precision accurately.
PETER BRADLEY

Better mannered than its cousins

Q I should like to keep a shoal of the delightful Dwarf distichodus, *D. decemmaculatus*, in a 120 x 45 x 38cm/48" x 18" x 15" aquarium. The tank will be decorated with a large, twisted root that has been exposed to the elements for a number of years – we think it's a hydrangea.

Is this safe to use?

LUKE BODALHAI, WANSTEAD

A *Distichodus decemmaculatus* are fish that have recently found their way into the hobby, but they are great little characters that get on well together – which is more than can be said for many of their cousins. They come from the Zaire

basin in Africa, and grow to around 7cm/2 1/2".

They need well-filtered tanks with plenty of oxygen. Aim for a pH of 7, GH 6-10° and a temperature of 23-27°C/73-80°F. Suitable tankmates would be *Microctenopoma ansorgei* and *Synodontis nigricentris* (the Upside-down catfish). Try to introduce all your fish at

the same time as this will reduce the likelihood of aggression.

D. decemmaculatus typically retail at £10-12 each, not cheap but they are worth it. I definitely would not advise using hydrangea. It's toxic and contains dangerous cyanogenic glycosides.

Beech branches are a much safer bet.
RICHARD HARDWICK

Sea frog keeps you on the hop

Q I want to keep a puffer in a tank of other oddball fishes. The most suitable species would seem to be the Sea frog. Can you tell me about it?

LIAM WALSH, LONDON

A The 'Sea frog' is, in fact, the Ocellated or Avocado puffer, *Tetraodon lineatus*, which originates from Bangladesh and Sri Lanka. It can live in either fresh or brackish water conditions, but it has an aggressive disposition which suits it best to a species tank.

It grows to 15cm/6", so if you insist on keeping other fishes, go for medium-sized barbs such as the Spanner, *Puntius lateralis*, Clown barbs, *Puntius everetti*, and Long-fin barbs, *Puntius arulius*, as these are hardy.

Feeding your puffer could be difficult as barbs are quicker off the mark. Offer earthworms, bloodworms, chopped cockles and snails, and aim for a pH of 7, 24-27°C/75-80°F and GH 10°.

RICHARD HARDWICK



Colius microlepis

Do Tiger fish savour salt?

Q I have just added six juvenile Siamese tiger fish to my large freshwater aquarium and was wondering if adding salt would increase their longevity. The tank also houses a 30cm/12" *Dormitator maculatus* and a *Megalodoras irwini* catfish. How would these react to salt?

RICHARD BARNES, SOUTHWATER

A You don't mention which Siamese tiger fish you have. There are several species and subspecies, but the Four-barred *Colius quadrfasciatus* and *C. microlepis* are the most common.

The latter seems happy kept in freshwater for its entire 20-year-plus lifespan, and I have maintained one like that for six years with no problems. My colleague keeps *C. quadrfasciatus* in

brackish water and, although this species will survive fresh, he's adamant they grow faster if there is a little salt.

Your *Dormitator* likewise tolerates both conditions, but *Megalodoras irwini* (now *Megalodoras unanoscopus*) are exclusively freshwater catfishes, coming from the soft, acidic rivers of the Amazon basin. They won't like added salt.
RICHARD HARDWICK



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Why nitrite sticks around

I recently set up a 90 x 38 x 30cm/36" x 15" x 12" tropical tank containing bogwood and live plants, running on an internal filter with carbon.

It has been going three weeks and the nitrite reading is 0.5 mg/l and the pH 7.2. I add Cycle weekly, but the nitrite level appears to have stuck. How long before I can add my fish?

ANGELA GALBRAITH,
ABERDEEN

Your aquarium is probably well on the way to being ready to accept fish.

Ammonia is the first

product of the maturation process and normally appears within a few days and lasts for around two weeks. Once this has gone down, nitrite appears and peaks at around three to five weeks. Once this too has gone, the tank is considered mature.

Many factors can extend or reduce this period, and tropical aquariums as a rule mature faster than coldwater tanks because of the higher temperature.

You can shorten the maturation period by using gravel or filter media from an existing mature aquarium to seed the filter with bacteria. This method is usually far more effective than using commercial bacterial additives.

It is slightly unusual to have a nitrite reading without any livestock present as there is nothing to produce any



Stock a new tank slowly and test your water between each addition of fish.

waste. I would guess that your bogwood could contain some decaying organic matter that is causing the problem.

You could dilute the nitrite by carrying out several large water changes, which would enable you to stock

with hardy fishes such as Zebra danios.

However, if fish are added, it may be necessary to carry out frequent water changes to keep the nitrite at a safe level until the tank fully matures.

JASON SCOTT

FACTFILE

Common name: Denison barb, Red-lined torpedo barb, Denison's flying fox

Scientific name: *Puntius* (formerly *Barbus*) *denisoni*

Origin: Endemic to India. Found in Chaliar, Kallada, Dhakakudupuzha, Aralam wildlife sanctuary, Mundakayam, the Kallar river and Travancore hill ranges.

Habitat: Fast-flowing streams and rivers.

Water: This species is found in mountain streams where the temperature ranges from 15-25°C/60-77°F. The pH varies from 6.3-7.8 with hardness ranging from 60-120°, making it very adaptable.

Aquarium: A high oxygen level is a prerequisite, particularly if the water temperature is on the high side. It's fairly peaceful and non-territorial and can be mixed with most tropical community fish. However,



there are reports of some specimens being a little waspish. Keep in a group. Use a tight-fitting lid.

Notes: There's some debate, but could be two different fish being sold as *P. denisoni*. It's not yet known whether these are species, subspecies or geographic variants, but

they appear to differ in their temperament. Some retailers tell us that some imports differ slightly in both colour and temperament, others disagree... We'll keep up to date with developments!

Rarity rating: An environmental assessment in 1997 listed this species as

endangered, however it is not on the current (2002) IUCN redlist for fishes. It's still fairly new to the hobby, but is turning up fairly regularly in specialist stores at the moment.

Price: New and extremely desirable, so still a bit dear at the moment. Expect to pay £15-20 each.

Tetra

Just a snack for two Oscars

Q I have a 90 x 38 x 30cm/36" x 15" x 12" tank and was thinking about getting two Oscars – but I already have two frogs and a newt. Would the Oscars eat them? RUSSELL BROWN, BARROW-IN-FURNESS

A I think there is a great likelihood that an Oscar would try to eat frogs and newts, and it is not a good idea to try and keep fishes and amphibians together. 'Someone' usually gets hurt.

A 90cm/36" tank is not large enough for two adult Oscars.

However, without the frogs and newt, you could keep small ones you were growing on.

Another problem is that if you were to buy two Oscars, they might be two females (OK), male and female (OK) or two males (disaster, they would fight). So the usual method is to grow on five or six little ones as from that number you should get a pair. Once a pair forms, you will need to find homes for the spares!

Ultimately, you will need at least a 120 x 38 x 38cm/48" x 15" x 15" tank for an adult pair, and also to complete the growing-on pairing process, which should take place at about 13-15cm/5-6".

A 90cm/36" tank isn't big enough for five or six Oscars that size.

It's horses for courses



Mbuna, like this *M. zebra*, are found in rocky habitats.

Q I have set up a 120 x 30 x 35cm/48" x 12" x 14" Rift Valley tank which is filtered by two air-powered undergravels, a powerhead and an external canister filter filled with crushed shell. It contains tufa rock and bogwood, on which Java fern grows well.

The pH is a steady 8.1, and I add a spoonful of salt each week.

The tank contains two *Methochromis zebra* and a trio of *Melanochromis johanni*, which have bred. There are also *Corydoras*, Clown loach, a Skunk loach and a small plec. I should like your comments on this system.

R. REYNOLDS, EDINBURGH

A First, a Rift Valley tank should be just that, not a general community. It is no place for *Corydoras*, plecs or loaches, which come from quite different water and will be most unhappy in a tankful of cichlids.

Second, you need to decide which lake you wish to simulate, and what habitat. There are different habitats with different fishes, and the cichlids you have so far are mbuna (rock-dwellers from Lake Malawi), so you

should stick to that group.

For these, you want masses of rock. Bogwood with Java fern is totally out of place – there are no plants in the rocky habitat, except perhaps dead trees washed down into the lake during the rainy season. But the effects of this wood on the water are minimal as there are

billions of gallons to dilute anything that leaches from the wood. In an aquarium, wood can acidify the water, which might result in sick or dead fish.

Don't add salt, as none of the Rift Lakes is saline, and salt has been identified as a probable cause of the disease known as Malawi Bloat.

FACTFILE

Common name: Zebra cichlid
Scientific name: *Methochromis zebra*
Size: 10-12cm/4-5"
Distribution: Endemic to Lake Malawi, East Africa.
Habitat: Rocky shoreline with algal growth.
Aquarium: Must be kept in a Malawi rock-dweller community, minimum size 90 x 38 x 38cm/36" x 15" x 15", with large amounts of rockwork providing caves.
Water parameters: Moderately hard and alkaline. Never acid. Must be well oxygenated and good quality, but not turbulent.
Temperature: 25.5-28°C/78-82°F
Diet: Avoid too much dried food, which can lead to the fatal Malawi Bloat. Best fed live/frozen aquatic invertebrates, chopped shrimp/prawn, and vegetable

matter. In nature feeds on algae and invertebrates.
Sexing: Males are more colourful than females and usually have more eggspots.
Breeding: Polygamous maternal mouthbrooder. Mates only for the duration of spawning; female broods eggs and fry for about 21 days; no brood care after first release.
Similar species: Other *Methochromis* are the same shape, many other Malawis have the same stripe pattern. Most likely to be confused with the smaller *Gynochromis* which are similar in shape and form but have different dentition.
Notes: Formerly *Pseudotropheus zebra*. Orange-blotched females are common, males less so. For years thought to have other colour morphs (red, cobalt, white) but these are now separate species.



Sponsored by Tetra - experts in fish health

Don't fret over water hardness

I have been successfully keeping mbuna and haps for two years, with zero ammonia and nitrite readings, and nitrate held down to around 25ppm through 30% weekly water changes.

My problem is the pH and how to increase the hardness as the water supply in this area is naturally soft.

Coral sand mixed with the regular gravel, and décor of ocean rock with some tufa, have allowed me to keep the pH at around 7.5, but the water remains moderately soft for both total and temporary hardness.

GRAHAM SMITH
FATELEY BRIDGE

A My water comes out of the tap with a hardness of 0.5° GH. When keeping Malawi

and Tanganyikans, I use a calciferous substrate which gives me a hardness of 3-4° GH and a pH of about 7.5.

For Tanganyikans, I increase the pH to 8.0 using plain bicarbonate of soda. I am happy with pH 7.5 for Malawis, as although it is a little lower

than optimal, I know that it won't slip into the dangerous acid zone because of the buffering effect of the substrate.

I have had no problems breeding these hard-water fishes using this system, and they generally live long lives. I had a male *Metracostus zebra* that

was bred in this water and lived to the age of nine, and at present I have Julidochromis that are seven years old.

In other words, I think you are fine. Don't worry about the hardness. If you want to increase the pH, use bicarb. You will have to experiment to find the correct dosage for your water - use a storage container for this.



A calciferous substrate will help raise the hardness.

Cichlid Stock / Photostock.org.uk

Leave Krib pair to do their own thing

A female Krib in my community tank 'claimed' a vase-like ornament, and after

reading how easy these fishes are to breed, I bought a male. I should like to know if they are



Kribis are easy to breed - but they cannot be rushed!

likely to spawn, how long it will be before this happens, and whether there is anything I can do to encourage them along?
MICHAEL NICHOLSON (13),
CRAIGAVON

A I am sure your Kribis will breed, but it would be foolish of me to even try and predict when it might be next week, or it might be several months.

It will depend on the hormonal state of the female (ie how near she is to ripe) and how long it takes the male and female to get together to form a pair.

They will undoubtedly (well, almost certainly) spawn in the 'cave' the female has already claimed as her own.

There are three things you can do to help:

- Make sure water quality stays good.
- Feed a varied diet, including live or frozen live foods. Chopped earthworms are an excellent conditioning food.
- Leave them alone! The last is probably the most important. The one thing that puts cichlids off breeding is their owner constantly fiddling with the tank to try and get them to do it.

Please be patient. I know it is difficult, especially when you are young, but if you can learn to provide your cichlids with the ideal conditions and then leave them alone to do their thing, I am sure you will be successful.

TIPS FROM THE EXPERTS

There are two different species of South American 'Panda' dwarf cichlids in the shops at the moment.

Amblygrammus nassus and *A. jacobsoni* - the latter may still be seen for sale under its old trade name of 'Pandanus'. The females are yellow with black panda-like markings on the face, hence the name, while males are predominantly blue with a red edge to the caudal fin.

Both species are fully grown at 10cm for males and around 5cm for females, and can be kept in a community tank with other placid fishes. However, neither tolerate particularly hard alkaline conditions, nor high nitrate levels, so you'll need to check water conditions are spot on before buying them. Expect to pay about a fiver a pair for decent tank bred fish.

MATT CLARKE

DISCUS LETTER OF THE MONTH



THE AUTHOR OF THE DISCUS LETTER OF THE MONTH wins a 7kg tub of Tetra Primo which is a slow-releasing granular food for mal-water to bottom-feeding fish like Discus.

TIP

Very low Discus keepers say they don't want to breed them, and with a pair of fish and an 80, it is a strong possibility. But there are numerous potential problems with captive breeding. Planning is vitally important as you'll need growing or tanks, suitable foods and an outlet for the baby fish. Perversely, in captivity Discus breed almost too well, so think it through properly before trying. One thing is for sure - a more rewarding experience is difficult to name!

MARK EVENDEN

Ways to combat hole-in-the-head

We recently diagnosed an early case of hole-in-the-head disease in three of our seven Discus and took the alpha male, which had the most advanced symptoms, to a vet.

He took bacterial swabs and prescribed Baytril antibiotic solution to be administered by quarantining the fish in a dilute solution for five hours daily. We were also given a tube of Orabase cream to apply directly to the holes.

However, the fish reacted adversely to this treatment, which we stopped. Later the results of the swabs came back, showing that no bacterial activity was related to or contributing to the pinprick holes.

Another problem to manifest itself was the appearance of small whitespot-type cysts between the veins of the tail fin, which the vet identified as a rare fungus, but he could not be more specific.

We want to treat these dual problems, and wondered if you could help.

MARK GRAY, ANDOVER

Hole-in-the-head is a syndrome which we still know little about. It has been linked to a protozoan parasite (Sporonucleus), possibly in combination with a bacterial infection.

The most widely advocated treatment is metronidazole, from the vet, which can be administered with the food (10mg soaked in



Discus with hole-in-the-head syndrome.

100g of food, fed exclusively for three days). It can also be given via the water (say, 25mg/l). It is poorly soluble in water, so mix vigorously in a little tapwater before adding it to the tank.

The abnormal 'fungus' could be Dermocystidium (a strange, protozoan-like organism) or something similar, but its true identity would need to be confirmed by a trained fish health scientist/vet. These

atypical fungi are difficult, if not currently impossible, to treat, and I certainly would not advise the use of any toxic chemical such as malachite green.

I would be inclined to try metronidazole and see how the fish progresses.

Obviously, do not buy any more stock for the time being, and keep the affected Discus tank and equipment isolated from other aquariums or ponds.

PETER BURGESS

Why a TDS meter may fluctuate wildly

In one of my Discus tanks, the pH is 5.5-6.0, hardness GH 2° and KH 1°.

However, the electronic hardness readings from my electronic TDScan 1 meter fluctuate wildly before my eyes - anything between 90 and 250. I suspected the meter's accuracy, but it happens only on this tank. Why is this?

TOM TUCKER, WEYMOUTH, DORSET

A TDS meter measures the water's ability to conduct an electrical current and is an indication only of the total

hardness. It could be that this tank has some external forces or electrical activity nearby (such as a TV) that interferes with the reading. See if turning everything off alters the situation. Hard water conducts an electrical current more readily than soft.

Reasonably 'pure' water should have no appreciable level of electrolytes, so those causing hardness dominate the conductivity.

If in doubt, run parallel measurements of TDS (conductivity) and hardness using a chemical kit. These should confirm the readings from your conductivity meter.

MARK EVENDEN

Buying your Discus from a hobbyist may be cheaper, but your choice will probably be restricted to very small fish.



Sponsored by Tetra - experts in fish health

Serious about wild Discus

Q Can you please recommend a book on the keeping of Heckel Discus, and give me any advice on their feeding and lighting requirements?

MATT COCKELL, STROUD

A A book I refer to often is *Wild Discus*, by Bernd Degen. But anyone serious about wild fish should call Peter Daniels (01206 395484) as he keeps many different species.

When I have dabbled with wild fish, I aim for a pH of 6, temperature 30°C/86°F, GH 2°, KH 1° and conductivity 100ms or less. Settled fish will accept most foods: I never light my wild tanks, relying purely on daylight.

MARK EVENDEN



Discus do not like strong currents.

Where should I put my two filters?

Q What is the ideal flow pattern for the combination of an internal and external filter in a Discus tank?

PETER GIFFITHS, NEWPORT

A Ideally, the water flow should reach all areas of the aquarium. With two outlets positioned in the

same corner, there is a good flow around the perimeter, but little movement in the centre of the tank. With two outlets at the same end, but each occupying its own corner, there are few dead spots and this, in my opinion, is the best option.

If you direct the output from the external filter

diagonally across the aquarium, there will be no central dead spots and cleaned water will be picked up by the internal filter. In all instances, the effects of décor must be taken into account, and remember that Discus do not appreciate strong water currents.

JASON SCOTT

YOUR DISCUS EXPERT

Write to Discus Answers using the form at the end of the Ask the Experts section or send an email to discusquestions@practicalfishkeeping.co.uk

and mail to send your letters to the relevant expert. Please note that we cannot offer a quicker service for small queries as every question is processed in turn and each one has to make its way to the top of the pile. If sending your query by post, please include a stamped addressed envelope.

MARK EVENDEN is one of the UK's top Discus experts and a regular PFK columnist.



How can there be such big price differences?

Q Why is there such a huge difference in price between dealers when it comes to Discus?

L. LLOYD, FIFE

A If you are buying from a fellow hobbyist (probably the cheapest option), all he has to do is make a few bob to supplement his hobby, which is fine, but your choice will probably be restricted to very small fish.

A retail shop or dealer has to pay rent, rates, water rates, electricity, the pet trader's licence,

wages, advertising, make a profit - and remember, 17.5% of the price you pay is VAT.

However, he will also generally have a broader selection of Discus to choose from and will be able to offer you different ways to pay (ie credit card).

You are also protected by consumer law and if the seller is a member, you have recourse to DATA if there are any problems.

As with most things in life, you get what you pay for.

MARK EVENDEN

MARINE LETTER OF THE MONTH



THE BENDER OF THE MARINE LETTER OF THE MONTH wins a Tetra Nitrate test kit. High nitrate levels in a marine aquarium can severely affect the health of both fish and invertebrates. Levels below 10mg/L are recommended. Tetra's Nitrate test kit will do 40 tests and is suitable for freshwater and marine use.

Bad hair days

I have a bad hair algae problem in my 284 l/75 gal. reef aquarium - four of my powerheads intakes (I have a total of seven powerheads) were clogged with it, and some live rock are now beginning to grow hair algae in the crevices.

To try and keep it at bay, I put 50 Blue-legged reef hermits, five Emerald crabs and 75 Red scarlet hermits in the tank, all to no avail. I cut all nutrient foods, except for a two-part calcium additive, for two weeks, and decreased the lighting from eight hours per day to six.

I do weekly 54 l/12 gal. water changes. According to my test kits I have less than 1ppm nitrate, no phosphate, no silicate, 3.8 meq/l alkalinity, and 430ppm calcium. My pH is 8-8.1. I use an ETS 800 skimmer equipped with a Gen X pump, which is on all the time.

I wonder if temperature swings could be a problem? It reads 25°C/77°F in the mornings, but rises to about 27°C/81°F at night. I have a 25cm/10" fan in my cabinet and want to buy a chiller.

DANNY KEY, VIA EMAIL

Hair algae is a major problem when it gets a foothold. Even though water parameters appear fine, not realising the importance of certain microbial functions, along with certain husbandry procedures, have caught up with you.

Too many hobbyists surmise that if ammonia is

oxidised to nitrite, then nitrate, that takes care of animal wastes. And those with reef aquariums believe lots of live rock will get rid of nitrate. However, there is more to it than that.

There is now scientific evidence that more thought should be applied to microbial processes in our aquaria. If the area that houses inefficient bacteria (such as in the depths of a deep sand bed and inside that of live rock) become greater in volume than that housing efficient microbes, the system will become nutrient rich.

And when inefficient areas produce more nitrogen products and phosphate than can be dealt with, the aquarium will eventually succumb to algae. Very efficient skimmers and water changes reduce the intensity, but they don't cure the root cause.

So what are these areas? Anaerobic areas generate ammonium, an algal nutrient (nitrate is reduced to ammonium in anaerobic areas). Therefore, anything over 2.5-5cm/1-2" of sand and/or the over-abundance of live rock is, I believe, perfect for ammonium.

Many hobbyists also fail to control phosphate, which is also abundant in anaerobic areas. But not enough hobbyists understand this situation and use too much sand or rock in their systems.

Even though you say zero phosphate, I doubt that very much. Anything over 0.015 mg/l is sufficient to get an algal spore growing.

Unfortunately, almost all aquarium test kits only read down to 0.05 mg/l. Phosphate production is a



normal microbial process - we just have to keep it in line.

Adding dozens of crabs does not resolve the root cause. I have 10 hermits in my 681 l/180 gal. system - and consider that five too many!

Covering more than 25% of the substrate with rock provides places for detritus to collect or sandbed areas that can't be cleaned or vacuumed. Eventually there will be unwanted nutrients.

Your powerheads are a

perfect place for hair algae to grow - not only are they near detritus-filled substrate, but ammonium may be leaching into the water and being pulled towards them. Once growing, it needs little light. So why cut back on lighting?

When it comes to ridding an aquarium of hair algae, herbivores can help if growth has not proceeded too far. But hermit crabs are not part of the solution as they will not eat tree-like growths.



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Lettuce slug,
Tritidactia crispata

The Common sea hare, *Aplysia dactylomela*, feeds on algae of all types. Also the Florida sea slug or Lettuce slug, *Tritidactia crispata*, is fond of *Bryopsis*, a bushy form of hair algae. Yet their waste products need to be vacuumed out so they don't become a source of nutrients.

As for weekly water changes, it has no bearing on this situation so that's a waste of money.

An honest assessment is needed. Do anaerobic areas

have a greater volume than anoxic areas? If so, how best can that be resolved? What impact will it have if you redistribute and remove some rock and sand, vacuum more often and have a larger sandbed surface that is accessible for maintenance?

Reassess the use of additives, use a quality phosphate remover (and change it often), and remove any hair algae once seen. And keep using the skimmer.

Skimmer effluent can be flowed through a sponge or enter some kind of diffuser area where the bubbles have a chance of surfacing before the water flows into the aquarium. And don't change your photoperiod as the animals needing light have become used to it.

Don't use any of those algae-killing additives as some algae is a sign of a healthy system and is quite beneficial.

As for adding a chiller, if

you can keep summer temperatures from getting above 28.5°C/83°F, the equipment may not be needed.

For example, my system usually has a daily swing of one to three degrees. Keep in mind the exhaust should be vented to outside air. If not, the room temperature will rise, causing the unit to work harder.

Many of these points are discussed in my new CD book, *The New Wave*. BOB GOEMANS

YOUR MARINE EXPERTS

Write to us using the form at the end of the Ask the Experts section or send an email to us at questions@practicalfishkeeping.co.uk

and we'll forward your query to the right expert. Please note that we cannot offer a quicker service for email queries as every question is answered in turn and each one has to make its way to the top of the pile. Please include a stamped addressed envelope for all letters sent by post.

GENERAL
PHIL BENT is a UK marine hobbyist who has shared his experience with PFK readers for many years.

GENERAL
JULIAN SPENCER is a USA marine expert. He's written several books on reefkeeping and marine life.

GENERAL
Dr BOB GOEMANS, USA reef expert, is best known for his study of denitrification and living sand filters.

HEALTH
Dr PETER BURGESS of the Aquarist Advisory Service is an expert on fish diseases.

Starting on the right track

Q I have decided to set up a 120 x 45 x 38cm/48" x 18" x 15" fish-only marine tank, and would like to get it right the first time. I intend to use live rock in the system.

Would an external canister filter also be necessary and, if so, what media should it hold? And should the protein skimmer be sized to a tank twice the capacity of the one I am using?

The only other equipment would be a powerhead for water circulation, possibly a UV steriliser, and an over-tank luminaires unit. Do these allow for sliding cover glasses underneath?

Fishes that appeal to me include Midas blenny, Pyjama wrasse, Sea fighter, Orange-spotted goby, Common downfish, Green chromis, Scarlet or Long-nosed hawkfish,



A Pyjama wrasse will take on a Sea fighter.

Purple firefish and Royal gramma. Would you agree that these are all suitable for beginners, and perhaps suggest a stock list?

MISS J FLETCHER, BLOTON

A If you are going to use live rock for filtration you don't really need any additional filters with the exception of a small filter packed with carbon.

You might find Rowaphos useful if you have algae problems, but it is not essential. Instead of adding more filters, make sure you have plenty of water movement by putting in a couple

of big powerheads.

A luminaire would be adequate to light your tank and yes, these do accommodate cover glasses. You will need 20-25kg of Fiji rock. Make sure it is cured or seeded.

Add it right at the start and it will do the maturing for you. Just check ammonia and nitrite levels after adding it, and when these are both zero, you can start stocking.

Look for a good, colourful coating of coralline algae and fanworms or polyps. Big pieces tend to look better than smaller ones.

The fish you mention

are all suitable for beginners, except for the Orange-spotted goby, Valencienna puellaris, which can be difficult to keep well fed.

If you like gobies, the Watchman goby, Cryptocentrus sp., is a better bet.

Don't try and keep a Pyjama wrasse with a Sea fighter as these will scrap. You could keep a smallish tang species.

A Yellow would be better than a Regal as these are less prone to whitespot. Add it as your last fish, maybe six months after you start stocking.

Plenty of scope with clowns

Q I plan to set up a fish-only tank for clownfish. What size would be needed to keep up to four individuals, and what other essential equipment would I need?

ANTHONY SENA, GIBRALTAR

A It sounds as though you need the help of a really good reference book. I would recommend



Keep clownfish singly or in pairs.

Clownfishes by Joyce D Wilkerson (Microcosm, ISBN 1-890067-04-1), which can be ordered from the Internet suppliers, Amazon.com.

Briefly, clownfishes should be kept singly or in pairs, rather than groups. The smaller species can be kept as pairs in 90 x 38 x 30cm/36" x 15" x 12"

(106 l/23 gal.) tanks, while large ones need a 212 l/47 gal. tank (120 x 45 x 38cm/48" x 18" x 15").

Clownfishes are not especially fussy about water quality, and any standard filtration system (undergravel, fluidised sand, powered canister filter or living rock-based system) will suit.

You have plenty of tank occupants to choose from: there are 28 different clownfish species, plus different colour varieties of some of those most commonly kept.

Try to obtain captive-bred specimens if possible.

PHILIP HUNT



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Why boost nature's pH?

Q I have a 180 L/40 gal. fish and invert system fitted with a sulphur denitrator and a calcium reactor. I add kalkwasser daily to replace evaporation loss, yet my pH remains low, at between 7.9 and 8.1, and I feel the stony corals are suffering as a result.

The calcium reactor is on only when the lights are operating, and of late I have stopped

using it altogether as calcium levels are high. Buffering does nothing to raise the pH, so can you suggest anything else I can try?

MICHAEL SCANLON,
DUNGARVAN

A Are your corals really suffering? A pH of 7.9-8.1 is quite normal, and it could indeed be the case that a calcium reactor is not needed full time.

The maximum calcium level should be 400ppm,

and 380-430ppm is quite acceptable. However, note that it is not wise to leave a calcium reactor inoperative for too long, otherwise harmful hydrogen sulphide can form in the media.

The denitrator may not be needed either, depending on the nitrate level (which you do not mention).

Below 15ppm is acceptable for a mostly soft-coral environment, or below 5ppm for specialist corals.

Sulphur denitrators may release water with a low

pH into the aquarium, so check the pH of the water leaving the unit to see whether this is responsible.

If your goal is to speed Mother Nature's growing schedules for the sake of patting yourself on the back or possibly selling fast-track stony corals, then a pH of 8.3-8.4 is desirable.

A separate buffer is not a good idea as the chemical element in the bulk water would be far too radically affected, especially in such a small aquarium as yours.

BOB GOEMANS

TIPS FROM THE EXPERTS

Low-salinity quarantine can improve your chances of long-term success with new fish, especially the more disease-prone species like tangs or wild clownfish. Quarantine the fish at a specific gravity of 1.019-1.022 for at least two weeks, and six weeks for wild clowns. Keep the salinity at about 2.8mg/L. Fish should be acclimatised slowly to these conditions. Add water from the quarantine tank to that in the shipping bag over an hour or so to reduce the salinity gradually. Reverse the process when adding the fish to the main tank.

PHIL HENRY

FACTFILE



Colour patterns allow the Long-nosed hawkfish to blend in with the environment.

Common name:

Long-nosed hawkfish

Scientific name:

Dysommeter typus

Pronunciation:

Oh-ee-see-yeet-ohs tie-puss

Origin: Widespread

throughout the Indo-Pacific, being found in the Red Sea, Japan, Hawaii and Panama. However, the species is not particularly common at any point within this range.

Size: Usually around

10-12cm/4-5", but

sometimes a little larger.

Diet: Mysis, gamma shrimp

and brineshrimp are all

taken readily.

Habitat: Long-nosed hawkfish live among branching hard corals and gorgonians on reefs, usually in between 10 and 100m/33' and 330' of water.

Temperament: Although capable of eating small fish and shrimp, this species is very peaceful and mixes well with most other reef aquarium fishes. It is best kept individually or as a pair. It is probably a hermaphrodite as two young fish will often form a lasting pair bond when

introduced in the aquarium. Larger specimens don't take well to match-making.

Aquarium: Although this species leaves sessile invertebrates such as corals alone, it is capable of swallowing small fishes and shrimp so be careful what you mix it with. It is generally very hardy and easy to keep and should do well in a reef tank or fish-only system of over 120cm/48" or more.

Breeding: On the reef, long-nosed hawkfish rise

above the coral heads to spawn in pairs in open water and produce moderately large pelagic eggs. Males are said to have a dark edge to the caudal and pelvic fins.

Notes: Although this fish appears to have quite a conspicuous pattern, this colour scheme works cryptically and allows the fish to blend in with the branches of gorgonians and corals.

Price: Expect to pay about \$25-40, depending on the size.

PHOTO: GARY BOW/ISTOCKPHOTO.COM

COLDWATER LETTER OF THE MONTH



THE ANSWER OF THE MONTH
DEBATED
LETTER OF THE MONTH

Here's a pack of Tetra Pond Variety Sticks. This three-in-one feature contains Tetra Pond Floating Food Sticks - to provide a highly nutritious staple food, Tetra Pond Koi Sticks - to enhance colouration, and Tetra Pond WheatGerm Sticks - to promote health and vitality and can be fed to your fish throughout the spring, summer and autumn.

TIPS FROM THE EXPERTS

How many Koi do you have? You should conduct a head count every morning. Missing fish may have been eaten or stolen, but more likely they are hiding because they feel unwell. Very small fish may have worked their way under the bottom drain cover into your filtration system, so check your settlement chamber - fish usually come to us here if needed promptly. **NICK FLETCHER**



Most goldfish are of mixed pedigree.

Gordon Ross / photos.com

Housing those waifs and strays

I We had to set up a 675 l/150 gal. pond quickly to rescue the goldfish and Koi of a neighbour who was moving (the new house owners wanted to fill in their pond). Initially there were many more fish than we could cope with, so we found most of them a home and kept 13 goldfish and several babies.

These youngsters are all 2.5-4cm/1-1.5" long, and all of them are blackish-bronze - except for one which is a lovely clear

white, with orange and black patches.

Is there a chance it's a Koi and, if so, should I bring it indoors for its first winter?

SANDIE STIMSON, CROWLAND

I Your colourful young fish could indeed be a Koi, or even a Koi/goldfish cross, although I think it more likely that it is just a precocious goldfish which is showing mature patterning earlier than the rest.

Most goldfish sold in aquatic shops are of very

mixed pedigree, and when they spawn, all manner of colour combinations are possible. White and orange goldfish are very common, while black is a colour that often shows itself early in life and then fades.

The sure way to tell if it's a Koi would be to gently net it out and examine it to see if there are any barbels around the mouth - a Koi has two pairs, one pair longer than the other.

Hybrids may have one or two pairs, or none.

As your youngsters are

still quite small (and your pond is 675 l/150 gal.), it might be a good idea to overwinter all the babies, irrespective of species.

A 120 x 38 x 30cm/48" x 15" x 12" tank would accommodate them, and the only hardware you would need would be an air-powered sponge filter, presuming the tank was sited in a centrally heated room.

Congratulations on your caring attitude in helping out a neighbour in a fishy fix!

NICK FLETCHER

How to divert a somewhat vigorous waterfall

I I have a 15,750 l/3500 gal. pond served by Oase Biotec 8 and Bitron 36UV, with an Aquamax 5000 pump. The return is via a small, pre-formed waterfall feature. I should like the rigid filter return pipework

to be made adjustable, as the flow is a little too vigorous for my liking. Is this feasible?

ROY HOLMWOOD, GORSEFIELD

I Your idea is sound, but it is always a pity to throttle back a pump

Rather than having a simple adjuster valve on the return pipework, I'd advise you to plumb in a T-piece, either side of which incorporates a ball valve.

One side of the tee delivers down the waterfall, the other takes

a pipe down to the pond just above top water level, and that way the filter benefits from the full power of the pump with no risk of water backing up and overflowing the filter chamber.

There is a further benefit to such a system



Sponsored by Tetra - experts in fish health

When a fish loses balance

One of the fancy goldfish in my coldwater aquarium is losing its balance and floats on its back or side rather than swimming normally. Is there anything I can do to help it?

SOBHAN MITCHELL,
POSTBRIDGE

If the problem is only sporadic, it might be due to the fish gulping air or suffering from indigestion. Air gulping occurs when the fish feed greedily on surface foods.

Try holding flake food briefly under the water so that it sinks on release, and avoid foods such as

floating sticks or pellets. You can also try feeding a high roughage diet (frozen peas thawed to tank temperature) for a few days.

In chronic cases of swimbladder disorders, the swimbladder itself may be distorted or malfunctioning so that the volume of air cannot be regulated by the fish. Affected individuals either float permanently or remain on the bottom, depending on whether the swimbladder has 'jammed' while inflated or deflated.

Bacterial infections can similarly affect the swimbladder, but it is near-impossible to tell whether the problem is mechanical or bacterial in origin.

PETER BURGESS

Bacterial infections can affect the swimbladder.



LORENZ HORN/SPRENGER NINE

in that once the weather cools, you can divert all the flow past the waterfall down the new pipe (which can be disguised with rockwork, etc).

You need to keep your filter running all winter, but waterfalls are a bad idea at this time as they quickly chill the water.

Take a sample piece of

your return pipework to a plumber's merchants and they will fix you up with the necessary bits and pieces.

Ball valves are a little more expensive than slide valves, but they operate more smoothly, with no tendency to stick, and flow rates can be adjusted much more finely.

NICK FLETCHER



Koi can learn to recognise individuals and will feed from their hands.

Koi pond is a major project in the making

I want to build a 5 x 5m/16' 8" x 16' 8" pond. Could you give me some advice and a list of the equipment I would need. Will any lights work underwater?

MICHAEL TYERS,
WATERHOUSES

Giving you a full answer would take up several pages, but I can offer you some guidelines.

You haven't mentioned the most important dimension - depth. Koi need a 1.5m/5' minimum depth, preferably 1.8-2.1m/6-7' as deeper ponds do not suffer so badly from rapid temperature fluctuations and give adequate swimming space.

Such a pond would need gravity-fed filtration from at least two bottom drains, feeding into a filter with settlement (a vortex chamber) and biological stages, and a UV of at least 55W on the return side of the pump, which should ideally be of the external-mounted type.

You can build liner ponds to the size you mention, in which case the first step would be to construct a concrete collar to provide a shelf for any

wall you might raise, and stabilise the ground against cave-ins. Rendered concrete blocks, finished in either G4 resin or fibreglass, provide the most durable pond shell.

Underwater lighting is the least of your worries and there are many options, from inexpensive submersible kits (Hozelock Cyprio) to Certikin Swimming pool lamps built into the wall.

Visit some Koi dealers in your area and take their advice. It is better to have a properly equipped smaller pond than a larger one in which you have skimped on the essentials: the more labour you provide, the cheaper things will be - but don't forget to build the cost of skips, cement mixers, etc into your budget.

The smallest viable Koi pond I would recommend would be 3 x 3 x 1.5m/10' x 10' x 5'. For that, one bottom drain would be fine. The depth can either be all below-ground, or you can have a part-raised, walled pond which will save you some digging and may offer fish better protection from predators.

NICK FLETCHER

YOUR COLDWATER EXPERTS

Write to us using the form at the end of the Ask the Experts section or send an email to us at questions@practicalfishkeeping.co.uk

and we'll forward your query to the right expert. Please note that we cannot offer a quicker service for email queries as every question is answered in turn and each one has to make its way to the top of the pile. Please include a stamped address so we can return the knowledge for all letters sent by post.

FISHES AND FUN
NICK FLETCHER answers your general pond queries and koi rearing questions.

FAMERIES
DAVE HALLS of Southport Cottage offers well-kept ponds and general queries.

FISH DOGS
JAMES ALLISON is our pond building and outdoor plant expert.

HEALTH
Dr PETER BURGESS is an expert on fish health and coldwater fishes.

QUESTION
Dr JOE SMART is a professor of Sustainable University in a world where we're all working and growing.

Tetra

Stuff you need to know about...

Going all the way...

Are you bored with your current job? Do you long to create a business that combines your love of fish with making money?

Mark Evenden outlines what it takes to set up your own shop.



ABOVE: Do you see your first million here?

RIGHT: Costs of running a shop can mount up very rapidly...



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you, stop reading now.

Many people will say how the first year is the hardest - yes, it is difficult to find your feet, but be prepared for much longer than one year before you get any financial reward.

If you are still determined to pursue that dream of yours, you need basic financial infrastructure which includes an accountant, a solicitor and a business bank account. It is also a good idea to join the aquatic trade association, DATA, and/or the Pet Care Trust.

All about banks

Banks will welcome you with open arms. They may even offer you an unbelievably good deal. However, all banks are pretty much the same and will offer a fee-free period so long as you remain in credit. Be aware that as soon as that period is up, you will pay a fee for everything and anything to do with banking.

Also, banks hate cash. They will charge if you deposit it and when you take it out. They even charge if you want to exchange a £5 note for a bag of 10p coins.

Many businesses will have two accounts: a standard bank account, usually for borrowing, and a post office giro account or small business account.

The post office needs cash and for around £10 a month, you can pay in up to £100,000 a year. A bank would typically charge £550 for this.

You need a credit card terminal. The rental charge from your bank is normally £15 plus VAT a month. Commission charges vary, but expect to pay 4% on credit card transactions and 40p per debit card. You can see how hidden costs start to mount up.

Your bank will also require you to have a business plan, cash flow projection and some money of your own. They will also insist you consult an accountant.

Accountants

Always choose one of long standing and good reputation: your new, friendly bank manager will help you find one.

Avoid the small adverts in the local press and make sure the accountant is a member of the Institute of Chartered Accountants. He may suggest that you use the services of a book-keeper. If you're at a loss of where to find one, he may know someone.

Are you going to trade as a limited company, sole trader, partnership, etc? Your accountant will set up a VAT registration and handle all things financial. He will also advise you of

your tax position - note that taxes are now paid in advance and not arrears.

An accountant and book-keeper will cost around £1500 a year for a turnover of up to £250,000, but always ask for an estimate.

Property

Whether you take on a lease or opt to buy the freehold of your business premises, a solicitor will need to be involved. Generally speaking, freehold properties are preferable, but these are rarely available and as such fetch top dollar.

Financing a commercial property is not like a domestic mortgage. They are more expensive and you usually need a big deposit. The advantage of freehold is obvious - there is no rent to pay and, of course, there is appreciating asset.

However, renting is usually the way to start. You will have to find a property, get it surveyed and then your solicitor has to sort out a lease with the landlord. Leases are usually 'full repairing and insuring', which means you are responsible for its upkeep.

Landlords or their agents will inspect the property from time to time, and if

you don't do the work, they send a bill.

The amount of rent will depend on the location, size and market forces. Currently rents are soaring so expect to pay at least £15 per square foot per year. A small 500sq ft shop in a small town could easily cost £7500 a year.

Then there are business rates. This will be based on the rentable value. In the above example, you could have to pay an additional £2200 a year. However, some landlords may give a short (three- or six-month) rent-free period to assist you in setting up. Rent is generally paid quarterly in advance, and rates are in ten monthly payments.

Never default on them. The consequences are horrendous.

The nitty-gritty

Finally after a few months, you have the keys in your hand. You should by now also have decided how you are going to lay out the interior. And this is where you stop being a hobbyist and start to look at profit. To pay these bills.

No matter how tempted you are, do not stock what you think might sell. Initially it pays to get advice from your wholesaler, both on dry goods and livestock.

Selling livestock does not necessarily bring in buckets of money. Choose with your head, not your heart.

Back to our 500sq ft shop. If this has 50 tropical tanks, modern shelving, a till, a safe, flooring, freezer etc, you'll be looking at costs of at least £10,000. OK, you could always build wooden racks and shelves - but first impressions and presentation generate sales. Marinis and Koi will cost a good deal more. Then there are all the incidentals such as carrier bags, price gun, computer, tool kit, first-aid kit, fire extinguishers, etc.

And don't think that you can just start stocking fish for sale. You need a licence to do this. To get one, you have to apply to your local council, they visit, advise you on regulations, charge an annual fee of up to £400 - and when they are satisfied, will issue you with a licence. Some councils require you to have an industry-based qualification before issuing a licence to trade.

As far as dry goods are concerned, your wholesaler will advise - and never buy too much of the same thing, such as three brands of an antibacterial treatment. The only exception to this is foods.

go for the best-sellers. Your wholesaler will help.

Upon delivery, check the sell-by dates (you won't get a refund if it goes out of date). You usually have 24 hours to return products that you feel are not up to scratch. You need to set aside £15,000 for dry goods. After a while you can trim or increase this as your business develops and you get to know the local trade.

The big day draws close and you place ads in the local papers and publications like PFK. Finally, in walk the first customers. They look around, like this and dislike that. Some will buy, some won't, some will return.

Is it worth it? Well, only you can say. You have certainly kissed goodbye to an ordinary life. Your week now consists of an early start, tank maintenance, ordering and sorting fish and dry goods, paper work and customers. As for holidays, well, there is Christmas day... maybe.

It takes a special breed of person to become a fish-shop proprietor.

It does not matter one iota how enthusiastic you are about your new venture or how much of your life you are going to dedicate to it - survival and ultimately success is all about cash flow. Every business has busy and slack periods.

When you start there are more of the latter, yet you will have entered into legally binding agreements with your bank, landlord, local authority, Inland Revenue and Customs & Excise. All of these bodies will insist on payments as agreed, usually with no compromise.

You need to have a sound capital reserve to cope with the slack periods - and don't go out and buy a car just because you have had a good week...

THINK CAREFULLY: DO

- Research
- Use professional services
- Budget realistically
- Use your head, not your heart when making a decision
- Play your creditors on time

DO NOT

- Assume anything
- Overstock
- Promise what you can't deliver
- Expect help from the shop down the road
- Sell rubbish
- Book a holiday

INITIAL EXPENSES

- Professional fees
- Rent deposit
- Furniture and fittings
- Stock
- Living expenses prior to opening

DAY-TO-DAY COSTS

- Rent
- Rates
- Property maintenance
- Meter rates
- Electricity
- Phone
- Advertising
- Cleaning
- Bags
- Oxygen
- Losses
- Staff
- Maintenance

YEARLY

- Accountant
- Book-keeper
- Licence
- Insurance
- Subscriptions
- Income tax

NOW AND AGAIN, BUT NOT EVERY WEEK

- Your wages



YOUR EQUIPMENT EXPERT

Write to Equipment Answers using the form at the end of the Ask the Experts section or send an email to us at questions@practicalfishkeeping.co.uk and we'll forward your letters to the relevant expert. Please note that we cannot offer a quicker service for email queries as every question is answered in turn and each one has to make its way to the top of the pile! If sending your query by post, please include a stamped addressed envelope.

Equipment Answers team JAGGA
30815 of the
Water Zebra. Need to
know your tank and
its contents.



How does it work?

Number 3: RO unit

Membrane

A central tube inside the top of the RO contains one or more membrane envelopes. The water passes through this under pressure and separates the chemical waste from the staff using osmotic force. The type of membrane installed determines what the unit is capable of removing - most units have a thin film composite (TFC) membrane. You will need to check the rejection rate data for the model to find out what the manufacturer claims the unit is capable of removing from the water. The H-S membrane in this unit removes more than a typical TFC RO.

Sediment pre-filter

Despite looking clean and sediment-free, tapwater contains a surprising amount of suspended material. A sediment pre-filter will save fine particles (down to about 1-5 microns in diameter) out of the water, so the water that reaches the membrane is much cleaner. This extends the lifespan of the membrane. The sediment pre-filter will need replacing periodically, depending on how much gunk is present in your water.

Waste pipe (orange pipe)

The water flowing into an RO unit needs to be at a high pressure and at the right temperature for optimum performance. It's best to buy a unit that's a little bigger than you think you'll need.

Waste pipe (orange pipe)

The waste water contains the rejected minerals and some pollutants, but has had the chlorine and other chemicals removed by the carbon, as well as the solids by the sediment pre-filter. Much more waste water is produced than purified water. Most people feed the waste pipe into a drain, however, it's cleaner than tapwater so is still OK to use for most hobbykeeping uses.

Drain pipe (blue pipe)

The small quantity of pure water produced has had most of the nitrate, phosphate, pesticides, heavy metals and silicates removed, as well as most of the minerals. The water is generally a little lower in pH than the tapwater and hardness free. It's ideal for use with Discus, or for marine, where the low pollution content helps keep algae at bay and improves coral health. The quality of the water will depend on the type of membrane fitted. The amount produced varies with temperature.

Remineralising compound

RO water contains so few minerals that it needs to be remineralised. If the pH of the water is exceptionally low (as it is with RO), the pH could plummet or fluctuate wildly. Remineralising compound is added to boost the hardness. Some trial and error may be required to get the desired chemistry, but the water will be much purer and cleaner than anything else you can get.

Carbon pre-filter

A cartridge containing activated carbon is used to remove chlorine from the tapwater, which would otherwise damage the sensitive membrane. The better RO units come with a solid carbon block rather than granular activated carbon (GAC).

Saddle valve

A self-flushing drain saddle valve (supplied with the RO) is used to permanently plumb the unit into the mains water supply. This will go through copper pipe fairly easily, but don't forget to turn off the water at the stopcock first, or you'll get soaked. You don't need to be a plumber to install an RO unit. It's a fairly straightforward procedure and should be quick and easy, even if you're rubbish at DIY.



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EQUIPMENT LETTER OF THE MONTH

No easy way to disguise scratches

I have two long scratches on the inside of my Juwel aquarium, caused by a piece of gravel that became caught on the algae magnet when my daughter was cleaning the glass. Is there any way to remove these?
TERRY MOORE, BOLTON

Glass is very hard but can still be scratched with gravel or sand. As far as I'm aware, there is no easy way to remove scratches, especially if

they are deep. I have heard that jeweller's rouge (a fine polishing compound used on soft metals) may work on very fine scratches, but it involves a lot of elbow grease.

Chicago Glass, based in Kent, can remove scratches from windows, mirrors etc using a device called The Renovator. This causes glass to flow into the scratch, making it virtually invisible. But, as I understand it, the process can be quite expensive

and may outweigh the cost of a new aquarium. Contact them on www.scratchremovers.co.uk
JASON SCOTT

Don't get gravel stuck between your algae magnet and the tank glass, or you may end up with unsightly scratches.



THE OWNER OF THE EQUIPMENT LETTER OF THE MONTH wins a 4kg tub of TetraMin Pro fish food. TetraMin Pro is produced using a low heat process to lock in higher vitamin and nutrient content. In addition, the strips are easy to handle and don't powder down like conventional flakes, so have very little waste that in the pack.

Ozone – treat it with the respect it needs

I have been given an ozoniser with a 0-50 setting for my cichlid tanks. What setting should it be run on and for how long?
GEORGE ROWLANDS, HUXTON

Ozone (O_3) is a powerful oxidising agent and can reduce the number of free-swimming disease-causing bacteria

and even viruses. It will neutralise the yellowing that sometimes occurs in established aquariums, and lower pollution caused by organic loading from fish waste.

However, the gas is deadly to all life-forms and for safe use in fresh water, you need a gas reactor: a tall, sealed cylinder filled with high surface area media to

which water from the aquarium and ozone are added. These run under slight pressure to increase the solubility of the gas. Never add ozone directly to the aquarium, and ideally, use it with a proper controller!

The setting refers to its output in milligrams per hour - an air pump is used to push air through. For maximum efficiency the

air needs to be very dry.

There are conflicting views on dosing, but as a rough guide, aim for somewhere between 0.1 mg and 0.5 mg per gallon per hour for the home aquarium.

In my marine aquarium with a high bio-loading, I run the ozoniser 24 hours a day on a dosage of 0.3 mg.
JASON SCOTT

Tubes laid end-to-end

I plan to set up a 210 x 75 x 60cm/7' x 2' 6" x 2' planted tropical tank. Could you advise on the best lighting, heating and filtration system for community fishes?
TIMOTHY LAFFAN, REDDITCH

Your tank will have a gross capacity of 990 l/218 gal, and will therefore require a larger-

than-average filtration system. The easiest type to install would be an external canister filter, such as those manufactured by Eheim.

I would be inclined to use two smaller models rather than one large, to give you a safety net if one develops a problem.

For lighting, you can choose between suspended illumination or fluorescents.

With the former option, you will require three (ideally four) 150W metal halides with 6500K lamps. Fluorescents for aquarium



External power filter and CO₂ unit.

use only go to 1.5m⁵ in length, so you will have to use two 90cm/3' tubes end-to-end. I recommend a total of eight tubes, ideally the new T5s, which will be enough even for plant species requiring high levels of illumination.

If you want really lush plant growth, I advise the use of CO₂ fertilisation.

Heater-thermostats are normally supplied as a combined unit. Assuming your tank is sited in a warm room, you will need 750W of heat, or three 250W heaters.
JASON SCOTT

Healthcentre



MP & C. Newton/Jarvis.com

ABOVE: The stuff nightmares are made of. Tapeworms can be rather nasty, but rarely cause the death of their fish host.

What are tapeworm?

Also known as cestodes, these parasitic worms are relatively flat in the cross-section, hence the 'tape' in its name. They are strictly internal parasites. Some species live as adults within the fish's gut (where they attach to the gut wall using hooks and/or suckers), others occur as larvae within the fish's body cavity or internal tissues.

They are large parasites - some species reach 10cm/4" or more. Ironically, the tapeworm's larval stage may be bigger than the adult!

Typically, they are white to pale yellow depending on the species.

How do tapeworm multiply?

Tapeworms have complex life-cycles in which they must pass through two or three different host species in order to complete each generation (see diagram at right).

Depending on the species, the adult may live in the gut of either a fish, mammal or bird. Various annelid worms (such as Tubifex) or aquatic crustaceans (such as copepods) serve as intermediate hosts. Tapeworm are hermaphrodites, meaning they possess both male and female reproductive systems, so even a solitary worm can produce fertile eggs.

How common are tapeworms in aquarium and pond fish?

Tapeworms are not common but sometimes occur in wild-caught or pond-reared fish.

Dr Peter Burgess of the 'Aquarian' Advisory Service takes a look at tapeworm.

Occurrence: Relatively uncommon. More likely in wild-caught and pond-reared fish.

What are the signs of a tapeworm infection?

Despite their large size, tapeworms tend to go unnoticed. That's because they live inside the fish and typically cause no tell-tale symptoms. Nor will you find tapeworms

living freely in the water. In heavy infestations involving a large number of tapeworms (or a single large worm), the affected fish may visibly bulge in the belly region. However, this abdominal enlargement can also stem from other causes (such as liver enlargement or dropsy), so is not diagnostic of a tapeworm problem.

The affected fish is often listless or shows poor growth, but these vague symptoms can be due to a wide range of diseases or water problems.

Can tapeworms kill their hosts?

Yes, in a few cases. But generally, tapeworms are more debilitating than life-threatening.

They weaken their host by 'stealing' the food from its gut and draining its energy reserves. The degree of damage depends on the size of the tapeworm(s) relative to the fish. In general, small fish are far more vulnerable to the harmful effects of tapeworms.

How are infections diagnosed?

With difficulty! Generally, tapeworms are only discovered by chance when a dead fish is cut open and examined (even where tapeworms are present, they are unlikely to be the cause of death).

An indirect way to confirm gut-dwelling tapeworms is to look for eggs in the fish's droppings. This requires a microscope and

WHAT DOES IT MEAN?

Intermediate host: The animal (eggs) in which a parasite (eg tapeworm) spends part of its life cycle, but in which it does not reach sexual maturity.

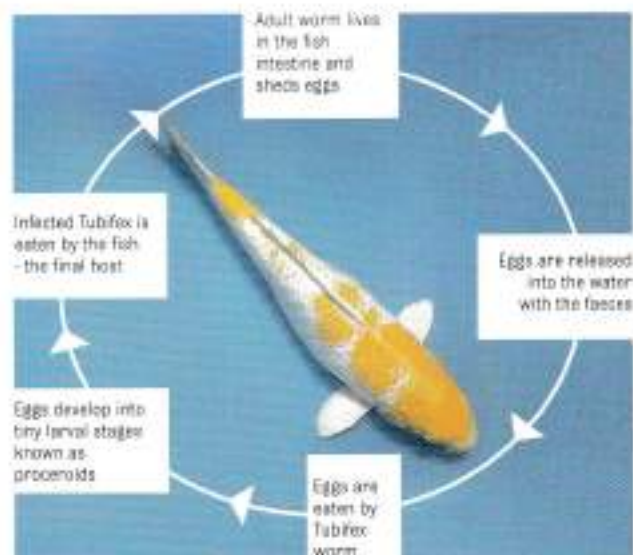




Photo: Steve J. Coe/Water Aquatics

knowledge of parasite egg identification, so you will probably need the services of a fish parasitologist or vet. However, even if your local vet is not a fish specialist, he will recognise the eggs because these parasites also infect other pets and farm animals.

It is only the gut-dwelling adult tapeworm that lay eggs: if your fish harbours larval tapeworms, you won't find eggs in the faeces.

Are all fish susceptible to tapeworms?

Tapeworms have been found in a wide range of freshwater and marine fish, both coldwater and tropical species.

Which species of tapeworm are common in ornamental fish?

Those affecting pond fish are the best known. The following two species are Asian tapeworms which were accidentally introduced into Britain via infested fish. They occur as adults within the fish's gut.

Khawia sinensis: This species reached Britain around 1986. It infests Koi and common carp, sometimes goldfish and tench. The larval stage infects aquatic annelid worms such as Tubifex.

Bothriocephalus acheilognathi: This seems capable of infesting a wide range of fishes including



Credit: Langshay

various cyprinids (carp and minnow), sunfish and catfish (eg *Catlas*). The larval stage is in freshwater copepods.

Can live foods carry tapeworms?

Yes, some can. Fish may contract tapeworms by eating infected Tubifex worms or copepods (the pin-head sized copepods are often seen swimming jerkily among wild-caught *Daphnia*).

How do tapeworm spread to new hosts?

Some tapeworm have to pass through a bird or mammal, and those cannot complete their life cycle in tank conditions and only rarely

under domestic pond conditions.

Others may transmit in aquaria or ponds (albeit rarely) if the appropriate intermediate hosts, such as Tubifex or copepods, are present.

Tapeworms are more of a problem on ornamental fish farms, especially farms that are frequented by fish-eating birds (such as gulls) that may harbour the adult worms in their guts.

Can humans contract tapeworms from their fish?

No - provided they do not eat their pet fish!

Can they be eradicated?

Only the gut-dwelling tapeworms can be eliminated using special medications, known as anthelmintics, from the vet.

An example is Praziquantel which is administered as a series of short-term baths (up to 10mg/l) or given orally. Consult your vet for precise dosage. Anthelmintics work by either killing the worms or causing them to lose their grip on the gut wall, so that they get flushed out of the fish's vent.

Larval tapeworms residing in the fish's body cavity should never be treated as the dead and dying larvae may rot inside the fish. Their decaying bodies could then trigger a bacterial infection.

You should only administer anthelmintics if tapeworm eggs are found in your fish's faeces, proving that the problem is due to adult tapeworms and not the larvae.

How do I prevent a tapeworm infestation?

Avoid buying emaciated fish or those with abnormally bulging bellies. Fish that have been bred and reared in indoor aquariums are unlikely to harbour tapeworms.

You may decide to avoid feeding live Tubifex worms or copepods, such as cyclops, to your fish as these creatures can harbour the larval stages of tapeworms.

DID YOU KNOW?

Squid-like tapeworm facts!

• Fish tapeworms are considered a human delicacy in some countries. The large larvae of a tapeworm known as *Ligula* (which infests the cavities of roach and other cyprinid fish) are fried with butter and garlic.

• Humans may contract the broad fish tapeworm (*Diphyllobothrium latum*) by eating certain raw or smoked fish such as pike. This tapeworm may reach 10m over 20 in the gut of its human host!

A bitter pill?

• Humans who suffer from a heavy tapeworm infection may lose weight as a result of the worms absorbing vital nutrients. This provided a rather negative trade in Vietnam times: tapeworm eggs were sold as 'stomach pills'!

TIP: Tapeworm infections may only be found at death.

CESTIDE: Tapeworm adults may live in the gut of seagulls.

Retail round-up

Our monthly forum for Britain's retail shops forms an important part of every issue of Practical Fishkeeping. We help you find the best shops with those all-important high-quality fish, and we hunt out the specialists in every area...

Calling all retailers and readers

Retail round-up's our dedicated zone for retailers and our readers' recommendations, comments and enquiries.

Readers, please take advantage of this space to complain, applaud or comment about current events, report changes to your business, and tell readers about new ventures. Readers are asked to recommend their favourite shops, recognise good service, and direct other readers to the best shops.

Discus - and rays - in Plymouth

Chris Ingham of **Plymouth Discus** opens his new shop this month, selling not just quality Discus but also a range of dry goods including foods, filters, RO units and many more Discus-related items.

Chris is a keen hobbyist-turned-retailer. As his hobby grew over the years, his fish-house was extended three times and still wasn't big enough to meet the demand. So he

turned his hobby into a full-blown business.

Chris tells us: "The shop not only specialises in Discus but will also be stocking freshwater stingrays for the Discus keeper with the larger tank. We will be running two main large centralised systems, one large tank filtered on its own for the stingrays along with a shoal of Discus, plus 15 breeding tanks and also

a large quarantine area where new arrivals will spend at least two weeks before going out into the main Discus showroom.

"In all, Plymouth Discus will have 8500 l/1872 gal of water pumping around the tanks. We'll have a large range of Discus. Some will be shop-bred with others coming from Germany, Thailand and Malaysia.

"We are fully licensed

and the business is run by myself at the moment, so personal service is guaranteed."

A courier service is offered if you're unable to travel to the shop. Hours of trading are 10am-8pm seven days a week.

Anyone wanting to contact Chris can do so on 01752 784671 or by email: krisandchris@eurobell.co.uk

MAC Certified fish from TMC

Tropical Marine Centre, the UK's largest wholesale supplier of marine fish, has become the first MAC (Marine Aquarium Council) certified company in the UK. The Marine Aquarium Council is an international not-for-profit organisation working to ensure the sustainability of coral reefs, coastal communities and the

marine aquarium trade and hobby.

Its certification system is based on taking the best practices of the most professional companies and extending and enhancing them to address environmental concerns.

MAC certification enables consumers to select retailers who sell animals that comply



with internationally approved environmental and quality standards, from reef to retail.

MAC certified fish are healthier and have better

survival chances in captivity because they are collected, handled and transported according to internationally approved best practice standards.

LEFT: MAC-certified retailers comply with international standards.

More captive-bred marines

Following our feature in the November issue on captive bred marines, the following shops have asked us to mention that they also stock tank-bred marines on a regular basis.

Aqua Logic UK, London Tel. 0207 820 0611
Reef World Aquatic Centre, Epsom, Surrey
Tel. 01753 570777

More Malawis at Viscum

Viscum Water Gardens & Aquatics in Doncaster has expanded its range of Malawi and Tanganyikan cichlids and the stock now includes some of the more difficult-to-get-hold-of species. There are now 30 tanks dedicated to these popular cichlids and new stocks of fish are arriving weekly. Viscum tells us that this expansion is due to customer demand.

The shop is at Doncaster Road, Barnburgh, Doncaster, South Yorks DN5 7EF. Tel. 01709 893265

