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◀ Goldfish
Breeding ... Page 38

Koi Pond Design -
part two of our series
on pond construction ...
Page 10 ▶



**TROPICAL • COLDWATER • MARINE • DISCUS
KOI • PONDS • PLANTS • REPTILES & AMPHIBIANS**

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COVER PICTURE

M.P.C. PEDFOR

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EDITORIAL

Last month I spent many hours searching for a suitable photograph for the Editor's page and came up with the one you see here. Once again my publisher does not seem to think it is quite what he had in mind. I suspect it is because I didn't tell everybody I am the person on the left. Now I have cleared that up hopefully my publisher will be happier with this photograph and I won't have to hunt through thousands of photographs again in search of one more to his liking!

The Aquazoo insert is here again and with it another opportunity to enter their competition. If you have never surfed the net before this is the ideal opportunity to take over the computer for an evening and see if you can figure out the three fish illustrated. I was always a sceptic about the internet but since going on line have found it a useful source of information. Using the Aquazoo site you will be able to subscribe to A&P online using your credit card and also check out a few old articles you may have missed. Check out the competition at www.aquazoo.co.uk/competition and move on from here through the rest of the website to see everything else.

May is here and with it some semblance of spring (I hope). With British summer time being ushered in with snow storms and blizzards over much of the country it makes the timely advice that John Dawes gave all our pondkeepers back in March to "Spring into action — but not too hastily" all the more important.

This month's A&P has been a joy to put together. Sonia Guinane's article on Kribensis was very much a trip down memory lane for me. I first bred these fish in 1973 and had just about forgotten how beautiful they are and what wonderful parents they make. Gobies are another of my favourite fish and this month Kathy Jinkings writes in Cutting Edge to bring us a rare glimpse at a lovely freshwater Goby I have always wanted to keep — but never found for sale.

Pondkeepers and coldwater fish are still very much to the fore with the second part of Peter Skinner's series on pond construction. Bernice Brewster has been out to Japan to see how they produce the world's finest Koi and we draw on A&P's 75-year history to bring you an article by one of Britain's best known Goldfish keepers — Arthur Boarder. Even Arend Van Den Nieuwenhuizen has jumped on board the coldwater band wagon with a fascinating article on North American Shiners.

Marnists need not worry they are being left out in the cold as they still

have Dave Gerratt and Andrew Caine on stream with Crabs, Lobsters, Surgeons and Tangs all featured this month. Beginners to our hobby are catered for in the Blue Pages and this month we have put together a special feature on Pond Fish Foods to help make sense of the analysis on packs of food. This was something of a nightmare feature to prepare and I have to thank all the manufacturers who kindly sent us all the information we needed.

DEREK LAMBERT EDITOR

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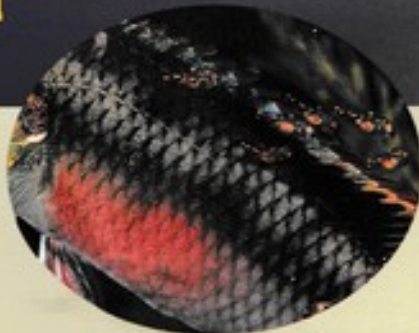
AQUAZOO COMPETITION

Great prizes and easy to enter!

In this month's A&P you will find a competition insert from Aquazoo.

All you have to do to enter is find which three fish the photographs belong to (a careful look through this month's A&P will help), and then go to www.aquazoo.co.uk/competition.

By following the instructions there you will have a chance of winning one of these fantastic prizes



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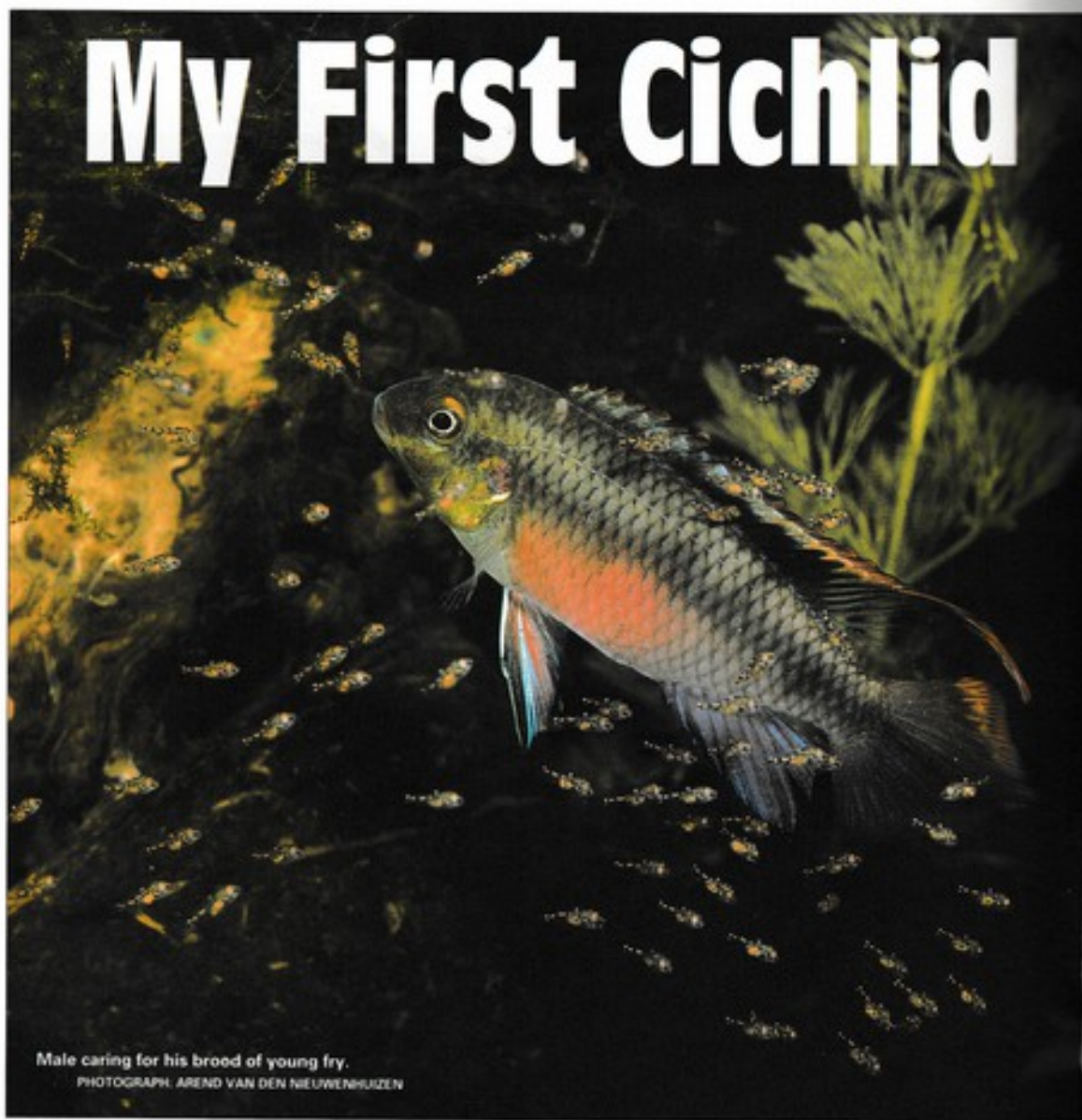
- ★ 10 of these to be won: 10 pairs of free tickets to the London Aquarium

TROPICAL

Like many aquarists **SONIA GUINANE'S** first introduction to cichlids was the humble but ever popular Kribensis:

PHOTOGRAPHS: M.P. & C. PIEDNOIR UNLESS OTHERWISE STATED

My First Cichlid



Male caring for his brood of young fry.

PHOTOGRAPH: AREND VAN DEN NIEUWENHUIZEN

One Sunday morning about 11 years ago, my other half, Dave Tourle, and I were wandering around the aquatic section at a local garden centre, admiring the colours and variety of the marine and freshwater tropical fishes being offered for sale. Later, over a cup of coffee in the cafe, the inevitable question was asked, had either of us ever kept fish and by coincidence, both of us had kept goldfish at some stage in our respective lives? It also transpired that, while we had considered keeping a tropical set-up, neither of us had ever got around

to it, but that situation was about to change!

That very same day, a tank measuring 30 x 12 x 15 inches (it was still pre-metric then!), was purchased, as well as a stand, an undergravel filtration system, plastic plants, rocks and some bogwood. The sales assistant was very helpful, as he seemed to know immediately that we were complete novices and explained the need for a water conditioner, to remove some of the nasty things in tapwater that are harmful to fish. I wanted to buy some fish straight away, but he advised us that to do so

would be a death sentence to the fish and to wait until the tank water had matured sufficiently. Before we left the garden centre, with our new equipment and reference book, I was already trying to decide which species of tropical fish, I wanted in my aquarium.

Dave and I spent the next few evenings 'fighting' over the newly acquired fishy book, as he wanted to read all the technical bits to ensure that he had set the tank up properly, which in retrospect was the correct thing to do. My reasons were completely different, but just as necessary, as selecting colour coordinated fish is not that easy. At last, we reached a compromise and I bought another fishy book the following weekend. Deciding which species to buy first was fairly straight forward because, thankfully, our choices were fairly similar. Dave wanted Cardinal Tetras and Guppies, which were on my shopping list as well as



Platies, Silver Dollars and many others. At last, after what had seemed an eternity to impatient me, he was confident that the water was mature enough to enable us to start putting a few fishes into the tank.

Happy with their new home

The initial inhabitants were six Zebra Danios and five gorgeous Guppies, all of which seemed happy with their new home. Their diet consisted of flake and frozen Daphnia and I was very careful not to overfeed them, so the water conditions remained at an acceptable level. Dave carried out 25 per cent water changes every two weeks and by degrees, it was possible to add more fishes to the tank. He had worked out how many inches of fish it was possible to house in our little aquarium, but we, especially me, were finding it increasingly difficult to stick to his original estimation.

Most weekend activities now consisted of visiting various aquatic outlets throughout Sussex where we live and on occasions travelling even further afield. For some reason, Dave and I began to develop a definite interest in Cichlids rather than the community fishes. I was especially taken with the iridescent colours of the fishes from Lake Malawi, but was continually discouraged from buying any, for as far as we knew most cichlids were very aggressive, territorial and extremely difficult to keep. However, there are a few exceptions which can be kept in a community tank and are fairly undemanding with their water conditions, provided it is well filtered and regular water changes are carried out.

Finally, after much discussion, we decided to buy a pair of young Kribia, although at that time, keeping a cichlid species really seemed a very daunting prospect. The pair of *Pelvicotromis patcher* were purchased from a nearby aquatic store and we were really impressed that the owner was able to pick out a pair for us. In my ignorance, I

above Female caring for her eggs. These have been laid on the underside of a coconut shell.

left Mum out and about with her brood. Kribensis will herd their fry back to a safe defensible place at night.

MY FIRST CICHLID

was still unable to see much difference between the two fishes, although Dave was more positive and confident that we definitely had a male and a female. As he had obviously done his homework, he took great delight in pointing out to me the differences between the two sexes!

The background colour of both male and female is a pale greyish-green, with two longitudinal black bands. One of these bands runs through the eye from the snout and continues along the flank to the caudal peduncle, while the other extends along the base of the dorsal fin. The rounded dorsal fin of the female is mainly black in coloration with an iridescent gold running along the spines. There are one, sometimes two ocellated spots at end of the spinous area which can extend on to the soft ray. The belly area of the female is a very bright pinkish-red

colour which intensifies considerably prior to spawning. Her caudal fin is rounded and apart from the extension of the longitudinal line is virtually colourless, although some irregular yellow markings may be visible. Overall the female is smaller than the male, being shorter and much deeper-bodied.

Unusual diamond shaped caudal fin

The male *Pelvicachromis pulcher* is a more elongated fish with a more regular body shape. He lacks the intense pink belly coloration of the female and has much longer anal and dorsal fin extensions. The caudal fin of the male is an unusual diamond shape, with several ocelli in the upper half. The pelvic fins are longer than those of the female as well as

being a normal shape, whereas the pelvic fins of the female are curved and the same colour as the belly area.

After the initial exploration of their new home, the pair of Kribbs soon settled down with the rest of the tank inhabitants. An expectation of two exceedingly aggressive fishes rushing around the tank, perhaps killing everything in sight just never materialised. Dave had changed the décor of the tank slightly to try to simulate their natural habitat in the forest streams and ponds in their native Nigeria. He added more bogwood, rocks and small flowers to offer as many breeding sites and hiding places as possible in the tank. Having read our then vast reference library of tropical fish books (all two of them!), there was nothing that concerned him slightly. The two books had slightly conflicting suggestions as to the correct water conditions for the species, although they both agreed on the same temperature range, 26-28°C.

One book recommended medium hard water, 8-10 dGH, with pH 6.5, whereas the other stated that Kribbs, especially tank bred specimens are not that fussy with their water requirements. They can tolerate various parameters, as long as they are not subjected to extremes of alkalinity and hardness. It is spawning in alkaline water that causes resulting higher ratios of males to



above left *Pelvicachromis taeniatus* is a close relative which has recently been introduced to the aquarium hobby. It is generally only found in aquatic shops which stock rare and unusual fish.

left *Pelvicachromis humilis*. The Yellow Krib is another unusual Krib rarely found in aquatic outlets. There are several different colour forms of this species in the hobby. This one comes from Guinea.

female fry. Obviously, in spite of this fish accepting varying water conditions, it is still necessary to carry out regular water changes, using a water conditioner as I have already mentioned.

The pair continued to flourish, with no aggression towards their tank mates, and would eat everything that was offered to them. As both reference books recommended, the fishes were fed a varied diet of good quality flake, frozen and live Bloodworm, Brine shrimp and Daphnia, with the ultimate aim of trying to get the Kribbs into breeding condition as soon as possible. As fate would have it, our very first tropical aquatic reproduction occurred when we became 'Mummy and Daddy' to five little Flaties or maybe that should read 'Grandmother', etc! Needless to say, Dave and I thought this was cause for a celebration, immediately wetted their heads and proceeded to call the largest Flaty baby 'Cecilia', who later turned out to be a 'Cecilia'.

About two weeks later, it was noticeable that the coloration of the female *Pelvicachromis pulcher* had intensified, especially the bright pink in her belly region. She began to quiver in front of the male displaying her pink areas, while bending her body into a distinct S-shape. At first the male did not respond and chased her away, but eventually, her persistence paid off and his coloration also intensified. The female seemed to be very interested in a small tank ornament that resembled a broken flagon and had a small aperture on the top, into which both fish kept disappearing.

A grandmother second time around

I was now becoming very excited at the prospect of becoming a 'grandmother' for the second time, as it was just possible to see her cleaning the inside of the ornament. She continued to display on occasions to the male when his attention was distracted, although his defence of the flagon and the surrounding area increased, so both Dave and I were cer-

tain that spawning was imminent.

We were not disappointed as two days later, the male was fiercely guarding the area around the flagon and keeping their tankmates at a safe distance. Through the small opening of the flagon it was just possible to look inside and see the female fanning the small eggs, numbering about 100, that were attached to the side and roof. After three days the eggs had gone and I could not see what, if anything, might be going on in the flagon. The male continued to patrol the area and the female was constantly in and out, so Dave was still confident that things were proceeding as they should.

I checked the inside, but could not see anything, but when Dave had a look, he was positive that he could see tiny fry wriggling on the bottom. I know he is an eternal optimist, but how is he able to see round corners or was it just to reassure my uncertainty?

Seven days later the little female emerged from the flagon, surrounded by a 'cloud' of fry, closely guarded by the male. The other fishes in the tank seemed to have the sense to keep out of the way as the pair guided their foraging brood around the tank. When any tankmates made the mistake of approaching too close, both parents made jerking movements to the fry, while driving the interloper off. Any fry that wandered too far from the group were quickly retrieved by the female in her mouth and deposited back with the others. At night all were guided by their parents to the safety of the flagon. Dave and I were utterly amazed and fascinated at the parental care shown by this young pair of *Pelvicachromis pulcher*, as neither of us had realised until then, the lengths that cichlids will go to protect their fry.

The pair succeeded in raising about 20 youngsters from their first spawning which left Dave and I completely 'hooked' on cichlids. Another two tanks were immediately purchased, one of which became home to this delightful pair of Kribbs. They continued to spawn on a fairly regular basis until we reluctantly decided to move them on to a very good friend. As more tank space became available, other cichlid species were now being considered, including Malawis, but that is another story!

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KOI

Professional pond builder **PETER SKINNER** continues his series on pond construction with a look at one of the most important aspects of pond design — the excavation:

PHOTOGRAPHS: PETER SKINNER
UNLESS OTHERWISE STATED

Koi Pond Design *Part Two*

You may be forced into having a semi-raised pond if the water table is too high because it is extremely difficult and expensive job coping with ground water while building a pond. If the finished product looks as good as this, however, nobody would complain at being "forced" to have a semi-raised pond.

PHOTOGRAPH: MICHAEL EDWARDS

Site surveying and excavations

For most people cost and space will be the over-riding considerations when deciding what type of pond to build. These may need to be run in tandem with a thorough site survey, otherwise the design may have to be changed several times during construction, as difficult site conditions are negotiated.

Site surveys

Before construction begins it is important to make sure that there are no underground services which will be in the way of excavations. Small-bore plastic water or gas pipes can usually be diverted if necessary (contact the relevant authority for advice) without too much trouble. Large water, gas or electricity mains, sewers or cable ducts would be expensive to relocate, not to mention the bureaucratic attention it would attract. In this situation it is probably best to relocate the pond or at least change its shape to avoid the services.

Soil type

Before the final pond design is chosen it is necessary to determine the soil type on the site. There are many types of soil and they behave differently in certain circumstances. Sometimes you can dig a deep hole with vertical sides and they will not collapse. Other soil types will collapse as they dry out and some will cave in constantly as the hole is dug. These characteristics may determine how the pond should be constructed but, more importantly, for safety reasons it is very important to establish how the soil type will behave. Many pond excavations are very deep and in such

cases it may be necessary to shore up the sides to prevent collapse.

Test hole

If you are in any doubt about your soil type, dig a hole as deep as the pond will be, but keep the sides vertical and then leave it alone for a few weeks; you will soon see how the soil will perform. An extra advantage of digging a test hole is that you will be able to check whether or not there is a water table which will interfere with the project. If you find water that remains at a constant level it is better to call that level the bottom of the pond and build from there up.

Water table

You may be forced into having a semi-raised pond if the water table is too high because it is an extremely difficult and expensive job coping with ground water while building a pond. If your pond is to be built with a liner or a plastic moulding it is important to keep it full during wet weather conditions. If at any time the water level outside the pond reaches a higher level than inside then in the case of a lined pond the liner will float but a moulding may pop out of the ground altogether.

Levels

When the plans are drawn up it is usual practice to determine a fixed point from which all height measurements are taken; this is



If the pond is going to be more than, say, 1,000 gallons (4,500 litres) the use of a machine to dig the hole is strongly recommended. If you do hire a machine try to find a good operator because he will make a professional job and do no damage. Trying to learn to drive the machine yourself could well prove to be false economy.

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KOI POND DESIGN

known as datum. Finished pond water level is commonly used as the datum.

The next step is to survey the levels on site so that a datum level can be chosen which corresponds with the plans. There are several ways of determining the levels on site. A spirit level on a straight plank of wood is the simplest and is suitable for small works, but if the site covers a large area then a water level is more convenient. These can be purchased fairly cheaply or you can improvise with a length of clear hose pipe filled with water. The ideal tool for the job is a site level which is very accurate but are quite expensive, although some hire shops stock them.

Datum

Once the datum has been established it must be marked. This can be a nail in a fence, a concrete block set in the ground or an indelible mark on an immovable object. The ideal would be to concrete a wooden post in the ground just beside the pond and put a nail in at datum level. All relevant marks such as patio level, top of filter, wall height, etc. can then be marked with a pencil above and below the datum. This simplifies the job and can help avoid mistakes.

The excavation

The first step is to remove any top soil from the pond location, this is necessary for several reasons. Top soil is not suitable as a base for any structure because if it is covered with, for instance, concrete all plant

life will die and in time the humus in the soil will rot. As this happens the soil shrinks, settles and will not provide reliable support for load bearing structures. If the pond is to have soft landscaping, some of the topsoil should be stockpiled on-site so that it can be re-used when the pond is complete.

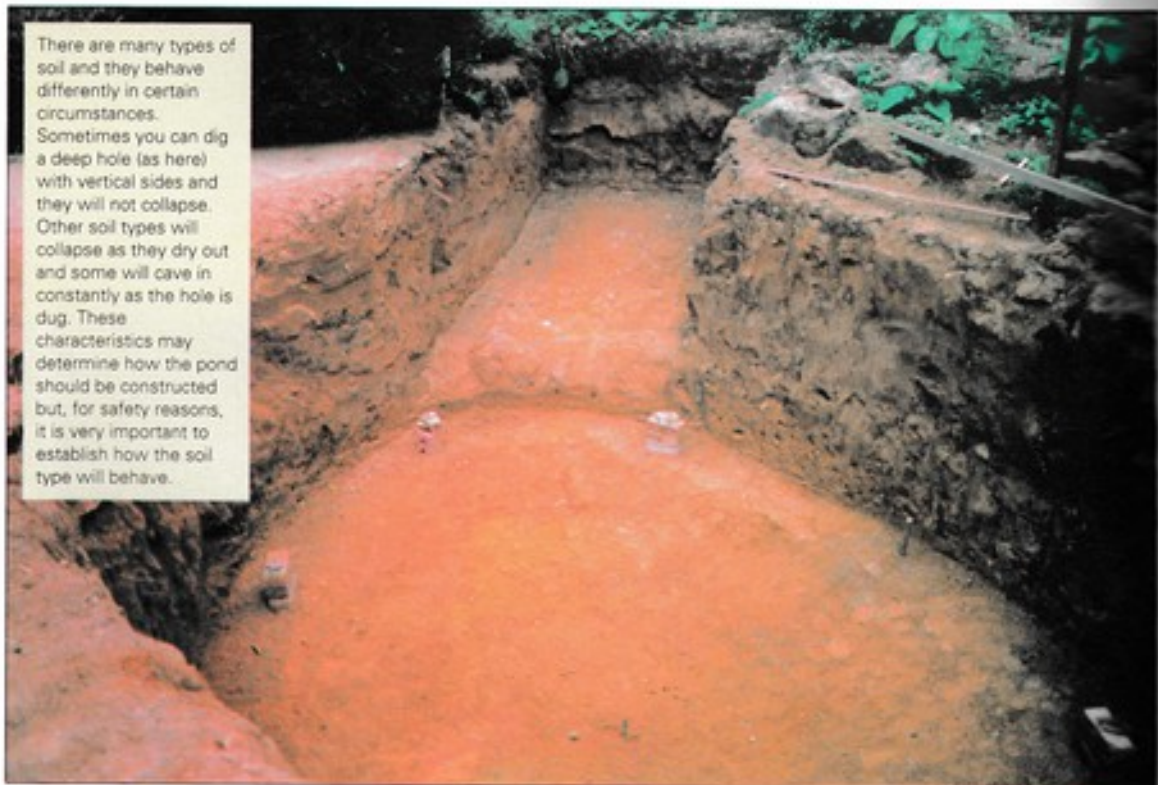
Marking out

Before beginning excavations, make sure that the holes are carefully marked out in accordance with the plans and so be sure how deep the excavations need to be. Not only do you want to avoid making the hole(s) larger than necessary but misplaced or oversized excavations can cause problems later. If, for instance a hole was dug 24 inches (60cm) too deep you couldn't just throw some spoil in the hole to make it up to the required level because this would not provide a stable base for the pond structure. If the spoil is sand or gravel it can be used as long as it is very well compacted. If topsoil, subsoil, or certain types of chalk and clay are the only materials available, it would be better to import some hard core or suitable material for make-up.

Excavators

If the pond is going to be more than, say, 1,000 gallons (4,500 litres) the use of a machine to dig the hole is strongly recommended. Access to the site may be restricted but there are mini excavators which will go through a 39 inch (1m) gap and dig the hole with a fraction of the effort that would be required to do it by hand.

There are many types of soil and they behave differently in certain circumstances. Sometimes you can dig a deep hole (as here) with vertical sides and they will not collapse. Other soil types will collapse as they dry out and some will cave in constantly as the hole is dug. These characteristics may determine how the pond should be constructed but, for safety reasons, it is very important to establish how the soil type will behave.



If a machine is going to be used to dig the pond, don't forget to excavate any holes to accommodate filtration systems and trenches for services. If you do hire a machine, try to find a good operator because he will make a professional job and do no damage. Trying to learn to drive the machine yourself could well prove to be false economy. With the right soil type the hole can be dug to an accuracy of about three to six inches which will minimise the amount of backfilling required when the pond is complete.

If your garden is mature and the movement of machinery is likely to do damage to your lawn or drive, it is worth considering the hire of road mats. These are large mats of timber held together by steel strapping which you lay down and the traffic can run over them without damaging your garden. When you have finished the project these mats can be removed and the ground can be swept or vacuumed.

Spoil removal

Getting rid of the spoil can sometimes be a problem. If you have plenty of room perhaps some of the spoil can be used to shape the garden. If it has to be taken offsite you will need to hire either a skip or a tipper

lorry. Bear in mind that every 1,000 gallons of pond volume will yield approximately 10 tons of spoil. In practice, with ponds up to 3,500 gallons skips are more cost effective but for larger ponds lorries will be more practical.

Whichever method you choose be careful about inviting lorries in off the highway. The asphalt, paving or concrete in your drive was probably not designed to bear the weight of large lorries and could well be damaged. Manhole covers in your drive may be of the thin galvanised variety. These are fine for taking the weight of a car but don't attempt to run a skip lorry over them. If the manhole covers are likely to be in the path of any heavy vehicles put some thick timbers or a sheet of steel over them.

When removing spoil from site make sure that enough remains on site for back-filling when the pond structure has been completed, otherwise you may have to import some material for this purpose.

Contouring

If your garden is sufficiently large it may be possible to avoid the need for spoil removal by using much of it for recontouring part of the site.

Before any of this material is used, be sure to remove the topsoil to where you are going to put it. As the spoil is dumped each layer must be compacted either by tracked excavator or by vibrating roller so that excessive settlement is avoided in future. Using the spoil in this way can create many new aesthetic opportunities for the pond design and keep the excavation costs to a minimum.

Be very careful if you wish to use this made-up ground as part of the structure for the pond because, no matter how well you compact the earth, it may settle a little more over the next 18 months. If this were to happen it could have catastrophic results with your pond especially if it is a rigid structure. The rule of thumb when constructing a pond using blocks or concrete is always to ensure that you begin with a sound footing set in undisturbed ground. If you choose a liner to seal the pond then a very small amount of movement will not cause a problem.

When digging a deep hole be sure to have someone else present, otherwise if the side of the excavation were to collapse you could be buried alive and there would be no-one to help. Never allow children to play in or near a deep excavation. Whenever a hole has been dug it is necessary to mark the boundaries of it with a rope, special coloured tape, fencing or scaffold boards. Also ensure that any excavations which are close to trees, walls and load bearing structures do not make them unsafe.



left Ensure that any excavations which are close to trees, walls and load bearing structures do not make them unsafe. This pond has been built close to both a fence and the house — but sufficient space has been allowed so these structures are not threatened by the excavation.

PHOTOGRAPH MICHAEL EDWARDS

Stepping Stones ...

to Success

PHOTOGRAPH: KEITH LAMBERT

Q Why has my pond water turned green, and more to the point, how do I make it clear?

A Green water is the bane of many a pond keeper's life. It is caused by free floating single celled algae which used to be very difficult to control. With modern technology this has been solved by incorporating a UV sterilizer in filter systems. This kills the cells to dump together and can be filtered out. It is important to remember that the UV sterilizer produces UV light only and does not kill the algae and should be replaced every year at the latest.

Q Why do I need to filter my pond?

A Fish produce wastes in the form of ammonia which builds up in the water and could eventually reach dangerous levels. In a natural pond the number of fish will be fairly small and naturally occurring bacteria can break the ammonia down into nitrites and then different species of bacteria break that somewhat less toxic nitrite product down to nitrate. The nitrate is then used by the plants. This is called the nitrogen cycle and goes on in every pond environment.

The system with relying on this natural system is that we tend to have more fish in a pond than there would be in a natural environment. They are also fed a regular dose. This means there is always not enough bacteria living in the pond to cope with all the waste.

To overcome this problem you need a regular filter of some sort. There are three different types of filter, biological, mechanical and chemical. Most filters combine several of these

different methods of filtration but the most common and useful to a pond keeper is biological.

This form of filtration makes use of the natural nitrogen cycle but gives it a helping hand by providing ideal conditions for the nitrifying bacteria to live in. That means passing oxygenated pond water over something with a very large surface area. Special sponge pads are commonest, but brushes, balls, large pea gravel, etc., have been employed for this purpose. As the water passes over these surfaces the bacteria living on them will break down the ammonia and nitrites.

Q What is the correct pH range for my fish?

A Freshwater, pH 6.5-8; Marine, pH 8.2-8.4.

However, certain delicate fish and invertebrates have specific requirements, so check before you buy any animal.

Q What is the correct temperature for my fish?

A Freshwater tropicals, 70-80°F; Coldwater, 55-70°F; Marines, 75-79°F.

Again some delicate species have very specific requirements, so read up on them before you purchase.

Q How many fish can I keep?

A For freshwater aquaria it is safest to work on surface area rather than volume. We recommend 12 sq inches of surface area per one inch of adult fish. This means you must take into account how big your fish will grow to, not just how big they are when you buy them.

Marines require a different method of working out the number of fish you can house in an aquarium. You need to work on volume here and

one inch of fish to every six gallons of water is a safe stocking level for a reef style aquarium. Fish only tanks can house more fish, but the exact level will depend on how good your filtration system is. Again you need to find out how big your fish grow to rather than just measure how big they are now.

Ponds are usually calculated on volume and for a filtered pond you can house an absolute maximum of 100 inches of fish per 1,000 gallons. It is vital to remember this only works when you calculate it on the final size of your fish — not the current size. A six inch Koi will grow to 24 inches long and increase its weight 50-fold. This can happen very quickly and often leads to ponds becoming over stocked with fatal results.

Q Why can't I add fish directly to a new aquarium?

A When a new aquarium or pond is set up you should test for ammonia and nitrite every day. Initially you will see ammonia levels rise and then start to fall. Then nitrite levels will rise and fall. After this you can be sure your biological filters have developed a healthy colony of bacteria which will break down fish wastes.

During this initial period the aquarium or pond should not house any fish. Once these two poisons have peaked and dropped back to safe levels again you can start putting a few fish into your aquarium or pond. No more than four to start with followed by a slow build up in numbers over a period of months. This way you will avoid sudden spikes in ammonia or nitrite levels which will harm your fish.

Once your aquarium has become established it is still important to check for ammonia and nitrite every

two weeks or whenever the fish look ill. Most health problems can be traced back to poor water quality so it makes sense to look at this first.

Nitrates will build up over a period of time and will also need monitoring. In some areas of the UK aquarists have been reporting high nitrate levels in their tapwater. If this is the case in your area you will need to find a way of reducing these before you use tapwater for topping up. A vegetable fiber works very well given enough time, alternatively you can buy a water purifier specifically designed to remove nitrates.

Q Water changes — how much and how often?

A In freshwater aquaria you should change 10 to 20 per cent of the water weekly. If you live in a water area where chloramine is added to your tap water it is essential to add a water conditioner to the fresh water before use.

The ideal for marines is 20 per cent every two weeks. This will reduce nitrates to a safe level and replenish the vital minerals and trace elements. Never change larger volumes of water than this, however, as large water changes in a marine aquarium may cause osmotic shock or other problems which will harm fish or invertebrates.

Pond fish also benefit from regular water changes but here it is rarely practical to change large volumes on a regular basis. Even so regular water changes should be carried out and ammonia, nitrite and nitrate levels monitored regularly or whenever the fish look in distress. With enough growing plants in the pond nitrate should be reduced naturally and providing your pond is not overstocked or over fed, ammonia and nitrite should always read zero in a mature set-up.

The YOUNG AQUARIST



Mosquito Fish, *Gambusia holbrooki*. This is a rare black speckled female. Black speckled males are common in Florida but coloured females are very unusual.

PHOTOGRAPH: DEREK LAMBERT

When we started keeping tropical fish we kept a few goldfish in an outdoor pond and our interest in coldwater fishes, then tropicals, became the focus of our interest. These were kept indoors in heated tanks but over a period of time we found out that some tropical fish can be kept in cooler conditions and will even benefit from this. These species can be moved outside during the summer but must be taken in before the first frost. They will then move outside showing good growth and much deeper coloration just like tropicals.

These are small fish that can be kept in mini-ponds and containers such as half water barrels which is what we kept in the past. The containers should not be too shallow and contain water at least 10cm deep. The container should have as large a surface area as your tank has. Remember that they will have to return to the indoor tank in the Autumn. These small ponds make it much easier to catch your fish when the time comes. It is also easier for you to keep an eye on them to see that all is well. It really is like having an outdoor pond.

The container should not be too shallow, as the water heats up very quickly on a hot day and you need to keep your fish in the bright light or in a courtyard is the best place to have your container, but definitely not under a tree.

Make sure that your container has been thoroughly cleaned out. If you plant one of the

pygmy water lilies in your container the shelter of the leaves will be enjoyed by your fish. To make your fish happier plant up your mini-pond, you can prepare this in the spring but do not put your fish out until all danger of frost has passed. A small pot of submerged plants and a few marginals fixed round the edges will make your mini-pond very attractive.

Many of the tropical fish that we keep cannot be kept outside, even in the summer, as our summers are much too cool for them. These containers are really too small for goldfish and much too small for Koi but there are small cool water fishes which are ideal for this kind of pond. Let me introduce you to a few that you can search out. These are fishes that we or our friends have kept in outdoor ponds through the summer.

An attractive little livebearing fish is *Heterandria formosa* or Dwarf Top-minnow (sometimes called Mosquito fish). This fish is very small and lively growing to 0.75 inches in males and 1.25 inches in females. A dark line runs from the nose to the tail and there is a red spot above a black blotch in the dorsal. The colours become much more intense after a summer in the pond.

The Golden Medaka, *Oryzias latipes*, is another peaceful small species which grows to about one inch. We had some in our outdoor pond in our early days of fishkeeping and the gold became very deep after a season in there. Guppies can also be kept in outdoor ponds in the summer. The swordtail types are best for this as they are more hardy than the

big tailed ones.

These three are peaceful, community fish and a small group of each of them would be enough to stock your mini-pond. Remember that the same rules apply to your outdoor pond as your indoor aquarium as far as stocking levels are concerned.

Another good fish for a mini-pond is *Gambusia holbrooki*. This has become known as the Mosquito Fish (see photograph above) because it has been used to eat mosquito larvae in countries where malaria is a problem. They will do the same thing in your mini-pond and prevent this becoming a breeding ground for mosquitoes.

This fish is a fin-ripper and has to be kept away from other species. With luck you may find the black speckled variety for sale otherwise you will have to make do with the plain green one. Either way these livebearers are interesting fish to keep.

Points to remember

- English summers are usually far too cool for most of the tropical fish we keep.
- Prepare your fish's outdoor home as carefully as their indoor one.
- Carry out regular water changes.
- Do not overstock or overfeed.
- Do not put any of the cool water fish in your mini-pond until all danger of frost has passed.
- Bring the fish into their indoor aquarium at the end of summer.

If you are reading this column will be keeping fish already. Have you had any problems or experiences you want to share with other young aquarists through this column? Do you need help? Then you can write to me at: Pat's Young Aquarist Page, Inline Magazines Ltd., Suite 4, Invicta Business Centre, Orpington Park, Ashford, Kent TN24 0HB. All letters which enclose a stamped addressed envelope will receive a personal reply regardless of whether your letter is published. You can also contact me directly by e-mail at: White.Shark@btinternet.com

See you next time ... **Pat**

HELPING YOUNG FISHKEEPERS BECOME YOUNG AQUARISTS ... HELPING YOUNG FISHKEEPERS BECOME YOUNG AQUARISTS

How do we get clear water in ponds?

There are two different things which prevent fishkeepers from having 'clear' water in ponds. When food, fish waste and vegetation rot down, they break down into tiny solids, which can be called particles. Sometimes these particles are swept around in the water as it moves and they stay suspended throughout the body of pond water.

This makes water cloudy. Sometimes it is a fairly minor problem, e.g., you can't see through the last few inches of water to the bottom of the pond. Sometimes it is a major problem, e.g., you can only see through the top six inches of the pond water and that's on a good day!

Cloudy water can be a nightmare for the fish keeper, but with careful intervention it is resolvable.

If you have a fairly still water pond and leaves, etc., lie on the bottom, then the sooner you remove the rubbish the more you prevent fine particles from being produced. The rubbish can be removed quite easily by using a pond vacuum. Some pond vacuums are hand operated, these are ideal for smaller ponds.

Fish don't like large water changes

Electrically powered pond vacuums are more useful on larger ponds, but be careful how you use them. If you spend ages hoovering the pond you risk throwing away a large volume of the pond water. Fish don't like large water changes. To get the best effect with the vacuum pump, Hoover the pond very regularly for a short time only.

Sometimes pond pumps are placed on a shelf or are raised off the bottom of the pond. This prevents the pump from keeping the bottom of the pond clear. Put the pump on the bottom of the pond, at the opposite end of the pond to the water return. This will set up a better current of water to help sweep the debris towards the pump. You may need to clean the pump more often but that extra bit of work is worthwhile.

There is an argument that pumps should be raised so the bottom layer of pond water stays warmer in winter. Some interesting research showed that ponds probably need to be more than ten feet deep to establish different water temperature layers. So bypass the fountain or waterfall in the winter, keep the pump on the bottom and keep it working!

Pumps can help cause cloudy water as they tend to 'chew up' the bits and pieces of waste into fine particles. The finer the particles the harder they are to trap. Some submersible pumps are better than others at keeping the waste materials in larger pieces. If you are going to have a pump in the pond, then do seek advice as to which type of pump you should choose.

'Sieve' the pumped water

Whatever you do the solids will go through the pump and for 'clear' pond water you need to 'sieve' the pumped water and trap all those little bits and pieces before the water is sent back to the fish. This is



ANN TELFORD
of AII Clear
Water Purifiers
explains
explains how to
solve the
problem of
'cloudy' water in
small
ornamental
ponds

PHOTOGRAPH
DAVE BEVAN

The sludge can be tipped onto a bare patch of soil and left to drain.

called mechanical filtration.

Mechanical filtration can be linked to your pump. This is why some pumps have sieving baskets or foam blocks attached to them. Don't be tempted to leave off this important piece of the pump.

Many people pump the water out of the pond to an external filter box. Apart from other filter media, the filter box may have brushes, foam or possibly something like filter floss. These are all mechanical filtration aids. They will trap the bits and pieces and finer foams will 'polish' the water.

Clean enough to do the job

Do remember that these mechanical aids need to be washed regularly in a bucket of pond water so they are clean enough to do their 'job' and to prevent them from blocking. If you allow sponges to block, water will overflow the filter box and you risk gradually emptying the pond. Fish really don't like flapping around in a few remaining inches of water, so a regular cleaning session is essential.

Pump speed, i.e., the amount of water it pumps in an hour, is an important part of the equation. Too slow a turnover of water and there won't be enough 'current' to sweep the bottom of the pond clean. But if you pump the water through a mechanical 'sieve' too fast you won't allow the 'sieve' sufficient time to work and you will still get cloudy water. Pumps, which work too slowly, or too quickly, can cause cloudy water.

POND TIP

For safety,
domestic hoovers
must NEVER be
used to Hoover
fishponds!

Send your queries to: Ask A&P, INLINE MAGAZINES LIMITED, SUITE 4, INVICTA BUSINESS CENTRE, ORBITAL PARK, ASHFORD, KENT TN24 0HB or E-mail them at: aaandp@btinternet.com
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STAR LETTER - COLDWATER

SWIM BLADDER PROBLEM?

Q I own a small Chocolate Oranda which seems to be having trouble with its swimbladder — whenever it stops swimming it immediately floats to the surface. It recently recovered from a bad attack of Fin Rot and is feeding on flake food with an occasional feed of dried Daphnia and Tubifex. Would you please advise me on what to do?

Louise Bacon, London

A Your fish is most certainly suffering from a disorder of the air (or swim) bladder. This is a common complaint in the twintailed, round-bodied varieties of the Goldfish and is not always curable. There are several causes. In some instances it is an inherited weakness and therefore a cure is unlikely. Incorrect feeding or rapid water temperature fluctuations can also bring on an attack. Eggs in the female can sometimes cause her to swim off balance as the swollen roe begins to restrict the space needed for the air-bladder. In some instances it may be due to other serious internal conditions such as the presence of bacterial infections, parasites or tumours. To avoid causing this condition always make sure, when doing water

changes, that the fresh water is no more than five degrees different in temperature

to that which it replaces. Rapid fluctuating temperatures are one of the main causes and small volumes of water can lead to this problem. This is an obvious disadvantage when keeping fish in small aquariums, especially if they are located where they receive the full rays of the sun or are positioned too close to a radiator.

Feeding the occasional meal of live foods such as chopped earthworms and live Daphnia, not only are a great treat and help the fishes' general good health and vitality, but is also thought to act as a laxative, clearing out the system. If the condition is caused through incorrect feeding or a chill brought on by water temperatures, then a cure may be possible. Raise the water temperature slowly to about 68-70°F (20-21°C) and withhold all foods for a few days; then offer live Daphnia for a further three or four days. This usually brings relief and, often, a cure.

It would also be a good idea to try Interpet's new swimbladder treatment number 13. This has been formulated to cure bacterial swimbladder infections which may be the cause of your fishes' problems.

TROPICAL

CHERRY BARB PROBLEM

Q I have a problem with my male Cherry Barb. Ever since his mate died three weeks ago he has been becoming increasingly aggressive towards the other fish. I thought it would be a good idea to buy another female for him but all I can find in the shops are very small fish. The way he is behaving at the moment I am not sure if it would be a good idea to try such a small female with him. What would you advise?

P. Moore, Yorkshire

A Single Barbs, even relatively peaceful ones like Cherry Barbs, can turn nasty towards other fish. Tigers are well known for it but males of just about any species can be a problem. The solution is to introduce some more fish of his species, but since all you can find are small specimens it would be better to add in three females instead of just one. That way any aggression will be spread throughout the group and not concentrated on just one individual.



ALGARDE
AQUARIUM PRODUCTS

These pages are generously supported by Algarde who are offering a Midt Therm Electronic Thermostat suitable for aquarium or vivarium use as a prize for the featured problem. The unit, with a 300 watt handling capacity, has two heater connections and a fully waterproof probe which senses water (or air) temperature and easy-to-follow instructions.

MARINE

IS MY DEALER LYING TO ME?

Q I ordered an Emperor Angel from my local aquarium shop and when it arrived it did not look anything like the pictures in the book. The shop keeper said it was a young fish which would completely change colour as it grew up. Is this correct or is he trying to sell me a different fish to the one I ordered?

Alan Proudfoot, Lincoln

A Emperor Angels do change in colour as they mature — very dramatically. The youngster in the shop should have a blue body with a white circular pattern over it. As a mature fish it develops

diagonal yellow lines over most of its body. The body shape also elongates, so instead of a round, almost Discus shaped fish, the adults are oval — verging on rectangular in shape.

It is a quite remarkable transformation but by no means unique in the marine world (see article on Angelfish by Dave Garrett in September Issue of A&P).

Your dealer has actually done you a favour by obtaining a youngster for you as they are much better at adapting to captive conditions and you will have the pleasure of watching the colour transformation as your new pet matures. Young fish are also considerably cheaper so you will save money too.

FISH PROFILES

BLACK PRINCE (CHARACODON AUDAX)

By Derek Lambert

The Black Prince burst on the aquarium hobby less than two decades ago and was an immediate hit with livebearer fanatics. It remains one of the most popular Goodeids to this day. Much of its popularity is due to its lovely coloration which is dark grey across the back paling to white on the stomach. Each scale, however, is brilliant silver in the middle and the throat and lower abdomen is suffused with a pink flush. All the males fins are jet black in mature specimens. Females are very plain being dark grey with a whitish belly. Apart from these colour differences, which can be seen at only a few weeks old, males also have a notch in the anal fin.

In common with all members of this family the Black Prince comes from Mexico, but here it is found in the far north. The landscape in that area looks a lot like the West-erns you see on television with rolling desert plains, cacti and the odd oasis dotted here and there. It is in one of these small springs that Black Prince are found and probably nowhere else in the world. The spring rises under the shade of a few trees and forms a small stream which meanders from pool to pool for a few hundred metres into the desert before drying up.

The water conditions in this stream are very hard and alkaline, however, this hardy fish will adapt to just about any normal



BLACK PRINCE CV

Family: Goodeidae
Species: *Characodon audax*
Origins: El Ojo de Agua des las Mujeres, Durango State, Mexico
Aquarium Type: Community with robust larger fish or species tank
Feeding Position: Mid water
Size: 2.5 inches
Temperature: 70-76°F
Diet: Flake with live foods as a significant part of the diet

aquarium conditions. They can be fin nippers if kept with slow moving or small fish but otherwise can be maintained in a community aquarium.

Aquarium care of all Goodeids is more difficult than the common species of live-bearer. They need feeding with lots of live foods as well as a good quality flake food. The water quality must also be maintained at a very high level and regular partial water changes are essential.

Breeding is different from Guppies, Platies, etc., which belong to the Poeciliidae family. Males have a modified anal fin but instead of a rod-like structure this involves a notch in the fin. For mating to occur the female has to be a willing partner and will drive off any male which attempts to mate with her at the wrong time.

Once fertilised the embryos take between six and eight weeks to develop and are born about 7mm long. The actual baby size will depend on the females size — a small young female will produce much smaller numbers of babies (about five) but at a bigger size. Large females may drop as many as 50 babies but many of these will be rather small and weedy.

The fry will eat all foods but grow best on a diet of newly hatched brine shrimp, Grindal worms and growth flake foods.

PHOTOGRAPH: DEREK LAMBERT

GOLDEN LYRETAIL (APHYOSEMION AUSTRALE) GOLD FORM

By Derek Lambert

Golden Lyretails are a very popular cultivated form of Lyretail Killifish. Whilst the cultivated form only occurs in captivity the wild species originates from southern Cameroon through to Gabon in west-ern Africa.

This is one of the hardier killifish which can tolerate hard, alkaline water, however, they do best in soft, neutral to acidic water. They will adapt to a good quality flake food but are insectivores in nature and need some live food in their diet. Live Daphnia, Blood, Grindal or White worms should be fed at least once a week or their frozen equivalents if live food is unobtainable.

They grow to a maximum of about two inches (5cm) and are sexable when only a few weeks old. Males have all the colour and extensions to their fins, females are a drab brown with just a few red spots in their fins.

This fish makes an excellent peaceful community fish providing it is kept with similar sized fish and there is plenty of cover in the aquarium. Alternatively you can house them in a small aquarium by themselves. Here they are likely to hide themselves away for much of the time, only



GOLDEN LYRETAIL CV

Family: Cyprinodontidae
Species: *Aphyosemion australe* Gold Form
Origins: Western Africa
Aquarium Type: Community with small peaceful fish or aquarium by themselves
Feeding Position: Mid to bottom feeder
Size: 2 inches
Temperature: 70-76°F
Diet: Flake with live foods as a significant part of the diet

coming out to feed.

Males can be pugnacious towards each other so it is best to keep only one per aquarium.

Since they can be hard on females it is also wise to try to keep two females to each male. Alternatively, a large group of both sexes can be kept, in this situation aggression between males is kept to a minimum.

They are easy to breed and most fish will spawn every day.

Only a few eggs will be laid by each female but it is surprising how these can mount up over a period of time. They are normally laid in clumps of plant such as Java Moss. These clumps should be moved to another aquarium every week where the eggs will hatch out after a further weeks development. The fry can be fed on newly hatched Brine shrimp or Micro worms. In very hard water areas you will probably need to soften the water for the eggs to hatch.

The fry grow very quickly and will start breeding when only one inch (2.5cm) long. At this size most of the eggs will be infertile as males take longer to become sexually mature than females.

PHOTOGRAPH: DEREK LAMBERT

Choosing Pond Fish Foods

Of all the decisions a pond keeper has to make, choosing a fish food can be one of the most daunting. We can all compare pack size/price and publicity blurb but this is a very superficial way of making what is the most important decision in your fishes life. So how should you make this decision? Well first of all you need to think about what fish you have in the pond. All species of fish have different dietary needs and feeding positions, within the water column. Indeed, during the life of any fish its requirements will change. This means that in an ideal world there would be a specific food for each species of fish (and stage in its life cycle) we keep in our ponds.

The reality is, of course, that compromises have to be made and most foods will be suitable for most fish but will not be ideal for all. Goldfish and Koi do best being the fish that most foods are designed for. These are the two most commonly kept pond fish and a great deal of research has been done to find out their dietary needs. Specialist foods have been created for each of these species and you will even find foods for enhancing colour or increasing growth rates of young fish.

Don't make the mistake of thinking the only difference between a food for young growing fish is the pellet or granule size. It should not be. Young growing fish have specific dietary requirements so a food designed for them will have a different analysis than one designed for adults.

Water temperature is also an important factor to consider when feeding pond fish. Below 10°C pond fish feed very little and the food can remain in the intestine for long periods of time. This can lead to severe problems if the wrong diet has been fed. For this reason many manufacturers have produced wheatgerm foods specifically designed to be easily digested at temperatures as low as 4°C. These should be fed sparingly during cold weather but may make the difference between life and death for many fish during winter months.

Commercial foods come as either flakes, granules, pellets, tablets or sticks and your choice of which of these to feed your fish will also be determined by your fishes requirements. Flakes soften quickly without disintegrating in the water and do not sink too rapidly. As the flakes pass through the water column they will be taken by differing species. The top-feeders first, followed by mid-water and bottom-feeders.

Despite their general suitability flakes are not the most popular with pond keepers. Floating pellets and sticks are. These remain at the surface for the longest and allow pond keepers to watch their fish feeding. On the face of it this is a big plus because you can check for disease or injury at this time and make sure all your fish are feeding. The likelihood of overfeeding these foods is also lessened. The down side is for any bottom feeding species. It is quite possible for them to starve to death if nothing but floating pellets and sticks are fed! Some brands will sink long before others, so you will have to test them out and make sure you feed at least one which will reach the bottom in a few minutes.

Tablet foods and sinking pellets, however, are by far and away the best for bottom dwellers. These sink quickly and reach the fish they have been designed to feed as soon as possible. There are very few of these on the market for pond fish, but a quick look through the tropical section and you will find plenty of foods to satisfy your bottom dwelling pond fish.

Granules are probably the least popular of pond foods, yet they have a lot to recommend them. They float long enough for most of the surface feeders to eat their fill but then sink through the water column allowing other species

to feed. The danger with these foods is the risk of over-feeding because a larger proportion of the food ends up sinking. Goldfish and Koi, however, will spend much of their time grubbing around the substrate looking for food which escaped them at the surface (these fish are naturally bottom feeders which have adapted to feeding at the surface because they are "pigs with fins") so with care you should not overfeed.

Looking at the other commonly kept pond fish, Orfe are probably most often seen. These differ greatly from Goldfish and Koi in that they are basically carnivores (Goldfish and Koi are omnivores) and need a diet with a higher protein content to satisfy their requirements. They are also surface feeders so floating pellets and sticks are ideal for them.

Tench are one of the commonest bottom feeders to be kept in ponds. They are also the fish most likely to suffer from incorrect feeding. If you have these in your pond make sure you feed a sinking pellet or tablet food at the same time you scatter your floating foods. Flakes will be fine — if they have a chance to reach the bottom. Koi and Goldfish can hoover these up long before they start to fall down to the bottom.

American Fathead Minnows are an interesting addition to ponds. These are surface feeders which will do well on a staple flake or pellet food supplemented with a high protein food two or three times a week. This takes the place of live foods which normally make up a large part of this species natural diet. Similarly European Minnows need this addition to their captive diet.

Chubb, Roach and Rudd, however, are typical omnivores with similar requirements to Koi. The colour enhancing foods designed for Koi will do much to improve the fin colour of these species.

Two species to steer well clear of are Channel Catfish and Wels Catfish. Bottom dwelling scavengers they are not! Both these fish are large predators which will eat all your Goldfish and smaller Koi. A large Wels catfish will even pose a threat to a full grown Koi!

Looking to the analysis of each food many aquarists are left wondering just what do each of the categories mean? Since this is a very complex subject we have selected just the two most important ones — Protein and Fats.

Protein

This is the major ingredient required for growth of fish and makes up most of the body structure. Fish fry and larvae grow rapidly and require a very rich diet for maximum growth. In the wild this will usually top 50 per cent of their diet on a dry weight basis, however, as they grow this requirement tails off and adults will only need 35 to 40 per cent depending upon species. Most pond fish foods have only 25 to 35 per cent protein levels because these fish are expected to forage for themselves as well as be fed by their owner.

Fats

Fats supply energy for most fishes' needs, although proteins can also be used for this. A good food will, therefore, balance just enough fat to satisfy all a fishes energy needs, whilst not overdoing it and producing fatty fish — a common problem with aquarium and pond fish. Most pond foods contain between five and eight per cent fat although higher levels will be found in foods designed for youngsters and carnivores.



Manufacturer	Designed for:	Protein (%)	Oils & Fats (%)	Fibre (%)	Ash (%)
Aquarian Goldfish Flake	Goldfish	33.5	12	3	13
Astra Goldfish Flake	Goldfish	42	6	2.4	8
Astra Pond Fish Sticks	All species	27	5	2	6
Astra Flake	All species	36	8	2	8
Astra Variety	All species	30	5	5	10
Astra Kai Sticks	Koi	34	5	2	8
Hikari Staple	Koi	37	3.8	3.2	10
Hikari Gold	Koi	42	4.8	2.2	10
Hikari Spirulina	Koi	42	3.8	3.2	11
Hikari Wheargem	Koi	32	4.8	2.2	10
Hikari Hi-Growth	Koi	44 Green 27 Yellow	8.8 Green 7.8 Yellow	1 Green 1.2 Yellow	10 Green 5 Yellow
Interpet Low Temperature Science Food	Low temperature food for all fish	30	6	2	7.5
Interpet Original Pond Science Food	All species	28	6.4	2	7.5
Interpet Kai Science Food	Koi	35	5	2	9
Laguna Goldfish & Kai Pellets	Goldfish & Kai	29	3	8	9
Laguna Goldfish & Kai Sticks	Goldfish & Kai	29	3	8	9
Laguna Supreme Kai Colour Sticks	Koi	29	3	8	9
Omega Floating Pond Sticks	All species	35	4.3	2	8.5
Nishikai Staple Pellet	All species	28	7	2.5	9
Nishikai Growth Pellet	Young Kai	37	6	2.5	6
Nishikai Sticks	All species	25	4.5	2	9.5
Nishipond Flakes	All species	20	2	4	8
Nishikai Sinking Pellet	All species	37	17	2	9
Nishikai Wheargem Pellet	Low temperature food	20	6	2.5	4
Phoenix Kai Pellets	Koi	35	4.9	2.3	4.9
Phoenix Pond Sticks	All species	25.8	2.9	2.3	2.5
Phoenix Goldfish Flake	Goldfish	35	5	1	6
Pond Pride Floating Sticks	All species	23	4	2	4
Pond Pride Ultimate Flake	All species	43	12	1.5	5.5
Pond Pride Ultimate Kai	Koi	38	6	2	7
Pond Pride Ultimate Pellet	All species	38	6	3	9
Sera Midgran	Young and growing Kai	35	5.1	5.8	n/a
Sera Kai Royal Granulated	Adult Kai	33	5.3	5.8	n/a
Sera Kai Plus Stick	Adult Kai	32	3	5.6	12.1
Sera Diagonal	All species	32.8	5.3	2	10.9
Sera Diatomes	All species	21.5	4.2	5.2	12.5
Sera Mix Special	High protein food for all fish	51.2	5.2	7.1	21.8
Sera Goldy Flake	Goldfish and other species	34	4.7	3	1.8
Sera Goldy Royal	Goldfish and bottom feeders	39	5.3	3.6	1.8
Sera Goldy Color	All species	36	4.7	3	1.8
Tetra Variety Sticks	Goldfish, Kai and Orfe	31.5	4.5	2	7
Tetra Floating Food Sticks	All species	29.5	3.5	2	7
Tetra Floating Kai Sticks	Koi	33	5	2	7
Tetra Wheargem Sticks	Low temperature food for all fish	32	6	2	6
Tetra Growth Food for Kai	All young fish	43	9.5	2	7
Tetra Variety Sticks	All species	31.5	4.5	2	7

TROPICAL

This month **TONY SAULT** is our guest Discus Pool writer:

PHOTOGRAPH: MAX GIBBS

Sexing Discus



RED DISCUS.

One question I am asked very often by potential Discus breeders is: "How can I sex my Discus", and quite simply there is no easy answer.

One of the earliest reports of a Discus spawning in the UK was in the early 1960s by Mr R. Skipper of Hendon. He is quoted in *All About Tropical Fish* by Derek McInerney and Geoffrey Gerard as being able to sex the Discus by the shape of the ventral fins, and I quote: "These fins on a male hang down and curve backward in a crescent, whereas in the female the tips take a further downward sweep, forming a kind of letter 'S'."

Evading the issue

A lot of other books evade the issue and simply say that there are no external sexual characteristics. In Schmidt-Fockes' *Discus Book* published by TFH, the information is a little more precise, as is to be expected from someone who has spent a large part of his life with these fish, and I quote: "The differences are clearly defined between the sexes of Discus collected from the same river near Alenquer ... all the males had a striped pattern on the flanks, while the females had a red brown ground colour and only slight striping on the head and anal fin". And on

tank bred fish "sexing is easier in lines of the same species that have been bred for several generations, the males and females develop certain characteristics."

This is to say that certain breeders' lines develop certain characteristics such as higher dorsal fins in males than in females. But what about other breeders' lines — are there no standard characteristics? There are more theories among breeders than actual Discus strains. Some of the popular ones include: Males develop elongated dorsal fins and females do not. The shape of the male's head is more pronounced as if a nuchal bump is forming. All males grow faster and larger than females. The underside of the female is concave and the underside of the male is convex ... and on and on.

Some basis in fact

All of the proposed theories on sexing have some basis in fact but not all facts fit all Discus. Taken together they are all useful in helping the inexperienced Discus keeper selecting a prospective male or female, but theories must consistently produce the same result time after time and if they do not then they are flawed.

In my experience it is extremely difficult to sex Discus under five inches body size or approximately one year old, as they are not fully developed under this size. It is much easier using a proven sexed fish.

For example, a proven female is placed in a tank with an unknown but suspected male, a male will acknowledge the female by bowing to her as he swims by and then displaying to her sideways on with his fins spread. Similarly when introducing a suspected female into the tank of a proven male. If you get it wrong and the suspected female is actually a male you will know within minutes as the original male will become very territorial and aggressive to the newcomer.

The single most outstanding characteristic

The one thing that all Discus have in common are their genitalia or breeding tubes, and when lowered these are the single most outstanding characteristic of all males and females. The female's reproductive organ is designed for egg laying and consequently is long and rounded; the male equivalent is short and pointed. If these can be pictured as letters of the alphabet then the female tube is 'U' shaped and the male's is 'V' shaped.

So, in conclusion, all the theories mentioned above, and popular ones that have been omitted, taken together, can only be a helpful guide and the only certainty is that if you see eggs come down the tube then you most certainly have a female, and if fry appear 48 hours later you can bet there is a male in the vicinity!

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70 TANKS OF TROPICAL FISH

This month **DAVE GARRATT** looks at Surgeons and Tangs — a group of marine fish well able to take care of themselves:

PHOTOGRAPHS: M.P. & C. PIEDNOIR

Surgeons



The Surgeons and Tangs belong to the Acanthuridae Family, a Family characterised by laterally compressed oval bodies and long dorsal fins. Their popular name of Surgeon fish derives from the pair of scalpel-like spines that occur either side of the caudal fin. These sharp spines can be used as weapons of defence, or attack, should any dispute arise. Unfortunately for the hobbyist, attack as opposed to defence, appears to be the preferred option for many Surgeons, a situation that, as we shall see later, causes considerable problems in the aquarium.

Natural habitat

The Family has a wide distribution throughout the world's coral reefs with most of the commercially available fish coming from the Indo-Pacific region, although imports are seen from Hawaii and the Red Sea. Many of the species are shoaling fish but unless housed in an exceptionally large aquarium they will not show this trait in captivity, in fact the opposite is true, they will fight incessantly. The entire Family are herbivores and therefore constant algae grazers, some also show omnivorous tendencies and supplement their diet with small Crustaceans and worms.

Surgeons reproduce via free floating (pelagic) eggs that may take many days to pass through the planktonic stage, therefore captive

breeding is highly unlikely. The sexes show no obvious variations in size or colour, neither do they show great colour differences between juvenile and adults, the Caribbean Blue Tang (*Acanthurus coeruleus*) being an exception.

Aquarium needs

Many commonly available species attain four or five inches in captivity, couple this with their constant browsing nature and it becomes obvious that the Surgeons need a fair amount of swimming space and will do best in a tank of four foot or more. Water quality is of paramount importance for these fish and they are probably best attempted after a beginner has acquired a little more experience.

I have already mentioned their herbivorous nature and constant algae browsing, so it is absolutely vital that this need is catered for. If your

above Many of the species are shoaling fish but unless housed in an exceptionally large aquarium they will not show this trait in captivity. In fact the opposite is true, they will fight incessantly. Here we see *Zebrasoma flavescens* (the yellow fish) with *Zebrasoma xanthurum* living together in the wild.

tank does not have a reasonable amount of algae then feeding several times a day may be necessary. Luckily, once established, many species will adapt to an omnivorous diet and will take a wide range of frozen, freeze dried and flake foods. However, it is still necessary to supplement the diet with the addition of vegetable based foods and there are vegetable based 'Surgeon diet' products available in flake and frozen form. Fresh vegetable matter added to the diet is really a must and can be provided in a number of ways. You can encourage a good algae growth in your main aquarium or even set up a small algae tank to raise algae as food for the main tank. Lettuce and spinach leaves are also good dietary supplements providing they are first blanched by being plunged into boiling water beforehand.

A word of warning is required at this point. You must ensure the lettuce or spinach are free from any chemical sprays or additions, perhaps a good case for purchasing organically grown produce.

Drawbacks to ponder

The Surgeons are brightly coloured, highly patterned, active and interesting additions to any aquarium — unfortunately, as with most things in life, there is a down side. This comes in the shape of disease susceptibility and aggression to the point of undue viciousness.

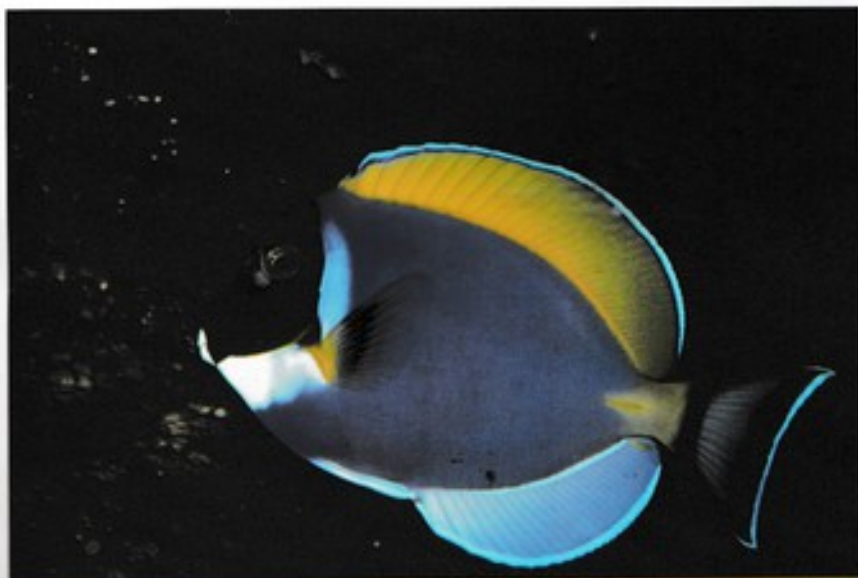
• DISEASE

I believe the experiences of many hobbyists bears out what you will find in the literature, i.e., Surgeons seem prone to all manner of skin parasites. Specimens I have kept always seemed to pick up the odd blemish, spot, bump or other unidentified mark. In most cases it was just the odd spot that, given their boisterous life style, may just as easily have been caused by the odd skirmish or by a hasty dash into the rock-work. Nevertheless they are prone to specific parasitic diseases, especially *Amyloodinium ocellatum* and *Cryptocaryon irritans*.

If your fish develops any of these diseases they can be difficult to eradicate and will require copper based treatment. Copper is toxic to the majority of invertebrates, therefore if your tank houses any you will have to set up a separate treatment tank to isolate and treat the infected fish. I cannot go into details of treatment or the pros and cons of quarantine in the confines of a short article such as this, instead I would refer the hobbyist to any good marine text. With dis-



above A staple of the marine hobby the Regal Tang (*Paracanthurus hepatus*) is amazingly for the Surgeons generally very well behaved and will not present the compatibility headaches so apparent in their cousins.



left Powder Blue Surgeon. Despite all my warnings about the unsavoury character of this fish it remains not just my favourite Surgeon but one of my all time favourite marine fish.

ease prone fish such as the Surgeons you have a limited number of viable options:

- (a) Buy from a reputable dealer who quarantines his/her stock before sale.
- (b) Run a separate treatment/quarantine tank in parallel with your main tank.
- (c) Do not mix fish and invertebrates, so as to enable the use of copper if necessary.

Trusting to luck and keeping your fingers crossed is not a viable proposition.

• AGGRESSION

Taking the word of many others and my own bitter experience into account I have to say that, size for size, certain species of Surgeons are the most evil tempered, mean minded, vindictive bullies you are likely to encounter. Most aquarists are aware of the real psychopaths of the hobby, such as some of the Triggers, and steer well clear of them, but the Surgeons still catch many by surprise. Do not underestimate the power of these fish, I have seen serious wounds inflicted on other fish.

There are precautions you can take to avoid the worst cases:

(a) Do not attempt to keep two species of the same genus, i.e., you cannot keep two *Acanthurus* such as the Powder blue (*A. leucosternon*) and a Gold Rim or Powder brown (*A. glaucopareus*). Similarly two Zebra-soma such as the Yellow Tang (*Z. flavescens*) and the Sailfin (*Z. veliferum*) would be a non-starter.

(b) Some species although a different Genus are too similar to be kept together, for example a Powder Blue and a Yellow (or Sailfin) Tang would probably bully and fight until one succumbed.

(c) Some Genera have species of a less aggressive nature, for example the Lipstick Tang (*Naso lituratus*) and the Regal Tang (*Paracanthurus hepatus*) are generally well behaved. Bear in mind that whilst these may be peaceful fish any other established Surgeon may not show them equal consideration and may well attack them.

(d) If you want to keep a known aggressive species either buy a very small juvenile or make it the last addition to your tank.

You can guarantee that adding fish to a tank that contains a well established Surgeon of one the more aggressive species will cause problems. The resident Surgeon will almost certainly attack any new fish of a similar shape, size or colour as itself. I strongly urge any hobbyist to take heed of point 'd' in the above list. If you already have a problem in your tank I suggest you consult a good marine book for suggestions for dealing with excess aggression.

When some species (I have seen this on Powder Blues, Browns and Sailfins) go into a frenzied state of aggression their body colour lightens and whitish stripes appear on the body. This is a sure sign that the aggression is going to be brutal and sustained. However, similar signs can be seen when these fish are in distress, for example if subjected to very poor water quality.

right Lipstick Tang. Unfortunately this somewhat shy, docile fish is not the hardest of creatures with larger specimens having a particularly difficult time settling into captivity.

SURGEONS & TANGS

Available species

POWDER BLUE SURGEON (*Acanthurus leucosternon*)

Despite all my warnings about the unsavoury character of this fish it remains not just my favourite Surgeon but one of my all time favourite marine fish. The contrasting colours of powder blue, yellow, white and blue/black are stunning. Add to this its perpetual motion and I feel you have a real winner — with the proviso it is the last addition to your tank! The Powder blue reaches a size of seven inches in its native Indian Ocean but in captivity five inches would be considered a large specimen. Like all Surgeons its bold grazing nature and constant activity requires a suitably sized tank. A relatively hardy specimen only if provided with perfect water quality and so probably best avoided by the beginner.

Other *Acanthurus* species

The Powder Brown (*A. glaucopareus*) apart from its less striking coloration is similar in all respects to the Powder Blue. The Clown Surgeon is a very strikingly patterned fish with a yellow body and light blue stripes that have dark edges. No prizes for guessing that it is just as aggressive as its predecessors. Many years ago when I first started in the hobby this was a very common import but today I rarely see one for sale, I have no idea why this may be.

The Blue Tang (*A. coeruleus*) is unusual in as much as it is one of the few Tangs to show a colour change from juvenile to adult phase, the young fish being yellow and changing to blue as it matures. Apart from this feature it has similar characteristics to the species already described.

The Majestic Surgeon (*A. sohai*) is yet another eye catcher should you be lucky enough to see what is generally a rare import from the Red Sea. Like many Surgeons it draws attention to its scalpels with a bright coloration surrounding them, perhaps as a warning sign to other fish. I know of very few of these fish in captivity so I can offer no advice as to its hardness although I can hazard an educated guess as to its temperament.

The Achilles Tang (*A. achilles*) is yet another beautiful fish its dark brown (almost black) body highlighted by a vivid orange tear-drop





shaped area surrounding the caudal peduncle and reflected in the caudal fin. Character wise it is not as aggressive as the previous mentioned species but unfortunately it does not usually cope too well in captivity and is definitely for the experienced aquarist.

Zebrasoma species

The Yellow Tang (*Z. flavescens*) is by far the most common *Zebrasoma* seen within the hobby whilst two other species are also seen on a regular basis, the Sailfin Tang and Emperor Tang (*Z. xanthurum*). All are aggressive towards their own kind and any other fish that is a threat — perceived or real. You may come across two names for the Sailfin, *Z. veliferum* and *Z. desjardini*, some authors regard them as sub-species of the same fish, separated purely by their Red Sea or Indo-Pacific location.

THE YELLOW TANG

Like most of the fish discussed so far this species will reach eight inches in its natural habitat whilst being restricted to a maximum of five inches in captivity. These fish have been kept successfully, particularly in public aquaria, as a small group that stay together, behaving as a small shoal. Under any other circumstances forget keeping anything other than a single specimen. Unlike most Tangs the coloration is a solid, single block of colour. Apart from the skin parasite problem this is a hardy species representing real possibilities for the beginner.

THE SAILFIN TANG

The large very tall dorsal fin, that obviously gives this fish its common name, coupled with a large anal fin, makes it difficult to imagine this fish as a Tang. However, it has the tell tale compressed body shape and

left You may come across two names for the Sailfin Tang, *Z. veliferum* and *Z. desjardini*. Some authors regard them as sub-species of the same fish, separated purely by their Red Sea or Indo-Pacific location.

caudal scapels to prove it's lineage. I have come across reports that suggest this fish may be peaceful — do not believe a word of it. I kept one in an understocked six foot 160 gallon aquarium and it soon came to regard the whole tank as it's territory thus making the attempted addition of any other similar sized fish a difficult and fraught experience. Sorry to keep harping on about aggression, I am not really paranoid, rather just trying to help hobbyists avoid the problems I encountered as a beginner.

THE EMPEROR TANG

Red Sea Emperor Tangs, even at premium prices, are much sought after fish. The species has a high dorsal fin, but not to the extent of the Sailfin, and is a solid purple colour with a contrasting yellow caudal fin. Possibly a peaceful species but I would not bet any hard cash on this statement. Reports on hardness in captivity tend to vary considerably.

Peaceful alternatives

There are two Genera of Surgeons that are usually represented in the hobby by a single species from each genus. They are the Lipstick Tang (*Naso lituratus*) and a staple of the marine hobby the Regal Tang (*Paracantharus hepatus*). Amazingly for the Surgeons these fish are generally very well behaved and will not present the compatibility headaches so apparent in their cousins. Although belonging to a different genera both these fish retain the Family's dietary needs and constant browsing habit.

LIPSTICK TANG

This fish has the most amazing 'painted' face you could imagine with orange lips and a yellow and black face mask. The dorsal, anal and the lyre shaped caudal fin are all edged in various colours dependant on the location of the fish. They are large fish that can reach eight inches in a suitably large aquarium but this is still small in comparison to the 20 inches they can attain in the wild. Unfortunately this somewhat shy, docile fish is not the hardest of creatures with larger species having a particularly difficult time settling into captivity. Some authorities would argue as to the relative hardness of Red Sea and Indo-Pacific species. Occasionally other *Naso* Tangs such as the Unicorn Tang (*N. unicornis*) are available to the hobbyist.

REGAL TANG

Sometimes described as the 'bluest' fish in the ocean this popular fish is a rarity in as much as it makes a good, well behaved, community fish. The blue coloration is contrasted by a bright yellow caudal fin that is edged in black which then continues as an abstract pattern on the main body of the fish. The blue is particularly vivid in young adult fish whilst it does fade slightly as the fish ages and increases in size. The species is perhaps the easiest of the Tangs and if the beginner takes care and purchases a prime, healthy fish with no hint of any skin blemishes it should make an excellent choice for them.

Conclusions

The Surgeons, or Tangs, are a beautiful Family of fish with a number of exceptionally striking species. They are worthy of a place as the 'showpiece' in any reasonably sized aquarium and can rival the Angels in this aspect. They also provide great interest with their constant browsing activity. There are the pitfalls of a proneness to skin parasites and a greater problem with their marked aggressive tendencies but with care, knowledge and common sense, success should be within reach of any aquarist just graduating from the beginner stage.

KOI CALENDAR

The second Koi show on this year's calendar is just about upon us and will take place on the

weekend of May 6/7. This is the South East Koi Chapter of ZNA and is being held at Fleming Park Leisure Centre, Passfield Avenue, Eastleigh, Hants. Like the first show this is a new venue with 11,000 sq ft of floor space which we are told will be filled with "lots of interesting themes". Be that as it may, we are all probably more interested in seeing the Koi and at this year's show there will be some of the finest examples of Koi in our hobby including many champion fish from 1999. AllClear Water Purifiers are treating the water at this show so exhibitors will have no worries on that score. Tel: 01722 340313 or fax 01722 313340 for further details about the show.

Following this show the next event will not be until the end of the month on May 29 and 30. This is being held by the BKKS South Hants Section and is their 9th Open Show (Millennium 2000). The main show will be held in the Sports Hall, South Downs College, Crookhorn, near Havant, but they also have an outside marquee to accommodate extra Dealers wishing to attend. Contact Rod Isted on 01243 572762 for more details.

KOI

SHOW CALENDAR

MAY

6/7 SAEEK OF ZNA. At Fleming Park Leisure Centre, Passfield Avenue, Eastleigh, Hants. Tel: 01722 340313 or fax 01722 313340 for further details.

29/30 BKKS South Hants Section 9th Open Show in the Sports Hall, South Downs College, Crookhorn, nr. Havant. Also features an outside marquee to accommodate extra number of dealers wishing to attend. Contact Rod Isted on 01243 572762.

JUNE

10/11 BKKS Worthing & District Section Open Show at Worthing United Football Club, The Robert Alton Memorial Ground, Lyons Way, Worthing, West Sussex. Contact Dennis Cross, Show Chairman, on 01903 218171 or 07801 296100 (mobile).

10/11 BKKS Yorkshire Section at Temple Newsam (M1 Junction 46). Contact Fred Harston, Show Chairman, on 01226 722578, or Mike Fullerton, Show Secretary, on 01226 727311.

18 Scottish Koi Club Closed Show at OKI (UK) Ltd, Cumbernauld, Central Scotland. Contact David Rivett (Chairman) on 01292 317947 or Marc Raeburn (PR) on 01236 731908.

JULY

15/16 South West Koi Club at the Royal Bath and West Showground. Contact Colin Baker on 01934 822620, John Sprouting on 01934 822620 or Dennis Hunt on 01884 258710.

16 BKKS South Wales Section. Closed Show at Maidenhead Aquatics, Crowthorne.

23 BKKS Essex Section Open Show at Avelley Sports Ground, Avelley, Essex. Contact Ian Prior (Show Chairman) on 0181 592 3268, Esther Ball (Show Liaison (Dealer Bookings)) on 0181 6327, Margaret Spurr (Nat Bookings) on 01702 292766.

30 Yorkshire Koi Society (celebrating its Silver Jubilee) at York Racecourse. Contact Jeff Glasspole (Show Manager) on 01845 526164.

AUGUST

5/6 International Koi Show, organised by D.J.s Koi, at Billing Aquadrome, Northampton. Contact 01922 493290.

SEPTEMBER

2/3 BKKS Isle of Wight Section Show.
3 BKKS Leicestershire Section Annual Show at Farm World, Gartree Road, Oadby, Leicestershire. Contact Nigel and Pip Ostell on 0116 220 1522.

KOI SOCIETY MEETINGS/ EVENTS

There are numerous Koi clubs/societies throughout the UK and we will publish details of their meetings each month as and when we receive details. However, don't forget to include a contact name and number.

THE BRITISH KOI-KEEPERS' SOCIETY SECTIONS

Central, Pat Stevens (Membership Secretary), 0121 588 2446.

Cheshire & District, Keith Grougier, 01782 773392.

Crook Valley, Brenda Scott, 01375 942321, 773392.

East Pennine, Betty Koerner, 0114 2941151.

Isle of Wight, Kevin Driscoll, 01983 291675.

Kenavon Valley, Peter Gilmore, 01635 821684.

Leicestershire Koi, Karen Boyton, 0156 233 0797.

Manchester & District, Sue Ennis, 0161 480 5821.

Midlands & Surrey Border, Jim Freestone, 0181 641 2086.

Mit Staffs, Val Stokes, 01543 278359.

Northants, Peter Parker, 01908 31382.

Nottingham & District, Shirley Hind, 0115 981 0023.

Pembrokeshire & District, Tina Burgess, 01782 617526.

South East, Mick Wright, 01634 718943.

South Hants, Dr Harrison, 01705 596099.

Suffolk & North Essex, Alan Carter, 01206 860011.

West Wales, Basil Evans, 01554 772190.

Worthing & District, Carole Coote, 01903 232277.

Yorkshire Section, Andrea Thomson, 01924 275749.

INDEPENDENT KOI CLUBS

Birmingham and West Midlands Koi Club, Alan Smith, 0121 422 3896.

Black Country Koi Society, Tony Rownton, 0184 395299.

Bristol & West Koi Club, Larry Lerway, 01454 896207.

Cambridgeshire Koi Club, Graham Hagger, 01487 711129.

Dorset Koi Keepers, Alison Allen, 012082 875437.

East Coast Koi Club, Alan Wright, 01502 587116.

East Midlands Koi Club, Richard Jones, 01283 224975.

Eastbourne & District Pondkeeping Club, Brian Dale, 01323 731369.

East Yorkshire Koi Society, Steve Matthews, 01964 527860, or Chris Hill, 01482 344777.

Fylde & District Koi Club, Chris Ingelore, 01772 635581.

Heart of England Koi Society, Paul Stray, 01203 674821.

Merseyside, Syd Bennett, 01962 209948.

Midland Koi Association, Keith Eason, 01527 545230.

North East Koi Club, Joan Hope, 0191 416 5794.

North Lakes Koi Club, Ken Bush, 01472 883077.

North of England ZNA Chapter, Yvonne Mason, 0114 289 1437.

North Wales Koi Society, Keith Parry (Chairman), 01492 580303 or Dave Davies (Membership), 01352 762149.

Southern Koi Club (ZNA Friendship Club), Olympia Morgan Davies, 01706 218243.

Surrey Koi Club, Jenny Allen, 01603 452932.

Wiltshire Koi Club, Kevin Bennett, 01265 874008.

Wiltshire & District Koi Keepers' Society, Sandra Crocker, 01752 210018.

South Devon Koi Club, Stan Moring, 01803 843019, or Christine Bradstone, 01803 833472.

South Essex Koi Club, Mick, 01702 342400, or Barry, 01268 365739.

South West Koi Club, John Sprout, 01934 822620.

Wessex and Southern Koi Society, Mrs Jenny Leaton, 01425 275885.

Wirral & District Koi Society, Dave McCulloch, 0151 677 1582, or Steve Cape, 0151 327 7457.

Wiltshire Valley Koi Society, Ray Lee, 01522 872723.

York & District Koi and Pond Fish Club, Andy Hudson, 01904 340185.

Yorkshire Koi Society, Rita Thomson, 01723 864887.

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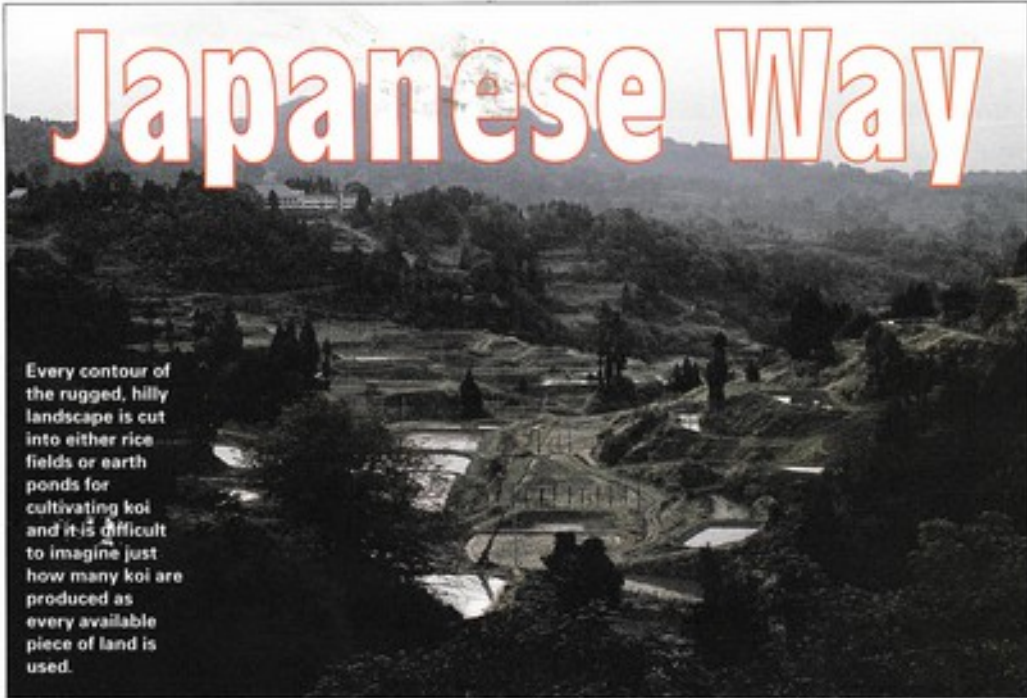
KOI

BERNICE BREWSTER visits Japan to select Koi and picks up a few tips from the world's experts on these magnificent fish:

PHOTOGRAPHS: BERNICE BREWSTER

KOI – The

Japanese Way



Every contour of the rugged, hilly landscape is cut into either rice fields or earth ponds for cultivating koi and it is difficult to imagine just how many koi are produced as every available piece of land is used.

In November of 1998 Lorraine Hubbard of Pond Life Ltd., Neil Black and I started a new business venture called 'Finspiration Ltd' to wholesale coldwater fish, including Japanese koi. December of that year saw us busily negotiating prices of koi with the Japanese by fax and e-mail, with stocks arriving from early January to March. After a very successful season, Lorraine and I decided we would try a different approach to buying the Japanese stock by going to Japan and selecting our fish.

Neil drew the short straw to stay at home to keep our fish farm running, well Lorraine and I did tell him he had the most important job and that we really were forcing ourselves to go to Japan! We left on October 25 from Heathrow Airport — did I mention that Lorraine was a heavy smoker and the thought of 14 hours without a single puff meant the journey was undertaken with some trepidation. Nonetheless, armed (literally) with nicotine patches we set off for the Niigata region of Japan.

After a very uneventful journey and a trip on the famous bullet train, we arrived in Niigata, dropped off our suitcases at the hotel and immediately set off to the numerous koi farms in the area. The first thing to realise about this area is that water is abundant, so a vast quantity of rice is growing in the water logged rice fields but conspicuous by their absence are any farm animals, no cows or sheep. We did, however, come across an enormous bull, with thick, brown, fur and massive

horns, living in luxury on a bed of thick straw, in an outhouse at one koi farm. I hesitate to mention that these bulls are kept by the Japanese for fighting and not for any agricultural purpose!

Difficult to imagine just how many koi are produced

Every contour of the rugged, hilly landscape is cut into either rice fields or earth ponds for cultivating koi and it is difficult to imagine just how many koi are produced as every available piece of land is used. As our trip took place in autumn, when the koi are being harvested, we could see that many of the earth ponds had been recently drained and the koi taken back to the farms. The koi are transported in large tanks, supplied with oxygen and fitted with secure lids to prevent the fish from jumping out or being washed out from the back of the pick up truck. Once back at the farm, the koi are placed into holding ponds, roughly according to size and quality to await the arrival of buyers such as ourselves.

The ponds in which the koi are held vary from farm to farm in size, depth and style, but the quality of koi they hold is truly remarkable. Because there is an abundance of water, a few of the farms hold the fish

in ponds which are rather like concrete raceways, which means they are literally built with a slight slope. Fresh, clean water runs in from the top end of the pond, with the fish waste being continuously flushed to waste and back to the main water course at the lowest end of the system. Cheap but effective and works very well where clean water is in plentiful supply. It is possible to come across the occasional few koi, which have escaped, enjoying a life of freedom in the streams and brooks which run through the Niigata area.

The majority of farms hold the koi in square or rectangular ponds of about 1.5m depth and of varying sizes and which employ biological filtration to remove the effluent from the water. It is apparent that water conditions are paramount, in some areas the filtration is supplemented with the use of carbon. Many of the ponds are located indoors in buildings, which almost resemble two storey greenhouses. These 'koi houses' are used to over winter the small koi of one and two years of age, together with a limited number of larger koi. The Japanese winters are intensely cold and the koi houses tend to be heated, so polystyrene beads are placed between the inner and outer glass, to act as insulation. From the large quantities of oyster shell on many of the koi farms it is apparent the water in this area is of low alkalinity, often called 'carbonate hardness'.

The alkalinity of water is a measurement of those salts, primarily hydrogen carbonate (bicarbonate), which tend to cause the water to exceed neutral and is extremely important in buffering the water from changes in pH. Ideally the alkalinity should exceed 100mg per litre to provide adequate buffering of the water. Where the alkalinity of water is poor, or the water is slightly acid, oyster shell is frequently used to improve the carbonate hardness as the chalky content of the shells readily dissolves to add more carbonate to the water. The oyster shells are

placed in open net bags, which can be readily placed into the filters and easily removed once the shells have crumbled.

Water a seething mass of colour

The ponds on the koi farms hold vast numbers of koi, the baby fish are keen to feed in the warm temperatures and the water becomes a seething mass of colour and open mouths as you approach the pond. Even though the stocking levels appear to be incredibly high, the Japanese Koi farmers feed the young fish frequently in the warm days of late Autumn, when we visited, which will help these smaller koi through their first winter.

One of the features which was very apparent to both Lorraine and myself was the attention paid by the Koi farmers to the amount of aeration in the ponds of both small and large koi. At one farm, there was a paddle wheel aerator, of the type used on coarse and game fisheries in the UK for waters of several hectares. It was quite surprising to see the paddle wheel aerator located in the middle of a pond, containing koi of may be only some 5-8cm in size, we looked carefully to see if the base of the paddle was caged in anyway to prevent the koi from being scooped up and turned to sushi by this vigorous machine. The koi quite happily swim in and around the machine without one ever apparently being hit by the blades of the rotating paddle! In addition to this paddle wheel aerator, there was an assortment of blowers and air pumps, continually driving oxygen into the water in all the ponds on the farm sites. This attention by the Japanese to aeration is something which is largely ignored by many of us in the UK and perhaps we should learn a lesson here and start to vigorously aerate koi ponds and holding facilities. Of course the earth ponds are generally not aerated but these are stocked lightly, so

the koi can grow to a bigger size — the whole basis of being a Koi farmer!

The autumn period for the Japanese Koi farmer is intensely busy, firstly, the earth ponds are harvested, the small koi are moved inside to over winter and this season heralds the arrival of Europeans and Americans to buy stock for shops and ponds for the forthcoming season. This is also the season for the Japanese Koi Shows to begin! In Japan, showing koi takes place primarily through the winter months, the koi are less active and handled more easily but of significance is that the cooler water causes the pigment cells in the skin to shrink, which makes the colours more intense!

Continued on page 37 ►



above The majority of farms hold koi in square or rectangular ponds of about 1.5m depth and of varying sizes and which employ biological filtration to remove the effluent from the water.

right Oyster shell is used to improve the carbonate hardness as the chalky content of the shells readily dissolves to add more carbonate to the water. The oyster shells are placed in open net bags, which are placed into the filters and easily removed once the shells have crumbled.



FACT FILE

PHOTOGRAPH: AREND VAN DEN NEUWENHUIZEN

Common Name: Giant Danio

Scientific Name: *Danio aequipinnatus*. In many books you will see *Danio malabaricus* listed as the Giant Danio. However, this species is not the same fish and bears the common name of Malabar Danio.

Family: Cyprinidae

Origins: Northeastern India

Size: 10cm

Diet: Will eat all foods. Whilst primarily a surface feeder this fish will rummage through the substrate looking for any food which escaped it at the surface

Temperature: 70-79°F

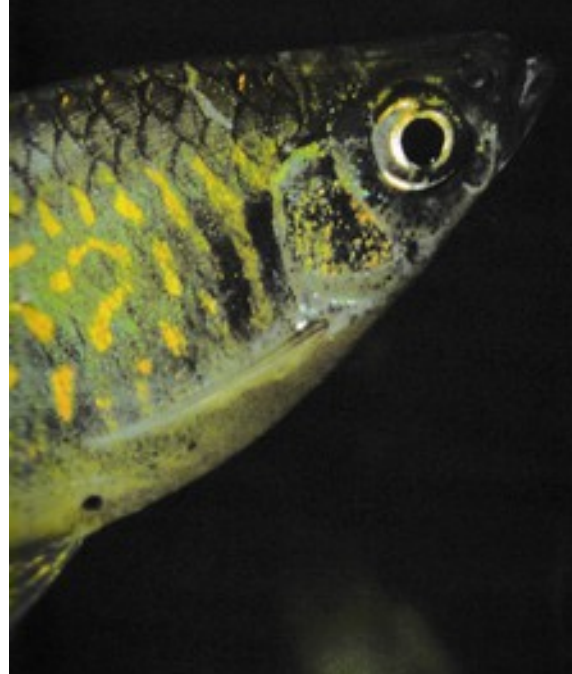
Aquarium Type: Does well in a normal community aquarium with some plant cover. Likes good water movement and does best when a power filter is included in the set-up

Reproduction: Typical egg scatterer which will spawn early in the morning. The eggs will be eaten almost as soon as the fish have finished spawning unless some method of keeping the adults away from them is used. Large pebbles or marbles thickly layering the aquarium bottom is often used for this. The fry are small and need infusoria or a liquid fry food for the first week of life. Brine shrimp or powdered fry foods will then be taken and growth is rapid from then on.



anner

MAY 2000



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August 19/20, Yorkshire Aquarist Festival (YAAS), Doncaster Exhibition Centre. October 20/22, Supreme Festival of Fishkeeping (FBAS), New Horizons, South Downs Holiday Village, Bracklesham Bay, near the Witterings and Chichester. October 28/29, British Aquarist Festival (FNAS), George Carrall Leisure Centre, Kingway Park, Urmston, Manchester.
FEDERATION CONTACTS: AoFA, Chris Ralph, 01703 560318; FBAS, Paul Corbett, 01983 721246; FNAS, Army Chadwick, 0161-652 6207; FSAS, James Sheekey, 01475 704219; USA, John Reid, 01738 634689; YAAS, Terry Nelson, 01724 289736

◀ KOI - THE JAPANESE WAY

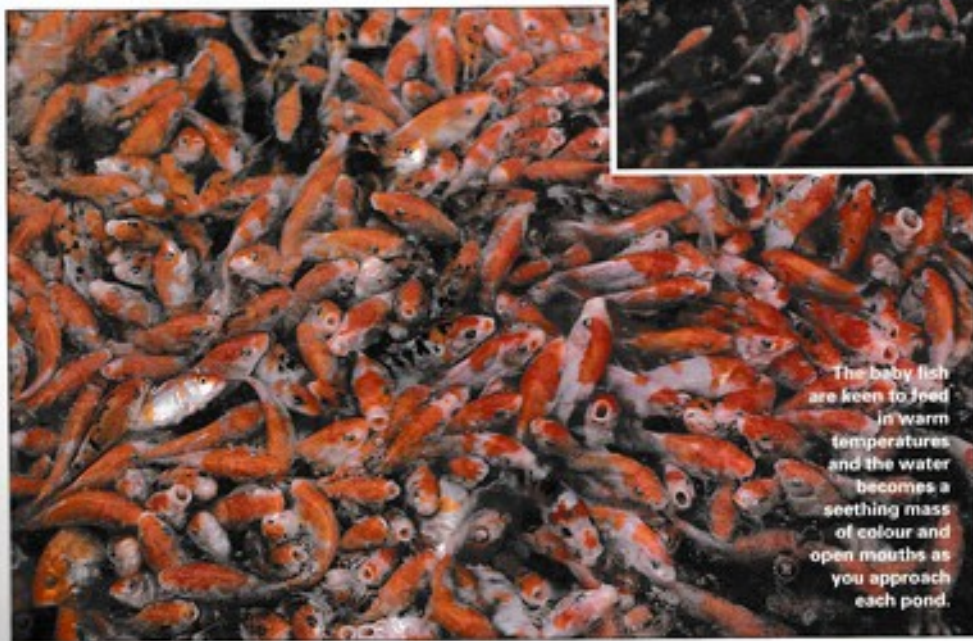
Continued from page 33

The desired colour patterns of a potential champion

Once the 'tourists' have gone home and the Koi Shows have finished for another year, the Koi farmer will turn his attention once again to the young koi in the indoor ponds, carefully selecting those with patterns which may have potential for great beauty and which will be kept in earth ponds through the summer, to grow and improve. Of the thousands of baby koi produced by each farmer every year roughly 50 will have the desired colour patterns of a potential champion and each year as the fish grow, this number rapidly dwindles. The remainder will be sold according to the quality of the koi, either within Japan, or to ever expanding markets throughout the world.

So what, if anything have Lorraine and I learnt from our trip to Japan? Without any question of doubt, it must be the amount of aeration we are giving our fish at any given stocking density. Since arriving back in the UK, we have been investigating aeration systems for fish farming and are in the process of refitting the premises with an improved system, which will drive the oxygen into the water. With regard to the quality of koi that we saw in Japan, this has been a tremendous experience and made us appreciate the efforts which the Koi farmers make to produce such beautiful koi. Not only do the Japanese achieve producing such wonderful koi but many are approaching a metre in length but still maintain the same quality of skin and colour pattern. It made both of us realise, there is still so much we have to learn!

Finally, our trip to Japan was a wonderful experience, it is a beautiful, clean country and the Japanese were the perfect hosts.



The baby fish are keen to feed in warm temperatures and the water becomes a seething mass of colour and open mouths as you approach each pond.

above Since arriving back in the UK we have been investigating aeration systems for fish farming and are in the process of refitting the premises with an improved system, which will drive more oxygen into the water.

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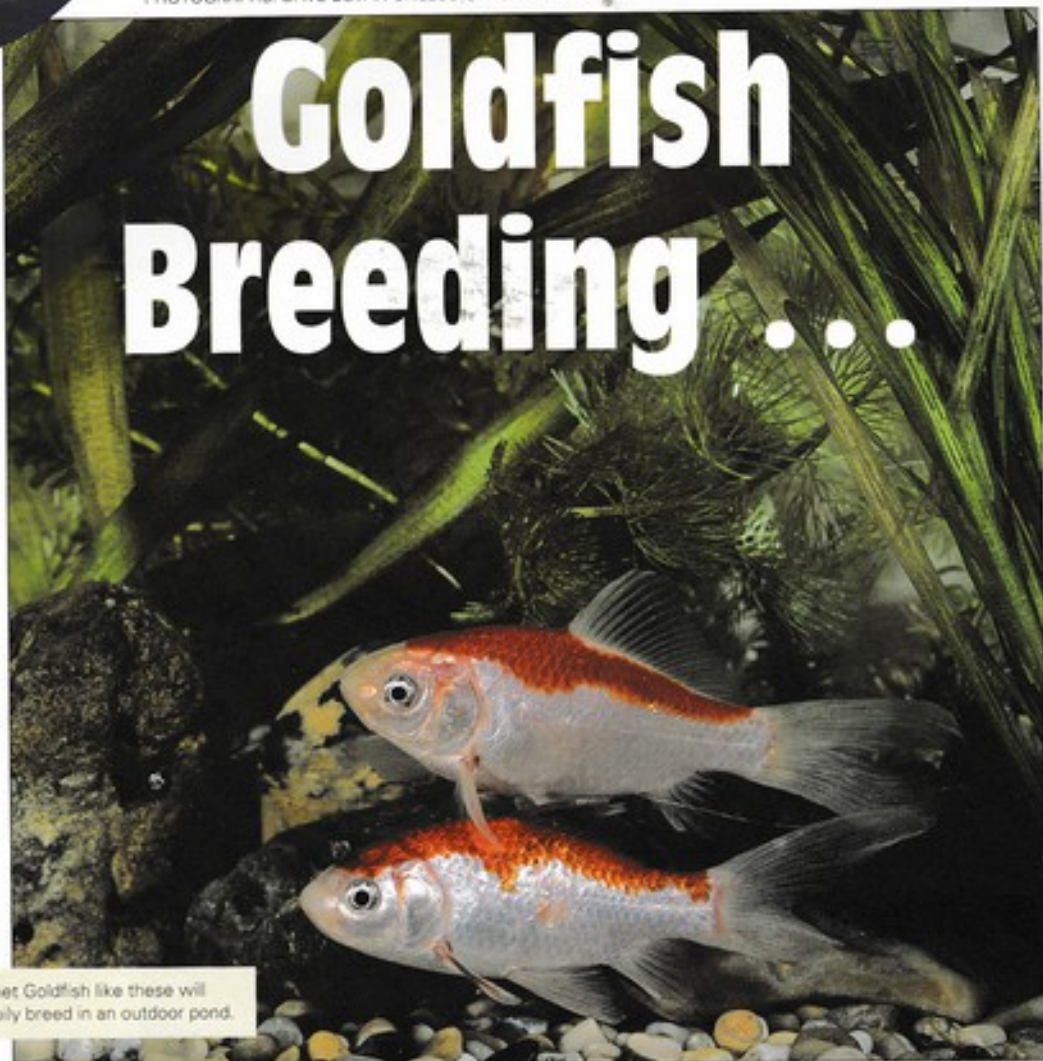
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ARTHUR BOARDER was one of the UK's best known and respected Goldfish breeders and wrote regularly for A&P over many years. This article first appeared in April 1951 and despite the passing years is still just as valid today as it was when he wrote it:

PHOTOGRAPHS: DAVE BEVAN UNLESS OTHERWISE STATED

Goldfish Breeding . . .



Comet Goldfish like these will happily breed in an outdoor pond.

in Tanks and Ponds

With the advent of spring all pondkeepers and many aquarists as well will be looking forward to breeding their fishes. Now, it is possible to breed many types of goldfish in ponds and also in tanks but it must be realised that the better the conditions then the better the chance of success. For instance, if one has a pond large enough the fishes can be left to themselves and are almost sure to spawn; then there will be many fry reared to strong healthy fishes. If, on the other hand, one only has a tank of 36 x 12 x 12 inches, then it can be understood quite readily that the chances of breeding fishes therein are much smaller.

It is not impossible, though, by any means, as some aquarists have managed to breed a few fish in such quarters. Of course, the more fishes

in the tank then the less chance is there of success. I advise all who are keen to breed a few goldfish in an indoor tank of the size mentioned to cut down the number of fishes to a minimum, so that there will not be so much chance of other fishes eating the eggs or young fry. Two male fish and one female fish are all that is necessary, and if you try to have more then you will not be as likely to get some youngsters. The tank should be well planted with water plants such as *Myriophyllum*, hornwort, *Eloëna* and willow moss. Any fine-leaved plants will do but there must be plenty so that there is not only plenty of cover for the fry but also enough growing plants to assist in oxygenating the water. (Editor's Note: Aeration is a better option today)

The tank should stand near a window — one which faces the rising

sun if possible, but not directly in front of it; better if it is at right angles to it so that only the end faces the window. See that the tank is in a healthy condition and change practically all the water before you actually try to get the fish to spawn. Remove all snails from the tank as these will only eat many eggs of the fishes when laid. The provision of some artificial lighting for the tank is an advantage but is not absolutely essential. Over a tank of the size mentioned two 25-watt lamps will do to give that little extra light and warmth on dull days. They should not be kept on for long periods but when there is little or no sunshine then it is beneficial to put the lamps on for a while.

Feed the fishes well and often on chopped earthworms and only a little of the ordinary packet food if you have been using this. Do not change the whole diet at once but gradually change it to an almost entirely living one if possible. White worms, Tubifex, Daphnia and mosquito larvae will all help to bring the breeding fish into that tip-top condition which ensures a good spawning.

Temporary parting

Having made sure that there are no fishes in the tank other than the actual spawners and having removed the snails it will be an advantage if the female fish can be removed from the tank for a few days. This temporary parting often encourages the fishes to spawn when they are put together again. If you have no other small tank in which to place the fish then it is policy to separate the sexes by a glass partition. The glass need not be clear, and I think it an advantage if the fishes do not see one another for a day or two.

When you are ready for the spawning then put the fishes together and do not disturb them any more than you can help. I know that once they start spawning in earnest they do not take very much notice of viewers, but some fishes are a bit shy and will stop chasing if anyone approaches the tank too closely. As most spawnings take place in the early morning it is advisable to put the fishes together late at night. I have noticed though that sometimes fishes in an indoor tank will spawn at times other than those they would spawn in an open pond, and so you may find them spawning late in the evening.

You will be in no doubt when the fishes are actually spawning as the males will be chasing and nudging the female continually. The female fish is pushed into the thickest part of the water weeds where she releases the eggs. These are fertilised as they are laid and being adhesive they stick to the weeds and show up as tiny balls of jelly as big as a pin's head. One female can lay thousands of eggs and so you will see my point about not having more than one female fish in the tank!

Once the eggs are laid the fishes will sometimes start to eat some of them. Although it is possible to rear a few fry in the tank, if something is not done to keep the parents away from the eggs then there are not likely to be many fry hatch out. If you have no other tank then divide the tank again as soon as the eggs have been laid. Do not worry about all the eggs — you could not rear all the fry that might hatch in any case. Divide off about a third of the tank and if you cannot see a fair number of eggs in that partitioned part add a few pieces of water plant which have



left Thick aquatic cover is essential if baby Goldfish are to survive in a pond. **right** Newly hatched Brine Shrimp are often fed as a fry food these days. The price of eggs has recently gone through the roof but they are still the best food for youngsters and well worth the expense.

a good sprinkling of eggs on them.

When you put the partition in be sure that it is tight at the sides. The fry are so very tiny when they are first hatched that they will be able to get through the slightest crack and can then be eaten by the older fishes. Get a piece of rubber tubing and cut this down lengthways with a razor blade. You can place a piece of this tubing down each side of the glass partition to seal any crack. Although there is no need to increase the warmth of the water for the hatching I am sure that it is advisable to get a fairly quick hatch.

More harm than good

In the average room the tank water will probably be about 60-65°F and this will give a hatching in about a week. If the temperature can be raised into the 70s then the eggs will hatch in four days. Do not under any circumstances raise the temperature to more than 75°F as you may do more harm than good.

Fry which hatch in the partitioned portion of the tank are not likely to require any artificial feeding from you for nearly a week after they hatch. At first they can exist on the yolk-sac with which they were born; this will last them for two days or so according to the temperature of the water. The warmer the water then the sooner will the food reserve be used up and vice versa.

The best food for the fry for the first week to ten days is Infusoria. This is a minute form of animal water life which is almost too small to see with the naked eye. It flourishes in old ponds and well established tanks and can be bred by placing some potato peelings, banana peel, crushed lettuce leaves or boiled hay into some water which has been standing in the open for a time. After a few days the medium will start to decompose and the Infusoria will appear. Aquarists have their own preferences for the medium but if you make a few experiments you will soon find which type suits you the best.

If you see a whitish moving cloud in the water you will probably have a good culture of Paramecium or slipper animalcules. These make very good food for the fry of all types of goldfishes. They can be fed little and often either by pouring some of the liquid into the fry container or by straining the liquid through a very fine silken net first. The net is then rinsed in the container for the fry to pick up the Infusoria.

GOLDFISH BREEDING

Almost continuous supply of food

The ideal is to be able to keep up an almost continuous supply of food and this can be done by placing a container over the fry with a siphon drip feed which is kept replenished so that it hardly ever stops. As long as the fry can keep eating they will soon grow. In cold weather it will be noticed that the fry do not feed as well as when the weather is warmer. The fry tank is kept at 70°F for the best results. Once the fry are two weeks old they can be tried with food slightly larger than Infusoria. Small worms, either white or earth, can be well crushed up nearly to pulp and this will form a very good building food. (Editor's Note: These days newly hatched brine shrimp, micro-worms, and commercial fry foods are used for this stage of feeding the fry.) It must be realised that Infusoria is of little value once fry are a fortnight old, but during the early days keep the supply of Infusoria going by changing part of the water in the culture each day as otherwise it becomes too foul.

Having dealt with the breeding of fishes in a tank I will give a few tips for those who wish to breed in a small pond. Ponds vary as to their size and suitability and one which is about 6 x 4 feet with a depth somewhere of at least 18 inches can be used to breed goldfish successfully. On the other hand if the pond is so large that parts of it are out of reach then it may not be quite as good as the smaller pond for the purpose of breeding.

There is no doubt that all types of goldfishes prefer to spawn in shallow water, and where this has not been provided for when the pond was first made it is a decided advantage if a shelf of some kind is added. If you can arrange for a shelf with the water shallowing away gradually to almost nothing this will be ideal.

Place some bunches of fine-leaved water plants at the shallow end and see that they are anchored to prevent them from floating out into the middle of the pond. Each day wash this weed up and down in the water so as to wash off the dirt and muck which will form on it. This muck may prevent the eggs from sticking to the weed when they are laid. If

your pond is of a fair size and does not contain too many fishes you have a very good chance of breeding some fishes in the pond without having to take the eggs away. It depends a great deal on the size of the pond, the amount of water plants therein, and the amount of live food which you are able to provide for the parent fish. If your fishes are of a fancy type such as Shubunkins, fantails, moors or veils it will be advisable to remove some of the eggs as above and continue with the treatment described.

If you are of the opinion that the pond is too small to expect much success in rearing fry then you must try to form some sort of a screen to prevent the parent fishes from getting into the shallow part of the pond once the eggs have been laid. This can be either in the form of a partition or just a line of large stones. It must be remembered though that once the fry are free swimming they will swim through very small openings and so reach the older fishes. Another method is to make a fairly large floating screen or sieve so the eggs can be placed inside when they are laid. This will prevent the parent fishes from eating eggs or fry but will allow plenty of Infusoria to enter the screen as food for the fry.

The more cover the better ...

Pond bred fry are not as likely to need artificial feeding to the same degree as those hatched in a small container, in fact it is possible that the fry in the pond will not be visible to you for about a month from hatching. The more cover in the pond, from all types of water plants, the better the chance of success but the less chance of you seeing the fry for some time. In a fair sized pond which is well established there is little need for any artificial feeding of fry for about a month and then a little dried food can be sprinkled on the surface of the water in warm weather. This may be the first time you see the fry — if you keep at a distance and are very quiet.

For the specialist breeder the above method of breeding will not be good enough. Where particular fishes are needed for spawning then it is imperative that the fishes are caught from the pond and spawned in a tank or small pond so that there is more control. In the open pond all of

the male fishes may take part in a spawning and so the specialist breeder may get crosses which are not wanted. If the actual fish with which it is intended to breed are separated it is easy to keep to a special pair or trio.

I like to use a good sized fairly shallow tank for spawning. See that there is plenty of water weed in this tank and see that the water is changed before the spawning time. Leave the water to sweeten for about a week and then put in the male fish. After three days or so the female fish can be added. Spawning may take place in a day or two. Once the eggs are laid you must remove the fish immediately, as no chances can be taken with specimen fishes. This method always seems to ensure plenty of fertile eggs and a consequent good hatching. The treatment of the fry will be the same as that already described.

Lionhead Goldfish are best bred in the controlled environment of an aquarium.
PHOTOGRAPH DEREK LAMBERT



JOHN RUNDLE is one of the UK's most experienced fish breeders. This month he reports on a fish which is often overlooked in aquarium shops:

PHOTOGRAPHS: MAX GIBBS

The Ugly Drab that turns into a Swan

It is a fact that many fish in dealer's tanks get by-passed because they look rather drab. Often it is because the fish are young and have not reached the stage when adult coloration is showing through. Well, recently I came across some long lost friends in a dealer's tank: it was a group of not particularly attractive barb about one and a half inches (4cm) in length. But I knew that when these fish were near their full size of some four and a half inches (12cm) they would be seen in their full body colours of browns, silver and red. Not forgetting the striking bright red edging on the caudal and anal fins.

The fish in question is the Arulius Barb (*Barbus arulius*). Once very popular with aquarists, but now a bit out of favour, and in fact not seen so regularly in dealers' tanks. It was first introduced as an aquarium fish in 1954, so when I was breeding it in the 1960s it was still a new fish. This, of course, made it one to keep and breed, and why not. It was attractive and made an ideal inmate for the larger community fish tank.

Before telling you how I bred the Arulius Barb we will look at it in more detail.

History and habitat

It was first described by Jerdon in 1849, but only introduced to the hobby in Europe in 1954, and their natural home is in Southeast and Southern India.

Sexing

It is not easy to sex the fish when they are young, but when they mature the males are easily distinguished by the long extended rays of the dorsal fin, whereas the females dorsal fin remains rounded and lacks the long fin rays.

General tank conditions

I have already made the point that this fish is an ideal community fish for the larger tank, this means from 36 inches (90cm) upwards. Ideal company would be other barbs and fish of a lively nature and not too small. Make sure there is an area that is free from plants so they can have plenty of swimming space. They are by nature a shoaling fish so try and keep them in a group.

In most aquarium literature you will find that the temperature range for keeping the Arulius barb starts quite low. The range quoted is 20°C (68°F) to 25°C (77°F). Having always kept them at the higher end of the range, I cannot say how they fair in the lower temperatures. As for water conditions, I always kept and bred them in my local tap water that is soft and has a pH of 7. I am sure, however, that they will live and breed



below Longfin Barbs are difficult to sex as youngsters. Here two immature males can be seen. If you look closely at the upper fish you will see the dorsal fin rays are just beginning to extend. Both fish are showing some of their adult colouring.

uckling ...

1 - THE LONGFIN BARB

in other water conditions, as long as you do not go to the extremes.

Breeding

To bring these fish into breeding condition I do not separate the sexes. Males and females would be kept together in the same tank, it could even be the living room community tank. With good conditions and a balanced feeding regime, one that contains dry food and live food, the females will soon show signs of being in breeding condition. I once bred this fish when only about three inches (75mm) in length.

I have used tanks that range from 24 x 12 x 12 inches (60 x 30 x 30cm) to 36 x 12 x 12 inches (75 x 12 x 12cm) as breeding tanks and I suggest that you do not use an aquarium smaller than this, for this barb will use the full length of the tank when breeding. The selected tank must be well cleaned prior to filling with water, there will be no substrate (gravel). Set the water temperature to 26°C (78°F), this slight jump in water temperature seems to help to trigger the spawning action. I do not fit any filtration to the aquarium before the fish breed. I just have an open-ended airline producing a moderate flow of bubbles. Of course there is the compulsory wool spawning mops, two that are floating suspended on strips of polystyrene and two or three resting on the tank base.

At this stage the selected pair of fish can be placed in the breeding set-up, it is worth noting that these fish can be a bit shy when first put into a bare tank, so do not have the tank under bright lights. I covered the top with newspaper, this somewhat subdued lighting helped to calm the pair down.

I found that each time I bred the Arulius Barb it started the first signs of courtship on the second day of being placed in the breeding set-up. You will soon know when it starts for the male will be seen chasing the female all around the tank. At this time his colours are worth seeing.

Both fish will come together in or over the mops and the female will release small slightly sticky eggs. I have records in my notes of the spawning period lasting up to three hours. I have read in books where it is said that the output of eggs is quite small, about 100. Well I can tell you that it more like 200 to 300 from an adult pair.



Hatching and feeding

Once the pair has finished breeding they must be removed, if not they will start to eat their own eggs. At this point a sponge type filter is fitted. The eggs hatch within 36 hours, and feed on their yolk sac for another five days. Do not attempt to feed them during this period, wait until they are seen to be free-swimming. The fry are very small and require food that can match the minute size of their mouths.

In my case I use home cultured infusoria to feed the fry for one week and then feed newly hatched brine shrimp nauplii. Once on brine shrimp growth is quite fast and after about three weeks the black markings will begin to show. When they are 12 weeks old they are large enough to move on.

Conclusion

This is without doubt a very striking fish when seen as adults and one for anyone interested in keeping barbs. So why not have a go at breeding the Long Finned Barb, have a little patience and watch the ugly ducklings turn into graceful swans.

far left A fully mature male Longfin Barb. The dorsal fin ray extensions can clearly be seen now.

AREND VAN DEN NIEUWENHUIZEN has his patience tried to the limit whilst trying to photograph Red Shiners spawning:
PHOTOGRAPHS: AREND VAN DEN NIEUWENHUIZEN

COLDWATER

North American

Shiners

Experiences in Care and Breeding



A shoal of *Cyprinella lutrensis*.

There are some species of Shiner which are not only beautiful, but also very interesting and can be kept and bred in an aquarium. I housed Sailfin shiners, *Pteronotops hypselopterus*, early in the 1960s, in an aquarium which caught sunshine for the best part of the day. Although they did not have bright colours, they were still strikingly beautiful.

They are a social, peaceful, shoaling fish which grow to a length of about 6cm and, although they originate from the warmer regions of the USA it is not recommended to keep them

in a tropical aquarium with a fairly high temperature. The best is a temperature which changes between day and night and also summer and winter. During the summer the temperature can vary between 20 and 25°C. After the summer you should drop the temperature to 15-19°C. If they show that they are still not happy, however, it is better to drop the temperature even lower to 10-15°C. This wintering at a low temperature is necessary to keep the fish in good condition and prevent mortality. In nature, for example, in Florida the temperature can even drop lower.

NORTH AMERICAN SHINERS

Hardness of the water is not of great importance. I had success with water of approximately 5 to 13°DH. The males' colour especially is very nice when the sun shines into the aquarium. They are more colourful than the females and clearly distinguishable by a black spot in the dorsal fin. They love mosquito larvae, waterfleas etc. For variation and addition to the menu you can also feed dry food in little quantities.

To breed *Pteronotropsis hypoleopterus* an aquarium of 40 x 25 x 25cm is sufficient which is filled with soft water up to 13°DH. If the water in your community tank is not of a suitable quality it is recommended to use clear rain water which was left standing for at least a week, or use distilled water to which a little tapwater is added. The bottom of the tank is covered with a layer of sand. If the fishes are transferred from a tank with a darker bottom, then it is a good idea to put a peat slate here and there in or upon the sand. For egg depositing Java moss (*Vesicularia dubyana*) growing on the substrate and plants with fine leaves like *Myriophyllum* are suitable. The temperature in the breeding tank is kept at approximately 24°C. If the sexes have been kept apart for some time they will deposit at a lower temperature.

Approximately 36 to 48 hours after depositing the eggs the fry will hatch. They are free swimming five days later and their first food will need to be infusoria, although they will also eat newly hatched very small *Artemia* nauplii. While raising the fry the water temperature should be kept at a constant level. Crystal clear water which is regularly changed will make them grow quickly. The pH-value should be 6.8-7.0. For care of the parents as well as raising fry it is not a good idea to exceed these neutral values.

Pteronotropsis hypoleopterus is found in the southeasterly part of the United States, from Georgia to Florida. This species lives in running waters and swampy parts like the Okefenokee-swamp in Georgia. Another good aquarium subject is the related species, the Red Shiner.



above After I changed the decoration of the breeding tank every time the male swam to a certain spot he swam downwards and stroked over a small stone with his papilla. Next he started courting again and finally the female followed him to the same spot after which mating followed.

left After every spawning the fishes parted with a jerk. This is practically the only picture I have of this as all the others were out of focus.

right What no hobbyist likes to see: the female fervently eating eggs. Two eggs are still glued to the wood at the left side of her eye.



Cyprinella lutrensis, which is found from the Rio Grande, Kansas and South Dakota into southern Illinois.

Males attract attention by their blue coloured red fins

P. hypselopterus does not show a striking colour outside the breeding season which is in contrast with *C. lutrensis* for even outside the breeding season the males of this species will attract attention by their blue coloured red fins. Females lack these colours and are more or less greyish-brown. Some years ago I saw these fish for the first time, but did not pay much attention because I had no space to house them. Last year, however, I discovered them again in an aquarium at the Royal Discus Centre in Witten-Stockum in Germany where I

bought six couples, because the males had for the breeding season the typical white rash on their heads. A short time later I also saw hundreds of them in the Netherlands with the importer Ruinemans in Montfoort.

I housed the growing fishes in a roomy aquarium. That was a good choice, because as it turned out they were lively and fast swimming. In a shorter and taller aquarium it is interesting to see a shoal of these fishes not only moving in a horizontal way. Dividing at different levels and in a somewhat more compact group they swim above each other in the open water. Their behaviour made me suspect that they would like running water. I therefore put large internal power filters in their aquarium as well as in their breeding tank. The over capacity of these filters created a reasonable flow in the water.

Water hardness was 13°DH and the pH 7.3. At a lower pH value these fish did not look very happy. As these fish were clearly in need of oxygen rich water, my water was kept crystal clear, being regularly changed (every two days) by approximately 50 per cent. This is important because *C. lutrensis* have a very good appetite and they produce a lot of waste. They are constantly searching for all kinds of live food and love to hunt for small water bugs and are interested in everything that moves.

Since nothing in literature was known about breeding and I only had experiences with *P. hypselopterus* in the 1960s I decided to set up a breeding tank of 45 x 40 x 25cm. Upon the sandy bottom I put a number of small round cobble stones from a mountain brook and in between a flat stone along which a bunch of Java-moss was put. Behind this, against the rear side, I put a piece of driftwood with a dark hole in it, this was shadowed by a small group of *Limnophila equatica*. Thus the breeding tank was left for about two weeks. After this the tank was partly refilled with the water composition already described. The water temperature was 25°C.

Male and female caught and housed separately

In the meantime I had regularly and closely observed the shoal. A clearly dominant and beautiful male and female with roe were caught and housed separately. They almost overfed for a week, after which they met in the breeding tank. Being wise after the event, this was wrong because these fish were very shy. It would have been better to keep the six males and females as a group. However, the other 10 I took to my friend and professional breeder. I did this to guarantee the conservation of this species for the hobby because of his expertise. From the following account it shows that *C. lutrensis* should be kept in a shoal and that buying just a couple is useless. Neither the fishes nor yourself are served by this.

Their shyness faded, as snow in the sun, as soon as they were put together in the breeding tank. The next morning the male started courting in front of the female. I did not know if the fish were going to deposit eggs early in the morning or later in that day. To find



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out, that morning and also the following mornings at sunrise I sat in front of the breeding tank. At day break the fish remained fairly quiet at first. After an hour or so the male became more vivid and gradually started courting the female.

This happened in a startling way, because he tried to push the female to the bottom in the same way *Nothobranchius* do. At first this happened throughout the tank, but gradually this activity transferred more and more to the group of small boulders at the bottom. It seemed that the female — just like *Nothobranchius* — was looking for a suitable spawning site. Finally she swam every time to a vertical smooth stone, standing upright at one of the sides. At that spot every time the male tried to come besides her she avoided him and did not give in. The hours passed by and the male became so vivid and fast, that a flash-speed of 1/700 of a second was not enough to photograph his movements sharply. During the afternoon he finally gave up his efforts.

This courtship lasted three days which meant that I spent more than 30 hours in front of the aquarium to photograph (on a large number of films) the spawning behaviour without the spawning itself. On the fourth day it seemed to go just as before, but then every time the female pressed her belly against the side of a round boulder and kept stock still in this posture. However it was impossible for the male to come besides her. This happened a few times so I took it that the fish wanted to spawn in between the boulders. I moved the stones with a little stick but this didn't seem to help. On the contrary, the male suddenly changed his behaviour and started to draw very fast circles above the female. This happened so fast that I became dizzy looking at it.

Finally — this was at 11am — suddenly the female remained in

between two vertical stones and swam away. This was repeated a few times then the male shot in beside her and the fish spawned close to the water surface in the crevice between the stones. At that moment the female ejected approximately 30 eggs. This all happened so quickly that I was unable to record it. Moreover, the eggs were eaten within a few seconds by both fish.

Here was my problem: it was impossible to photograph the spawning at the spot where it was happening. So what now? I decided to rebuild the spawning site very carefully without removing the fish from the breeding tank. If I moved very slowly they would have enough space to swim away without getting frightened. Anyhow this is what I hoped for. Thus I arranged a few stones, in which I closed the crevices with some Java-moss. I placed a piece of driftwood in between, with some moss for cover. This activity did not bother the male. He happily courted but his partner did not like it and sat very quietly in a corner. When I had finished nothing happened for a while.

Then the male swam in circles and went towards the female, turned around and swam to the spawning site. After some time the female followed and they mated. However, this again went so fast that I (as I found out later) had no success with the photographs. Then, suddenly, the up till now stormy behaving male stopped at the spawning site and with his rear body and sex papilla stroked over one of the stones or the piece of driftwood. Afterwards he swam towards the female again. Shortly after the fish mated. In between the male seemed to be polishing the spawning site, but he was just eating the eggs ...

Egg eating looked like polishing

The somewhat greyish-white eggs can hardly be seen with the naked eye and because of the strong adherence, the egg-eating looked like polishing. Later on the slides I saw eggs here and there glued to stones and wood but later on in the same series of slides they disappeared. With the passing of the time more and longer rests were taken, even longer than half an hour by the end of the afternoon. Then I decided to remove the fish from the tank and afterwards found just a few eggs glued to the substrate, which were unfortunately mouldy.

To prevent the egg consuming it is not only necessary to feed the separated sexes very well on varied food, but also that they spawn immediately the day after they have been put together in the same tank. It is much better if they do not need to be fed in the breeding tank.

The fry of *C. hubrensis* hatch after approximately 40 hours at a temperature of 25°C. The further development and raising is much the same as *C. hypselopterus*. After the spawning season the males are less intensely coloured and the spawning rash disappears from the head and the front of the back.

left The male being out of focus in this otherwise sharp picture shows how very fast he swims around the female during courting. The picture was taken with flashlight (1/700 sec.). I got the same kind of pictures of a suddenly fast moving shoal of this fish.



ANDREW CAINE of Aqua-World continues his look at the world of invertebrates:
 PHOTOGRAPHS: M.P. & C. PIEDNOIR

Life in the Oceans

The Crustaceans

Animals with Exoskeletons — The Crustaceans. These belong to the major grouping called the Arthropods, which, when all the sub groupings are combined, have a total of over 750,000 species, with many more certain to exist which remain unknown to science. This number is over three times greater than that of all the other species of animal known to science inhabiting the earth. Commonly they include insects, beetles and spiders. However, the crustaceans we shall study include crabs, lobsters, shrimps and barnacles. These crustaceans have over 42,000 species and are mainly marine, but a few exist in fresh-water and on land, with most being permanent members of the plankton.

The two main features are the hard exoskeleton and segmented body, which go 'hand in hand' as the exoskeleton is broken into segments to allow movement. Each piece of cuticle (exoskeleton) is joined to the next by an articulate membrane which stretches as the joint moves. This provides a barrier protecting the inner soft, otherwise exposed, body. This protection keeps out foreign bodies and parasites which are ever present waiting to invade a host.

Segmentation usually has three major regions, the head, thorax and telson or the head, body and tail. With the process of evolution segments have fused together, being changed or reduced in size, often making the distinction between body segments difficult. In lobsters, the telson is easily seen and is a major part of the animal, but if we move up the evolutionary tree to crabs, the telson is not evident. Looking under the animal you will see that it has become reduced in size and curled round underneath the body. The female uses this as a protective area when carrying eggs that are deposited here.

As it is mainly inorganic, the cuticle which encases the whole animal (it's like wearing a medieval coat of armour) poses a serious problem. All animals grow (isn't that surprising!), so they can only achieve this by shedding their skin. It's a case of 'off with the old and on with the new'. The old cuticle splits and the animal climbs out and instantly swells to its new size. Now the animal is vulnerable to attack as it is soft, so it



hides until the new cuticle hardens which can take from a few hours to many days. The Antarctic krill probably shows the most rapid moult. If disturbed it can shed its skin in seconds. There is no need for it to hide to allow the new skin to harden as they exist in massive swarms often kilometres wide and long with a depth in the tens of metres, protection here being in numbers.

Some moult every day ... others only once a year

Each species has a different amount of moults within its lifetime. Some moult every day, others only once a year. When the last moult has been reached any damage that occurs is permanent. As up to 85 per cent of its life time is spent fighting, this last moult represents the beginning of the end for that individual. To illustrate how useful moulting is, if a shrimp loses a claw, it is replaced (often to the same size) on the next moult. If it does not moult any more it is lost for good.

We now have an animal that is covered in cuticle, and is segmented

above *Cherax tenuimanus*. Blue Lobsters make fascinating freshwater aquarium inhabitants.

but what about the legs? These exhibit a great specialisation from species to species, some of which can only be seen by a microscope, ranging up to huge robust claws. The longest legs, those of the Japanese spider crab, can grow up to six feet. They are utilised for feeding as mouth parts, cutting up food, defence or attack as claws, walking, swimming, filter feeding, stabilisation, communication and copulation. Here the legs hold on and, using specialised areas, sperm is delivered to the female in small packets.

There is also a very important evolutionary process which has occurred in these beasts. The body shows a high degree of cephalization, that is the formation of a distinct head region with a concentration of sense organs such as eyes and a relatively complex centralised brain. This gives the animal a direction of travel to any stimulus within their locality. It also allows rapid reaction to such stimuli which can mean the acquisition of a meal or avoiding becoming one. The presence of eyes also allows communication between individuals and has allowed complex mating and territorial behaviour to exist. This has been shown as an effective method, not only to progress the species but also to avoid unnecessary fighting, thus increasing the life span of an individual.

The Decapods: Crabs, Lobsters and Shrimps

The grouping Decapoda is only a small grouping within the order of crustaceans and their distinction from the other groupings is found in the legs. Three pairs have been reduced and specialised into mouth parts, cutting up food and passing it for ingestion. The decapods have all their other legs attached to the thorax. The remaining 10 legs, five on each side of the animal, are easily seen, their main function being locomotion with important secondary functions, depending on the species and habitat. The ten visible legs give rise to the name Decapoda.

With over 4,500 species, the crabs are the biggest group within the decapods, and are found in every environment within the sea. They also represent the latest animal to invade the land from the sea. Everyone knows the tale of how fish evolved into amphibians which crawled out of the sea and then became reptiles. The modern day equivalent are the crabs, which are found from high in the rainforest canopy to deserts. Land crabs most commonly exist on damp forest floors but they have one big problem which has not yet been rectified by

Gaetes depressus, with over 4,500 species, the crabs are the biggest group within the decapods. Whilst most species live in marine habitats some have adapted to land and can be found high in the rainforest canopy as well as in deserts.



Anemone Crab, *Neopetrolisthes* sp. These crabs live at the base of or in the tentacles of stinging anemones.

evolution. (A few more million years and they should be OK!).

They have to find water to reproduce, as all have larvae stages. At breeding time on Christmas Island the whole island becomes a seething mass of crabs, all walking to the beach from the forest to breed, and when the young return the problem is even bigger as many more millions are present. Roads have to be closed as driving could result in a human fatality by sliding on the juicy parts of crushed crabs.

The coconut crab also causes serious concern for the local human population. As its name suggests it feeds on coconuts, breaking the shells with its claws to consume the soft inner nut. These crabs grow to quite a size and are well known for their bad temper. They are extremely aggressive and, armed with a formidable set of claws, are quite capable of severing a man's arm without a second thought! So be warned, leave these well alone.

The body of a crab is well known and characterised by the wide flat carapace which covers the entire upper body, with the legs protruding from under the side regions. The head area is located to the front of the beast, the mouth is protected by the front legs known as maxillipeds, and can be seen opening and closing when feeding in a tank. Try this with a piece of mussel, but they are shy creatures, so be patient. The eyes are located on stalks which can be moved and directed in any direction.

This location allows the crab to observe any predators from any direction, including birds from above.

The first pair of true legs are often surmounted with claws whose shape is often an indication of the feeding strategy. Fiddler crabs show great modification with one claw the size of its body and the other reduced. Here the claw is used in fighting other males in territorial battles and when breeding it is waved around to attract a female. The following four legs are mainly used for locomotion. The majority of crabs walk or crawl over a surface but swimming crabs have the last leg flattened to act as a paddle. A few years ago, when in Thailand, I was taking a little dip in a sea which supported a heavy sediment load. I could not see my body, but I did feel those legs crawling over my chest. It was only a swimming crab, but as I was young then and I certainly did not wait around to discover the species.

Crabs make a meal for many predators including octopuses, other crabs, fish, etc., and their claws are only a minor inconvenience for these, so other often novel strategies are devised to deter any animal making a meal out of them. Some species place anemones on their claws and wave the stinging tentacles at a potential predator. The anemone obtains nutrition from broken off body bits when the crab itself feeds. Hermit crabs carry these around on their adopted shell and when changing house they also move their complement of squatters. The decorator crab, as its name suggests, places anything it can find on its body. They have flexible hooks which hold on to anything including bits of sponges, shells, and stones. They remain inactive during the day and are very difficult to locate by sight alone.

FEEDING: Every strategy that you can think of is utilised by these animals, from active hunting to filter feeding, and the shape of the claws always gives a clue to the preference of each species. Most are active hunters and scavengers, but a preference for one prey group is always shown. Some species predate mainly echinoderms, others mainly shell fish, some taking worms. This allows many species to co-exist whilst not competing for the same food source. The prey taken can often be identified by claw shape. Species that take shellfish have one claw heavier with blunt teeth. This is used for crushing, whilst the other is slender and used for cutting flesh. Deposit feeders and algae scrapers often have flattened spoon shaped claws which are utilised for snipping off algae or spooning up sediment. Filter feeders have a modified maxilliped or antenna which sticks up into the water current to collect particles, often with the crab completely buried within the sand.

REPRODUCTION: The reproductive behaviour and biology of decapods is quite complex but always sexual, never asexual. First of all, to reproduce it has to find a receptive partner, the emphasis here being on the word receptive, as if the crab makes a mistake it could quite easily lose a part of its body. Many species therefore use body language and elaborate courtship dances. Fiddler crabs wave their enlarged claw to attract females. Different species have different waving patterns. Also, when the female is attracted the male then bangs the claw on the substrate to produce a species specific sound. Species of tropical ghost crabs build pyramids out of sand to attract females, the size being a reflection of the crab's reproductive prowess.

This mainly occurs just before the female is ready to moult, though some species court just after a moult. After the ceremonies have been completed the male grasps the female and climbs on top. This is to protect her as copulation occurs just after moulting when she is soft and vulnerable. At this point I would like to suggest that if you see two crabs in this position, it is wise to leave them alone as the male is very aggressive at this time.

The sperm of decapods lacks a tail, thus it cannot swim to find an egg, so it is packaged up into small parcels and is deposited via the legs into



cavities within the female. The female then hardens and the male crawls away, his job done. Meanwhile, within the female, eggs are passed singularly, past the sperm packet and fertilised. These are then passed to the telson under the crab's body. Here they develop and, when hatched, they join the members of the plankton.

Lobsters have a well developed body plan even though they are below the crabs in evolutionary terms, as the telson is well developed with the largest species attaining a weight of around 20kg. They live in holes in reefs or under boulders and lead a solitary nocturnal life. If you locate one it's best to leave it alone unless you are skilled in handling them. Their downfall is the tail region which is highly muscular and is consumed by humans to such an extent that many fisheries are now seriously overfished. To meet this demand many areas have tried to culture them, but there is one big problem insofar as they are cannibalistic, so that if the young are not separated you will end up with one big lobster.

One study involved growing them separately to six months old, and then taking them out on to a reef and sliding them down a tube to a waiting diver, who placed them in a hole. They are territorial animals so, after six years, the survivors would still be in the area. The return catch was about 15 per cent of the release figure, which is a good survival rate, but it was not feasible to continue.

Lobsters are vulnerable to a wide range of predators when young, but as their size increases their heavy body armour really takes effect and reduces the number of animals with the ability to eat them. Mating is similar to the crabs but, shall we say, they adopt a more human position, and the act of copulation does not last long.

above *Panulirus versicolor*. Blue spiny lobsters occur throughout the Indo-Pacific area. They eat all meaty foods in captivity but can be trained to take commercial tablet foods as well.



Bob & Val Davies's

FROGS & FRIENDS



FINDERS KEEPERS?

Apparently not where tortoises are concerned! Some readers will have seen the newspaper story in 1999 concerning a young lady from Manchester who was holidaying in North Wales and spotted a tortoise near a road. For its own protection she moved it into a nearby wood. The tortoise's owner employed a private detective to trace her and she finished up in a police cell for several hours charged with stealing a tortoise.

Fortunately the resultant publicity brought to light the tortoise which had apparently been later found by a couple and taken home — it was then returned to its owner. One can understand the owner's concern for the pet she had had for 40-odd years — since the import ban in (1983) tortoises have risen in value and have frequently been the target of thieves. This particular specimen was said to be worth £500 in the first report (£600 in the next). This seems over-inflated — few people would pay that for a 50-year-old tortoise.

As the law stands 'stealing by finding' is an offence; yet most people would be concerned to see a tortoise ambling along a road — even if it escaped the traffic it could eventually succumb to winter temperatures or be attacked by dogs or rats. Tortoises are by nature wanderers; in

the wild they may have to travel considerable distances to find sufficient food or to find a mate. Placed in an enclosure or garden they will explore and given an escape route will wander off.

Any weakness in the perimeter will soon be exploited either by pushing, digging or climbing, particularly in corners. When constructing an enclosure these activities must be borne in mind; mesh is not suitable as the animal, because it can see through, may try to push out and can damage its head and legs. The fence should be buried a good depth to prevent tunnelling and a round enclosure will avoid the persistent attempts to climb which square corners produce.

We recently received a call from a petshop owner to ask if we would look after a lost tortoise. It was eventually returned to its owner who had realised where it had escaped from. As soon as it was released back in its garden it immediately made for the same spot which had by then been boarded up. 'All's well that ends well', as the saying goes; the lady had had the tortoise for 33 years and was glad to get it back safely — it too had been found wandering along a busy main road and even a tortoise shell is not proof against vehicles.

If you own a tortoise make sure it cannot escape; should you find one it might be a good idea to inform the local police immediately to avoid being accused of stealing. Some tortoise owners photograph the plastron (undershell) so that identity can be proved.

Under present regulations the DETR requires captive-bred Mediterranean tortoises (*Testudo* spp) to have micro-chips inserted when they reach a size of four inches (100mm) shell length. The breeding stock must also carry micro-chips. The identification numbers on the chip would have to be supplied to the DETR when applying for exemption certificates which are needed should the tortoises be passed on to other people either by sale or as a gift.

However, tortoise breeders are questioning the need for micro-chipping which increases the cost of a tortoise. There is the cost of the chip, the cost of having it inserted by a vet, and possibly (currently under proposal) pay the DETR for issuing a certificate. Apart from this many people, including some vets, regard micro-chipping as cruel — the hollow needles used are exceptionally thick.

Theoretically, the idea behind micro-chipping is to identify legally-held specimens as against smuggled specimens. A proposal has been made by some keepers and breeders that micro-chipping, which is often flouted anyway, is unnecessary red tape and that photographs of the plastron are as good as fingerprinting. The DETR has recently stated that such photographs are adequate for babies until they reach the four inches (100mm) shell length.

Therefore, why is it not adequate for the rest of their life? At least one breeder is researching changes in plastral patterns to see if the birth pattern remains throughout its life. If so the DETR could insist on photographs instead of micro-chip numbers. In fact photographs would probably be more effective whereas the micro-chip system can be abused.



left Mediterranean tortoises showing that plastron patterns are as unique as fingerprints.

PHOTOGRAPH: BOB & VAL DAVIES

Do snakes dislocate their jaws in order to swallow large prey?

FACT OR FICTION?

In a word no; nor do they 'unhinge' or 'detach' the jaws — expressions occasionally seen in various books. Most snakes can eat prey that is larger than their head — the simple explanation is that the mouth can stretch to accommodate large prey.

Generally snakes' teeth are sharply pointed and recurved for the purpose of holding prey and facilitating its movement into the oesophagus. Unlike humans the tongue does not manipulate food — it is withdrawn into a sheath when eating.

The lower jaw in humans is a continuous U-shaped bone, in snakes it is actually two separate bones connected at the front by an elastic ligament and muscles which allow them to move apart in a sideways movement.

The upper jaw and palate consist of six toothed bones each of which is independently moveable. This movement is possible because all of the jaw bones are attached to the skull only by ligament.

This unusual structure allows the jawbones to be individually manipulated from side to side, up and down or backwards and forwards. Prey, once seized, is then 'walked' down the oesophagus by alternating movements of the jaw bones particularly those of the lower jaw.

One side is lower, advances and then retracted onto the food — the other side then executes the same procedure. At the same time manipulating movements are observed in the upper jaw. The skin of the lower jaw and throat are extremely flexible to accommodate food items.

Since snakes have no pectoral girdle, passage of large food items



above A pink mouse is much larger than this baby sand boa's head but poses no problem. PHOTOGRAPH BOB & VAL DAVIES

through the oesophagus is not restricted. The ribs are not joined in a rib cage (as in humans and other mammals). This, together with the flexible skin on the body, enables the food to pass down into the stomach where it is digested.

There are variations in the anatomy of the skull — in some species such as the blind snakes (*Typhlopidae*), their lower jaw is toothless, their food consists mainly of small insects.

HERP FACT FILE: Frogs and Toads (Anurans)

Although popular English usage differentiates between frogs (smooth skins) and toads (rough, warty skins) scientists use the collective term anurans since biologically there is no difference. Some 'frogs' have rough skins, some 'toads' have smooth skins.

The exact number of species is a matter of conjecture — new species are regularly discovered, partly due to more systematic surveys and improved methods of identification including molecular analysis. The latest number for formally described amphibian species (frogs, toads, salamanders, newts and caecilians) stands at around 4,780 and will increase. In 1985 it was only 4,003.

Anurans constitute around 90 per cent of all amphibians. There is however the usual ongoing dispute over what constitutes a species and the number of anuran families is also disputed — some taxonomists recognise 20, others up to 25, divided into 303 genera and over 3,500 species. A number of diagnostic features are used in classification including tadpole type, fossil evidence and internal anatomy, particularly the structure of the skeleton.

DISTRIBUTION AND HABITAT

Anurans inhabit all continents except Antarctica. More than 80 per cent are found in the tropics and sub-tropics — South America is particularly rich in species. They

have adapted to practically every type of habitat, even deserts, although they are dependent on moisture to survive. Most live in water and on land but some are completely terrestrial. Both still and moving water are used by certain species.

The anuran body — all have a basic body 'design' — shorter than other amphibians; no tail and a short, rigid backbone with no more than nine vertebrae (up to 100 in newts and salamanders). Various adaptations of body shape and other physical features have evolved to suit different lifestyles — aquatic species tend to be streamlined with long, powerful hindlimbs; more terrestrial forms (especially burrowing species) tend to be squat with short limbs.

Long limbs with adhesive discs are an adaptation to an arboreal lifestyle. Bony ridges on the limbs or head are used for digging by certain forms. Webbed feet are an obvious adaptation to life in the water. The eyes are often bulbous to give a good view with just the head above water — depressing the eyes into the mouth cavity assists in swallowing food in some species. Some, but not all anurans have a sticky tongue which can be uncoiled to capture prey.

THE SKIN

Anuran skin contains colour cells in an amazing variety of shades and



Hyla leucophyllata, an attractive tree frog from South America. PHOTOGRAPH BOB & VAL DAVIES

patterns, mucus glands to moisten the skin — in a number of types the skin secretions are unpleasant or even highly toxic. In many species the skin, especially on the belly, can absorb moisture from the surroundings to prevent dehydration.

REPRODUCTION AND DEVELOPMENT

Anurans exhibit a greater variety of breeding modes than any other vertebrates; some authorities distinguish 29. The number of eggs varies from one to several thousand — the American bullfrog (*Rana catesbeiana*) recorded at 47,840. They may be laid in clumps, strings or even singly — sometimes in water, attached to leaves; on leaves overhanging water; in thin layers on the water surface; in foam nests or artificially constructed pool or in tree holes.

Certain species lay eggs in burrows and others simply deposit them on damp soil in a secluded

spot. Parental care includes guarding eggs and larval transport to water in some forms. Swallowing the tadpoles which then complete their development inside the parent is another strategy; a few species rear them in a dorsal pouch. Live-bearing is not common but does exist — embryos are retained in the oviduct and nourished by the mother in a similar manner to that of placental mammals.

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Derek Lambert's Cutting Edge

PHOTOGRAPHS: AREND VAN DEN NIEUWENHUIZEN
UNLESS OTHERWISE STATED

• OUR MONTHLY LOOK AT RARE FISH AND THE SHOPS THAT SUPPLY THEM •

This month has been a very hectic one from the fish import side of things. The new Koi season has just kicked in and dealers have some of the cream of Japanese breeders fish on offer. Whilst, up to now, not a great fan of Koi Carp, I found myself entranced at Shirley Aquatics on April Fools Day as they showed off some of the this season's imports. Absolutely stunning creatures every one and proof that I have been the 'April Fool' for not looking closer at these wonderful works of living art.

Moving on to my 'shop of the month', I was pleased to visit Swallow Aquatics at their Rayleigh site in Essex. Despite living in the London area for many years I had never visited this shop before, so it came as something of a surprise just what a good venue it is (I thought I knew all the good ones!). Thinking about it now, it should not have come as a surprise since the owner is Mike Seaby (Chairman of OFI and a board member of OATA). The high standards these two trade organisations want our aquatic industry to reach are epitomised by this shop.

For those of us who are looking for something a little on the unusual side, this shop had a good range of catfish (plenty of 'L' numbers and *Corydoras*), characins including *Baetisguethops breuseghemii* (a rarely seen African species) and some lovely Altum Angels competitively priced at £17.95.



Importing fish from all parts of the globe like this aquarium shop does means that odd things turn up from time to time. This was the case a few weeks before my visit when some 'Indonesian Butterfly Fish' arrived as a replacement for a species which was unavailable. They were about 5cm in body length and mottled brown and tan. They mostly sat on the bottom and had a large upturned mouth. Typical ambush predators if ever I had seen one.

These unasked for creatures certainly caught my eye and despite a hunt through all the books available at Swallows we could not come any closer than *Nothestes robustus*, which has the unlikely common name of Bullrout! This species was fairly similar until we took a close look at the dorsal fin and found our fish had two distinct dorsal fins instead of one.

Normally such a rarity would have found its way into my ever present polystyrene box for the trip home but these fish were living in brackish water and I had no aquarium available to house such animals. Reluctantly I had to leave them behind but promised to try and find the scientific name of these strange imports.

Using the Bullrout as a starting point I checked up on its close relatives (Scorpionfishes) and after a little searching tracked down our 'Indonesian Butterfly Fish'. *Vespicula depressifrons*, Waspfish, were a perfect match. They live in estuarine conditions throughout Indonesia, Philippines and New Guinea. My first impressions of them being a bottom dwelling ambush predator were confirmed, although these have learned to take frozen foods as well as live.

A cautionary note was also sounded. Many of the fish in this family have poisonous spines and number some of the most deadly poisonous fish in the world. Whilst nobody relates just what would happen if your finger were impaled on a Waspfish's dorsal fin spine, a degree of caution would be wise when handling these creatures.

Apart from the tropical freshwater and marine fish sections, coldwater fish had their own hall. Here my eye was taken by some full grown Axolotls. There were some youngsters on sale which turned out to be the offspring of the adults. Whilst a little early for the new season coldwater fish, what was on sale were healthy fish of a reasonable standard. One or two Fantails were well up to British show standards and would have done well on any show bench in the country.

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above A general view of Swallow Aquatics tropical hall.

PHOTOGRAPH: DEREK LAMBERT

Moving on from Swallow Aquatics to our 'fish of the month' I hand you over to **KATHY JINKINGS** who brings us one of her personal Goby favourites. These rare fish turn up in the trade from time to time and are well worth searching out.

The Red-throated Goby (RHINOGOBIUS WUI)

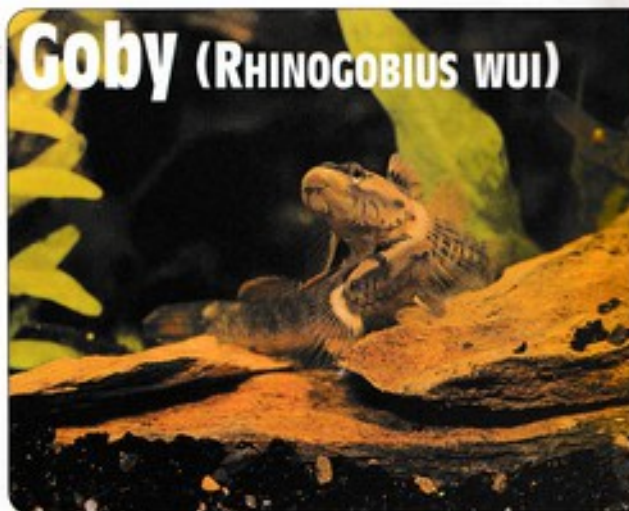
If you pass all the aquariums in the shop with only a quick glance, you might well miss one of the most interesting and endearing little fish around. This little brown Goby blends in well with natural coloured gravel, and spends most of its time at the bottom of the tank. With such a description you might well wonder why on earth you would want such an unobtrusive fish, but once you have a few in the aquarium it is very easy to become anthropomorphic about them and believe them to have real personalities.

The males assume a much more attractive colour once they are in the mood for spawning (which is all the time once they have settled in) and become a dark chocolate brown with white markings and a bright red throat. Originally hailing from China, these undemanding little fish will settle into both temperate and tropical aquaria, and as they grow to just under two inches most aquarists will be able to find the space for a trio.

Although not good swimmers, they bound actively across the gravel, play 'king of the castle' with one another on rocks, and perch in the plants peering down like dragons in mediaeval illustrations. Perhaps this gives rise to their other common name of 'dragon Goby' (which is a name also applied to another, much larger, totally different fish, so buyers should make very sure which one they are getting — the other one is big and purple).

Males display to one another and to the females by throwing their heads back and inflating their red throats. In spite of their constant displays, these are peaceful fish, and will do no harm to members of their own species or other community fish. Like all gobies, they need a high protein diet, and although they will sample flake food occasionally much prefer Bloodworm or other meaty foods — frozen is quite adequate, although live foods are even better.

They spawn easily in the aquarium; all you need is a good supply of



above Although not good swimmers, they bound actively across the gravel and play 'king of the castle' with one another on the rocks.

live foods, a few flat stones on the floor of the tank, and a pair of gobies! The male excavates a hole underneath one of the stones, and eventually persuades a female to deposit between 10 and 50 large eggs on the 'ceiling'. When the female leaves, the male seals up the entrance with gravel and settles down to tend the eggs in isolation for around fifteen days. When the tiny fry hatch they still have large yolk sacs attached, but as soon as these are absorbed will enthusiastically stuff themselves on brine shrimp nauplii.



above They perch in the plants peering down like dragons in mediaeval illustrations. Perhaps this gave rise to their other common name of 'Dragon Goby'.

right They spawn easily in the aquarium; all you need is a good supply of live foods, a few flat stones on the floor of the tank, and a pair of Gobies! These eggs are 48 hours old and still have a long way to go before they will be free swimming youngsters.

RED-THROATED GOBY
FACT FILE

FAMILY: Gobiidae
SPECIES: *Rhinogobius wui*
ORIGINS: Chinese highlands, Hong Kong
AQUARIUM TYPE: Small community or species tank
FEEDING POSITION: Bottom
TEMPERATURE: 55-77°F
SIZE: 4.5cm
DIET: Live or frozen foods



TROPICAL

Guppies are probably the most popular aquarium fish in the hobby today, and yet they are frequently misunderstood. **DEREK LAMBERT** exposes some of the myths about these beautiful aquarium fish:

PHOTOGRAPHS: AREND VAN DEN NIEUWENHUIZEN

Facts ... not Fiction

With careful selection over a period of several generations you can develop your own line of guppies where most of the males will look similar.

After over 100 years in captivity you would think that aquarists would know almost all there is to know about guppies. Yet, this most popular of aquarium fish is probably one of the most misunderstood in the aquarium hobby. Right

from the start the Guppy has been surrounded by myth and fantasy. Some of these myths are quaint, rather romantic and harmless. Others, however, do the fish no good at all and, in some cases, are inaccurate and can lead to problems with guppy maintenance.

The most logical place to start examining these myths is the one surrounding the guppy's first capture. Legend has it that the Reverend Robert John Lechmere Guppy discovered this species on the island of Trinidad and shipped some back to the British Museum for identification. They were duly described as *Girardinus guppyi* in honour of the discoverer. This is fine as far as it goes, unfortunately, the species had already been described some seven years previously from fish collected in Venezuela! Hence the Guppy is now known as *Poecilia reticulata* (Peters, 1859).

That in itself is not too unusual, many fish have been described by science several times in the past, which is one of the reasons scientific names change from time to time. What makes this particular case more interesting is the "Reverend" Robert John Lechmere Guppy himself. Whilst certainly a gentleman of some means he was never a Reverend! During his travels around the world he found it much easier dealing with various government officials if he was dressed as a vicar and adopted the title of Reverend.

The vegetarian myth

Moving on from this harmless myth, we come to some which do Guppies no good at all. There is the one which says they are vegetarians needing lots of vegetable matter in their diet. Wrong! In the wild guppies can be seen right at the water's surface for much of the time. When anyone approaches they will dive down a few feet and you will see them picking at plants or algae at this time. When all is quiet again, however, they swim up to the surface — why? The answer is obvious if you watch long enough, they are on the hunt for insects. Whenever a small fly or

mosquito falls on to the water's surface, they all rush towards it and gobble it up in the blink of an eye.

Apart from its dietary requirements an important part of producing good quality guppies is your feeding regime. If a closer look is taken at the gut of a guppy you will not find any clearly defined stomach sac. Instead, they have a very long tubular gut, with little balls of partially digested food spaced throughout its length.

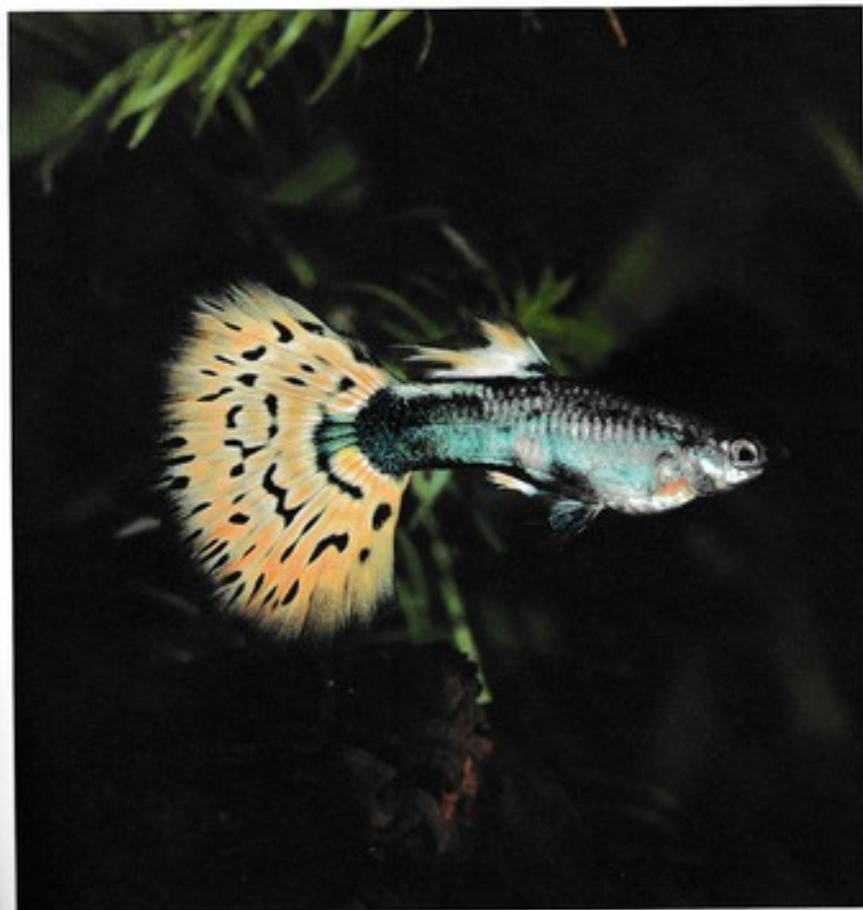
This gives a clue to the correct feeding of guppies. In the wild, they will eat a small meal whenever they chance on one — hence all those little balls of partially digested food. In the aquarium, this means you need to feed them small amounts often, rather than one big meal. If you do that, they will take a couple of mouthfuls and then swim off. A little while later they will be back to grab a little more. The problem is that most of the vitamin content will have leached out into the aquarium water and the food will have minimal goodness left in it. If the aquarium houses other species of fish, they will snap up all the surplus food or, worse still, it will lie around until it rots and pollutes the water.

The brackish myth

The brackish water myth that all livebearers come from brackish water has probably caused more harm to the guppy than any other myth. For the moment we will not delve into just how much harm this myth has done to some of the other livebearers but just concentrate on the reality for guppies. Take a look at the guppies natural habitats — Trinidad and mainland South America, north of the Amazon, specifically Northern Brazil, Guyana and Venezuela.

Notice any similarity between this range and many other popular aquarium fish? Yes, Catfish and Tetras are distributed throughout this range as well. Are these hard, alkaline water fish which prefer brackish conditions? Of course not, most of these species need soft water and dislike salt added to their aquarium — just as guppies do.

Being an adaptable fish, guppies can tolerate a wide range of conditions, so hard, alkaline water and even brackish conditions will not cause undue stress — provided they have time to adapt to them. The problem is that they often don't have time to adjust to them because of another guppy myth that guppies are hardy fish. For hardy you can read "OK to abuse" in many peoples' minds. So, instead of proper acclimation, they just throw them in a new aquarium rather than adjusting them to new water conditions. This means they may be transferred from water which is hard and alkaline directly into water which is soft and acidic. No wonder the fins fall off or they succumb to a wide range of illnesses. If the bag had been opened and the two waters allowed to slowly mix



left A beautiful male Delta fish of this quality are only produced when they are given the very best food and conditions.

FACTS ... NOT FICTION

over a period of several hours then they would not have been shocked by the change in conditions and consequently survived for more than just a few days in their new environment.

Breeding — the final myth

The final myth is that guppies are easy to breed. On one level this statement is true, but not if you want to produce good quality guppies. This takes a lot more effort than most people are prepared to make.

First off all you need to find good quality adults to breed from. This may not be as easy as it sounds, as most guppies found in aquarium shops are sold from tanks full of males or females only. You have to search through these until you can find a pair of the same strain, bearing in mind females will only have a hint of the male's colour in her fins.

You need to place your chosen pair in an aquarium by themselves until the female has produced a brood of young. Since female guppies store sperm from previous matings, this first litter will most likely be the offspring of a different male from the one you purchased. The next brood, however, will be mostly the offspring of your male, since fresh sperm is used in preference to older stored sperm. So it is this second brood you need to save and rear up to provide your next generation.

To produce youngsters as good as those large, robust specimens sold in aquarium shops you need to be prepared to feed your new born fry at least six times a day. During the course of a day you should give them at least two feeds of live food as well as a good quality fry food. With such heavy feeding you will need good filtration and aquarium maintenance. Many top guppy breeders change some water in all their tanks — every day.

The next important step to take is to make sure your fish are not over crowded. Aim for no more than about 20 guppies in a 30 x 12 inch aquarium. Small fry should be started off in smaller tanks of about 18 x 12 inches and then moved into larger quarters as they grow. With this sort of care it is possible to rear good quality guppies up to adult size in about four to five months depending upon the strain. This will give them an adult life of about a year for the large Deltatall types, and up to two years for the Swordtail and Wild forms.

If you intend to take your guppies through future generations it is important to isolate males and females before they have a chance to mate. This means carefully looking at your youngsters every day to see if any are developing a gonopodium. Fish beginning to show this male characteristic must be moved over to a male only aquarium as soon as they are spotted. During an eight week period all the males will sex out and you should now have a tankful of virgin female guppies (the rarest fish in the world) and a tankful of males.

Another way of spotting female guppies is to look for the gravid spot which is present long before they are sexually mature. In grey bodied strains this can be seen in a matter of three weeks.

right Female guppies have come a long way from the wild type fish which have almost clear fins and a dull grey body colour.

Even gold bodied fish can be sexed by this method, but that takes a sharper eye and more experience than with other types.

Good information the key to success

I hope this article has opened your eyes to some of the myths that surround one of the most spectacular of aquarium fish. For those of you interested in including breeding guppies as part of your hobby it would be a good idea to start by buying a good book on the subject.

For my money the best book on breeding fancy guppies has to be Stan Shubel's *The Proper Care of Guppies*, published by TFH, code number TW-133. With over 60 years experience breeding fancy guppies Stan really knows his subject and has put heart and soul into producing this excellent publication. It is not a pretty picture book like so many on the market today, it is an old style aquarium book full of great information at a reasonable price.

below A young bottom sword male. As he matures his sword will extend until it is as long as his body and his dorsal fin will also grow out until it reaches beyond the start of his tail.



Diamond Tetra

(MOENKHAUSIA PITTERI)

Moenkhausia pitteri (Eigenmann, 1920), the Diamond Tetra, lives up to its name in adulthood when its silver coloured body with its many shiny highlights, gleam like a many faceted diamond. The red highlight on the eye adds to the beauty of this tetra. When young, they are grey to buff coloured individuals, lacking the iridescent scales that come with maturity.

The buff coloured caudal and anal fins are very much larger in adult male fish, making it easy to tell the sexes apart. The Diamond tetra reaches a size of 2.5 inches TL (6cm). The Diamond tetra comes from Lake Valencia in Venezuela where it is found in waters that are soft and acid. Here it feeds on small aquatic invertebrates and insects that might land in the water.

Because it is relatively easy to tell male and female apart, this is no excuse for just keeping one pair of these fish in your community aquarium, since in the wild they are a shoaling fish. In a nicely planted aquarium, a shoal of Diamond tetras swimming through the plants with displaying males could be a spectacular sight.

The Diamond tetra is a peace-



ful fish and should be housed with other similar sized fish that require similar conditions. One is spoilt for choice for suitable companions, as South America is a gold mine of fish species of similar size and temperament.

A 36 inch long aquarium could possibly hold three or even four contrasting shoals to form a spectacular display. In the aquarium, these tetras will adapt to life in moderately hard water provided it is clean, well aerated and filtered and kept at 25-28°C. These amenities are

best provided by an outside canister filter and a heater thermostat. Diamond tetras will usually eat all foods offered, such as flake foods, but should occasionally be offered some live and frozen foods.

The Diamond tetra, being a resident of South America, naturally needs soft water for successful breeding and egg development. An easy way to achieve this is to collect rainwater and use a small, separate tank containing Java moss for spawning the Diamond tetra. Males and females, which have been kept

apart for about two weeks so that the female can fill up with roe should be brought together in the spawning tank.

Once spawning is complete the adults should be removed to prevent them eating the eggs. Eggs hatch in a couple of days and should only be fed when the fry are free swimming. This can be infusoria to start of with followed by larger foods as they grow.

The Diamond tetra, is an active and attractive fish. This tetra is a hardy, undemanding fish that lives up to its name and adds a sparkle to the community tank.

FACT FILE
FAMILY: Characidae
NAME: Moenkhausia pitteri
ORIGINS: Lake Valencia, Venezuela
AQUARIUM TYPE: 36 inch community tank
FEEDING POSITION: Top and mid-water
TEMPERATURE: 75-80°F
SIZE: 7.5cm
DIET: Flake, small live food, frozen Bloodworm

WORDS: IGGY TAVARES PHO
 PHOTOGRAPH: AREND VAN DEN NIEUWENHUIZEN