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The Better Fishkeeping Magazine

WATER WORLD MANAGERS

THE DEFINITIVE YEAR PLANNER OF POND MAINTENANCE

BACK TO BASICS
THE SIAMESE FIGHTER

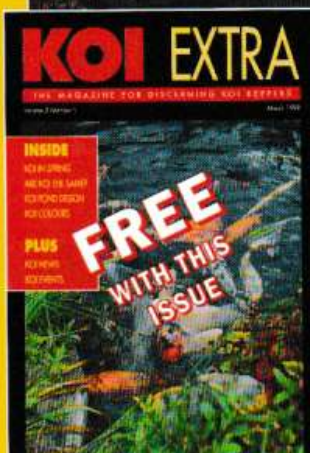
DECORATIVE WATER FEATURES
WATER IN THE GARDEN ... WITHOUT FISH OR DIGGING

COMMUNITY SET-UP
MARINES FOR THE SMALLER TANK

THE GOLDFISH SEASON
CHARTING THE YEAR'S ACTIVITIES

SEA SQUIRTS
MARINE INVERTEBRATES

A NATIVE FIREMOUTH
THE STICKLEBACK



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EDITOR
Dick Mills

ART EDITOR
Mick Beeken

**ADVERTISEMENT
MANAGER**
Gwen McNeil
Tel: 01233 713188

SALES CONSULTANT
John Young
Tel: 0181-904 8886

PUBLISHER
Ian Hunter

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**TELEPHONE:
SUBSCRIPTIONS/
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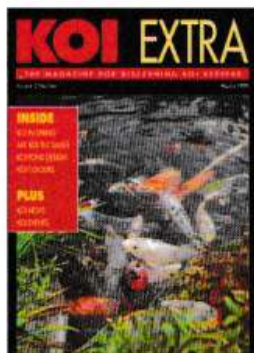
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Despite its tranquil appearance there should be a lot going on "behind the scenes" throughout the season to ensure that the pond looks its best. Our year's guide to Water World Management should set you on the right road to success.

PHOTOGRAPH: DAVE BEVAN

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Spring is in the air (or so they tell me) but having to write this ahead of the actual event only time will tell if the traditional regenerative season has made a punctual appearance or whether it's only a myth passed down from generation to generation.

Anyway, we're going out on a limb — whatever the eventuality — to usher in the new coldwater season with a "no-apologies-for-it" issue which is unashamedly aimed at this aspect of fishkeeping.

We have a forward looking Pond Planner for the whole season prepared, in his own inimitable style, by Peter J. May, whose approach is in believing that being forewarned about likely problems is going a great way to forestall them happening in the first place.

Also looking forward to an eventual season Alex Stephenson has also prepared "a season's worth" of advice about breeding Goldfish and this will extend from March to the August issues of A&P.

Do you remember your first tiddler? Roy Osmint recalls the excitement of struggling home with jam jars full of Sticklebacks and presents a detailed exposé of this favourite fish, together with an item from 50 years ago reporting on one of its behavioural characteristics.

Of course, we have not forgotten the Koi keeper and our seasonal addition to the magazine, **KOI EXTRA**, is making its return appearance to bring you many different slants on this colourful area.

We are well aware that there may be many people who are not fortunate enough to have sufficient space to accommodate a pond but who, nevertheless, would appreciate the addition of water in their garden or in their conservatories. The "water feature" has become almost ubiquitous in every garden centre or garden show and we have gathered together a few ideas for you to consider.

Finally, we have still managed to cram in our regular features plus a few things to keep our "tropical" readers involved and promise not to allow their interests to become submerged during the coming "outdoor" fishkeeping months.

Dick Mills

EDITOR

E-MAIL ADDRESSES:
dickmills1@compuserve.com
dick@aandp.freemove.co.uk

COMMENT

Back to BASICS

The Siamese

IGGY TAVARES, PhD ... photographs by the author using a Pentax Z-20 camera

Male Siamese
Fighter
displaying to
female.

I remember building and setting up my first community tank some 20 years ago. Silicone rubber had already hit the market and I used it to build a long narrow tank to fit onto a shelf.

Among the first fish I kept was a beautiful blue Siamese Fighter together with some Swordtails, a pair of Angels and some Neon Tetras. All these fish were new to me, as my previous experience had been limited to wild Guppy keeping in Africa.

Apart from disappearing Neons, the other fish settled down in their new home. The male Fighter in this set-up was a sedate character with drooping fins, who minded his own business. A week later, a blue female Siamese Fighter was added to the tank.

As if by magic, the male woke up and suddenly became a flamboyant character, with fins outstretched, swimming vigorously while courting the female and threatening all the other fish. This embarked me on the great adventure of studying spawning fish.

Betta splendens (Regan), the Siamese Fighting Fish, as its common name suggests, is today a splendid, colourful, man-made, long-finned anabantoid fish. Wild-type fish originate in Thailand, where they are found in ponds and slow-flowing rivers.

Today's cultivated males have long flowing dorsal, caudal and anal fins and come in all shades of red or blue as well as pinks and some yellow.

Females have shorter fins but usually have colourful bodies. Males are pugnacious and territorial and in order to preserve the long fins undamaged, shops tend to keep the males in small individual



jars. Females are less aggressive and are usually kept together in a tank, until sold.

The Siamese Fighting Fish, which is an anabantoid, breathes through its gills but also has a labyrinth organ which is an auxiliary breathing apparatus. The labyrinth organ is filled with air gulped via the mouth at the surface and aids in oxygenating the blood.

The labyrinth organ has saved my Bettas on more than one occasion when they have jumped out of the

tank. On one occasion I found a dried up female on the floor, still alive, who made a full recovery in time. On another occasion a female was found in a teacup which contained enough liquid to keep her alive all day.

Aquarium set-up

Companions for Siamese fighting fish need to be chosen with care. Barbs and other fin-nippers such as

Fighter



Serpae Tetras target the long fins of the male; so these fish should be avoided if the male Betta is to have a decent life. The Betta might do reasonably well in tanks of mild-mannered fish, such as Guppies and Tetras.

However, if a female Betta is added to the tank, the male could get very aggressive and even kill some of the other fish. I recently set up a male Betta in a small tank (12x8x8 inches) fitted with a sponge filter and a small heater-

thermostat. Plastic plants were used for decoration and also to provide cover for the soon to be added female Betta.

Feeding

My Bettas happily ate TetraMin flake, but occasionally I fed them Whiteworm and small Earthworm. It was interesting to watch them eat the worm which they obviously relished and ate with a great deal of chewing.

Breeding

I put a glass divider into the tank and introduced a female on the other side of the male. It is always a pleasure to see a sombre swimming male suddenly perk up and stretch his colourful fins into a glorious display. Soon the male was building a bubble nest at the water surface in one corner of the tank.

For a few days I started feeding live food more regularly, and the female soon filled with roe. Her white ovipositor was showing and horizontal bands on her body indicated that she was ready to spawn. The divider was carefully removed and the pair were allowed to get on with it.

They spawned the next day in the afternoon. The male, fin flaring wildly, finally managed to entice the female under his nest. Here the male wrapped his body around the female and after many dummy runs they released eggs and milt.

The male would break away from the embrace, collect the falling eggs and pop them into the nest, sometimes helped by the female

who was slower to recover from the Microworm. Some serious breeders swear by newly-hatched Brine Shrimp but I find Microworm just as good and easier to raise.

At about four weeks the growing fry need to inflate their labyrinth organ for further proper development of the fish. There are many casualties at this stage if this is not accomplished as the fish develop breathing and buoyancy problems.

The requirement for warm air when the labyrinth is first inflated is apparently a myth, as proved by its proper development under various conditions. However, the tight-fitting lid is required to stop them jumping

Female Siamese Fighter.

FACT FILE

Scientific Name: *Betta splendens*

Common Name: Siamese

Fighting Fish: Fighter

Distribution: Thailand

Size: 2.5 inches (6cm)

AQUARIUM CARE

Aquarium size: 36x15x12 inches (90x37x30cm)

Aquarium decoration: Well planted tank

Temperature: 26-28°C

Water: Hardness, not too fussy (pH 6.5-7.5, 4-10°DH approximately)

Diet: TetraMin flake, some live or frozen food

Fish kindly provided for photography by Fin King Aquatics, Elephant and Castle, London.

BACK TO BASICS ... The Siamese Fighter

out! I did manage to raise some 20 fry to young adults before passing them on. To successfully raise a large number would require bigger tanks.

At the stage where the fry are

free-swimming most fish breeders recommend that the male be removed to another tank, which is what I did. However, many fry were also transferred accidentally with the male to his new tank.

The male Betta did not molest these fry and what I found was that these fry grew at a very much faster rate than those left in their original tank, even though they did not get any extra feeding or treatment. I am not entirely sure what the reason for this was and whether the father's presence had any influence on their growth.

A more likely explanation might be that the fry were less crowded and therefore grew at an enhanced rate compared to their more crowded siblings in the spawning tank.



Red Male Siamese Fighter.

Conclusions

Betta splendens is a beautiful yet tough fish, which can live in waters that are less than perfect because of their labyrinth organ. Only one male per tank can be kept because of their tendency to fight, which involves ripping each other's fins to shreds.

Under certain circumstances they can be kept in a community tank but always do better in a small tank of their own.

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DICK MILLS says that water in the garden needn't necessarily involve fish, or digging ...

photographs by A&P Library unless otherwise stated

Decorative Water Features

Just a simple water feature — if you've got room for it!



Mention to most people that you're thinking of having water in the garden and they immediately offer advanced sympathy, usually in respect of hard work, back problems, digging machines, muck and filth and so on.

However, it doesn't have to be like that at all. Not everyone is blessed with sufficient space to put in a water garden, nor even the smallest of ponds. A recent television programme showed that even a rooftop garden or balcony can play host to a very inventive water garden design and there was not a solitary fish or true aquatic plant in sight.

What appeals to most people is not so much the visual appearance of water as its sound which, if you think about it, can be generated by the merest trickle rather than a cascading torrent than drowns out all conversation.

This is particularly of benefit when a water feature is to be set up within the ordinary "living space" such as a conservatory (or even a lounge). The success of the myriad of design that you see at all the house and garden furnishing exhibitions all depends on one thing — a small electric water pump, which re-circulates the water — often from the shallowest of reservoirs.

It goes without saying, therefore, that the vast majority of such features are entirely unsuitable for the inclusion of any forms of wildlife; either the water content is too small or the design may be constructed of lethal materials,

smallest practicable reservoir but you must remember that in summer there will be considerable evaporation losses and any water feature with an inadequate "reservoir" will soon run dry with tragic consequences for the pump

and for your temper.

The now ubiquitous pebble-fountain or millstone design can be serviced by a sunken reservoir without any problem (nothing being visible above ground to give the game away) but there should be a reasonable "catchment area" around the feature so that all the falling water is returned to the sump for recirculation and not allowed to seep away into the surrounding ground.

An area of pebbles is thus best laid on a plastic-covered wire mesh (to support them) with the whole collection area having a sheet of pond liner material beneath which drains towards the central reservoir. Having a large catchment area also solves a water loss problem on windy days where water could be blown well away from a smaller water feature.

For maximum effect water should emerge from where you want it to and not where gravity and poor connections dictate. Drilled boulders having hoses passed through them should have the clearances around the hose outlet sealed so that water emerges from the top of the boulder to flow over its face and not and seep down the

The smallest space can be a home for a water feature.

Pebbles make an attractive base for this bell fountain.

PHOTOGRAPH: DAVE BEYAN



such as copper tubing or "leaves" formed from the same toxic metal.

On the other hand, the very absence of life in such water features means that they can often be "cleaned up" should they fall foul of algae growth by the simple expedient of adding a little household bleach to the recirculating water.

As already mentioned the design of decorative water features centres around a reservoir of water, a simple submersible pump and then it's a case of any creative structure you care to name to affect the water movement.

This can be from an "overturned" watering can, any number of angelic cherubs with water coming from any orifice you might care (or not!) to name, right up to inclined sheets of glass either forming a free-standing garden sculpture or even the roof of the conservatory; you name it, and it's probably had water pumped around, through or over it at one time or another.

Ensure minimal water loss

The main point to watch, when designing a water feature, is to ensure minimal water loss. Of course, it is advantageous in some respect when installing to have the



DECORATIVE WATER FEATURES ... Minus fish and digging

The use of strategically placed light can give an extra dimension to any water feature.

A trickle cascade made from reclaimed materials.

PHOTOGRAPH: DAVE BEVAN



hole! The same sealant can be used to construct any desired "boulder mound" and also to seal unwanted diversions to the wanted flow path for the water.

As many of the water features will be constructed to be used in a small space, generally nearby to the house, it is a classic opportunity to make use of low-voltage submersible pumps. The necessary "step-down" transformer is conveniently housed in a room facing the garden or conservatory and the



electrical wiring to the pump simply passed through the wall (or even a window or door-frame).

No special protection is required — either to safeguard the cable against damage as there is no risk of receiving an dangerous electrical shock: the cable does not need to be of any robust gauge, it needs no armour-protection and need not be buried to any depth. You can bury it in a length of plastic coldwater pipe for ease of location or simply hang it along a fence.

DECORATIVE WATER FEATURES ... Minus fish and digging

Look closely at the gently rippling overflows from these pots — you don't always need high rise jets to create an effect.

An artistic variation on a theme, well suited for a corner of the conservatory.



Solar panel operation

Most modern low-voltage pumps are not affected by a drop in performance due to excessive lengths of cable (extension cables are available) and lengths of up to 100 metres are not detrimental to performance these days. If you really want to get right up to date there is not reason why your pump cannot be operated by a solar panel.

However, this is not an "upgradable" option from an existing low-voltage pump set-up; the solar panel has to form part of a completely dedicated package. Even though the voltage may be the same any conventional low voltage pump will not work with

a solar panel.

Using solar energy means that the amount of wiring can be reduce with

the panel sited alongside (or even form part of) the water feature.

There's only one drawback to this operation you are dependent on sunshine (or at least a cloudy-bright sky) for any performance.

Whilst there are many set-ups commercially available the extra appeal of a decorative water feature is that you can make tem out of almost anything, thus opening up all sorts of designs to you fertile imagination. Most ceramic, terracotta and even glass, materials can be drilled with care and silicone sealant can "rescue" many a lost causes.

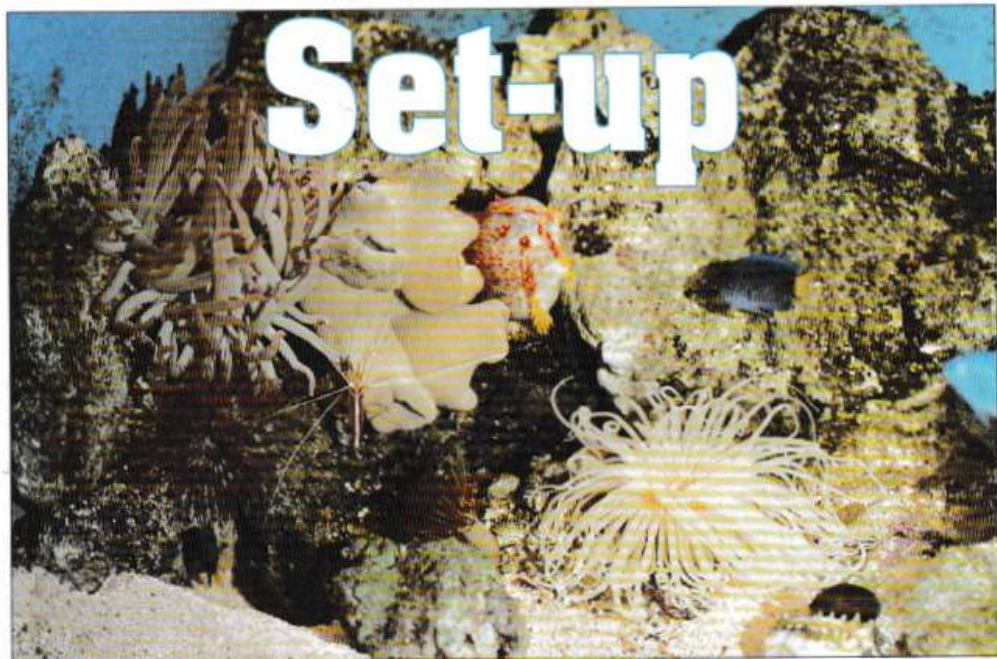
There's a final bonus to consider too — should you move house you can always dismantle the water feature and take it with you — how many pond owners can do the same?



DAVE GARRATT offers a marine community for the smaller tank ...

photographs by A&P Library

Small Tank Community



With light biomass, this lightly stocked aquarium houses small fish and the occasional invertebrate.

Many newcomers to the marine hobby will start with a fairly small tank. From an economic viewpoint this is the sensible option because if the hobby loses its attraction then a much smaller amount of cash has been lost.

Unfortunately, small tanks are not the easiest of tanks for the beginner to keep as larger bodies of water are inherently more stable. However, it is overstocking, not the potential instability, that leaves many beginners floundering.

A standard three foot aquarium is

usually of the order of 36x15x12 inches and after allowing for displacement by the filter bed and rockwork holds no more than 21 to 22 gallons.

Using old fashioned, but nevertheless reliable guidelines, of one inch of fish per two gallons of water, then such a tank can only house a maximum 11 inches of fish, even when the tank is at full maturity.

Although I have mentioned the old-fashioned nature of these stocking guidelines they are still regularly used for example, as late

as December 1998, a very respectable American magazine was quoting similar guidelines.

The only way to make the system more scientific would be to weigh your purchases and use weight of fish per gallon of tank water, not really a practical approach.

These draconian stocking levels bring a dilemma for the aquarist as tank capacity is easily reached with just a few fish. The hobbyist is then tempted to overstock, with disastrous consequences. A small tank need not be a hindrance to keeping a thriving marine

SMALL TANK COMMUNITY SET-UP ... Compatibility

community as the thought and careful planning needed for such a tank can only foster good fishkeeping habits.

Added interest

With such strict stocking limitations the marine aquarist has to ensure that every single fish earns its keep by adding to the overall beauty, balance and interest of the tank. After all, if the tank holds your interest you are less likely to be looking to squeeze in that last extra fish or two.

Hopefully, using the vast range of colour, patterns, habits, quirks and lifestyles found amongst marine fish, I can suggest ideas that should develop an interesting and attractive tank, capable of retaining the interest and attention of even the most demanding hobbyist.

Classic partnership

In previous beginners' articles I have always suggested fish only as the best way forward. Again this article will follow that same basic advice except to enhance our small community I will include a few hardy (or irresistible) invertebrate options. The first exception has to be one of the most evocative of all marine life images — the Clown/Sea-Anemone relationship — few can resist its attraction.

Clownfish come in a number of

varieties, each with their own degree of aggressiveness, hardiness in captivity and preference for certain anemone species. One of the most common fish within the hobby is the Common Clown, a name often applied to two species, *Amphiprion ocellaris* and *A. percula*.

Whether they are in fact two species or a single species with a sub-division is open to debate. Both fish reach around two inches in the aquarium and both favour *Heteractis magnifica* or *Stichodactyla gigantea* as their host Anemone.

Both are available as tank-reared species, although I know to my personal cost that if they have been raised to a fairly advanced adult stage in a tank without an Anemone, they may not take to one at a later date.

The Common Clown is a fairly peaceful species but nevertheless, in common with other Clownfish, it will aggressively defend its anemone and territory from other fish including other Clowns. Therefore, in a small tank you should only keep a single species or a pair.

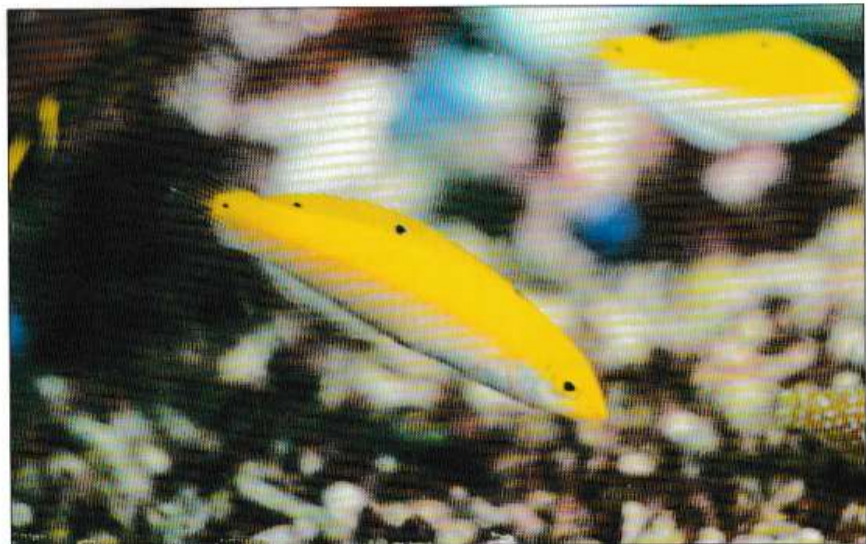
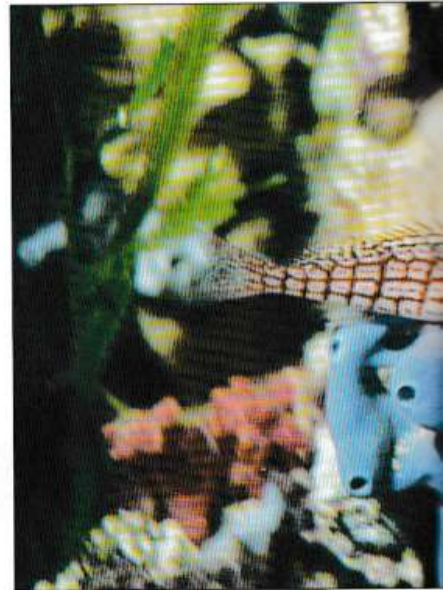
Some Clownfish, such as *A. polymnus*, the Saddletail Clown, and *Premnas biaculeatus*, the Maroon Clown, are too aggressive to consider for a small tank. Tomato

Clowns can be a problem because of confusion over their name and identity, because some can become aggressive they are best avoided unless you know exactly the which species is being offered.

Clownfish, other than the Common Clown, that offer similar possibilities for a small, Anemone-fixated addition to your community include: *A. akallopisos*, the Skunk Clown, and *A. perideraion*, the Pink Skunk, both are peaceful additions that will only reach two to two and a

This Longnosed Hawkfish, *Oxyrrhites typus*, finds an outcrop of Blue Coral is the perfect lookout point as it awaits a passing meal.

The colour and shape of this fish means it can only be called a Banana Wrasse!



half inches in captivity and prefer similar Anemones to the Common Clowns. *A. clarkii*, the Banded Clownfish, may grow slightly larger, reaching three inches but remains generally peaceful and will happily use quite a range of Anemones.

Perpetual motion

Never ending activity in the shape of browsing, inquisitive nose-poking and the odd skirmish, is another way of adding interest to your tank. In this respect the Damselfish are the masters, although many come



with the unacceptable price of aggression.

Definite non-starters are *Abudefduf oxydon* (Black Velvet Damselfish), *A. saxatilis*, whose common name says it all — the Sergeant Major, *Stegastes leucostictus* (Beau Gregory), *P. caeruleus* (Electric blue), *Dascyllus trimaculatus* (Domino) and *D. melanurus* (Humbug). The Yellow-Tailed Blue Damselfish (*Pomacentrus violascens*/*Chromis xanthurus*) receive a mixed press as to their relative meanness. This may be due to individual fish, differing species, or geographical origin.

We would appear to have effectively removed the choice of all the common and/or colourful Damselfish from our considerations on the grounds of aggression. There is, however, a more peaceable genus of Damselfish, the *Chromis*, of which the Blue and Green (*Chromis caerulea* and *C. cyanea*, respectively) are regularly seen for sale. In view of the mixed reports of aggression you may also decide to risk the Yellow-Tailed Blue Damselfish mentioned previously.

Because Damselfish are colourful, active, small, easy to feed, very hardy (and cheap!) they must be worthy of consideration for your community. I would suggest you buy very small juvenile species and do not make them the first addition to your tank.

Striking colouration

Is there a single fish that can pack such vivid colouration and stark contrast into a two inch body than the False Gramma, *Pseudochromis paccagnellae*. You could almost believe that such a sharp a division of colour could only have been achieved by foul means (two different fish, a knife and some glue!).

The fish can have its drawbacks as older specimens can be territorially aggressive, viciously so to members of their own or similar species and I have heard that the fish can also become aggressive as it ages. The potential drawback has to be weighed against the striking appearance of this fish.

Other equally colourful, but not as striking, species include *P. diadema* (Flash Back Gramma), *P. porphyreus* (Strawberry Gramma) and *P. flavivertex* (Sunrise Dotyback).

A more peaceful alternative, but still aggressive to similar fish, may be the graceful, beautifully-coloured, but not quite as strikingly marked, *Gramma loreto* (Royal Gramma) or *Gramma melacara* (Black Cap Gramma).

Quirky behaviour

If you want added interest in your tank then the two, often confused Families, of the Gobies and Blennies are for you. Blennies and Gobies are bottom dwelling species that spend a great deal of time scurrying in and out of rock work



The Skunk Clownfish, *A. perideraion*, loves its home in this pin-tipped Sea Anemone.

SMALL TANK COMMUNITY SET-UP ... Compatibility

and caves.

Both fish also perch on surfaces throughout the aquarium. Blennies tend to rest on their pelvic fins whilst Gobies are even better equipped to hang around watching the world go by as their pelvic fins are fused into a disc that allows them to perch virtually anywhere and in any position. Both fish will swivel their eyes and seek refuge at the first sign of danger with Blennies having the endearing habit of reversing into their home burrow, this being seen at its best if you provide a multicompartment "house" such as a Barnacle cluster.

Both Blennies and Gobies are generally hardy, disease resistant, easy to feed, ideally suited for captivity, and do not require you to break the bank to purchase one.

Blennies are territorial and will not tolerate similar species although they are peaceful towards dissimilar species. Gobies are generally more tolerant but will not accept their own species unless a true pair is present.

Possibly the most common Blenny is the Bicolour Blenny (*Ecsenius bicolor*) whilst the Midas Blenny (*E. midas*), Redlip Blenny (*Ophioblennius atlanticus*) and Banded Blenny (*Salarias fasciatus*) are also suitable species.

Steer clear of the Sabre-Toothed Blenny (*Aspidontus taeniatus*) because of its unsociable habit of mimicking the Cleaner Wrasse and then biting instead of cleaning! I would suggest that the Scooter Blenny (*Petroscirtes temminckii*) is too demanding for the beginner.

There are some truly fascinating choices within the Gobies, the *Amblyeleotris* genus being one such choice. They excavate a burrow and then share it with a Pistol Shrimp (*Alpheidae* genus), hence their common name of Partner Gobies. I am not sure what each party gets from this symbiotic relationship but it makes for an interesting observation as the behaviour continues in captivity.

Other choices include the larger sand-sifting Gobies such as the Blue Cheek (*Valenciennea strigata*) or Orange-Spotted (*V. puellaris*). These fish constantly burrow, sifting sand and silt, by taking in large mouthfuls and sifting it through their gills as they search for food. They make an excellent hardy, interesting and attractive species for the beginner.

A further symbiotic lifestyle can be found amongst the Gobies, in the shape of the Neon Goby (*Gobiosoma oceanops*). They

willingly act as cleaner fish and whilst the Neon Goby is short lived (one or two years) it will survive a lot longer than your average Cleaner Wrasse.

Still more choices from this large and diverse group of fish are provided by the Lemon (*Gobidon citrinus*), Yellow (*G. okinawa*) or Catalina (*Lythrypnus dalli*) Gobies, none of which will exceed one inch in captivity, although like the Neon Goby they are relatively short lived.

Jewel in the crown

We have already mentioned the striking beauty of the False Gramma and the colourful grace of the Royal Gramma, but is there more choice when searching for that show stopper to put the icing on the cake.

The Dwarf Angels should fit the bill admirably, although they are not as hardy as the fish we have been discussing. If you choose a hardier species and make it the last addition to your tank (you should have gained a little experience by then) you should succeed.

They will add a source of constant motion to your tank as they ceaselessly glide and browse amongst your rock work and aquascaping. All the following belong to the genus *Centropyge* and represent the commonly available, hardier species.

Fireball or African Pygmy (*C. acanthops*), Cherub (*C. argi*), Coral Beauty (*C. bispinosus*), Lemonpeel (*C. flavissimus*), Resplendent (*C. resplendens*), Potter's (*C. potteri*) and Flame Angel (*C. loriculus*).

Another particularly beautiful fish is the purple Firefish (*Nemateleotris decora*). These spectacular fish require plenty of bolt holes as they are rather nervous, but should be ideal in a small peaceful community tank.

If you want a striking red colouration in your tank then look no further than the Scarlet Hawkfish (*Neocirrhites armatus*). It is easy to keep but is rather expensive and will be fairly inactive, spending much of its time perched on one of its favourite resting places.

Other choices

The beginner is by no means limited to the fish discussed so far. For example, to name but a few, other considerations could include:

Regal Tang (*Paracanthus hepatus*), Dwarf Wrasse, e.g. Six Lined Wrasse (*Pseudocheilinus hexataenia*), Banana Wrasse (*Haliocroereis chrysus*) or fish from the Tilefish, Cardinalfish or Torpedo Gobies.

Another very distinctively marked choice comes with the Long Nosed Hawkfish (*Oxycirrhites typus*), whilst the commonly seen Firefish, *N. magnifica*, presents an alternative to its previously mentioned, expensive cousin, *N. decora*.

No effect on stocking levels

For reasons discussed previously our small community tank will basically be fish only. I have however, made a couple of exceptions that I do not feel are beyond the beginner, i.e., Clownfish and Anemone, Partner Goby and Shrimp.

I will now make another exception as it provides a way of adding further interest, colour, beauty and movement to your tank, using hardy livestock, without affecting your fish stocking levels. Consider a Shrimp or two, there are many active and brightly coloured species to choose from and many have the added advantage of providing service to your fish as cleaners.

Cleaner shrimps (*Lyssmata amboinensis*), Blood Shrimp (*L. debelius*), Dancing Shrimps (*Rhynchocinetes urita*) and Pistol Shrimps (*Synalpheus species*) would all make suitable additions.

You could also consider one of the small species of Boxing shrimp (*Hispidus species*) but only a single specimen otherwise vicious fighting will occur.

Conclusion

Even with a small tank and its very restrictive stocking levels you have a large choice of readily available species to allow you to build a colourful, active, interesting, trouble-free, beautiful and peaceful community. You even have the opportunity for a little invertebrate interest too.

All this and at a relatively inexpensive price. Provided you leave a little of your outlay for a good aquarium book and find yourself a good reputable dealer you cannot go wrong — can you?

ALEX STEPHENSON charts the year's activities ... *photographs by Dave Bevan;*
graphic by the author

The Goldfish Season

Prologue

This series of articles takes a look at keeping Goldfish, and will attempt to "shed light" on some of the considerations faced by the hobbyist throughout the year. It

won't make you an expert but might help prevent some unnecessary pitfalls.

Part I

By the time you read this, the

Goldfish breeding season, for some hobbyists at least, will already be underway.

Because our climate only allows a very short growing season, breeders have a decision to make. Should they wait until the weather warms up and the parent fish come into

Telescopic
Eye Goldfish.



THE GOLDFISH SEASON ... Charting the year's activities

condition naturally or, should they hurry things along a bit by using artificial heating and lighting?

In reality, most amateur breeders employ a combination of both methods. Some fish will be "brought on" for early spawnings, while others will be left on a slower regime for later spawnings. One advantage of this, where space is limited, is to "spread the load".

Young Goldfish need an unbelievable amount of tank space, particularly in the early stages. So, having more than one spawning to deal with at any one time is a problem you don't need if your resources are limited.

Despite the fact that most hobbyists have developed, through experience, their own "pet methods", there is no magic involved when preparing fish for breeding. The whole process really begins the previous year and involves good water and good food in order that the fish are in the best possible condition before going into the winter period. It is at this time, during late summer, that the

females are developing the eggs which will mature the following spring.

If your fish are wintering outdoors and you intend to bring them in for an early start, it is important not to raise their water temperature too much, too quickly.

Remember, Goldfish need time to adjust their body chemistry. The ideal is probably a rise of a couple of degrees Fahrenheit every few days. This, of course, is almost impossible to achieve, unless you have a very sophisticated control system.

Need for temperature control

Furthermore, ambient temperatures can fluctuate widely in spring and the difference between night and day is often considerable. All this means that temperature control will need a bit of thought.

If your fish are already in an

indoor environment then some of these problems will be greatly reduced. Bear in mind that most Goldfish breeders agree some wintering, at lower than normal temperatures, is beneficial.

Also, that fish kept at a constant temperature throughout the year may be difficult to stimulate. Some may never breed, while others can spawn at any time of the year.

In situations where the prospective parents have been brought in from an outside pond, many breeders give the fish an anti-parasite bath, or a course of treatment if necessary, to remove any Flukes and such like. This can help prevent an outbreak among the resulting fry. Having to treat diseased fry is always "tricky", and those which don't die of disease often die of treatment!

If intending to use a prophylactic on the parents, wait until their water temperature is in the mid 50sF (13°C) or above and that they are eating well. Pouring chemicals into fish who are already in a delicate condition is "unhelpful". Also some



ANDY HORTON'S SHORE WATCH



IN THE COLUMN FOR THE YEAR I WILL EXAMINE SOME ASPECTS OF THE BIOLOGY AND BEHAVIOUR OF THE ROCK POOL FISH AND MARINE INVERTEBRATES THAT ARE BOTH INTERESTING AND USEFUL KNOWLEDGE FOR AQUARISTS

Monster Lobsters

At the beginning of December 1998, fisherman David Piers from Eastbourne, Sussex, hauled in a Lobster weighing 132lb (6.12kg). This is a monster specimen, dwarfing the normal sized ones; the large crushing claw was as large as a small Lobster.

Very few European Lobsters, *Homarus gammarus*, get this big although the record Lobster, from Fowey in Cornwall, caught in 1931, weighed a colossal 202lb (9.3kg).

These huge Lobsters are not caught in the normal Lobster pots for the simple reason that they are much too large to fit into them. They also tend to live in deeper water.

Lobster's fate

The Sussex specimen was kept alive and after a couple of weeks it was transferred to the Sea Life Centre at Brighton. This provoked a letter to the local paper stating: "If this Lobster has managed to evade the fishermen for so long, why it should be housed in a tank?"

This reply was rather ungenerous, as the fate of



European Lobster, Homarus gammarus. A wild specimen in a magnificent blue livery, with the large crushing claw secured with an elastic band so it cannot attack other Lobsters in the collection pens.

PHOTOGRAPH BY ANDY HORTON

most Lobsters caught is not so luxurious. With this particular specimen there is the obvious problem to find a cooking pot big enough to boil it up and turn its shell red.

However, this implies that all fishermen are entirely mercenary and they do not have respect for wild creatures they struggle to make their living from.

Marine Nature Reserves

There is always a problem of returning bottom dwelling animals to deep water. They may not survive the return to the deep sea. Lobsters are sensitive to small changes in pressure.

Furthermore, there is a good

chance of the Lobster being caught again. The second point can introduce an interesting idea of a Marine Nature Reserve where the marine fauna and flora can be protected from the depredations of fishermen.

This concept has already been incorporated on a small scale in British seas around the Island of Lundy in the Bristol Channel, around Skomer Island off south west Wales and in the Menai Straits separating Anglesey from mainland Wales. Marine life could be allowed to breed and grow naturally.

Lobsters in captivity

Lobsters have been kept successfully for years by the home aquarist but because of their large size are more suitable for Public Aquaria.

All aquatic crustaceans present their own special problems in aquaria because of their method of growth that requires the periodic moulting of their shell to make room for the new shell growing underneath.

The new shell is soft and the Lobster has to find a place to hide whilst the shell hardens by resorbing calcium from the

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Velvet Swimming Crab, Necora puber. This swimming crab can easily be identified by its bright red eyes, which are not found on any other British crab.

PHOTOGRAPH BY ANDY HORTON

old shell and incorporating minerals from the surrounding seawater.

This means that the aquarium water must be rich in the required minerals.

Aquarium water changes over a period of time with the increase of nitrates well known to the students of biological filtration, but there is also a drop in pH to about 7.8 if the required water changes are not made, as well as a shortfall of calcium, magnesium and other minerals required by the new shell.

When keeping Lobster and the larger crabs through their moulting cycle, it is imperative that the 25 per cent monthly water changes are made. This is the absolute minimum and the water changes may need to be more frequent.

Some Public Aquaria use a natural system where seawater is pumped in and out of the tanks when the tide comes in. This has advantages when keeping invertebrates but it is rarely the best system when keeping fish.

In the soft moult condition, all crustaceans are vulnerable to being attacked by hungry fish and even other Lobsters.

Feeding Lobsters

The frequency in which Lobsters enter pots indicates their preference of carrion as the easiest food to obtain when available. However, the seabed is full of scavengers and Lobsters cannot rely on this source of food.

They are formidably equipped with a large crushing claw to tackle Mussels which they can crack open and a smaller cutting and shredding claw to prise the flesh from the mollusc.

In aquaria they will push the sand up to the front of the glass to make their den to hide in and to successfully ambush and catch free-swimming fish like the Whiting.

Their great demands for food requires them to be kept in a larger tank than their physical demands suggest. Although they will eat every part of their prey, some remains may be left in the tank or even buried by the Lobster.

Although all crustaceans can tolerate higher levels of ammonia and nitrites than fish the uneaten remains can still

use up valuable oxygen in the water.

The death of Lobsters in captivity at the moult (ecdysis) stage can also be attributed to inadequate nutrition.

With the very largest of Lobsters the aquarist may not be to blame if the Lobster dies as it may not have obtained nutrition in the wild to satisfy its huge bulk.

There does not seem to be a maximum size that a Lobster can attain and the biggest Lobster will be one that can survive all the considerable hazards in the sea.

Other rare invertebrates

Lobsters are invariably a shade of blue, but the Spiny Spider Crab, *Maja squinado*, is an orange-brown in colour. However, in 1998 several blue specimens turned up, notably one reported by Sue Daly from Jersey and other specimens from off the Dorset coast and the Isle of Wight.

I think the colour may occur because of the crab's diet. A blue Velvet Swimming Crab, *Necora puber*, was also discovered.

In October 1998 a large

Common Octopus, *Octopus vulgaris*, was brought into Plymouth Aquarium. The Common Octopus has been rare in British seas for about 35 years, apparently since the cold winter of 1963.

Fishermen will not object as the Octopus feeds on Lobsters, even slithering into the pots to consume captured specimens.

Jon Makeham, from Looe in Cornwall, spoke to a fisherman who landed an unidentified Squid two metres in length in the autumn. Richard Lord, from Guernsey, reported a dead specimen of the southern Sea Hare, *Aplysia depilans* last year.

March rockpooling

If the weather improves March may be the first month to enjoy the lowest spring tides that occur in the middle of the month from the 16th to the 22nd this year. I would like to hear reports of readers' experiences, especially anything unusual discovered between the tides.

Reports of Large Lobsters: <http://ourworld.compuserve.com/homepages/BMLSS/Lobster2.htm>

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Spiny Spider Crab, Maja squinado. This specimen is in a particularly distinctive orange livery. Many specimens found buried in the sand on the shore are sandy-coloured.

PHOTOGRAPH BY ANDY HORTON

Andy Horton on behalf of the British Marine Life Study Society will help readers who have any difficulties to pursue their interest in the marine life around the British Isles. The first enquiry will be answered free of charge but please enclose a return stamp and do not forget to include your address. For more information please write to: Andy Horton, Shore Watch, British Marine Life Study Society, Glaucus House, 14 Corbyn Crescent, Shoreham-by-Sea, Sussex. BN43 6PQ. E-Mail: bmlss@compuserve.com Web Site: BMLSS (England) URL: <http://ourworld.compuserve.com/homepages/BMLSS/BMLSS> (Scotland) URL: <http://www.ed.ac.uk/~evah01/bmlss.htm> The Webmaster for the Scottish site is Alain Pemberton.

Kathy Jinkings logs
on for more Internet
Fish Information

CAUGHT IN THE NET

There can be few aquarists who have never owned, at one time or another, one of the labyrinth fishes. These fish from still waters have developed the ability to take in and use air from the surface, enabling them to live in stagnant and oxygen-poor environments.

Most people will be familiar with the jewel-bright colours of the Dwarf Gourami, and the trailing finnage of the Siamese Fighting Fish.

In addition to these, there are a great many others, some not so familiar to aquarists. This month, we will be trawling the Net for a catch of these fish.

We start this month's surfing with a fish that will be a familiar sight to everyone, at the 'Fighting Fish Page' in the Siamese Cyber Aquarium', <http://www.fortunecity.com/marina/sanpedro/122/main.html>. Bettas are common enough on the web, but this page is a little different. Written by a Thai who has been keeping and breeding fighting fish since 1965 it is written in a personal style as the author shares with us his experiences of first catching and keeping 'Plakat Thung', the wild Betta, and how his experience and knowledge grew.

On occasion the English is a little unwieldy, but is perfectly readable and, I suspect, a good deal better than most English people's Thai! As he now breeds and exports the fish, there is a page of shipping information, but commercial considerations are certainly not intrusive here.

Not everyone will approve of some of the thoughts on this page, as the title 'Fighting Fish' is still appropriate in Thailand. It is explained how fish are chosen to breed when they are successful in fights, while the loser returns to the river. The site continues with descriptions of an organised fish fight, the origins of the brilliantly-coloured long-finned fish that now appear in our aquaria, breeding the fish, different types of fish, and much more.

The gallery features a wide range of pictures, including wild and cultivated fish, as well as habitat pictures. Treatments for diseases will be of interest to Western readers, but probably not much use practically. They include Banana leaf for 'Pop Eye' and mud for general cures, as well as many other local cures.

It would be interesting to know the success rate of such treatments compared with our own bottled chemicals. For anyone interested in *Betta splendens* a visit to this site (as well as reading Iggy Tavares' article in this issue) is a chance to see the fish from a different culture, and learn a great deal about its origins while doing so.

This is worth spending some time at,

and is a must-bookmark for Betta enthusiasts.

For those interested in the behaviour of the Betta, a visit to the Centre for Innovative Computer Applications,

<http://www.cica.indiana.edu/projects/Biology/>, shows a novel use for the computer.

Using computer imaging the programmers created animations of the fish so that they could observe the behaviour of real Bettas when they were shown the pictures. The movies, animations, and still pictures can be viewed here.

Labyrinth Fishes, at <http://www.adera.be/fish/indexf.html>, is an extremely comprehensive site with information not just on the more familiar labyrinths, but on a wide variety. A link-up to the newsgroups provides quick access to conversations that have been going on (in several groups) about fish of interest. On first arriving at the site, clicking one of the main links from the menu on the left results in a submenu/information screen about the group in the right hand pane.

These 'starting points' include the Perciformes, Synbranchiformes, and Channiformes. When the information page opens on the right, the menu also changes to allow the user to select one of the families from the group. Eventually a species list is reached.

Clicking a species results in a page of information (in some cases more comprehensive than others — some are a few words, some are complete and lengthy articles), with a photograph, and, if appropriate, a 'number of messages'. Clicking on the messages link results in an index to the different messages posted about that fish on the newsgroups.

As with all newsgroup messages, some are more sensible than others. You may well be surprised, browsing through this section, with how many fish are listed as air-breathers!

In addition to this reference guide, the site features a set of buttons at the top of the page. The Maps section allows the reader to click on an area and see information on all the labyrinth fish that occur there. The reader can choose to work from a map of the whole world (bits without any labyrinths don't link anywhere or do anything) or detailed maps of Malaysia and Indonesia, and West and South Africa.

Siamese Fighting Fish fans get information here too, in the form of pages explaining (briefly) the complexities of Betta genetics, plus a guide to identification of different species, by simply clicking the options on a form that

fit the fish you are trying to identify. A list of books of

interest, which you can buy through the Amazon bookshop, and a Celsius to Fahrenheit conversion complete the list of features. This is a comprehensive reference site for anyone interested in all the labyrinth fish.

At the Communauté Internationale pour les Labyrinthides, <http://members.aol.com/Phlichev/>, a wealth of information awaits in both French and English. The CIL bulletin, *Le Macropode*, is unfortunately only in French, but there is plenty of other information for non-French readers, with pages, including pictures, on a variety of species. These include *Sandelia bairdii*, the subject of the 'Sandelia Project', which aims to save this threatened fish.

At Glass Houses, <http://www.indy.net/~harley/anaban.htm>, there are a number of articles on various labyrinth fish. The articles on the Pearl Gourami, Honey Gourami, *Betta imbellis* and the Croaking Gourami exist and are comprehensive and good reading. The other links, including the strangely-named 'Another Gourami' appear to have vanished.

The Giant Gourami not only grows to a huge size, but is also, in my humble opinion, astonishingly ugly. Nonetheless, this is a fish with friends, and one of them can be found at The Osphronemus Gourami Site, which is, for some unknown reason, found at the inappropriate address <http://www.users.zetnet.co.uk/clarias/>. Here you can decide for yourself on the appeal of the fish, as well as finding out lots of information. Tank setups, breeding, and suitable tank mates are just some of the subjects covered, as well as a gallery of pictures of both the Gourami and other fishes.

An owner's register is also being compiled via a fill-in form on the site, although there is no explanation of why the information is being gathered or of what benefit it will be. As a final touch, on which we will end this month's tour, a page from the links section offers alternative uses for your Giant Gourami — apparently if you write to Wilhelm Grabert, D72531 Meidelstetten, Germany, he will send you a selection of suitable recipes!

Next month we will take a look at two of the huge fishes which live short lives in garden ponds and aquaria but deserve better and are fascinating animals. The Paddlefish and Sturgeon are better observed at a distance than kept at home, and we will be finding out about them on the Net.

Kathy Jinkings (British Aquatic Resource Centre — <http://www.cfkc.demon.co.uk>), (AquaSource International — <http://www.aquasource.demon.co.uk>)



50 Years Ago ...

As recounted by Editor **Dick Mills**

In the period immediately after the war the increase of interest in all things aquatic was rapid. Looking through past issues of *A&P* makes interesting reading not only for the diversity of subjects raised but for the apparent enthusiasm by all contributors whether they be authors, reporters from Societies or letters from readers. March 1949 threw up this selection of topics ...

- Most people would assume that the hobby of fishkeeping is as innocent as the day is long but from time to time, doubts do creep in. Without wishing to either frighten societies or to malign the reputation of our Customs & Excise authorities, way back in 1949 the legality of societies' private auctions was questioned by one society which was asked for an extra fee of £20 (no small amount then either) to cover an auctioneer's licence!

- More 'bad news' was the announcement of a 25 per cent rise in the cover price of *A&P* — up from one shilling to one shilling and threepence (5p to 6p approximately in today's coinage). Having held the original price from 1925, through the general price rises of 1938 and also the more drastic rises seen in 1945, the increase was to be justified with more text for your money (narrower margins would allow the equivalent of four more pages) — remember paper restrictions meant no increase in page numbers per issue. A new cover design and the non-numbering of advertisement pages (to assist those readers wishing to bind up their own copies) were also innovations introduced with the start of the new Volume 14 in April.

- The popularity of the Bog Garden was in evidence with a detailed article on maintaining its necessary moisture by the

simple expedient of utilising the overflow from the adjacent pond.

- Readers familiar with the current use of a certain species to advertise the Goldfish Credit Card probably won't be surprised to learn that the inclusion of an aquatic subject is not a new, modern day phenomenon. Back in 1949 coloured pictures of exotic fishes were being used to advertise toiletry luxuries manufactured by a famous perfumer. Species featured included Seahorses, Fighting Fishes and Angelfish. Apparently the artist's work was complimented both for choice of subjects and for adherence to natural accuracy.

- A recurring feature in *A&P* throughout its history is the readiness of its readers to improvise, invent and generally adapt almost anything and everything to their aquatic needs. Obviously it wasn't long before War Surplus materials became pressed into service. But the conversion of the materials from a brick air-raid shelter into a pond takes some beating (and some knocking down come to that!). The rubble formed the necessary hardcore for the concrete base whilst the concrete slab roof came in handy for the surrounding walls and rockery.

- The name W. Harold Cotton became synonymous with fish

pathology through his postal "post mortem" services, which enabled aquarists to ascertain causes of death to their charges. However, in the early days, he also ventured into the equipment marketing side of things and the Air-Cushion Aquarium was of an innovative design. Available in blue, cream or gold, the aquarium used "no fully-immersed and temperamental electrical appliances with trailing wires." The beneath tank heat chamber used easily-replaced electric lamps and, thanks to its tank-surrounding design, heat losses were so gradual that a thermostat was not needed. The heating system could be switched off all day — to comply with current-saving requests. A nine gallon tank lost only two degrees of heat over 12 hours in an unheated, north-facing room with outside temperatures at freezing point. Prices ranged from seven guineas (7.35) for a 18x12x12 inch nine gallon aquarium to 10 guineas for a 15 gallon 30x12x12 inch. To the basic tank dimensions approximately an extra 2 inches in length, 1 1/4 inches in width and 6 inches in height had to be allowed for to accommodate the heating chamber.

- The Neon Tetra was, understandably, still attracting considerable interest just a dozen or so years after its introduction to the hobby in the mid 1930s; of course the race was on to breed it with often more failures than success. The quality of water was not thought to be the problem, as P. A. Shark wrote. Incidentally the expected pH of ordinary tapwater was considered normal at between 8 and 9 (and we think we have problems!). Using such water (left to "age" in sunlight for a few days) with some sprigs of salt-solution disinfected Nitella or Myriophyllum in the

spawning tank regularly produced eggs from the fish without fail. The secret of avoiding egg-disintegration was to exclude all direct light to the tank. Following hatching the covering to the tank should be progressively removed after around six days but still avoiding really strong lighting.

- The latest in DIY decorative aquarium design was a Table Lamp Aquarium made from a ten gallon glass carboy, complete with lampshade on top. The design also included an external filtration system housed in a cabinet on which the lamp stood and, of course extra aeration was provided to make up for the small water surface area.

- News of reptilian interests regularly featured in *A&P* and the British Herpetological Society reported that membership was up to 180.

- If you think video is the "in thing", a couple of reports showed that moving images of aquatic life was going strong way back in 1949. Ilford & District Aquarists & Pondkeepers Society enjoyed a film showing Angelfish spawning complete with egg-hatchings. Southport A.S. received from member Mr N. Burrows an excellent talkie film show, one of the films being "Fish Faces". Mr Burrows consented to act as film advisor and projectionist to the Society.

- In an effort to help the economy drive, tropical fishkeepers of the Luton & District Aquarists & Pondkeepers Society were urged to keep more of the exotically-coloured coldwater species, if they felt they were approaching the limit on their electrical-consumption capacity.



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EDITOR
Dick Mills**ART EDITOR**
Mick Beeken**ADVERTISEMENT
MANAGER**
Gwen McNeil
Tel: 01233 713188**SALES CONSULTANT**
John Young
Tel: 0181-904 8886**PUBLISHER**
Ian Hunter**PUBLISHED BY**
MJ Publications Limited,
20 High Street, Charing,
Nr. Ashford, Kent TN27 0HX**TELEPHONE:**
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EDITOR'S COMMENT

The beginning of any new season is the occasion for many exciting thoughts — anticipation, planning, comparisons to previous years and the like. For some it may be the very first fresh season after the winter and much interest will be taken to see how (and, for those inveterate worriers), if the fish have survived.

Despite the normally held belief that spring is the time for regeneration and a burst of enthusiastic life it is also a well appreciated fact amongst pondkeepers that it is also a time of danger for the health of the fish, especially until their immune systems have kicked in with their own natural defences.

Basic things like getting the fish to feed in a progressive manner (no sudden gourmet meals, until the water temperatures have attained a reasonable "high"), hoping that the dormant biological filter can be resuscitated in a short space of time, and whether that UV lamp will be up to the job for another season are among some of the subjects that top the list.

At this time, too, there are those for whom a pond is a dream, about to come true. The design of such will affect how successful the pond will be in years to come, so you might as well get it correct right from the start!

Once you get around to choosing the fish then there are more puzzles for you to unravel, but we won't go into identification of strains at this point. Instead, we ask the question: "Are all Koi the same?" Are some more difficult to keep than others; what are good strains for the newcomer?

Hopefully, having avoided the above potential pitfalls, you can then settle down to some pleasurable Koi keeping, with enough spare time to read further issues of **KOI EXTRA** throughout the summer!

EDITOR

E-MAIL ADDRESSES:
dickmills1@compuserve.com
dick@aandp.freemove.co.uk

FRONT COVER

PHOTOGRAPH BY DAVE BEVAN

KOI IN SPRING

**BARRY
GOODWIN**

looks at how
Koi cope with
the problems
of spring

*Photographs by
the author*



Your Koi may come to the pond surface on warm days during early spring, but beware: feeding them at times like this could be fraught with danger.

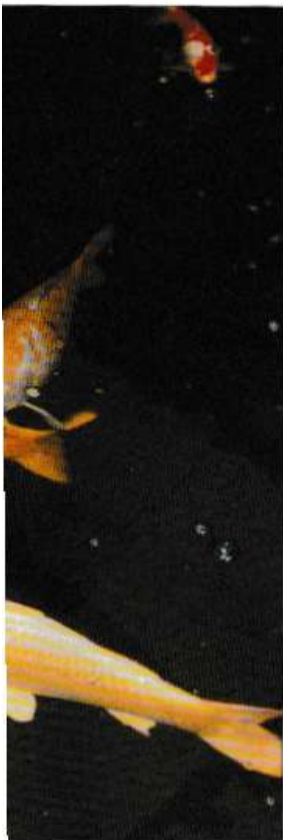
Most of us are now looking forward to the long hot days of summer again when we can sit in our gardens and enjoy our Koi to the full once more. However, before the summer arrives our Koi have to surmount the spring, and how well they do this can depend a lot on how

well we have overwintered them, which determines to a great extent how fit they are. It can also test our knowledge in how we interpret what our Koi are telling us as they wake up and become more active again. If your pond has been covered over winter, as I have often recommended, then your Koi will have been spared the coldest temperatures. Covering

will also have increased the length of time that you were able feed your Koi, which will place them in better stead to face the spring. If you leave your cover in situ until the beginning of May, instead of removing it in March as some Koi keepers do, then you will also spare your Koi the severe temperature fluctuation that inevitably comes with early spring.

As those of you who regularly follow my articles will know, I am in favour of letting my Koi have a winter until the end of January. My cover is then fitted and taken off again in the first week of May.

It is the extreme fluctuations in temperature encountered without any form of cover in place, during March in particular, that is responsible for many of the problems that can afflict our Koi in the later summer time.



WINTER CONSIDERATIONS

Let's consider first of all the winter period that our Koi have just been through. In a wild environment, carp will not have had extremely low temperatures to endure as they do in an unprotected pond.

The temperature will not have fallen too low and they will



have been able to find warmer layers of water at depth due to the establishment of what is known as a thermocline.

Here the warmer water is found in the bottom layers, rather than the uppermost. An average pond is too small for a thermocline to establish itself, the temperatures will drop throughout for longer periods of time, and as a result most keepers will not have fed their Koi for a long period.

This inevitably produces weakened Koi at the end of the winter. As temperatures start to rise in spring, the Koi will become more active, and we start to feed again but must be careful not to overdo this.

Not only will our Koi be at low ebb, but also the filtration system will not yet be capable. This must increase its biomass again to cope with the extra ammonia being produced by the Koi as their metabolic rate increases.

Ammonia could persist in pond water at this time, followed by the longer and more difficult to deal with nitrite as the oxidation process begins to function once more.

Consider all of these factors

together, and the result is high stress levels in Koi. Stress prevents their immune systems fully reactivating after the dormant winter period, and leaves them open to attack by pathogens — I am sure we can all follow the scenario from here onwards.

HIDDEN SPRINGTIME DANGERS

The fluctuations in temperature during spring are caused by unsettled weather that can give us glorious days of sunshine followed by periods of what seems like deep winter again. We see frost and even snow, accompanied by bitter winds. It is the cold wind that has the greatest effect of all.

This fluctuation in temperature has hidden dangers, for as well as those already discussed it is certain that we will be tempted to feed our Koi on days when the sun shines and they are swimming and actively looking for food. Their instinct tells them that the temperature is once more conducive to feeding, but it does not indicate to them the dangers inherent with pond existence.

The temperature could quite easily drop during the following days to that which is no longer conducive to feeding. If your Koi have undigested food in

Your filter will need time to recover after the winter period. Don't overfeed until it is back on line.

KOI IN SPRING

◀ their gut at this time, then this could lead to problems if it should putrefy. The lesson to be learned is not to feed your Koi until the temperature is constantly above 45°F-50°F (7°C-10°C) and rising. The temperature you choose will depend upon your size of pond, which will to an extent control its temperature stability. Feed only low-protein food at first, and as the temperatures rise further this can be mixed with higher protein food, and eventually high-protein can be fed exclusively.

NEVER MAKE THE CHANGE SUDDENLY AND COMPLETELY — ALWAYS MIX ONE WITH THE OTHER FOR A WHILE.

It is entirely possible that if you have let temperatures drop too

low in your pond during the winter, that you may have one or two Koi that have suffered in one way or another. The most common result of low temperature is failure of the swim-bladder to function. I have never known a Koi to completely recover from such swim-bladder damage. Keeping it in a treatment tank, in about 18 inches of water (to relieve pressure on the swim-bladder), and adding salt at 1/2 an ounce to the gallon may help.

POND SORES

Remember that this must be an established treatment tank, with a mature filter. Placing a sick Koi in an unfiltered environment, or one with an immature filter, would be

disastrous.

Another result of overwintering, where the Koi have spent long periods sitting on the bottom, is for "pond sores" to develop. These are usually on the undersides of the Koi or on the lower flanks and can be hard to spot sometimes.

Make sure that you have sufficient topical treatments available to cope with such lesions, and make sure that you keep your water quality on top line. In some instances, it may be necessary to resort to the treatment tank again, and the forgoing remarks about filtration apply even more strongly.

There is a range of topical treatments on the market now that are in spray containers, and I would recommend that you invest in a kit of these as they are specially designed for ▶

Beautiful summer ponds and Koi depend on your care during more trying times. Don't ignore your Koi during winter and spring.



KOI IN SPRING

◀ Koi, easy to use, and are very effective. If you are not sure how to carry out such treatments you will find that the instructions with them are quite comprehensive, but you can always ask another Koi keeper who has had occasion to use them.

PARASITES AND THEIR CONTROL

As water temperature rises, and your Koi become more active, then the microscopic parasites that all Koi carry in controllable quantities will be seeking the opportunity to multiply. If this is allowed to happen, then your Koi could be faced with much greater problems. Understanding how to cope with such parasites is the key to success, and to do this you must be aware of the factors that control their growth and multiplication. Such parasites are present in the mucous layer of most Koi, and are kept under control by secretions in this layer. If a Koi becomes stressed due to

poor water quality or any other problems that it may face coming out of winter, then these secretions are affected, and this signals to opportunistic parasites that the time is ripe for them to multiply. You could say that the Koi's immune system had become less effective.

Symptoms are easy to recognise, as your Koi will begin to jump, and to "flash" * themselves on the pond floor. Unfortunately, poor water quality, and ammonia also brings this about and nitrite in particular will cause Koi to jump and flash. If they start to do this, then your first action should be to test the water quality, and only if this should prove to be good, then suspect parasites. Even then, before you put any form of anti-parasite treatment into the water, you should take a mucous scrape from a Koi which is exhibiting symptoms and examine this under a microscope to be sure that you are correct. This will also tell you the type of parasite with which your Koi are

infested and this will determine which anti-parasite preparation you should use.

For instance, if it turns out to be White Spot, you must use the correct remedy, as ordinary formalin and malachite green will have no effect. Some parasites require a cycle of treatments to control them, and to do this successfully you must understand something of their life cycle.

The failure of some Koi keepers to control parasites successfully is due, no doubt, to ignorance of these points.

Above all, be sure that your problem is due to parasites before you put chemicals into your pond. I am sure that you must appreciate that if your Koi were suffering from a water quality problem, then chemicals would only compound this, and be totally counterproductive for the pond environment.

Koi keeping is something that we must all study and learn as much about as possible if we are to ensure our success. Koi will reward these efforts — giving us an enormous amount of pleasure in return.

A well set up treatment tank such as this one belonging to Ray Barker in Birmingham could get you out of trouble with springtime ailments.



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ALL KOI ARE THE SAME

**BERNICE
BREWSTER**

wonders if Koi from different origins could be obviously dissimilar

Photographs by the author unless otherwise stated

It is well known that Koi are just fancy or coloured varieties of the Common Carp, *Cyprinus carpio*, which have been selectively bred to produce the multi-

coloured and patterned fish with which we are familiar. Despite the supposed length of time that Koi have been bred, Balon (1995) cannot find any suggestion of domesticated

Carp with altered scale, body shape or colour pattern prior to the 16th century, although he does accept that some unusual body colour patterns may have been found in Roman times or

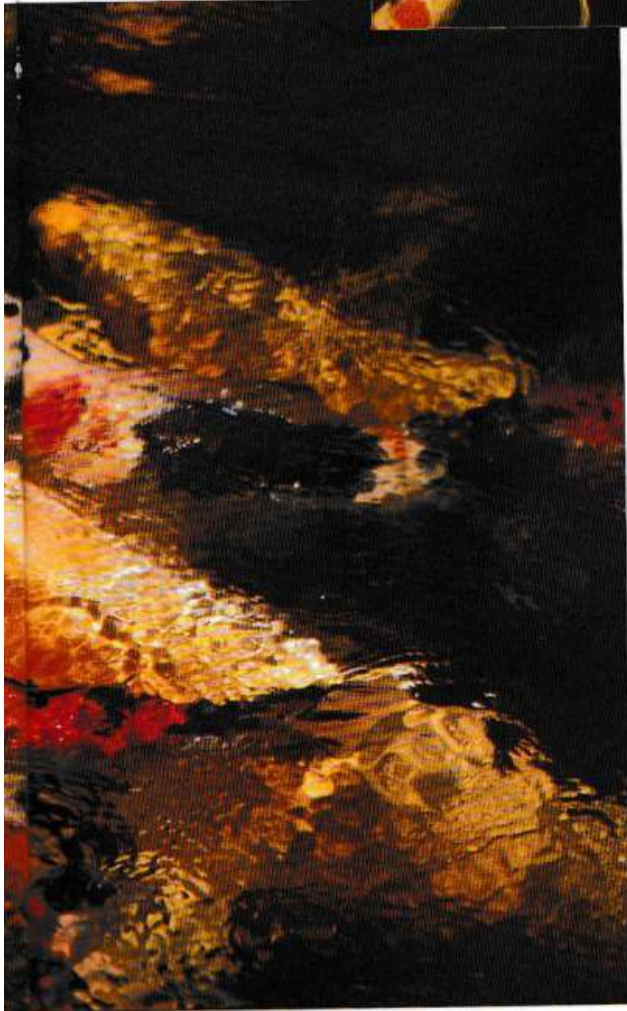


The inheritance of colour in Koi is difficult to predict.
PHOTOGRAPH: GORDON WIGENS

monastery stew ponds. It would seem that even in Japan the breeding and keeping of Koi has really expanded since the World War II and the quality of Koi has improved by leaps and bounds in the last 25 years.

Looking at the fish which were regarded as Champion Koi in the 1970s, for example, as found in *Koi of the World* (Axelrod, H. R. (1973)), you realise that many of these fish would be overlooked today as a "bit of a moose"!

Traditionally Koi have been bred in Japan and it is here that Koi keeping owes its origins and probably started in about the 18th century (Balon, 1995). In recent years other countries have begun to breed Koi, most notably Israel but also America, Thailand, Singapore, South



Africa and even England, to name but a few.

RENOWNED FOR QUALITY

In Japan the different farms have developed what have been termed "bloodlines" for certain varieties of Koi. In essence this means that selection and inbreeding of the Koi results in particular varieties being produced and many of the Japanese farmers have become renowned for quality of a certain variety.

Last year one of the Japanese Koi breeders said that if he could produce just 50 quality fish from the selective spawning of his Koi he would be a happy man, bearing in mind that a 4.5kg female carp produces 500,000-750,000 eggs!

The inheritance of colour in Koi is difficult to predict, although recent work by a group of Israeli scientists have

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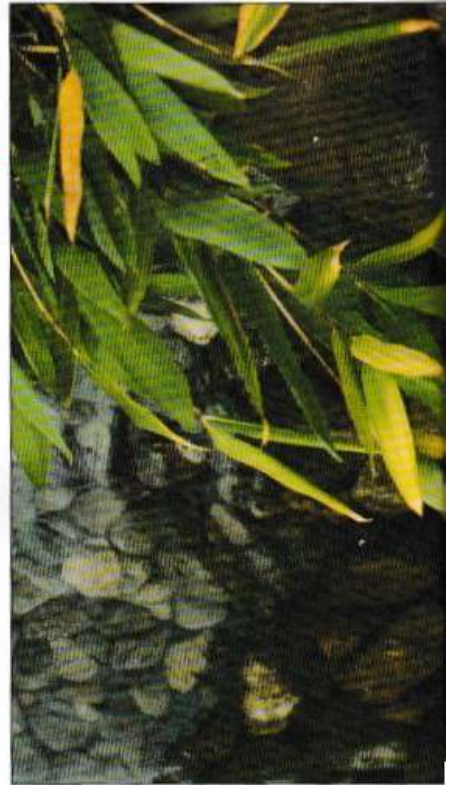
ALL KOI ARE THE SAME

◀ shown that certain colours are produced through the effects of "dominant" genes, which means they are more likely to be expressed in the offspring and others are "recessive", which means the colour will only be shown in the young if a copy of the gene is inherited from both parents.

Unfortunately, as many students of genetics can testify, in most instances the inheritance of particular colours is much more complicated than the presence of either dominant or recessive genes. Often the crossbreeding of selected parents produces offspring with none of the desirable colours found in the parent.

Given this information it may be appreciated the skills of breeding and culling involved in the product of quality Koi for the garden pond.

If you've ever tried to selectively breed some of your Koi you will most likely understand just how many things can go wrong.



ALL KOI ARE THE SAME

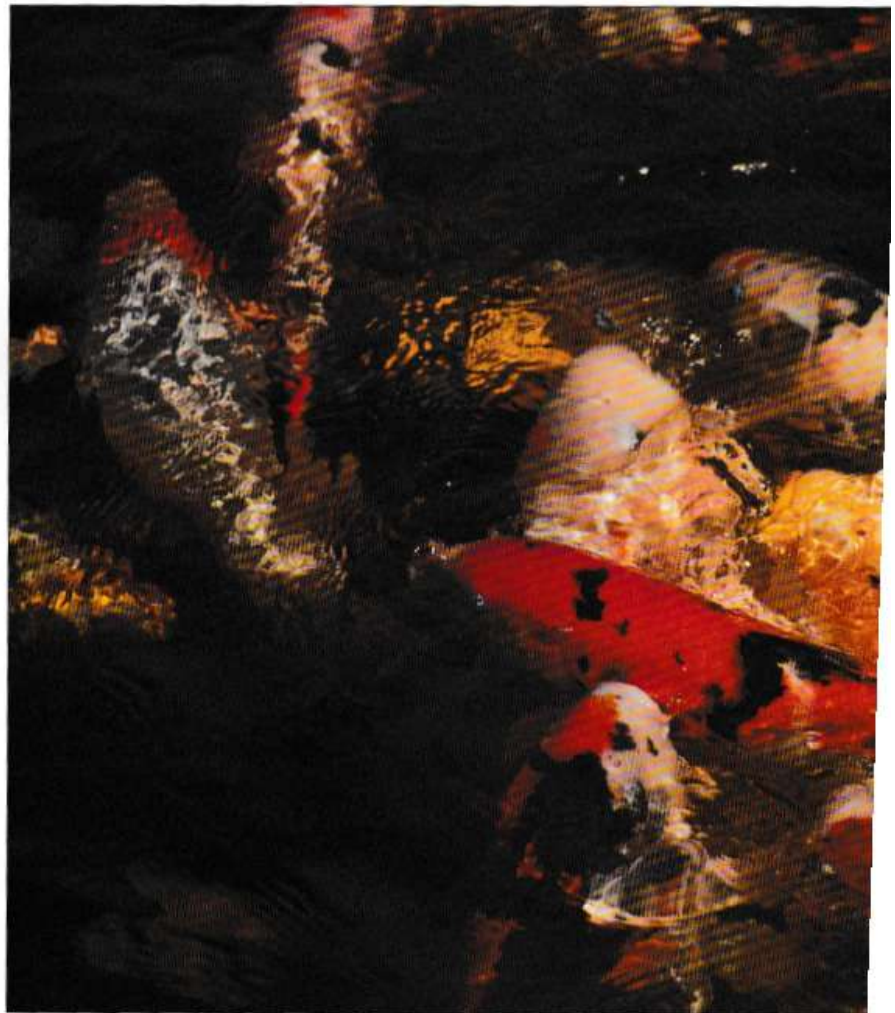
BERNICE BREWSTER wonders if Koi from different origins could be obviously dissimilar

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ARE KOI ALL THE SAME?

So, traditionally, Koi have been bred in Japan, and the traditional Koi hobbyist will prefer fish bred in this country over and above others imported from other parts of the world. Consequently, this leads us to the question of whether all Koi are the same, regardless of where they have been bred? The first point to realise is that whatever the country of origin of any import of Koi the original brood stock will have originated from Japan! So, technically, we could say that all Koi are of Japanese origin and theoretically this should overcome any prejudice — but it doesn't! All the Koi bred in Japan are produced on what might be described as a fairly small scale and continued through generations of the same family. If you compare these methods of Koi production with that of Carp production for the table where farms are of a vast size

and the majority of Carp spawned are all reared to a certain size before being packed for the market.

CONSIDERABLE PRACTICE AND SKILL

Most certainly with traditional fish farming methods the fish is simply the product. The breeding of Koi in Japan blends science and art. Breeding Koi or Carp requires considerable practice and skill, especially where natural methods of spawning are used. Firstly, the males and females need to be segregated and when the temperatures are right the fish are ready to breed. Then they can be placed into the breeding pond and hopefully something will go to plan and the Koi will spawn. If you've ever tried to selectively breed some of your Koi you will most likely understand just how many things can go wrong. ▶

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ALL KOI ARE THE SAME

◀ Once the eggs have hatched then it is essential the young Koi have sufficient live food to commence feeding, otherwise they die in a matter of hours. Within a few days of hatching the Japanese Koi breeder will begin the first of many intensive selection processes and the coloured fish are separated and the black fish culled. Even with selective breeding and using known brood stock there is a large number of progeny which will hatch as all-black individuals and there is little point in continuing to grow these to adults. The difference between the Koi which are bred in Japan and those which have been produced in other countries of the world really is in the intensive selection and skills of the Japanese Koi farmer in recognising a very limited number of small fish which have the potential to become outstandingly beautiful Koi as they grow.

MORE INTENSIVE METHODS OF FISH REARING

There is absolutely no doubt that other countries are also producing good quality Koi but often through the application of more intensive methods of fish rearing, such as using hormone induction and spawning and hatchery rearing of the fry. These methods most certainly increase the numbers of fry which can be produced and under such controlled conditions fish with undesirable qualities can be culled, but overall there is a bigger yield of fish. Often such operations take place in warm countries, where the brood stock may even be induced to spawn more than once. Under such intensive rearing conditions the bloodlines of brood stock are established and there is no doubt the quality of Koi produced is exceptionally good.

Such operations may be run in conjunction with the culture of other species of fish in a system known as polyculture.

There are a number of fish farmers in the UK who have produced a good standard of Koi but often the problem of Koi production in this country is the climatic conditions. Cool summers can influence the maturation of the males and females, numbers of viable eggs produced and growth rates of the young fish, which ultimately affects the retail price.

UNDESIRABLE QUALITIES

Repeatedly inbreeding Koi results in the fixing of undesirable qualities in these fish, much the same as selective breeding of cats, dogs, horses and other mammals to produce certain strains has resulted in deafness, hip, breathing and neurological disorders, to name but a few of the obvious ones. In Koi it is quite common to find individuals with one or more of the paired fins absent, deformities of the spine, swim-bladder, mouth and again these are the obvious results of inbreeding.

In addition to the visible effects of inbreeding are those less obvious such as reduced resistance to disease, 20 per cent less red blood cells, blood sugar level up to 26 per cent higher, and higher water content than truly wild Carp (Balon, 1995).

As a consequence it is very important to introduce new strains into the bloodlines, wherever the Koi are being produced, otherwise the final result will be increasingly fewer viable offspring.

In Japan it is easy enough to introduce new brood stock to maintain some genetic diversity. In other countries it may not be so easy to introduce new, imported stock either due to regulations governing the

import of fish, or simply a wish to avoid the potential introduction of disease.

TREMENDOUS ADVANCES

Most certainly the Israeli farmers have made tremendous advances in the use of genetic manipulation and collection of milt from male Koi with desirable attributes and freezing this using liquid nitrogen and which may then be used at a later date to fertilise eggs from existing brood stock. The tricky bit is trying to store any egg material because of the high fat content of the cells.

At the end of the day beauty is in the eye of the beholder and it really should not matter which country the Koi have been bred but that the animal is pleasing to the owner. Perhaps it is far too easy for us to get carried away with the importance of colour, patterns and shape with our Koi and forget they are animals and every bit as deserving of the care they demand, whether a Grand Champion or a "moose". To their owners Koi are more than just fancy Carp, they have individual characters and personalities and it is this feature which is far more important than the colour or quality of the skin. After all, colour is only skin deep and nothing stops that outstanding Kohaku from developing a shimmy!

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KOI BUY LINES

KEEPING YOUR KOI SAFE FROM HARM

As a fishkeeper how many times have you faced the headache of your dog disturbing your Koi? Before you know it the dog has discovered your fish pond is a fascinating place and great fun for playing with their inhabitants. But help is now on hand thanks to the Smart Fence from Champ, an electronic system designed to help keep your dog away from the pond without the

expense of installing and maintaining a conventional fence. The Smart Fence system works with an aerial wire being laid around the perimeter of the area you want to keep your pet away from. This gives out a low-frequency radio signal, generated by a transmitter installed in the house or garage. Wearing a small receiver on its collar when the dog approaches the boundary the receiver picks up the radio signal and gives an audible warning. If the dog continues he will receive a mild and harmless correction, which will quickly teach your dog to

respond to the warning signal, keeping him away from the pond. The Smart Fence is available at all good pet stores nationwide price under £200. • For further information on any of the Champ products please call the Champline Freephone on (0800) 515608 or write to Champ, The Old Brewery, Freeport, Burford, Oxfordshire, OX18 4SR, or contact Tim Smith at LLM on (01977) 685722.



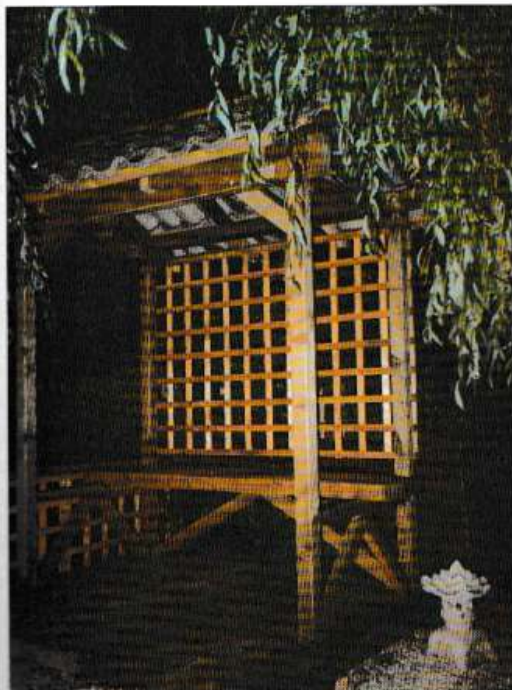
STEVE EADES INSTALLATIONS (formerly Old Yardley Koi)

Watching Koi is a remarkably addictive pastime but how

much better it would be to view the fish in comfort rather than stand around the edge of the pond. Why not treat yourself (and improve your pondside attractions at the same time) with a Koshikake? The Koshikake is a seated waiting bench where a visitor

can take time to pause and perhaps contemplate the tranquility of a Japanese style garden or water garden — so what better extra (some might say essential) accessory for your Koi pond? Traditionally built from tannalized timber with a choice of roof coverings — tiles, thatch or shingles. Each Koshikake will be constructed on site to your specifications. To further enhance the Japanese style of your Koi pond the company also offers the Tsukubai. Tsukubai means crouching bowl and is a water basin traditionally situated at

the entrance to a garden. Set at a low height to force a guest to stoop while washing this is an act of humility towards the host, as well as being one of self-purification. The basin is cast in concrete with a rough finish to help natural moss growth; to present a permanently brimming over water supply there is a pipe set in the middle connected to a pump and a rubber liner laid beneath the bowl under the gravel. • For further information please contact Steve on 0121 608 7785 or 0973 954 961.



KOI POND DESIGN

DEAN JOHNSON
has some advice when starting out to install a Koi pond

Photographs by the author

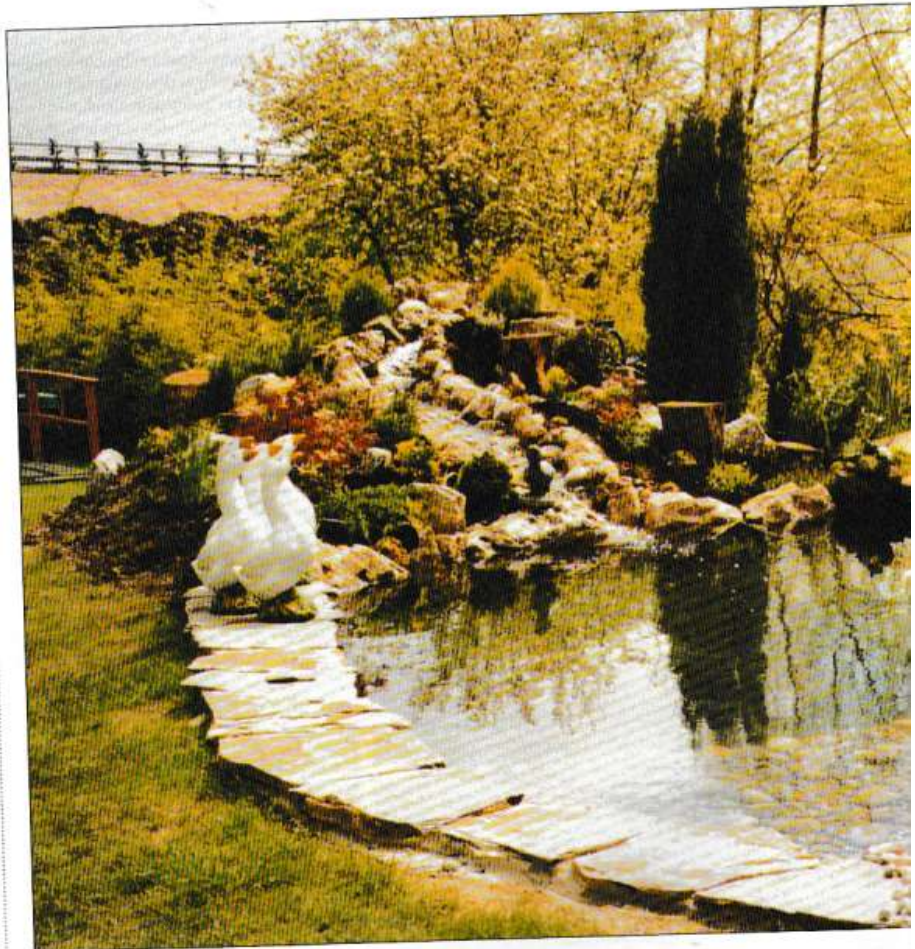
There are so many different ideas, tips and views on constructing a Koi pond that we can all be excused if we become a little confused at times. All these views have their own merits as well as downsides at times, but in this article I will

attempt to give you a few of my personal tips and ideas on how and what I look for when constructing a Koi pond.

SHAPE

My first port of call is definitely the shape of pond that will suit

your existing garden. It is most important you take a long hard look at the theme that the rest of your garden is using. After all, this project will end up being the focal point of your garden and it could make or break all the hard effort you have previously put into your garden design.



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STYLE

Each pond will have its own personal characteristics and very rarely do you find any two hand-built Koi ponds the same. It's always a nice touch to think of different ways to make your pond "One in a million". There are lots of obvious extras that you could add to your pond like a bridge, decking, ornaments, stone figures, lighting — the list is endless! It's always a good idea to take time to look at some of the many different Koi books available on the market and see if any of their ideas are what you consider to be the pond for you.

MATERIALS

Generally most people considering a Koi pond have kept fish before and they will have a reasonable idea of the possible problems they may incur with the construction of a new (and larger) pond. You must also consider what type of pond lining you can use: for example, a butyl liner, concrete or fibreglass. This will then lead you onto what type of equipment you will need to keep the water clean and healthy for the fish.

CONSTRUCTION

The majority of Koi ponds will be built above and below ground level. When you are constructing a pond of this type you will need to use a hollow concrete block, with reinforcing bars; this will then give you the ability to pour a wet mix of concrete into the hollows making the wall reinforced and able to withstand the considerable pressure of the water that will be exerted onto the pond walls.

ELECTRICS

If you are brave enough to ▶

The majority of Koi ponds will be built above and below ground level.

KOI EXTRA

KOI NEWS

◀ available for selection. If you have not yet joined the growing number of serious Koi keepers who make Tewel their number one choice for Koi and Koi foods — this is a great opportunity for you to visit and see for yourself just why Tewel Mill Koi Centre is the fastest growing Koi business in Europe. For more information about the Tewel Mill Koi Centre 1999 Spring Spectacular contact: Maureen McGurk, Tewel Mill Koi Centre, Kingsbridge, Tewel, nr. Welwyn, Herts AL6 0LJ. Tel: 01438 716019-07000 TEWEL MILL. 01438 718558-07000 KOI ICHI BAN. Fax: 01438 840096.



Secoh SLL 40 Koi system air pump.



Secoh Phoenix 10Lpm pump. Ideal for aquaria.

FIRST EVER SPRING SALE FROM SHIRLEY AQUATICS

Shirley Aquatics MD, John Cook, has just announced the first ever Shirley Aquatics Spring Sale to be held on March 26, 27 and 28 1999. In addition to some massive savings on Koi, which include up to 50 per cent off some 1998 harvest Koi and first viewing of the new arrivals,

including some incredible Tategoi from some of Japan's top breeders, the weekend also sees the opening of Shirley's recently completed extensive new Tropical and Marine section.

To kick off the 1999 season Shirley are offering some serious offers on Koi and Koi pond equipment, including: Fifty per cent off selected Koi, pumps from £99.95, Japanese blue filter matting at £49.95, Sequence pumps from £275, and Proclear UVs from £90. In addition to great deals on

Koi and Koi goods many top manufacturers will be on hand to offer expert help and assistance on their product ranges — and it's a great opportunity to meet other Koi keepers and exchange the latest ideas. Shirley is two minutes from the M42 junction 4).

For more information contact: Shirley Aquatics, 1355 Stratford Road, Shirley, Solihull, West Midlands B90 4EF. Tel: 0121 744 1300. Fax: 0121 744 0067. E-mail: shirleyaquatics@btinternet.com

The 1999 Spring Sale includes Koi like these: Doitsu Showa, 55cm (left) and Gin Rin Kohaku, 55cm (right).



KOI EVENTS

Koi Societies are invited to send in details (please include contact names and telephone numbers) of Shows for inclusion KOI EXTRA to Aquarist & Pondkeeper, MJ Publications Ltd, 20 High Street, Charing, near Ashford, Kent TN27 0HX or by contacting Liz Donlan on 0161-794 8282 or fax 0161-793 9696.

SHOW CALENDAR

JUNE

- 5 BKKS Yorkshire Section Open Show, Lottarston Hall, Leeds. Contact: Fred Harston (Chairman), on 01226 722578.
- 12 BKKS Essex Section. Closed Show, Aveley Sports & Social Club, Aveley, Essex.
- 12/13 BKKS Worthing and District. Open Show, Worthing Rugby Club, Angmering, West Sussex.

JULY

- 3/4 BKKS East Pennine. Open Show, The Heritage Centre, Easingwold, nr. Barmby, Yorkshire.
- 18 BKKS Essex Section. Open Show, Aveley Sports & Social Club, Aveley, Essex.

AUGUST

- 7/8 International Koi Show. Organised by UK's Koi. Tel: 01922 493290.
- 28/29 North East Koi Club Show. Goufforth Park & Aquatics. Contact: Jean Hope on 0191-416 5794.
- 29/30 BKKS South East Section. Open Show, Ravens Wood School, Oakley Road, Bromley, Kent. 10am-5pm both days. Free parking, dealers, Crafts, Torbols, Refreshments. Contact: Susan James on 0181-

WHERE DO KOI GET THEIR COLOURS FROM?

For many years people from different backgrounds and different lifestyles from all over the world have been drawn together into one similar lifestyle choice, keeping Koi and other similar pond fish. But why? Why do doctors, lawyers, pilots, and builders, all become attracted and eventually addicted to this hobby? Because of the Koi's striking colour patterns and because they are known world

wide as the "living jewels". But why is it that the Koi, in contrast with their "dark and drab" wild cousins the Common Carp, have such amazing colours in their skin, the question immediately arises where do the colours come from?

CELL TYPES

Fish colouration is determined genetically and expressed in skin pigmentation. Skin colour

is determined by skin structure, food quality and the environment. Speaking generally, the visual impact of skin and scales is governed by two cell types:
(1) Chromatophores — colour-bearing cells.
(2) Iridocytes — appear "silvery".
Chromatophores can be enhanced, and give rise to an assortment of colours such as red, orange, yellow, black and white and combinations of these pigment cells are

STEPHEN HOSKIN explains the wonders of Koi colouration

Photographs by Gordon Wiggins



Behind the myriad of colours of Koi there is a fascinating process at work.

WHERE DO KOI GET THEIR COLOURS FROM?

◀ responsible for the colour patterns found in the different varieties of Koi. Iridocytes act like reflectors and cannot be enhanced by feeding colour enhancers. They are prevalent in the Gin Rin varieties of Koi, which have the shiny and glittered appearance. Chromatophores can be divided into two categories: (1) Melanophores — which are coloured black and can change the shade of a fish, affected by water quality and other environmental conditions. (2) Lipophores, which contain soluble pigments (carotenoids), absorbed from the diet, can be enhanced and improved by care and controlled feeding of colour enhancers in the diet. But how does the Koi's skin change colour? What is the actual process that takes place? The scales that make up the skin

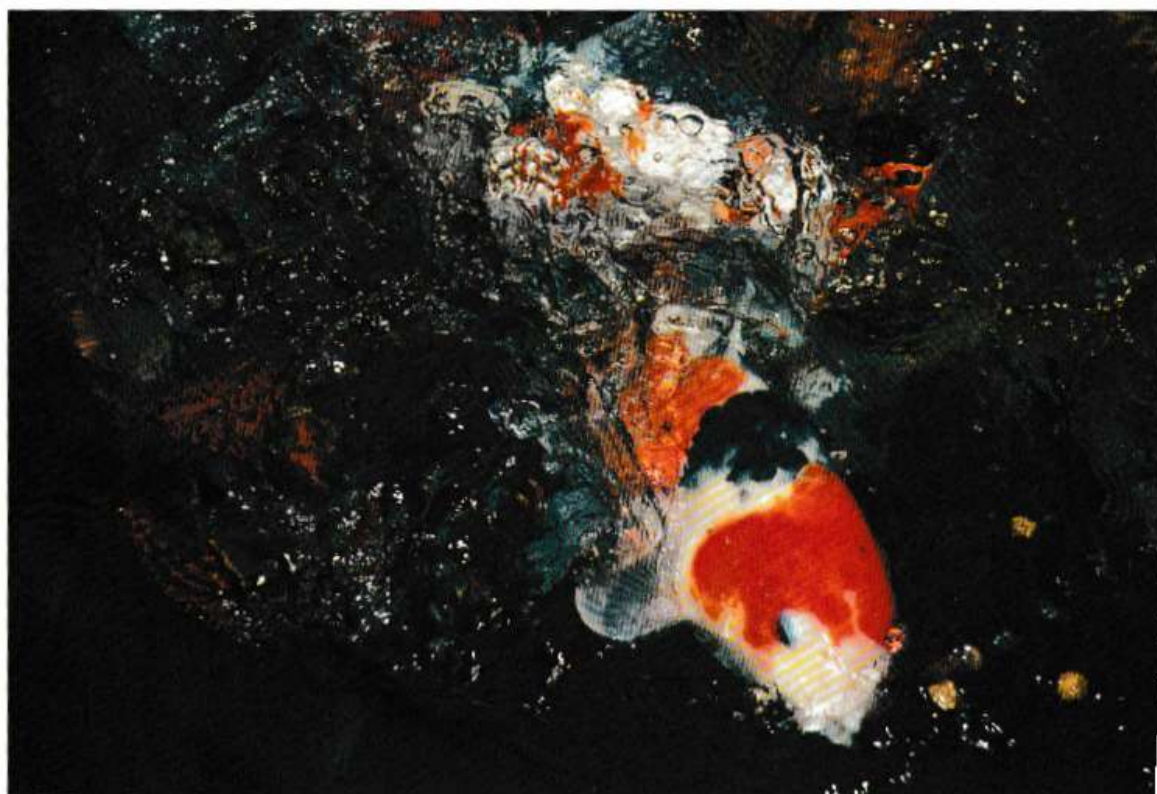
of the Koi are full of chromatophores.

COLOUR ENHANCERS

Each of these chromatophores can retain specific but different coloured carotenoids provided by the colour enhancers found naturally in the diet. When Koi digest and assimilate specific carotenoids they can manipulate them into other colour pigments or deposit them unchanged into chromatophores of a corresponding colour, improving and enhancing that colour. It is impossible to cause a fish to deposit colours, which its chromatophores do not already

express, i.e., you cannot change a white fish into a red one by feeding it excessive colour enhancers. Each chromatophore will store the carotenoids until it becomes full. This is when you will begin to see the skin colour improve, e.g., red scales become more intense as they retain more pigment. However, it is vital not to over indulge your Koi with colour enhancers, because when all the chromatophores become full of red carotenoids, the excess red carotenoids may be deposited into white scale or skin areas turning them from white to pink. The same applies for yellow and orange carotenoids, with excess colour potentially turning white chromatophores murky brown. Carotenoids are pigments, which colour, plants,

It is impossible to cause a fish to deposit colours, which its chromatophores do not already express, i.e., you cannot change a white fish into a red one by feeding it excessive colour enhancers.



fish and other animals, they cannot, however, introduce new colours that are not already expressed genetically. Their effect depends on both the quality and quantity of the carotenoid consumed and the ability of the fish to manipulate and change the ingested carotenoids into the colours that fish specifically expresses. Some carotenoids include: Mpha/beta carotene (yellow); Zeaxanthin (yellowy-orange); Astaxanthin (red); Lutein (greenish-yellow).



NATURAL AND SYNTHETIC PRODUCTS

Carotenoids are available in a range of natural and synthetic products. The natural products will often produce better enhancement as they carry a wider spectrum of carotenoid pigments. However, they can be quite unstable and prone to variations in quality. Synthetic colour enhancers are manufactured to provide a guaranteed content of specific carotenoids. They do not offer the wide range of carotenoids found in natural products.

NATURAL COLOUR ENHANCERS

Here are some different natural colour enhancers which can be used in the Koi's diet to enhance their natural beauty. (1) Spirulina — a blue green spiral phytoplankton which is 60 to 70 per cent protein. Their

thin cell walls make it highly digestible releasing a range of carotenoids including beta carotene. Excellent at enhancing reds in Koi.

(2) Marigold petals — contain high levels of a range of carotenoids, which have improved reds in Barbs, and gold's or yellows in Tilapia. Also used in hens to improve the colour of the egg yolk!

(3) Red pepper (paprika) — excellent for improving red colouration containing the carotenoid capsanthin.

(4) Lobster eggs — contain the carotenoids astaxanthin and zeaxanthin. Carotenoids have been shown to absorb radiation, protecting the developing embryo. Synthetic colour enhancers, unlike natural colour enhancers, are stabilised in the laboratory to ensure the Koi will ingest the carotenes and deposit them in the flesh. For example Carophyll Red (canthaxanthin) and Carophyll Pink (astaxanthin).

WIDE SPECTRUM

The benefits of using synthetic colour enhancers compared to natural colour enhancers is that synthetic enhancers will not be

altered by light, heat, oxygen or pH, and so will not alter their ability to enhance effectively. With both of these ingredients added Koi and other fish species are not only getting a wide spectrum of colour enhancers from the natural source, but also a guaranteed content of specific carotenoids from the synthetic source.

The process of enhancing the Koi's true colours and turning them into a living jewel is not an easy one. Careful consideration must be taken, so as to prevent any mishaps of discolouring the fish. A combination of both natural and synthetic enhancers is essential so you can guarantee your fish is receiving the correct amount to bring out the appropriate colours.

CHOOSING KOI FOOD CAREFULLY

By choosing a Koi food carefully you can make sure your fish are receiving appropriate colour enhancers in suitable quantities. Feeding Koi an unbalanced and poorly researched colour enhancing diet may cause your Koi's colours to deteriorate rather than be improved.

By choosing a Koi food carefully you can make sure your fish are receiving appropriate colour enhancers in suitable quantities.

Information for this article was provided by Nishikoi Aquaculture.

ASK A&P

SEND YOUR QUERIES TO: ASK A&P, MJ PUBLICATIONS LTD,
20 HIGH STREET, CHARING, KENT TN27 0HX

★ PRIZE WINNING PROBLEM ★

Coldwater

Q Could you tell me the average lifespan of a Goldfish? I have three in a small pond in an unheated conservatory which are just over 30 years old. It seems a bit long in the fin to me.

A Well done on keeping the pet fish for over 30 years. Could be heading for the record books! Goldfish often live 10 years in an aquarium and can live for 20 years. The oldest on record is indeed 30 years, but this was in a pond. The winter hibernation lengthens natural lifespan. Goldfish are Carp and of course they are a long lived species. Wild Carp have been found at 50 years old and it is claimed they can live 100 years. The lifespan of fish is very variable. Angels usually live five years, but can reach 10 (rarely). The average lifespan of tropical fish is less than coldwater species, about three years in captivity, but in the wild that can be much reduced because of predation. For example the Guppy male's average lifespan is only three months (before they are eaten), that is why they need to mature and inseminate females so quickly.

In general the larger the fish the longer it lives, so the big tropicals can last well past the average three years. eg, Angels and Discus. Catfish also tend to be long lived, because they just sit around most of the time! Koi live longer than their smaller cousins, Goldfish. Marines are longer lived too ... evidence is still being collected but mariners report Coralfish that are 10 or 15 years old. It is quite common for aquarists to set up a tropical community aquarium, then write to me about a mysterious disease some three years later ... it is just old age! Any fish (such as Neons) that last five or more are simply a recommendation of the good water quality the aquarist maintains. Note that some fish are annuals, eg, many Killifish and, surprisingly, Siamese Fighters.

Q I am a beginner and my tank has been running for six months now and my biggest problems at present are Hydra. My local retailer recommended removing them manually, but, after three months, have not noticed any reduction in their number. Books have said that Three-spot Gouramis (*Trichogaster trichopterus*) and Paradisefish (*Macropodus opercularis*) will eat them but aren't these fish too aggressive to put in my community tank (Angelfish,

Neons, Corydoras, RTB Shark, Keyhole Cichlids and Phantom Tetras)? Water conditions are excellent (pH 7.00, ammonia and nitrite both zero). My second aquarium (containing baby Guppies) also have a Hydra problem.

A Yes, Hydra are a problem. They are tougher than the fish so any chemicals added would kill the fish before they got to the Hydra. Gouramies (Blue or Pearl) will eat them when hungry (so do not supply tastier food). They are indeed fish that get aggressive with age, perhaps you could "borrow" a couple from the local aquatic shop, or from aquarists at the nearest aquatic club. Another method is to borrow a diatomaceous earth filter (ask at the shop or club) and polish the water for a few hours, giving the sides, etc., a stir — the Hydra get filtered out. The old fashioned remedy is to add a copper wire attached externally to the + and - of a flashlight battery. It was claimed the electricity killed them, but in fact it was dissolving Copper. Inverts are more susceptible to Copper than fish ... but the wires must be removed after a few hours. Look for dead Hydra and stop the treatment, doing a water change to remove Copper. A safer method is to remove the fish and any plants to a temporary home, raise the water temperature in the original aquarium to 45°C (110°F) for a few hours. If you cannot move the plants, just take the fish out and raise it to 42°C (108°F), which should not harm the plants over about two hours.

The "final solution" is to strip, sterilise, wash everything, filter water through a handkerchief and set up the tank again. Then do not add any live aquatic foods such as Daphnia or Tubifex (where the infestations originate). Of course, the use of tropical species cannot be used in coldwater aquariums and our Goldfish expert, Alex Stephenson, has an Hydra infestation, too. Some "elderly"

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books recommend using ammonium sulphate after first removing the fish and plants. Any modern remedies out there?

Tropical

Q I am intrigued by a fish on offer in my local aquarium shop. It's called a "Croaking Gourami". Do fish really make sounds that we can hear?

A The Croaking Gourami, *Trichopsis vittatus*, is a typical example of a noise producing fish. Reports indicate that this occurs usually during spawning or when removed from the water. Some Catfishes also emit sounds when handled (well, wouldn't you?). Probably the noisiest amongst fishes are the marine Drums (and, incidentally, also known as Croakers) of the Family Sciaenidae. Here, the swim bladder is used as a resonator to "amplify" muscle movements which then result in sound. There is an apocryphal story of the US Navy being justifiably perturbed by underwater sounds in the Pacific during World War Two, but this was no enemy threat — just some Drums sounding off!

Many of the species in the family are too large for the aquarium but members of the *Equetus* genus are suitable. Should you ever visit Sri Lanka, it is said on certain evenings you can hear the fish singing in the sea around the east coast at Batticaloa.

In the freshwater aquarium many fish produce sounds. A typical example is the rapid expulsion of water from the gills which produces a hard clicking, or knocking, sound. Some aquarists, on hearing this for the first time, think the front glass is about to go! Culprits are often Angelfish (*Pterophyllum* sp.) during pre-spawning courtships and Loaches (*Botia*) enjoying a hearty meal.



This page is generously supported by Algarde who are offering a Midi 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.

PETER MAY advises how, in the cut and thrust and mayhem that is pond-life, to keep on top and in control ... *photographs and graphics by the author*

Water World Managers

Shrubberies need pruning, mulching and grooming; lawns need mowing and a whole lot more; herbaceous needs staking, weeding, dividing; annuals need planting, nurturing and pampering; so do vegetables and half hardy annuals — watering, feeding, cossetting and pruning. And

did you think that having a water garden might be the end of all that work?

I can see that "think bubble" now. There you are relaxing in your deck chair by the pool, the soft murmur of a stream punctuated by the gentle croak of a contented frog. As crystal threads of water tinkle gently

into the pool, playful fish chase each other amongst the ripples; they sparkle with a myriad flashes of gold from the depths beneath divine lilies and amongst the blazing wreath of waterside plants ... PGP!

What is more likely? Will your water garden look more like an open bomb crater being used as a

huge reservoir for camouflage paint, with the plants looking like war-weary veterans on parade 10 seconds after reveille, and fish that look as though they have radiation sickness from nuclear fall-out?

Are you going to be out in the deepening gloom of October, dredging the stinking detritus from the depths of the mire? Will you be there on the "weasel nipping" February frosty days with cold fingers fumbling to divide obstinate plants? I'm sure you are.

Read on to see what your employment contract with water gardens might involve and see how committed you might have to be, because you are taking on a responsibility of a

MAINTENANCE TIP

Leave the dredged up rubbish on the side to drain so that small wildlife can make its way back to the pool.



little world. In other words, have you got what it takes to be a "WATER WORLD MANAGER"?

MAINTENANCE

Spring: April/May

- Remove the leaf net that has stopped leaves blowing into the pond.
- Check pumps and electrics. Even very well-sealed, weather-proof connections get affected by a build-up of humidity from damp air.
- On the marginal plants, cut back any dead growth from the previous year that has not previously been dealt with. Overgrown aquatic plants can be divided and replanted. In northern and exposed areas this ought not to be done too early as the old growth provides some cover for emerging growth and also the fish. Oxygenators can be cut back once full growth has started. This is best done on a regular basis with a little bit at a time, rather than a massive cut-back that will give algae a chance to over-populate.
- Fish feeding: Build up slowly to daily feeding to ensure the fish are in peak condition for breeding. Feed Wheatgerm-rich, low-protein varieties of food sparingly at temperatures below 10°C (50°F) and above 7°C (45°F). Do not feed at all below 7°C. Even if they take food it may not be digested and will only cause problems for the fish as it rots in their stomachs or guts. Fish food producers are making improvements all the time, so if in doubt about the most appropriate fish food for the time of year consult a well-informed supplier.
- Clean out fountains and waterfalls.
- If the pond is really dirty, clean out before the frogs spawn in mid-March to April. Rather you than me. Brrrr!

Many fish keepers will drain off between a half and a third of the pool water replacing it with

fresh water that has been conditioned with a proprietary pool conditioner or dechlorinator.

This is particularly important if there has been occasion through the winter to treat the pool water with medications or salt. They will then add a dose of tonic for the fish after the weakening trials and tribulations of the Winter.

This is mainly to help build up their protective mucous layer that is their only barrier to disease and many parasites.

Summer: June/September

- Evaporation may cause water levels to drop. Replenish periodically with a hose as sunlight on any liner material apart from concrete makes it deteriorate. Dropping the water in from a height helps disperse some of the chlorine from tap water. Add a dechlorinator particularly if this is a regular occurrence.
 - Net out Thread Algae. If green water is persistent, how about a filter? Either way "troubleshoot it".
 - Some early flowering plants, e.g., the Calthas or Marsh Marigolds, may need cutting back to encourage a second flush of flower.
 - As water temperatures rise above 60°C feed the fish on high-protein foods and watch out for disease.
 - New fish acclimatise easily as long as
- there is enough theoretical room for them.
 - If you have a biological filter leave it running all the time. The aerobic bacteria that build up in it, consuming the organic waste in the filter and transform the ammonia and nitrites into relatively harmless nitrates, they depend upon the oxygen to survive. This is brought to them by a constant flow of water pumped through the filter. Keep the pre-filters to your pumps clean.
 - Beware of filter delicacy — they are working hard and should not be cleaned too thoroughly otherwise you clean away the valuable aerobic bacteria that are working for you. Make sure you clean them with pond water or at least water without chlorine in it.
 - If you have a fountain or waterfall you might find it advisable to keep it running particularly on warm sultry nights because: (a) The oxygenating plants cease to give out oxygen; (b) As the water warms in the summer it is less able to hold oxygen; (c) The stillness of the air means that less oxygen is available at the surface of the pool; (d) The metabolism of the fish increases immensely adding ammonia to the water; (e) Algae may have taken advantage of the conditions and, in a bloom of over-population and death, add further loading to the nitrogen cycle in the pool; (f) The aerobic bacteria, that even if you have not got a filter, are still in the bottom of the pond digesting and breaking down

MAINTENANCE TIP

Cut back the marginals to basket level. Many people leave this until spring to maintain cover for wildlife. It may be necessary in order to net the pool.



WATER WORLD MANAGERS ... How to keep on top and in control

organic matter and ammonia, they need oxygen to survive and they need it all the time.

This is when you find out whether you are in love with your pond or not. When the fish are flapping, gasping at the surface with no one to save them from a surely tortuous end but YOU. And why has it happened? Because YOU haven't done everything YOU OUGHT TO HAVE DONE.

Now you must know your fishy first aid! Oxygenate! Partial water change "Nurse! Splash water from that hose in from as high as possible! You there! I want 25ml of Pool Conditioner delivered in dilution, FAST!"

Autumn/Winter: October/March

- Remove fallen leaves and dead foliage — cover pool and stream with a net.
- Dredge out any debris liable to rot in the pool. Serious fishkeepers suggest that a partial water change of about a quarter might be in order — especially if there has been a drought. The theory is that there will be a considerable concentration of dissolved solids because of evaporation. Treat the water with a conditioner. If you are going to clean the pool out, then October is the time to do it in most water gardeners' books.

Which plants are which is still fresh in your mind. The fish should be fat and healthy and capable of handling the trauma. So will you because the water is still warmish. Most of the hibernating frogs and toads will also take the disturbance in their stride. Once again, remember to "condition" the fresh tapwater you use to refill the pool.

- **PLANTS:** Remove tender aquatics from the pond. Floating plants that need winter protection include Water Hyacinth (*Eichhornia crassipes*). These can be potted up close together in soil or compost. Water them in and store them in a light frost-free place until late Spring. The Water Chestnut (*Trapa natans*), the Chinese Water Chestnut (*Trapa bicornis*) and Water Lettuce (*Pistia stratiotes*) need to be floated in water in a frost-free green house. Of the marginal plants commonly found in retail outlets *Lobelia fulgens* and *Zantedeschia aetheopica* are best either sunk to nine inches below the water level, or brought into a frost-free greenhouse or covered with ashes in a cold frame. *Zantedeschia aethiopia* 'Crowborough' is slightly more hardy and can be left in the pool. Various marginal plants usually sold as tropicals very often find their way out into a colder environment. As winter sets in the *Cyperus altemifolius* (Umbrella Plant), *Cyperus papyrus* and the aquatic *Canna* hybrids must go indoors onto a sunny windowsill or heated greenhouse.
- **PUMPS:** Surface pumps need protection and draining. Check submersible pumps for buildup of lime or silt on fins and bearing faces. As the temperature of the water in the pool drops to around 4°C then instead of the warmer less dense water being at the surface, as in the summer, the density of water changes and the water that is closest to freezing becomes the least dense and this floats to the top, and the bottom stays at a fairly steady temperature under a blanket of colder water that may freeze. If you wish to run a submersible pump, e.g., for a biological filter, as it gets colder reduce its flow and bring it closer to the surface so that only the top nine to 12 inches of water in the pool are circulated. The depths of the pool will remain an even temperature by being left undisturbed.
- **FISH:** Stop feeding the fish below 7°C. They hibernate below 5°C.

MAINTENANCE TIP

Here an overflow provides an indication that the filter might be badly blocked, but regular checking in summer will circumvent this.



Between 10°C and 7°C only feed very low protein foods two or three times a week and always remove uneaten food. But if in doubt **DONT FEED.**

- Float a ball or a piece of wood in the pool or install a pool heater. This will maintain a hole in the ice that prevents the buildup of pressure on the sides of the pool and more effectively allows the escape of toxic gases that build up under the surface of the ice. **DONT BREAK THE ICE,** it can

MAINTENANCE TIP

Between 7°C and 10°C feed only very low protein food. Below 7°C — do not feed at all! Over feeding is the commonest cause of problems.



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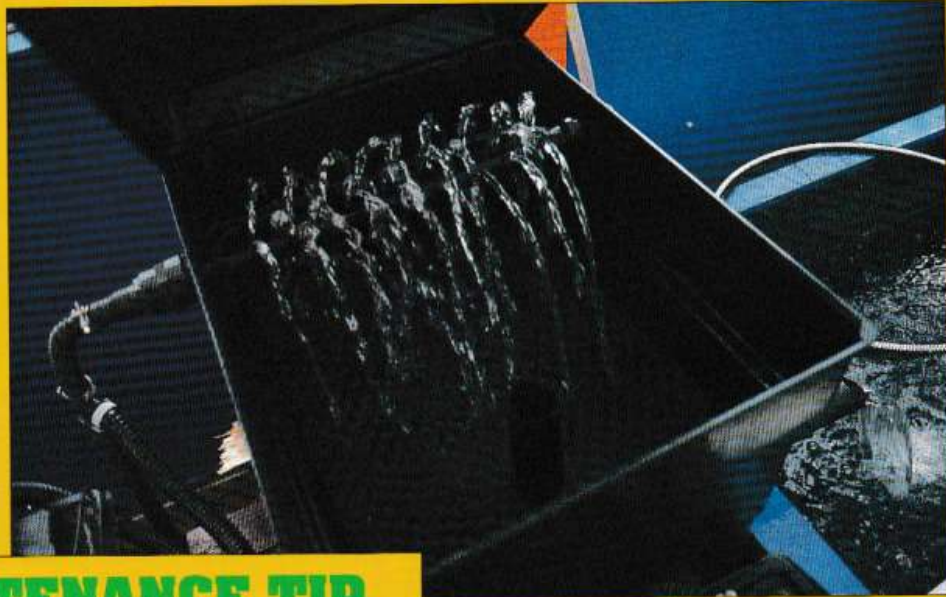
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WATER WORLD MANAGERS ... How to keep on top and in control

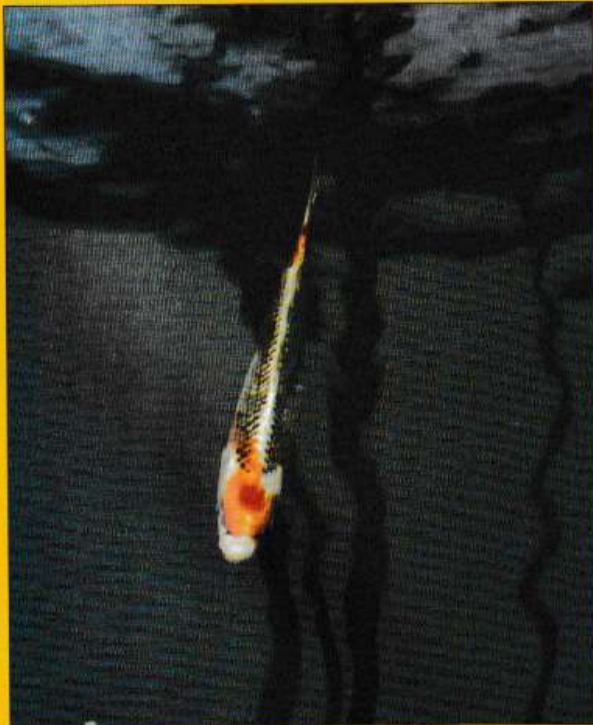
MAINTENANCE TIP

Check filters are clean and running freely. Don't clean them with tap water.



MAINTENANCE TIP

Late winter and early spring — look out for fish "under the weather", clamped fins and listlessness shows this fish has got the blues.



stun the fish. Melt a hole with hot water. If there is snow sweep it away so that the oxygenators get some light.

- Look out for Herons especially on still foggy mornings.
- Keep the pond topped up. If the water table in the surrounding soil rises above the water level in the pool, then you can find the pool liner lifting and toppling baskets or, if it is a rigid liner, the pond popping right out of the ground!

The commitment

I jest at the responsibility, and I exaggerate the quantity of work.

Really, it boils down to keeping a regular and informed eye on all things all the time. But I exaggerate the work commitment because when the work needs to be done it needs to be done at definite times, and generally times when you least feel like doing it.

This is a self-contained little world that you have created which, although everything that lives there is dependent on something else for its survival, the cycle of life produces muck and waste, that even in the best conditions will eventually build up and cause an imbalance.

Then the interdependence will cease to be, as one thing will eventually take over and the pool or pond will become a mere "boggy place".

The reward for your diligence and commitment is the fruition into reality of that "think bubble" of those early days.

Peter J. May is the author of the following pond books, all published by TFH/Kingdom Books: The Perfect Pond Recipe Book, The Perfect Pond Detective Book 1, The Perfect Pond Detective Book 2.

WATER WORLD MANAGERS ... How to keep on top and in control

A YEAR IN THE LIFE OF A WATER WORLD MANAGER ...

SPRING
CHECK PUMP AND ELECTRICS. CLEAN OUT FOUNTAINS AND WATERFALLS.



REMOVE THE LEAF NET. IF YOU HAVE TO CLEAN THE POND OUT - DO IT BEFORE MID-MARCH WHEN THE FROGS SPAWN. BRRR! BIT COLD - LEAVE IT UNTIL MUCH LATER IF POSSIBLE. PARTIAL WATER CHANGE? TONIC? HOW SERIOUS ARE YOU?

MARGINAL PLANTS: - GET BACK DEAD GROWTH THAT HAS NOT PREVIOUSLY BEEN DEALT WITH. ONLY CUT BACK ON GROWTHS WHEN FULL GROWTH IS OCCURRING THAN ONE YEAR!



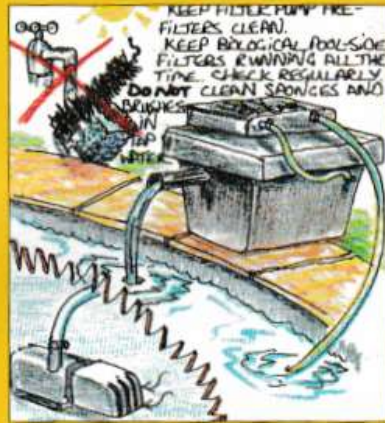
BUILD UP FISH FEEDING SLOWLY BETWEEN 7°C AND 10°C ONLY FEED VERY LOW PROTEIN FOOD. **DON'T FEED BELOW 7°C!**

SUMMER
IF YOU HAVE TO TOP UP THE WATER LEVEL DROP IT IN FROM A HEIGHT AND TREAT THE FRESH TOP WATER WITH TONIC.



NET OR HOOD A OUT THREAD ALGAE OR BLANKET WEED AND LEAVE TO DRAIN ON THE SHORE. KEEP WATERFALLS AND FOUNTAINS RUNNING ON HOT SUNNY NIGHTS.

KEEP FILTER PUMP PRE-FILTERS CLEAN. KEEP BIOLOGICAL POOL-SIDE FILTERS RUNNING ALL THE TIME. CHECK REGULARLY. **DO NOT CLEAN SPONGES AND BRUSHES IN THE WATER.**



AUTUMN
THE FARTY'S OVER! DREDGE OUT DEAD LEAVES. REINSTATE LEAF NET. CLEAN OUT DO IT EARLY OCTOBER. STOP FEEDING FISH BELOW 7°C.



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KEEP A LOOK OUT FOR HERONS!

Testing the Waters

In every aquatic shop the shopper will be confronted by serried ranks of water testing kits. Pills and potions, strips and drops, claiming to test for seemingly every diverse chemical under the sun. This array of packages can often confuse rather than enlighten.

While many aquarists test their water successfully and without fuss, there are plenty more who have either given up on testing altogether, or who await the results of each test with a mien more suited to a criminal awaiting a death sentence.

Choosing the type of test kits

The first decision is which test(s) you should buy. When choosing a kit, the main criterion is that it should suit you. All the tests work; they would not be allowed to sell them otherwise.

The variety can be divided up into three main groups:

Potions

This form consists of one or more bottles of chemicals. When precise quantities of the chemicals are mixed with the tank water in a test tube, a reaction takes place which changes the colour. The degree of colour indicates the amount of the substance for which you are testing that is in the tank water. Being liquid the chemicals are easily mixed in the test tube.

Pills

These tests rely on dropping a pill, which contains a mixture of chemicals, into a set amount of water in a test tube. As with the liquid tests, a colour change indicates the result of

the test. As the pill contains the precise amount you need, there is no measuring out of drops, and you will not be left with a half full bottle of one of the reagents when the other parts of the test have run out.

However, solids are not as easy to disperse as liquids, and if you have a problem with shaking the tubes a liquid test may be better.

Strips

These consist of strips of impregnated paper, which are dipped in the tank. After a set period the colour change indicates the results. These are the safest if you have small children who are prone to fiddling with bottles and pills!

All water test kits contain chemicals, and chemicals react with other chemicals, including air. A test kit that is past its "best before" date or on which the seal is broken is worse than not buying a test kit at all, as it may give incorrect results and lead you to perform potentially dangerous adjustments to your tank water.

If the test has been kept in bright sunlight, the colour chart may have faded. If you will be unable to read the results, the test will be pointless. Get one from the back of the shelf on which the packaging is bright and clear.

What to test for

Now that you have chosen the type of test kit the question remains of what to test for. There are tests for every conceivable substance, and most fish keepers will not need many of the offerings, so here we will discuss those of most interest to the new fishkeeper.

Ammonia

As the fish eat and breathe they,

like all living things, excrete wastes. When these wastes start to rot, they produce ammonia. Ammonia is a highly-toxic substance, and if there is any in the tank the fish will soon start to suffer.

It is important to know about even a small rise in ammonia, as this is the first sign of the filters failing or that the tank is overstocked. If the problem is noticed early, it can be dealt with without loss of life.

Just to confuse the fishkeeper, ammonia exists in different forms — ammonia ions and free ammonia. The more alkaline the water, and the hotter the water, the more ammonia becomes "free ammonia". Free ammonia is more toxic than ammonia ions.

However, if you happen to keep a tank of cold, soft water, this is not an excuse to ignore spiralling ammonia levels. You should still aim for a zero reading, regardless of "acceptable ranges" that may be given with your test!

Nitrite

The process of biological filtration involves billions of tiny bacteria living unseen in the tank, who feed on the fishes' wastes, thus removing them from the system and converting them to something else.

Just as fishes convert flake into ammonia, so one set of bacteria eat ammonia and convert it into nitrite. Nitrite is, however, still extremely poisonous to fish. Fortunately a second group of bacteria eat the nitrite, and convert it into the far less harmful nitrate. Once again, a tank with functioning filtration should contain no nitrite, and its presence requires action early.

Nitrate

When the nitrites are devoured by the bacteria the end result is nitrates. The acceptable level of nitrates

TESTING THE WATERS ... A valuable tool for the aquarist

depends on the fish you keep. Some fish, especially marines, are extremely sensitive to nitrates, and you need to have a zero reading. Most freshwater fish are a little more easy-going, and up to 150mg per litre is safe for all but the most delicate.

pH

The pH (0-14) is a measurement of the alkalinity or acidity of your water; 7 is neutral, while above seven indicates increasing alkalinity, and below increasing acidity. There is no "correct" reading for this, and usually it will depend on the way your tap water comes.

If you have a particular preference for a specialised type of fish, such as the acid-water Discus, or alkaline-water Tanganyikan Cichlids, you may need to adjust the pH and check it regularly to ensure it is at the right level.

When you are choosing your fish initially, it is easiest to select those which will enjoy the pH of your tap water. If you choose a range of fish which prefer different pH values, you have no chance of keeping them all happy.

Most fish are adjustable within reason, so a neutral or slightly either way value will be fine for a community aquarium.

Hardness

The hardness of the water indicates the number of dissolved salts within it. Usually (but not always) hard water will have a high pH, and soft water a low pH. There are a number of ways of measuring hardness:

GH: Indicates the amount of calcium bicarbonate and sulfate in the water.

KH: Indicates the amount of bicarbonate dissolved

PH: Indicates the amount of sulfate dissolved

Calcium bicarbonate can be removed by boiling, but sulfate is unaffected. If you only wish to use one test, then choose a GH test which tells you the total hardness of the water.

As with the PH, the correct value depends on the fish you have chosen to keep. Between 8 and 12 is an average that will suit most fish, although if you have chosen to keep soft-water Discus the value must be lower. For hard-water cichlids a higher value would be better.

Other tests

There are plenty of other tests available, but most will not be needed until you are an experienced

fishkeeper and quite at home with water chemistry. Copper, for example, is not usually a problem in an ordinary tropical tank, but in a reef tank even a trace would prove fatal. Carbon dioxide and oxygen will usually look after themselves, while iron and phosphates are of more interest to plant keepers.

This is not to say that you will never want to test for any of these, but they are not a vital part of your start-up battery of tests.

When to test

Normally a test once a week will be sufficient. Remember to do the test before any water changes or the results will be affected. If you are dealing with a problem then you can monitor the results of your actions by testing daily.

Testing more often will simply reduce you to a state of hysteria without increasing your understanding of the situation.

When you get an unexpected or bad test result panic can easily set in. Don't! While your fish will eventually be killed by bad water conditions if you just pretend you never saw it, they will certainly be killed by having the tank completely flushed with cold tap water.

The purpose of your tests is not to prove that you have a problem when all the fish are floating belly up — you will already know by then. The whole point is to see problems developing and be able to deal with them before the fish are affected.

If you get a totally unexpected test result, where a level has rocketed sky-high when it was normal the week before, it is a good idea to purchase a new test kit and retest.

Something may have happened to your kit; it may have been exposed to sunlight or air for too long, got wet, or simply aged. Retesting will ensure that you don't embark on a needless, and possibly harmful, course of action.

Ammonia and nitrite

Any ammonia or nitrate reading is cause for alarm in an established tank. A small water change of ten percent will alleviate the problem without shocking the fish. Next check that the filters are working, and that water is flowing freely. If you have been lax about cleaning your filter, this could be the cause.

Even if the water is flowing freely, it may be time to change chemical filter media. Once chemicals are

"loaded" then they cannot absorb any more poisons from the water and need to be replaced. If you use a biological filter, try to remember if anything you have done could have killed the bacteria.

Did you do a water change with straight tap water and no dechlorinator, or rinse the filter sponge out under the tap? Have you treated the tank with an anti-bacterial remedy? If you suspect these causes all is not lost — a hefty dose of "filter start" will get the bacteria growing again.

If the gravel has become very dirty, then it is time to get the gravel cleaner out, and to keep up a higher standard of cleanliness. Any waste matter decaying produces ammonia, and therefore keeping the tank clean will reduce the amount produced.

For the same reason, any dead fish, plant leaves, or uneaten food should be taken out as soon as they are noticed. If the tank is clean and the filters working, then it is time to look at other causes. Did you add that "just a little one" extra fish?

Perhaps your stock have grown. Overstocking is a common cause of water pollution, and the only solution is to find a new home for one or more of your charges.

There is one circumstance in which a high ammonia or nitrite reading is expected, and unfortunately this is the first thing the novice with a biological filter experiences. When a new tank is started, there are bacteria in the water, but very few, as there is nothing for them to eat. When a fish is first introduced, the ammonia builds up in the water.

As the ammonia builds up the bacteria rapidly start to breed until there are as many as can be supported by the ammonia produced by the fish. For a couple of days the ammonia will be high while the bacteria catch up — if you do a massive water change now, then the ammonia will be removed, the bacteria will starve, and the filter will not mature.

This is the reason for starting a new tank with one, hardy fish, and waiting for the filter to adjust. If you stocked the tank fully straight away, the ammonia would reach lethal levels before the bacteria caught up. There may be a little ammonia spike whenever you add new stock, but it should be back to normal within two days.

Similarly, the nitrite eating bacteria need a nitrite build up in the water before they can breed.

This is all quite normal and requires no action — just wait and add no more fish until the ammonia and nitrite readings are back to zero.

Nitrates

Except in a marine tank nitrates are not so much of a cause for worry. If you have a high nitrate reading, it is worth testing your original tap water. If this is high in nitrates then you need to incorporate active nitrate removing elements in your tank — a water change will just flush in more nitrates.

You could consider keeping real plants (or more of them) as these consume nitrates as well as looking attractive. Fast growing plants are best, as every time you prune them and throw away leaves, you are totally removing from the tank the nitrates that the plant used to grow those leaves.

Plants such as Duckweed, where you can scoop out and remove nets full every week, are efficient nitrate reducers. There are also chemicals for use in filters that remove nitrates from the water. As with ammonia and nitrite, removing solid waste from the tank reduces the amount of food for the filter bacteria, and therefore they do not produce as much nitrate at the end of the cycle.

pH and hardness

For most people the pH and hardness they expect and have learned to live with is

the way the water comes out of the tap. There are ways of changing this, including filtering water over peat (to lower pH) or coral sand (to increase hardness).

A reverse osmosis unit will produce totally pure water which can be mixed with tap until precisely the right levels are reached. However, tinkering with these values is a complicated business, and should not be attempted until you have a good understanding of water chemistry.

If the pH in the tank is higher than expected then check the decor. As mentioned before coral sand and some gravels actually dissolve slowly in the water, increasing the hardness.


The same thing can occur if you use rocks collected from the beach as decor.

All gravel and rocks should be thoroughly washed to start with. You can then drip a small amount of vinegar on it — if it fizzes the rock is not inert (unable to react with the water) and should not be used.

Living plants excrete CO₂ during the night, and this might cause a slight drop in pH. By always testing at the same time of day you will not be confused by a slight fluctuation.


Water testing is a valuable tool to the aquarist to help prevent problems from reaching crisis point. By regular testing dangers can be forestalled before they have had any effect on the fish. However, fish are quite tolerant. If you test regularly then you have plenty of time to take action, so don't panic!

Test Kit Type	What it Does	When to Use
pH	Measures acidity or alkalinity Low pH (below 7) = acid High pH (above 7) = alkaline	When setting up a breeding tank to special water conditions
Hardness	Measures dissolved salts (Calcium, Magnesium, etc.)	
Ammonia	Measures Ammonia levels	When setting up a new tank, to indicate when filtration system is mature and so safe to introduce fishes
Nitrite	Measures Nitrite levels	
Nitrate	Measures Nitrate levels	
Copper	Measures Copper levels	Especially useful to determine residual copper levels after treatment of the marine aquarium
Carbon Dioxide	Measures Iron levels	Useful when into serious aquatic plant culture
Iron & Phosphate	Measures Phosphat levels	

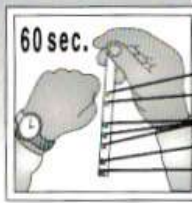


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- GH - Total Hardness
- NO₂ - Nitrite
- NO₃ - Nitrate
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FROGS & FRIENDS



HERP FACT FILE

Harlequin Toads (GENUS *ATELOPUS*)

Sometimes referred to as Harlequin Frogs this genus is placed in the family Bufonidae which includes the "typical" or "true" Toads (*Bufo* spp.). At present there are around 60 species but many of them are poorly known so the number may eventually be revised.

Possibly the most familiar species, usually portrayed in books, are *Atelopus varius* and *A. zeteki*. The latter, from Panama, is now endangered and is listed on CITES Appendix I.

Some of the other species are apparently declining even in undisturbed habitats. These are the subject of investigation and proposals have been made to include them on the endangered list. Few species are seen in the trade but some specimens of *A. peruvensis* from the high Andes of Peru have been on sale recently.

Distribution and habitats

Atelopus has been found in 13 countries in Central and South America — most species occur in Colombia, Peru, Ecuador and Venezuela.

Although mostly montane, a few species inhabit rainforest from sea level to 1,000 metres. A few live above 4,500 metres in slightly drier areas above the tree line but the majority are found in cloud forest between these two limits.

High humidity or access to water is essential; most species are found near to mountain streams where they breed. All tadpoles studied have a suctional ventral disc — an adaptation to moving water.

Lowland rainforest species can tolerate an air temperature of 28°C (82°F) but at high altitudes daytime temperatures are lower and night time temperatures can be around 0°C (32°F) every night.

High altitude species are usually dull-coloured and have been seen basking in the sun. Their colouration helps to absorb warmth and possibly protects against the intense solar radiation which is produced at high altitudes.

Skin toxins and colouration

Varying amounts of Tetrodotoxin (a potent neurotoxin) have been found in the skin of species studied and the ovarian eggs of one species. The toxin is also found in some marine organisms and in a few newts such as the California Newt (*Taricha torosa*). It is also known from one Dendrobatid frog (*Colostethus* species).

It is thought to be synthesised within the body and not acquired directly from the food insects as in the Arrow-poison Frogs (*Dendrobatidae*) — unlike these which lose their toxins in captivity certain *Atelopus* species have retained their toxicity even after three years in a vivarium.

Caution in handling any *Atelopus* species is therefore recommended. In view of their toxic nature the bright colouration of many species is said to be aposematic (warning). Some are a uniform bright yellow, others are an attractive combination of two or more colours.

In certain species colouration and pattern can be variable. Not all species have been studied but substantial amounts of toxin have been found in some. Toxins are measured in "mouse units" (MU) which equals 0.22 micro grams, this being the amount needed to kill a 20 gram mouse in 30 minutes.



Atelopus berusensis — a high mountain species and like many other *Atelopus* not really suitable for the inexperienced.

PHOTOGRAPH: BOB & VAL DAVIES

Species analysed have been found to contain as little as 0.6 micro gram or as much as 3000MU.

Dull, high altitude species are also toxic; in these cases the ventral surface is brightly-coloured although it has been suggested that this may be connected with species/sex recognition. Diurnal habits in *Atelopus* may well mean that colouration is important in this function. *A. peruvensis* is dull green with a bright orange belly and a light, spotted band along the flanks.

When disturbed it stands stiff-legged with the body raised — possibly a kind of "unken reflex" as seen in Fire-bellied Toads (*Bombina*) where the body is "curled" upwards with raised limbs to show the ventral colouration. The toxic skin of *A. peruvensis* is not a complete protection — some birds of prey and at least one snake are known to prey on them.

Reproduction

Breeding is said to take place in relatively dry periods when the streams are lower. Eggs are laid in strings in moving water. However, breeding habits in the wild are little known and may vary with rainfall and temperatures at different altitudes. Substantial numbers of toads are sometimes found migrating to the breeding sites — many pairs already in amplexus which can endure for long periods (125 days in one instance).

Unattached males are known to attack amplexant males. Male to male and female to female aggression has been observed and unreceptive females will also repulse would-be suitors.

In the vivarium

As relatively few species are imported captive breeding reports are rare although not completely unknown. Providing suitable conditions is difficult if the origin is unknown.

Ambient temperatures in the keeper's home may be too high for many species — it is much easier to raise temperatures than to lower them. Certain species are known to be specialist ant eaters and may not take to a captive diet.

Imported specimens are often already in amplexus and showing signs of emaciation — feeding in this position is difficult for females and practically impossible for males. Collection from the wild and transportation at this stage may well stress them further and cause failure to thrive.

In view of the above it has to be said that they are not really suitable for the inexperienced.

Problems of identification

Being unable to positively identify specimens can be frustrating as providing the right vivarium conditions is difficult which could also prevent breeding. A positive identification enables research providing there is some information available.

At one show recently we purchased some frogs labelled *Hyperolius* — the generic name of African Reed and Lily Frogs; small, arboreal species which often appear in the trade. It was obvious that these specimens were wrongly named since the pupil was vertical — horizontal pupils are a distinctive feature in *Hyperolius*.

Another clue was the large number of small 'dots' covering most of the dorsal surface — the frogs were actually Leaf-folding Frogs of the genus *Arixalus* (one book calls them Banana Frogs). The small dots are referred to as asperities and are typical of the genus although in some species they

are less conspicuous than in others.

Apart from these features there are several similarities between the two groups: relatively small size, webbing on toes and fingers, angular disc covering the males' throat sac and discs on the digits — typical of an arboreal lifestyle. Both groups can exhibit some degree of colour change which is apparently related to temperature and light although disturbance can sometimes induce it.

Identifying by colour alone is difficult as some of the 20 or so species of *Arixalus* can have different colours or patterns. Our specimens, from their colouration, would appear to be *A. formasini* but one book places this species in East Africa: *South African Frogs — A Complete Guide* by Passmore and Carruthers shows it with a limited distribution on South Africa's East Coast and into Swaziland.

Luckily both genera will thrive



Arixalus species. The dorsal stripe can disappear to produce a uniform brown colouration.

PHOTOGRAPH: BOB & VAL DAVIES

in similar conditions; a moist tropical vivarium even if the species is unidentified. However, *Arixalus* folds its eggs in leaves above the water; *Hyperolius* lays them on leaves or solid surfaces above water with some species laying on the upper surface of leaves in water (no leaf-folding).

Having purchased some unidentified *Hyperolius* from

Tanzania labelled "Kiwi Frogs" we are faced with a further problem of identification. The genus contains possibly over 140 species. Colouration is highly variable, also depending upon age, species and sex.

Some species are polychromatic — colouration and pattern showing widely ranging differences and being changeable.



Dendrobates leucomelas is one of our species of Arrow-poison Frog. *Dendrobates* are still as intriguing as they were when we obtained our first specimens 29 years ago.

PHOTOGRAPH: BOB & VAL DAVIES

Formative influences

Among the formative influences which fuelled our interests way back in the fifties and sixties were various books. Colour photographs were a real stimulus — to see a specimen in full colour was "mind-boggling" after the

black and white pictures and line drawings of older books.

In those early days A&P occasionally carried reviews of books on Reptiles and Amphibians. One review in January 1962 was Alfred Leutscher's *Vivarium Life*; worth all of the 25/- (£1.25) in spite of the line drawings; many hours were spent reading its every word.

naturalists to study them as scientific groups and produced a lot of the early information although some British and European authors wrote some notable works.

Two other books (reviewed in 1963) were *Reptiles and Amphibians of Europe* by W. Hellmich — more of a field guide with colour illustrations not photographs, but rivetting

April 1963 contained reviews of the five Handbooks of Lizards, Snakes, Frogs and Toads, Turtles and Salamanders. Even at that time they were out of print but were eventually obtained through the lending library loan scheme.

Although they dealt mainly with American species they opened up a whole new world. The huge variety of Reptiles and Amphibians in the USA led

at the time; and *Living with Reptiles* by Kathleen Pickard-Smith. This was a delightful tale by a lady who started to keep reptiles in her old Tudor mansion; most of them roamed free about the house — she also kept them in outside enclosures.

Although not a scientific

► Continued on page 74

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BOB & VAL DAVIES'S FROGS & FRIENDS

◀ Continued from page 73

work it was a pleasure to read and couldn't fail to stimulate interest. Among the "treasures" on our bookshelves stand three books which were rapturously reviewed, namely: *Living Reptiles of the World* by Schmidt & Inger (1957); *The World of Amphibians and Reptiles* by Robert Mertens (1960); and *Living Amphibians of the World* by Doris Cochran (1963).

All contained some marvellous colour photographs of previously unseen (and sometimes unheard of) species, many of which we were eventually to possess in

our collection. It was in the two titles on amphibians that we first saw Arrow-poison Frogs — these soon became one of our special interests and remain so today.

All of these titles are now out of print; they have been superseded by a host of others but are still seen occasionally as second hand and worth buying by anyone who is interested in old books on the hobby even if they are dated Schmidt & Inger's book was on sale at one show for £12 — a bargain for a classic!

Nowadays newcomers to the hobby have the advantage of many more books with mainly colour photographs which leaves less to the imagination.



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**NICK
DAKIN**

finds some invertebrates that may or may not be accidentally introduced into the aquarium ... *photographs by the author unless otherwise stated*

MARINE

Sea Squirts: The Missing Link

Class: ASCIDIACEA

Sea Squirts have a unique place in natural history as they have long been regarded as the "missing link" between vertebrates and invertebrates. This fact is not readily obvious when we look at the adult, as they conform to all the requirements of an invertebrate.

However, when the free-swimming larval stage is studied, it becomes clear that they possess a stiff rod which acts in a similar fashion to a backbone. This rod is known as the

notochord and marks these creatures as biologically very important in the evolution of marine animals.

Widespread

Over 1,000 species of Sea Squirts have been identified by science and they are widespread throughout the oceans of the world, from the very coldest to the very warmest regions. But it is interesting to note that hardly any are deliberately available to the

hobbyist as colonies or individuals.

More often than not they usually arrive accidentally on pieces of living rock or accompanying other sessile invertebrates. To this end, enthusiastic marinists would be well advised to inspect the base rocks of soft corals, polyps and the like, for signs of these fascinating (and usually free) "hitch-hikers".

Fortunately, Ascidiaceans tend to fare very well in the invertebrate aquarium and may spread quite freely if conditions are favourable.

Sea Squirts feed by drawing water in through one syphon, filtering it for



Sea Squirt,
Polycarpa sp.

SEA SQUIRTS ... The Missing Link



Sea Slug,
Chromodoris
sp.

PHOTOGRAPH:
ASP LIBRARY

suitable particles, and then expelling the "clean" water through another. They have gained the name Sea Squirts because, if squeezed, they can produce a jet of water from the syphons; although this is much more noticeable in larger specimens. It is not a practice to be recommended to the hobbyist as damage can easily result.

Owing to the vast number of species, colours are abundant and may vary from red, blue, green, white, yellow, beige or even transparent. Occasionally, some species also act as hosts to symbiotic algae.

The mariner aquarist would do well to nurture these interesting creatures as an aid, albeit small, to better water quality.

Tank and water conditions

A tank with a minimum volume of 20 gallons (91 litres) nett is to be recommended.

pH: 8.1-8.3

Temperature: 24-26°C (75-79°F) for tropical species

Ammonia: zero

Nitrite: zero

Nitrate: 20ppm or preferably less

Specific Gravity: 1.022-1.025

Phosphates: less than 0.5ppm

Redox potential: 350-400mv

Efficient protein skimming and activated carbon should be seen as

standard.

A 15 to 25 per cent water change is required very two weeks with a high quality salt mix.

Lighting is unimportant for most species as the majority do not rely on illumination and are often found in shady, if not dark, locations.

Feeding

Sea Squirts are efficient filter feeders and can often survive without any special attention. However, live Brine Shrimp nauplii, live rotifers and the juices from a freshly-thawed Molluscs are all readily accepted to assist with growth and the preservation of good health.

Health

Ascidians normally remain healthy even if water conditions are less than perfect. They can withstand a higher level of nitrates, phosphates and total dissolved solids (TDS) than many other invertebrates; however, the presence of ammonia or nitrite will be harmful.

SEA SLUGS

Class: GASTROPODA (OPISTHOBANCHIA)

Sea Slugs is not a very flattering

name for a largely attractive, if not stunning, group of invertebrates. Scientifically, they are more accurately known as nudibranchs — a word meaning naked gill — and belong to a group of gastropods called opisthobranchs.

These univalve molluscs possess either a very reduced shell, or no shell at all, making them the marine equivalent of land slugs (hence the common name). Some species, such as the Spanish Dancer (*Hexabranchus imperialis*) are graceful and agile swimmers; however, the vast majority creep over the seabed and have little, or no ability to swim.

As already stated, many Sea Slugs are exceptionally beautiful creatures with remarkable colouration and markings, making them particularly desirable for the marine aquarium. Such flamboyancy almost certainly acts as a warning device to potential predators of their poisonous or highly distasteful nature; much in the same way that highly decorative caterpillars do to birds.

External (naked) gills are often seen as feathery tufts adorning the back and some species have the ability to withdraw them into the body should danger threaten. Other species lack these decorative plumes and respire directly through their skin.

Contrary to popular belief, only a few Sea Slugs are herbivores, the vast majority are grazing carnivores

and frequently prefer to feed on specific hard corals, anemones, hydroids Sponges, Soft Corals, Gorgonians and other invertebrates.

It is an unfortunate fact that the most beautiful Sea Slugs are also the most carnivorous and can prove highly destructive to sedentary invertebrates as described. Realistically, therefore, the vast majority of these species, whilst commonly available, cannot be recommended to the marine aquarist as a long term proposition.

One species that generally does well in the marine aquarium and performs a useful service is the Sea Hare (*Aplysia* sp.). Greenish brown in colouration, it is no match for some of its gaudier cousins but it does graze on algae at a prodigious rate — hence the derivation of its common name.

Macro-algae is a favourite food as well as some species of Hair Algae. Unfortunately, Slime Algae is not an appealing foodstuff and is usually totally ignored!

The Caribbean Sea Hare can grow to 12 inches (30cm) in length, whilst Indo-Pacific species as supplied to the aquarium trade are generally much smaller at only 3.2 inches (8cm).

Sea Hares are good swimmers and able to move quickly to fresh

feeding sites, or away from danger. Given the right conditions *Aplysia* sp. will live in excess of two years in the aquarium.

Sea Hares should be housed with peaceful fish only as they are capable of releasing a poisonous dye from a gland in the mantle if aggravated.

Tank and water conditions

A tank with a minimum volume of 20 gallons (91 litres) nett is to be recommended.

pH: 8.1-8.3

Temperature: 24-26°C (75-79°F) for tropical species

Ammonia: zero

Nitrite: zero

Nitrate: 20ppm or preferably less

Specific Gravity: 1.022-1.025

Phosphates: less than 0.5ppm

Redox potential: 350-400mv

Efficient protein skimming and activated carbon should be seen as standard.

A 15 to 25 per cent water change is required very two weeks with a high quality salt mix.

Lighting is unimportant for most species as the majority do not rely on illumination.

Feeding

Sea Hares require a constant supply of green algae, both micro- and macro-. It will not only consume vast quantities of nuisance algae but will not discriminate against decorative algae and can decimate carefully cultured growths. Sea Hares should not be considered for the aquarium if copious amounts of algae cannot be supplied on a regular basis.

Most of the highly coloured Sea Slugs are unable to find the correct diet within the marine aquarium and gradually starve to death. Should they happen on a suitable food source, it will usually be a prized coral which they will feed upon until it is dead.

Health

Given good water quality Sea Slugs do not suffer from any particular diseases. However, shrinking of the body and inactivity will indicate the lack of a proper diet and death usually follows soon after.

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<http://www.nickd.clara.net>

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ROY ROSMINT considers the Stickleback ... *photographs by Dave Bevan*

A Native Firemouth

Male Three-spined Stickleback.



With enviable agility the Hunting Spider, *Dolomedes*, purposefully negotiates its way across the jagged overlapping plant fronds onwards towards the edge of the reed bed. Upon arrival it stops, waits motionless for a few moments before swiftly descending a sturdy

stem and gently stepping onto the water surface.

Moving into position the spider commences to engage in a strange rhythmic jig, tapping the surface tension with the tips of its front spindelegs. But this is no demonstration of pleasure or some curious arachnic watersport: the

creature is hungry and, for the unsuspecting fish below, it will undoubtedly prove to be a dance of death.

The young Three-spined Stickleback is itself cruising in search of food. Suddenly, from above, it senses a series of encouraging tell-tale vibrations

immediately reminiscent of an insect in distress. Cautiously it moves into shallower water.

From a depth of some nine inches the signals are very strong and the fish is able to pinpoint the precise location of the apparently stricken insect floundering at the surface. For a moment of two it instinctively hesitates for, despite all the favourable signs, it is still unable to positively identify the quarry.

But initial wariness is soon overtaken by incessant pangs of hunger and the fish suddenly darts upwards to claim its meal. As it arrows in on the target the Stickleback realises too late it has made a fatal error of judgement and has been cleverly deceived. But its fate is already sealed. Instead of winning a nutritious meal the young fish is ironically about to be made the subject of one — the predator becomes the prey!



Strange fishing technique

On the surface *Dolomedes* is confident and ready, its strange fishing technique having proven successful in this place on many occasions. As the fish comes within range the spider lunges downwards grabbing it firmly, at the same time administering a poison that quickly renders the struggling creature inactive.

Once completely subdued the spider carries the lifeless fish from the water and heads back across the reed bed, where it commences to feed, the single small Stickleback providing all necessary nourishment for a whole week.

This account of predation upon the Three-spined Stickleback (*Gasterosteus aculeatus*) is interesting, for although the fish appears to be easily deceived by the spider's cunning tactics and able to offer little defence against its ferocious assault, the little Stickleback in other situations is capable of exhibiting quite formidable aggression — as well as demonstrating an extremely effective defence mechanism against would-be assailants.

Even the mighty Pike (*Esox lucius*), our most fearsome freshwater predator, that will attack almost any living thing that it is capable of devouring, is frequently unable to make a meal of the comparatively tiny Stickleback. Although often snapping it up between its huge, powerful jaws, swallowing the fish is another matter entirely!

The secret of the Stickleback's defence against this form of

conventional attack lies in the vicious spines or stickles located on its back and underbody. Once threatened the spines can be locked in the upward position and remain so until voluntarily released. In this way the fish is able to continually and painfully frustrate attempts by the predator to swallow it, often being spat out in favour of some other more easily ingested (and less prickly) meal elsewhere.

Highly effective though the spines are in deterring aquatic assailants they offer no defence whatever against the Hunting Spider's particular method of catching and killing. Unlike underwater predators like the Pike, *Dolomedes* is not especially common so the Stickleback has not evolved any specific defence mechanisms to directly counter its attack. Furthermore, the fish will of course only fall victim to the spider if it is successfully duped and lured to the surface.

One of the most abundant fishes in Britain and much beloved by youngsters with net and jam jar (at least for my generation!) the Three-spined Stickleback is found in a wide range of aquatic habitats and seems little concerned with water chemistry.

It does not, however, tend to favour ditches and small ponds with muddy bottoms and excessive plant growth, conditions more to the taste of its less common cousin, the Nine-spined Stickleback (*Pungitius pungitius*).

During winter months Three-spined Sticklebacks tend to live in shoals often in the company of Minnows. Towards the end of April they break away to locate a suitable

breeding area, normally favouring a quiet relatively shallow backwater with a sandy bottom, moderate vegetation and away from strong currents.

Female Three-spined Stickleback.

Change in body colouration

Triggered by the warming weather conditions the fish's body colouration begins to change in preparation for spawning. The predominantly silver backs and flanks of male specimens gives way to an impressive iridescent blue/green, whilst the throat, gill-covers and belly develop their characteristic glorious flaming red appearance.

From now on the male redthroats become highly territorial and demonstrate violent hostility towards each other. Any that infiltrate another's square metre of water space will be furiously attacked, an assault that will continue until the trespasser is driven back beyond the invisible perimeter.

The actions of the Three-spined Stickleback during the courtship and reproduction period have been the subject of much study and research over the years. Investigations that have revealed many interesting and important facts and contributed significantly to our greater understanding not only of this particular fish but also of the control mechanisms and functions of animal behaviour in general.

Some of the most valuable research in this respect was carried out by the distinguished scientist

A NATIVE FIREMOUTH ... The Stickleback

Nikolaas Tinbergen, who, in 1973, shared the Nobel Prize for his outstanding work. He demonstrated through observation and experimentation that the courtship period of the Stickleback involves a complex sequence of definite behavioural events or activities alternating between the male and female fish.

A particular activity by the male, for example, would trigger a specific response activity on the part of the female, which in turn elicits another male action and so on through the courtship chain of events. interruption to the vital sequence being likely to bring matters to an abrupt end.

Stimulus for attack

With the use of models Tinbergen demonstrated that the stimulus for the furious attack by male upon male was the characteristic brilliant red colouration of the throat and underbody and not just simply the presence of a rival.

The models consisted of a number of crude relatively unlife-like

representations but with the red throat clearly visible; also some carefully crafted facsimiles which incorporated many species characteristics but without any traces of red.

When these models were introduced to the Sticklebacks it was the crude red-throated versions that were predominantly attacked, not the more realistic ones without the red colour. Tinbergen saw further evidence of this colour hatred among some aquarium specimens housed on his laboratory windowsill.

He observed that the redthroats ferociously flew at the glass whenever the local post office vehicle drew up outside to deliver the mail! This regular frenzy was, of course, not based upon any particular dislike of the postman himself, simply the colour of his van.

Having located a suitable spawning site the male Three-spined Stickleback sets about excavating a depression in the sand, shovelling out a mouthful of sand at a time and transporting it away from the immediate area.

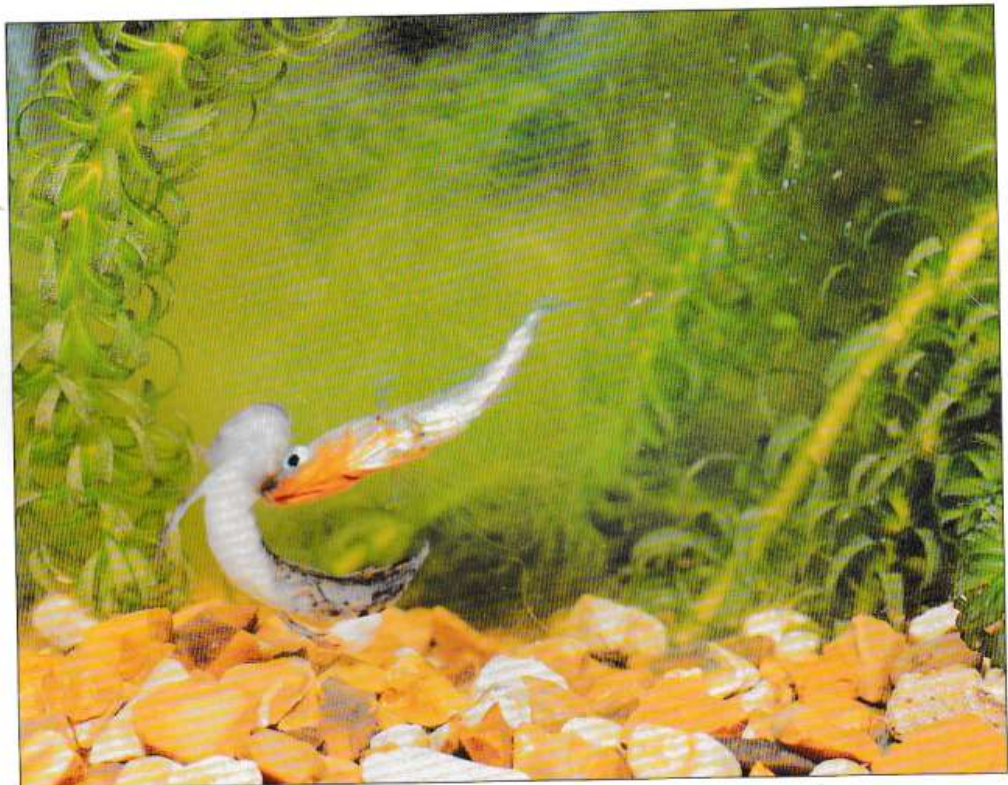
At the same time the territory will

be diligently guarded and policed with any intruders, be they other Sticklebacks, Newts, Sedge Fly larvae, Bullheads or anything else being attacked and driven out with quite phenomenal aggression and determination. Once a pit has been fashioned the fish will set about constructing a nest with in it, suitable plant debris being gathered from the surrounding area and brought to the nest site where it is then ingeniously cemented together with a sticky substance secreted from the kidneys.

This process continues until a dense coherent body of vegetable matter has been assembled. Completion of the nest is accomplished by forcefully driving the body through the centre of the plant mass and out the other side. This burrowing operation is repeated until such times as a satisfactory tunnel has been created. The nest is now ready!

It is this very act of tunnelling that seems to trigger the actual courtship phase in the male and he now endeavours to entice a ripe female to the nest by engaging in a strange jerky dance routine at its entrance. As demonstrated by Niko

Male Stickleback attacks young nest which sticks into breeding area.



Tinbergen the courtship must follow a precise pattern if it is to culminate in a spawning. If the female fish does not make exactly the right moves in the correct sequence the male will break off the romance. Amorous feelings quickly degenerate into hostility and she will be attacked!

Female's participation complete

Assuming the courtship goes to plan the female will eventually enter the nest and stimulated by the male vibrating her flanks with his mouth, deposit a clutch of eggs, on average numbering about 60 in total. The male then immediately enters the nest to fertilise them. This done the female's participation in the process is completed and she quickly leaves the area for deeper water to again start to ripen with another batch of eggs.

The male now assumes his responsibilities as a parent, a role that he takes very seriously indeed — at least for a while! He tends the eggs constantly, often pushing them deeper into the nest for safety so that they adhere together and cannot drift away. Also making room for more, as this will probably not be the only female he mates in this nest.

Using his pectoral fins he fans the eggs to ensure that they receive sufficient life giving oxygen. He also makes adjustments to the nest structure to ensure a good flow through of water for the same reason. At the same time he must be alert and on constant guard for there are many hungry predators abroad only too anxious to make a meal of his precious offspring.

Eggs normally hatch in about eight days when the free swimming fry will be between 3-5mm in length. The male continues to shepherd and fiercely protect the young for about a further week until they start to become more confident and independent, venturing further from the nursery. After this his parental interests suddenly begin to wane. The tiny fish are then on their own!

This is probably the young Stickleback's time of maximum vulnerability. Many will soon perish in the jaws of a diversity of hungry predators, which can often include adults of their own kind even, in some instances, their own now disassociated parents. Yet despite this period of inevitable danger the attentive protection afforded by the paternal parent during those earliest days helps ensure that the

Three-spined Stickleback enjoys one of the highest survival rates of any fish.

The young grow fairly rapidly reaching maturity in about a year. On average the length of adult fish is 4-5cm but this can vary quite considerably depending upon local conditions and circumstances with some specimens measuring as little as 2cm, others as much as 10cm.

Interesting and rewarding subjects

Sticklebacks can make extremely interesting and rewarding subjects for the coldwater aquarium, where given favourable conditions they will thrive and breed in the manner previously described. Though tolerant of almost any water composition if gradually acclimatised, diligent attention to water quality is essential for success. This is achieved through good filtration and regular partial

water changes.

The tank should be as spacious as possible incorporating a sandy, as opposed to gravel, substrate. A few large smooth pebbles and a scattering of plant life makes a satisfactory floor. The plants should be of varying species including some with feathery leaf forms so that the male fish has a good selection of nest building materials to choose from.

Although Sticklebacks will often live alongside each other in reasonable harmony for much of the year, as we have seen once the male's attention turns to reproduction, and he starts to don his fiery breeding garb, nothing is safe in his territory, especially another redthroat!

The humble Three-spined Stickleback, our abundant native firemouth with its intriguing characteristics and fascinating behavioural pattern, is in many respects highly reminiscent of certain of the tropical Cichlids so popular among aquarists. It can certainly be every bit as interesting and entertaining!

Great Diving Beetle (*Dysticus marginalis*) female eating Stickleback.



LIZ DONLAN'S KOI CALENDAR

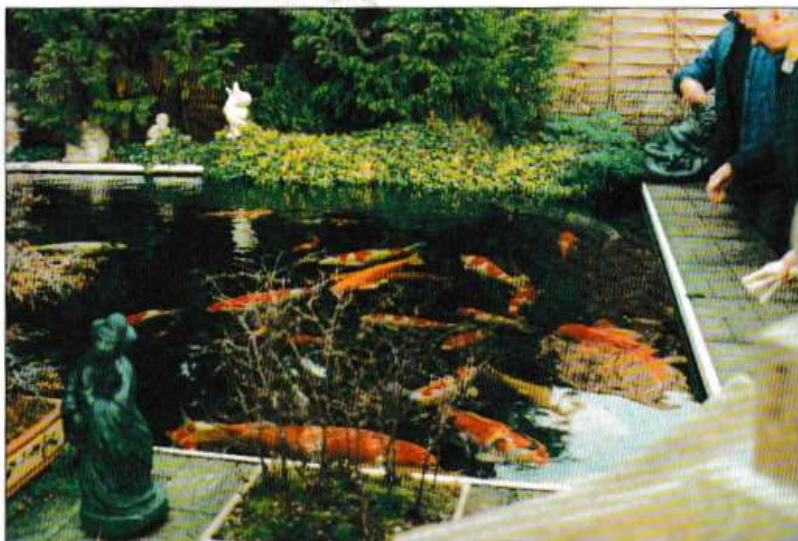
It's encouraging to hear from a number of new and old clubs this month which certainly proves that there's a great deal happening within the Koi world, so if you want to join a Koi club, visit other hobbyists' ponds, learn how to keep your Koi, borrow books and videos, etc., then pick up the phone NOW and ring one of the numbers listed in the Meetings Calendar.

This month's photograph features the pond of Colin and Carole Physick of Merseyside when

the Northern Koi Club visited on December 27 — yes, even

at the busiest time of the year and in the middle of

winter there are still activities within the Koi club world.



The Northern Koi Club has arranged a coach trip between Christmas and the New Year for several years and it is one of the most popular events of the year. The visit includes two to three hobbyists' ponds, a Koi dealer and finishing up with a meal and a pint (for those who aren't driving, of course!)

Colin and Carole Physick's pond, Merseyside.

PHOTOGRAPHY:
MIKE DONLAN

Show Calendar

MAY

2/3 Dealer's Koi Show (UK), Telford. Organised by DJs Koi. (Contact telephone number 01922 493290).

15/16 BKKS Koi '99, Bingley Hall, Staffordshire County Showground.

29/30 South of England Chapter ZNA, 5th Open Show, Fareham College, Hampshire. Contact Show Chairman, Martin Priddy, 01243 264719.

30 Lower Thameside Section (BKKS) Open Show, Southend-on-Sea (venue to be advised).

30/31 BKKS South Hants Section, 8th Open Show, South Downs College, College Road, Crookhorn, Havant, Hants. Further details from Ron Isted (Show Secretary), 012453 572762.

JUNE

5 BKKS Yorkshire Section Open Show, Lotherton Hall, Leeds. Contact Fred Harston (Chairman) on 01226 722578.

12 Essex Section BKKS, Closed Show, Aveley Sports & Social Club, Aveley, Essex.

12/13 Worthing and District BKKS, Open Show, Worthing Rugby Club, Angmering, West Sussex.

JULY

3/4 East Pennine Open Show, The Heritage Centre, Elsecar, near Barnsley, Yorkshire.

18 Essex Section BKKS, Open Show, Aveley Sports & Social Club, Aveley, Essex.

AUGUST

7/8 International Koi Show, Organised by DJs Koi. (Contact telephone number 01922 493290).

28/29 North East Koi Club Show, Gosforth Park Koi & Aquatics. Contact Jean Hope on 0191 416 5794.

29/30 BKKS South East Section, Open Show, Ravens Wood School, Oakley Road, Bromley, Kent, 10am-5pm both days. Free parking. Dealers, Crafts, Tombola, Refreshments. Contact Susan James on 0181 696 5779.

Koi Society Meetings

MARCH

3 BKKS Leicestershire Koi Section, Annual General Meeting. Contact Karen Boynton on 0116 233 0797 (home) or 01455 550550 (work).

7 Dorset Koi Keepers, New video and teach-in at Greyfriars Community Centre, Ringwood. 2pm. Contact Alison Allen on 01202 875437.

9 Nottingham & District Section (BKKS), Gary Hillier, "Stories of a Judge" (slide show) at the Western Club, Derby Road, Lenton, Nottingham, 7.30pm. Contact Shirley Hind on 0115 981 0923.

10 Merseyside Section (BKKS), Derek York of Classic Koi at The Childwall Abbey Hotel, Score Lane, Childwall, Liverpool, 8pm. Contact Syd Bennett on 01942 204948.

10 North Lincs Koi Club, Stallingborough Village Hall, a few miles north of Grimsby, and off the junction A1037 on the A180 — the Immingham/Stallingborough junction at 8pm. Contact Ken Bush on 01472 883377.

17 Crouch Valley Section (BKKS), Kusuri Products — talk on recent development of new food and Koi products. Contact Brenda Scott on 01375 642321.

21 Northern Koi Club, St. James Church Hall, off Eccles Old Road (nr Hope Hospital), Salford, 1.30pm. Topic, Bringing your Koi out of the Winter. Contact Glynis Morgan-Davies on 01706 218243.

21 South East Section (BKKS), Chelsfield Hall, Windsor Drive, Chelsfield, Kent, at 2pm. Contact Mick Wright on 01634 718943.

21 Yorkshire Koi Society, Collingham Memorial Hall, Collingham, nr. Wetherby, 2.30pm. Robin Whitehead from Bradley Bonsai will be discussing both indoor and outdoor bonsai. Contact Malcolm Buck on 01947 810372.

25 Witham Valley Koi Society, Guest speaker Terry Hill talking about pond design and construction. Contact Jeannette Preston on 01522 791135.

31 East Midland Koi Club, Guest speaker Paul Stacey. Contact Richard Jones on 01283 224975.

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. Copy for Koi Calendar can be sent to me c/o Koi Calendar, MJ Publications Ltd., 20 High Street, Charing, Ashford, Kent TN27 0HX, or by contacting me direct, telephone (0161 794 8282) or fax (0161 793 9696).

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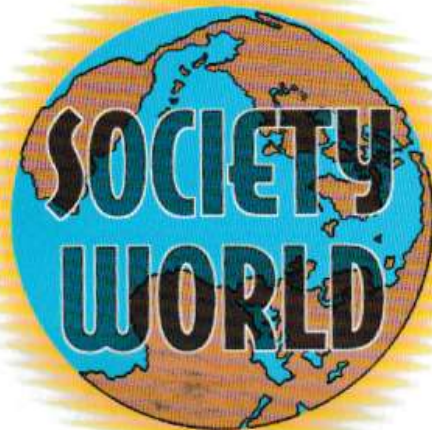
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Applications from societies for this year's Open Show sponsorship should be made as soon as possible to: Open Show Support, 5 The Nook, Corby Village, Northants NN17 1XA.

Auctions

- 14 March Cramlington A.S.
- 14 March Greenock A.S.
- 21 March Three Counties Group
- 28 March Merseyside A.S.
- 28 March W.A.S.P.
- 4 April Oldham A.S.
- 11 April Clacton F.K.S.
- 11 April Preston & D.A.S.
- 18 April Ryedale A.S.
- 25 April Robin Hood A.S.
- 9 May C.A.S.T. 88
- 13 June Thameside A.S.
- 27 June St Helens A.S.
- 25 July Merseyside A.S.
- 5 September Alden A.S.
- 12 September Silkton A.S.
- 26 September Darwen A.S.
- 3 October Halifax A.S.
- 7 November Merseyside A.S.
- 21 November Northern Area Catfish Group

Show Dates, Events & Festivals

(Rule Codes: A = A of A; FB = FBAS; FN = FNAS; FS = FSAS; I = International Goldfish Standards; N = NEFAS; U = USofA; Y = YAAS)

- 2 March Gloucestershire A.S. St Augustine's Church Hall, Matson Lane, Matson, Gloucestershire. 7.30pm. Open Forum, Project Discussion, Quiz. Information from Caroline, 01453 824810.
- 6 March FBAS General Assembly
- 7 March Eastleigh A.S. (FB)
- 7 March FNAS Annual General Meeting
- 7 March Ashby Fishkeepers Open Show. Grange Farm Hobbies Centre, Bellingham Road, Scunthorpe, North Lincolnshire. Booking in 11.30am-1.30pm. Auction. Information from Terry Nelson, 01724 289736.
- 13 March KAAS Convention, Smith's Court Hotel, 23-25 Eastern Esplanade, Cliftonville, Margate, Kent. Speakers: Bill Rundle, Andrew Smith and Brian Walsh. Quiz, Auction and Raffle. Ten Pin Bowling competition on Sunday morning for those who stay over. Admission £10 by ticket only in advance from KAAS, 73 The Fairway, Rochester, Kent ME1 2LT. (Tel: 01634 408656, Allan Best). Overnight B&B accommodation available hotel by direct individual contact with the hotel (not via KAAS). People who are staying overnight and wish to participate in the Ten Pin Bowling should advise when applying for their ticket(s).
- 14 March Greenock A.S. 14th Open Show. Town Hall, Cathcart Street, Greenock. Fish Auction, Raffle. Further information from Jim Sheakey, 01476 704219.
- 20/21 March Yorkshire Aquarists Festival, Doncaster (Y)
- 21 March Three Counties Group. Spring Fishkeeping Auction. Pinewood Leisure Centre, Old Wokingham Road, Bracknell, Berks. Information from Steve Hinkley, 0118 9811261.
- 21 March Association of Midland Goldfish Keepers. First meeting of the year. Note new venue: St Laurence Church Hall, Old Church Road, Bell Green, Coventry. Information from Bob Blades, 01827 285930.
- 28 March Isle of Wight A.S. Club Show. Binstead Community Centre, Coniston Avenue, Binstead, Ryde. Isle of Wight. Benching 10am. Guest speaker to be advised. Information from Les Pearce, 01983 613575.
- 28 March Northampton & D.A.S. Open Show. Northampton Christian School Rooms, Park Avenue North, Northampton. Information from Mrs D. Woodman, 01604 411591.
- 28 March Washington A.S. Auction of Fish and Dry Goods. The Nissan Sports and Social Club, Nissan Car Plant, Washington. Booking in from 11 am. Auction starts at 12.30pm. Bar and Refreshments will be available. Further details from A. D. Race on 0191 417 0768.
- 4 April Oldham A.S. (FN)
- 11 April Aberdare A.S. (FB)
- 18 April Kirkcaldy A.S. (US)
- 25 April Hull A.S. (Y)
- 25 April Robin Hood A.S. (Y)
- 25 April Strood & D.A.S. (FB)
- 1 May Southend, Leigh & D.A.S. (FB)
- 9 May Corby & D.A.S. (FB)
- 14/16 May Grocklemania, IOW (FB)
- 22/23 May Fishkeeping Through Millennium; British Open (Blue Planet) (FN)
- 5 June FBAS General Assembly
- 6 June Erith A.S. (FB)
- 13 June Bracknell A.S. (FB)
- 13 June Thameside A.S. (FN)
- 19 June Bristol Tropical A.S. (FB)
- 27 June St Helens A.S. (FN)
- 25 July Merseyside A.S. (FN)
- 1 August Three Counties Area Group
- 15 August KAAS (FB)
- 3 September FBAS General Assembly
- 5 September Alden A.S. (FN)
- 12 September Cramlington A.S. (FB)
- 12 September Silkton A.S. (FN)
- 19 September Northern Area Catfish Group Open Show
- 25 September Northern Goldfish & Pondkeepers Society (I)
- 26 September Darwen A.S. (FN)
- 3 October Halifax A.S. (FN)
- 23/24 October British Aquarists Festival, Manchester (FN)
- 5/7 November Supreme Festival of Fishkeeping (FB)
- 4 December FBAS AGM & General Assembly