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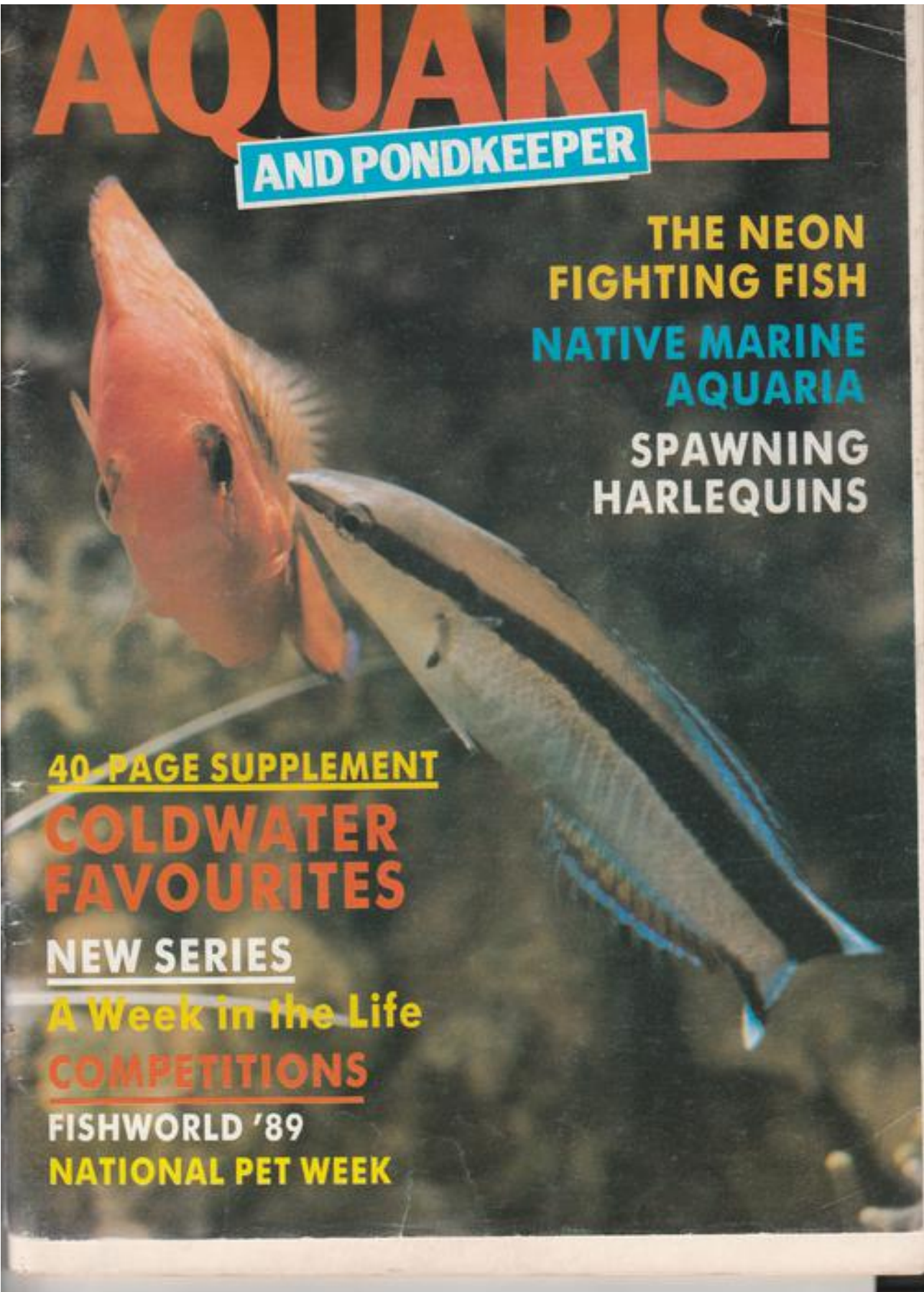
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AQUARIST AND PONDKEEPER

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COVER STORY

(Photograph: Jane Burton/
Bruce Coleman Ltd.)
Some fish look pretty; others
behave interestingly. The
Cleaner Wrasse (*Labroides
dimidiatus*) — seen attending
to a Flame Dwarf Angel (*Centropyge
loriculus*) in our
cover picture — does both...
and performs nightly dis-
appearing tricks as well. Once
its non-stop daily round of
cleaning is completed, this
hyper-active little fish will
burrow into the coral sand
and retire for the night. There
it will be safe from would-be
predators, some of whom
could well have been passive,
willing, non-threatening cli-
ents during the daylight
hours.



THE BEEFBURGER CONNECTION

Did you know that it takes 55 sq ft of rainforest to produce an American beefburger? No? Well, neither did I, until I read this mind-bending statistic in a recent Sunday Colour Supplement.

The point that the writer was making was the beefburgers consist of beef, that cattle feed on grass, that grass needs somewhere to grow, that that "somewhere" is often a cleared tract of rainforest, and that, if we persist in eating vast quantities of beefburgers, we are all, unwittingly or otherwise, contributing to the massacre of the world's ever-shrinking expanses of virgin jungle.

A sobering thought. To be fair, though, the same writer reported that some of the major beefburger producers claim to have stopped using "rainforest-reared" cattle for their supplies of meat. Even so, I find the thought that we may be, almost literally, eating away the future of our rainforests, a deeply disturbing one.

It's not just trees we're talking about when we refer to rainforest clearance, either, but the flowers, fungi, ferns, insects, mammals, birds, reptiles, amphibians, fish and all other forms of life that disappear with the annihilation of the life-giving canopy.

For us as fishkeepers, the whole concept of rainforest destruction and its consequences should not be too difficult to grasp. After all, many of our best-loved species, like Neons, Cardinals, Discus and countless others come precisely from such an environment.

And when the fish disappear we, probably, more than any other hobbyists, feel the immediate and awful impact of such a disaster, constantly striving, as we do, to re-create little "drops" of nature within our aquaria.

It may be a long way From the Armchair to the Amazon (to quote the title of David Sands's article in this issue)... but not so far that we can't attempt to bridge the gap... or do something about ensuring that some gaps remain for us to attempt to bridge.


John Dawes
Editor



CONTENTS IN FOR A PENNY, IN FOR A POND

How can such a small pond have produced so many frogs... and how can so many frogs ignore so many slugs? Asks Amanda Grimes **5**

SPOTLIGHT SPECIAL The Harlequin

Arend van den Nieuwenhuizen is probably unique among aquarists in having managed to spawn the Harlequin and photographed the whole process. **18**

SPLASHING OUT

Waterfalls and Koi go perfectly together says Nigel Caddock's guidelines. **25**

(NEW SERIES) ● A WEEK IN THE LIFE

Jerzy Gawor kicks off our brand new occasional series with an exhausting insight into a typical week in the hectic and ever-changing life of an aquatic consultant. **28**

CONSERVING FISH SPECIES

— PART 3
THE ROLE OF ZOOS AND
AQUARIA **83**

BULLHEADED SURPRISE

Do things right and your fish will oblige, as newcomer to the hobby Sandra Witter discovered. **87**

THE NEON BETTA

A Fighting Fish that is not only beautiful but also has a fascinating history, revealed by anabantoid specialist Stephen Clark. **85**

BRITISH MARINE AQUARIA

An up-dated comprehensive guide to unheated marine aquaria from our expert Andy Horton. **90**

FROM THE ARMCHAIR TO THE AMAZON

Attractive to look at, and ideal for fish, nature-based aquascaping should be every aquarist's aim. David Sands shows how to achieve the best results. **94**

GEISHAS WITH A DIFFERENCE

Geishas, Madakas or Rice Fish — all are one and the same... and have a great deal going for them, according to Peter Capon. **98**

COMPETITIONS

Win some exciting prizes with the help of 'Aquarist' Fish Foods in this easy-to-enter fish-pic competition. **7**

Answer three simple questions and you could win FREE tickets and Show Guides to Fishworld '89. **34**

Exciting advance news of a fantastic FREE HOLIDAY competition sponsored by 'Aquarist' **82**

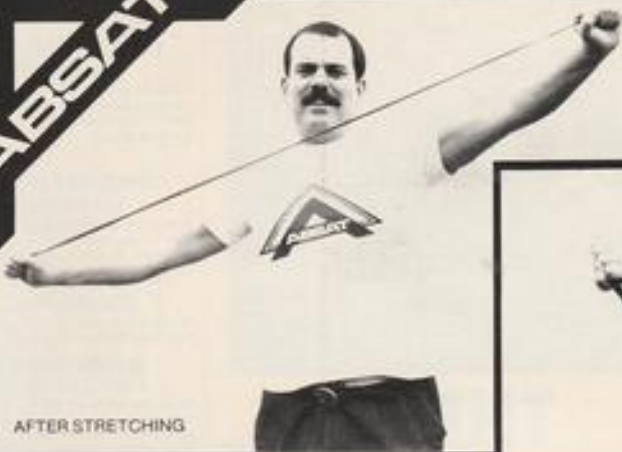
COLDWATER FAVOURITES SUPPLEMENT Pages 35-74 CONTEST LIST Page 37

(COVER PICTURE: DAVID ALLESON)

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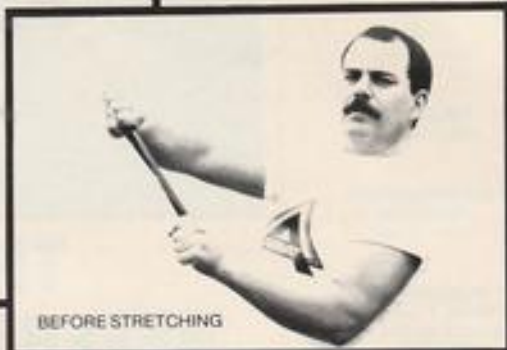
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AMANDA GRIMES

I've yet to work out how such a little pond as mine can produce so many frogs . . . or how so many frogs can ignore so many slugs!

IN FOR A PENNY, IN FOR A POND

Amanda Grimes had dreams of an organic paradise . . . but things didn't quite work out that way.

Having an inbuilt capacity for being proved wrong time and again, I would have sworn that I have never had frogs in my garden. Why should I think otherwise? Over the years, I have become more environmentally aware and have faithfully planted shrubs for butterflies, flowers for bees, lettuce and cabbage for pigeons, you-name-it-they-eat-it-for slugs.

So, in went the pond. It would be a good idea, I mused, to introduce some frogs into this in the spring. The natural balance would assert itself. No more slug pellets or night-time snail massacres. No more green, black and white fly. An organic paradise! No fish in the pond — just frogs. Frogs to rid my garden of lettuce-louts, hosta-hooligans and viola-vandals. Neighbourhood Watch, Jeremy Fisher style . . .

All this happy day-dreaming took place in 1987. In spring last year, I hauled out the mower and started it on the lawn. It's a rotary mower and the grass flies everywhere — as did the frogs. I stopped the mower. I cleaned my glasses. I had a long think. Then I cautiously crept across the lawn on hands and knees. About a dozen frogs of various colours and sizes exploded from the foliage in front of me like the Calgary Stampede.

My neighbourhood is very ecological. We have to be. We're surrounded by ring-roads, relief roads, planned roads and sneak-through-the-back-door roads, sometimes literally. We are now effectively an island. No one and nothing can get out or in. So we are fiercely protective of any wildlife that is stranded with us — including foxes, squirrels and frogs. As the island-mentality clings

to storm warnings, we cling to wildlife programmes — so I sought advice from a neighbour.

"According to Bellamy/Attenborough/whoever, this problem is quite widespread," said my helpful mentor. "Farmers are being asked to harvest from the centre outwards to safeguard wildlife. Try mowing from the centre outwards."

I did. Luckily, I had the blades set high for the first mowing of the year, so there were no fatalities. But the frogs' inbuilt survival instinct is about as useful as my appendix. They leapt out of my path, stopped, thought about it and leapt back in again. It took me the whole day to mow the lawn, carefully transferring Kamikaze amphibians from lawn to pond one by herded one.

About a week later, my pond was a witch's cauldron of spawn. The summer wore on and young frogs threw themselves over the sides into the freedom of my slug and greenfly-infested vegetation. Oh glory, now my pocket-handkerchief would blossom into Eden.

I planted yet another batch of Hostas, those superb poolside plants that look so architectural and lush — and succumb so quickly to slugs. No problem, I had more than the Neighbourhood Watch. My pond was turning out the Flying Squad. Which is exactly what they did. They flew straight past the Hostas, the runner beans, the strawberries. They flew under stones, an overturned wheelbarrow, over the wall and away. Presumably to gardens where the owners commented on the efficacy of their slug pellets, the beauty of their Hostas and the strange night-time cries of a neighbour who

could be heard roaming the streets, calling for some lost animal . . .

1988 marched ruthlessly onwards, as did the slugs on my plants — reducing them to skeletal lacework — and my beans sank under aphids. The exodus from the pond never really abated. Quite a few tadpoles have overwintered in there. My 'ecological' garden was more work than it had even been before. I couldn't use any insecticides or pellets for fear of poisoning the frogs; every pile of cuttings had to be examined exhaustively for short-stay frogs before I could burn it — and both my cats had surprise and unwelcome swimming lessons in the pond as the movements of the emerging population stretched their curiosity (and their balance) to danger level.

My cats are far more curious than malicious. They find frogs fascinating and patiently follow them for hours. I have watched this with interest and have found that the more intelligent of the frogs will soon learn that a cat is about as interested in a motionless object as they are. Consequently there have not been any massacres. But have you ever heard a frog scream? I didn't know they could. They seem to resort to this extremely loud language when they are cornered — and I have wrecked half my clothes in rescuing them from blackberry-laden brambles and over-zealous felines.

This year I'm going to try a different tack. I am going to pile rubble round the remaining Hostas, to attract both frogs and slugs to blind dates. I am going to grow the runner beans along the ground, in the hope that the frogs will stop off for a bit on their way out. I'm recruiting several hundred Miss Piggies to keep them in check. And if all else fails, I'll start breeding a hardy strain of those Arrow-Poison frogs that were featured in the December issue. Does anyone now where I get them?

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Books

T.F.H. New Book News

Handbook of Fish Diseases

By: Dieter Untergasser
ISBN: 086622-7032
Style No: TS-123
Hardcover: 8-75" x 11-25"
(220mm x 285mm)
Pages: 160

Colour photographs: 99
B/w photographs and drawings: 23
Retail Price: £16.95

Because of its simple style, **Handbook of Fish Diseases** makes the diagnosis and treatment of fish disease easier and more accurate than ever before. Keys to recognising fish diseases, giving the right treatment are provided in easy-to-follow "flow" charts accompanied by excellent colour photographs. By noting the symptoms



shown by a fish, readers can, by a process of elimination, use the charts to isolate the cause of the disease and determine the correct treatment. The treatments themselves are also listed in clearly understandable terms.

The book also contains an extensive listing of drugs and other substances used in the treatment of fish diseases, including the proprietary and other names by which they are known.

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T.F.H. have introduced three brand new aquatic titles (plus a non-aquatic one) to their popular **Step-by-Step** range of books, all competitively priced at £1.95. The four titles cover the following subjects:

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Guppies Tropical Fish Parrots

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The books offer detailed information on all aspects of keeping specific pets — from initial selection to breeding. They are soft-cover, easy-to-read books, and each includes a helpful section of suggested further reading and a comprehensive index.

John Dawes's Book of Water Gardens

By: John Dawes
Published by: TFH Publications Ltd
ISBN: 0-86622-662-1
Price: £13.95

With the tremendous increase in interest which the coldwater hobby has received over recent years, it is inevitable that a plethora of publications has become available — either for the guidance and instruction of the would-be pondkeeper, or for the indulgence of those already converted.

John Dawes's latest aquatic offering sensibly covers both categories. However, it is not "just another pond book . . ." Indeed **John Dawes's Book of Water Gardens** breaks new ground in the presentation of coldwater aquatic literature and promises to be a huge success in garden centres, aquatic shops, and pet stores throughout this country and further afield.

I am very much in favour of anything which serves to promote the coldwater hobby to those people who may yet be ignorant of its enjoyment. Suffice to say, this volume will also grace any coffee table,

complement any bookshelf, and delight any amateur gardener who wishes to get "that little bit more" out of his/her own piece of "Mother Earth."

Usually, the main attraction of this type of book is the illustrations: John Dawes and TFH have teamed up to provide these in abundance. Not only are the photographs rich — in both quantity and quality — but strong support is given to the text by means of colour drawings, as well as wash illustrations of pond schemes — accompanied by their own section diagrams.

However, while so much could be learned merely from the illustrative nature of the book, it is John Dawes's informative and instructional, yet highly readable, style of writing which makes the volume so valuable.

And he has left virtually no stone unturned in exploring the pondkeeping hobby.

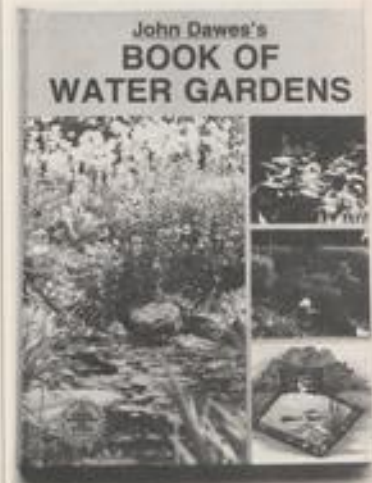
Not only are the "rudiments" of pond design and construction, and selection and stocking of plants and fish discussed, but close attention has been paid to the very details which make such a project so much more worthwhile, such as designing the edge of the pond, the use of cascades, waterfalls, and ornaments, and even a look at the very definition of the term "pond".

The advantages and disadvantages of certain materials, chemicals, methods, or principles, are also given the attention which the average pondkeeper has been crying out for.

For example, how many authors would be bold enough to show aged and yellow leaves on an end-of-season waterlily to illustrate the importance and advantage of planting lilies in baskets for easy maintenance?

In my opinion, this book takes up the hobby where many others frustratingly take their leave — just as you have at least got to grips with your own project. There is no need any more to struggle with the unanswered questions which arise only when you are knee-deep and committed — John Dawes's **Book of Water Gardens** addresses those circumstances which others dare not even anticipate!

Stephen J Smith



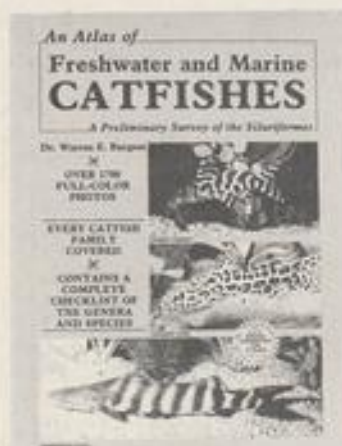
An Atlas of Freshwater and Marine Catfishes

(A preliminary Survey of the Siluriformes)

By: Dr Warren E. Burgess
Published by: TFH Publications, Inc
ISBN: 0-86622-891-8
Price: £65.00

Following in the footsteps of its predecessors, this latest **Atlas** from TFH is BIG

Books



— in every way. Despite the "preliminary" bit in the title's by-line, this book is about the most comprehensive single volume on catfish ever published.

It contains over 1,700 full-colour photographs, and mentions over 2,000 species, including listings for all 32 families. From the extremely common, to the extremely rare species, you are likely to find at least a mention of most in this giant of a book.

Whenever I come across a catfish book that claims to be "comprehensive," I invariably check to see if there is a mention or illustration of *Vandellia* (a Parasitic Catfish — family Trichomycteridae — known as the Carnero or Candiru, which has the unnerving and rather "painful" habit of swimming up a urine current and lodging itself inside the urinary duct of the animal (or human) concerned!), and *Cetopsis* (a Whale Catfish — family Cetopsidae — with extremely voracious and carnivorous habits).

The *Atlas* not only describes these fish quite extensively, but also has diagrams and full-colour photos of both, thus passing this test with flying colours.

The text also contains details of aquarium requirements and breeding methods for numerous species. Therefore, the *Atlas* is more than just a straightforward, if large, identification guide. It's a lot more than this, in fact.

Buying a book and using it to best effect are two very different things, though, and the total lack of a Common Names Index may make life difficult for many aquarists. I know that common names vary from place to place, and that many species just don't have a common name. However, an index of those common names that do exist (as published in many other books), would, in my opinion, have helped enormously. Perhaps the second edition might incorporate such a list.

It's difficult to see how the serious catfish enthusiast will be able to resist the tempta-

tion to buy this massive volume, despite its high cover price. Perhaps it might help to soften the blow if one knows that, in the hands of another publisher who does not possess in-house editing, typesetting, colour reproduction, printing and binding facilities (to say nothing of an extensive photographic library), the *Atlas of Freshwater and Marine Catfishes* would be selling, much nearer the £100 mark. Even at that price, it would be well worth considering.

John Dawes

Guppies, Fancy Strains and How to Produce Them

By: Noboru Iwasaki
ISBN: 086622-7024
Style No: TS-122
Pages: 144
Hardcover: 8.75" x 11.25"
(220mm x 285mm)
Colour photographs: 300
Retail Price: £13.95

This new book by Noboru Iwasaki, who is the foremost breeder of Guppies in Japan, is a guide book to producing beautiful healthy Guppies, including the development of new strains. It presents systematically arranged information on varieties and breeding techniques that have been put into practice over

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the years, as well as the latest thinking on the subject. A large number of recent colour photographs of Guppies are also included which will be of interest and help to Guppy breeders.

During its introduction, *Guppies, Fancy Strains and How to Produce Them* is being offered together with a free copy of Dr J Schroder's book *Genetics for the Aquarist*.

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HI SHOWA

The Koi pictured this month is placed in the variety Showa but is technically known as a **Hi Showa**. The definition of a Hi Showa is a Koi in which the red runs as a single band from the head to the tail as it is seen to do on this fish. It may also be seen that the red and black pattern predominates over the white — characteristic of the variety Hi Showa.

The *hi*, or red, on the fish pictured here is very deep and runs from the tip of the nose to the tail but does not encroach onto the caudal tail fin. The *sumi*, or black, is superb and stable, that means it will neither deepen or fade. On the head and body the *sumi* has developed into a very interesting pattern. The white skin is perfection, being clear and unblemished.

This Hi Showa is some 61cm or 24in and already has an excellent body shape and volume. It is a Koi with great potential.

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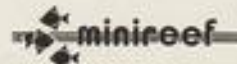
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Herpetology matters



By Julian Sims

Dancing adders

Male Adders (*Vipera berus*) usually emerge from hibernation in late March or early April. Sometimes, at the end of a mild winter, they might even venture out in early March, basking for a few hours in the mid-day sunshine.

Female Adders end their hibernation three or four weeks later than males, emerging towards the end of April. At first, the females laze about basking in the spring sunshine, vent open. This action releases pheromones from the anal gland. Such "scents" attract male Adders. At this time, males slough their old skins revealing their vivid black and white coloration. Even though hibernation is well and truly over, the males continue to lose weight because they are very active and their testes are starting to produce viable spermatozoa.

By early May, each female will have succeeded in attracting a male, and the two snakes regularly bask together. The female is still lethargic and dull in coloration — she has not sloughed her skin. Conversely, the male Adder is alert and active.

If a second male approaches the basking couple, he is rapidly chased away by the resident male. During this rivalry for the female, the so-called "Dance of the Adders" might take place between the two males. This is a demonstration for dominance

and is not a display to attract females as, for example, can occur between brightly coloured cock birds. The two male snakes face one another, heads held erect. Much pushing and thrusting with their bodies takes place for a few seconds before the intruder drops to the ground and tries to escape. The resident male rapidly pursues him. During this chase, the "Dance" or "Head to Head" might occur on two or three more occasions, but injuries are never inflicted and the "poison" fangs are not used.

The male being chased sometimes "doubles back" in his attempt to lose the resident male and claim the female for himself. However, in every observed instance of this pursuit, the resident male has always "seen off" the intruder before returning to his female. It is likely that his state of sexual arousal gives him the psychological advantage, whatever the relative size of the contestant.

Mating takes place in late April to early May.

A similar combat dance occurs between the males of some species of North American rattlesnakes, for example the Red Diamond Rattlesnake (*Crotalus ruber*).

Spring tortoises

The months of March and April can be a worrying period for tortoise keepers. At this



time, European tortoises (*Testudo graeca*, *T. hermanni* and *T. marginata*) are ending their hibernation but it is not yet warm enough out-of-doors for a totally "free range" existence.

From March onwards, hibernation boxes should be checked daily to ensure that an active tortoise has not fallen onto its back while trying to escape.

Tortoises lose weight during hibernation and a large proportion of this loss is due to water exhaled in the breath from their lungs. Thus, on waking from hibernation, tortoises benefit from a bath in shallow, lukewarm (NOT HOT) water. To avoid panic, the tortoise's feet ought to be able to rest on the firm base of the bowl or sink and the depth of water must not cover the nostrils when the head is in the resting position. While drinking, the tortoise will extend its neck and even try to submerge its head completely.

Two European Tortoises basking in the spring sunshine, shortly after awakening from hibernation.

This water helps to restore the lost body fluids and aids the digestive function of the gut to start again. A bath also loosens any dried mucus which may have collected around the eyes during hibernation.

A 20-minute bath often promotes the release of white uric acid. This waste material has also accumulated during hibernation. With increased metabolic activity in the spring, insufficient water can lead to the formation of damaging crystals of uric acid inside the excretory system. Healthy tortoises excrete uric acid as a white gelatinous mass.

After removing the tortoise from its bath, it is advisable to dry the reptile carefully with absorbent towelling. A damp tortoise is likely to be chilled as the moisture from the surface of its limbs and shell slowly evaporates.

On warm, sunny days the tortoise can be put into the garden to bask. This natural warmth, together with the water taken into the gut, will help the necessary digestive juices and enzymes to be produced. Fresh food should be available but feeding will probably not take place on the first few excursions outside. The smell of a freshly-mown lawn often stimulates a tortoise to start eating again.

Tortoises must be "brought in" as the afternoon cools down to prevent respiratory ailments developing. For the same reason, tortoises should remain indoors on cold or wet spring days.



"Gotcha, Henrietta! so you are the culprit responsible for putting my last 3 window cleaners under sedation."

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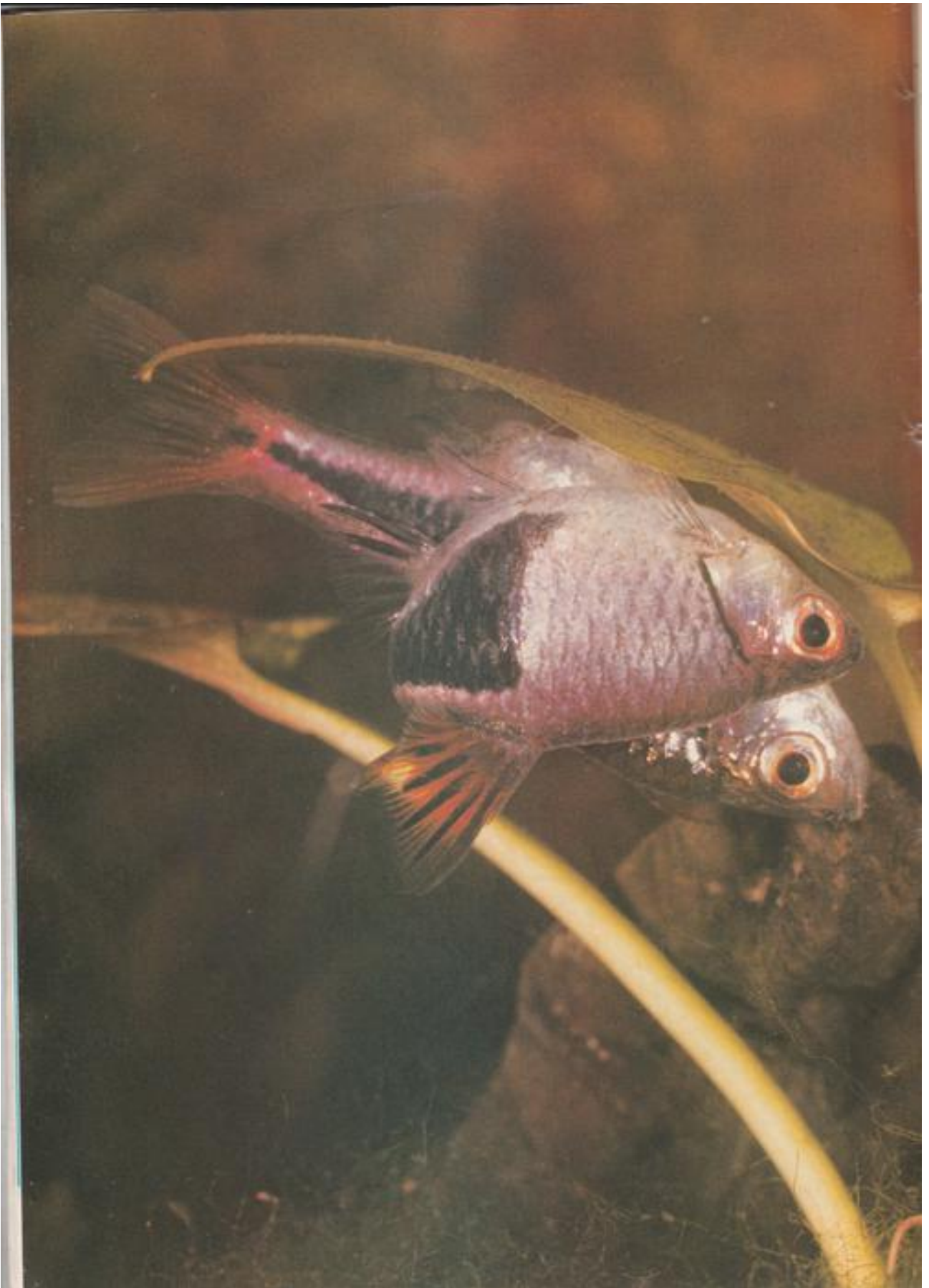
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THE HARLEQUIN

(*Rasbora heteromorpha*)

The Harlequin is a beautiful and interesting aquarium fish from southeast Asia which has been bred by **Arend van den Nieuwenhuizen** on several occasions.

(Translated from German by R. A. Bialek of the British Cichlid Association) (Photographs by the author).

One of the most popular fish species for the tropical aquarium is the Harlequin or Red Rasbora, *Rasbora heteromorpha*, which since it was first imported in 1906 into Europe has never disappeared from our tanks. This fish owes its name to the typical blue-black wedge-shaped blotch along the sides of its body. The gillcover, the frontal parts of the body and the belly region show a silver-white coloured sheen. In contrast, the upper-side of the head, the flanks, the back and posterior part of the body display an orange-red colour. Wild-caught specimens are covered with a purple-red sheen over the whole of their body. Sadly, this colour will be lost in the aquarium. Even the lovely red colour which can often be seen on Malaysian specimens, will fade away in time in aquaria.

The first rays of the pelvic (ventral) and anal fins appear red and sometimes, one can see an orange-red coloured edge on the anal fin of these fishes. On the frontal part of the anal fin lies a black mark, which is more intensive in the males, while, in females, these can be missing altogether. The dorsal fin is orange-red with black fin rays. The frontal part of the caudal fin and the upper and lower part of this, look similar too, while the rear part is transparent.

SEXUAL DIFFERENCES

With the "real" Harlequin *Rasbora heteromorpha*, the wedge-shaped mark is wide on the flanks and sometimes runs pointedly towards the front. In past times it was assumed, this to be a characteristic of the males, but this does not seem to be a certainty. It is, anyway, not difficult to differentiate between the sexes, as the females are slightly larger and of a more robust build than the more slender-built males.

Ripe females are easy to recognise if one views these from above, as the body is laterally thickened and wider.

Buy specimens of at least 2.5cm (1in) in length which are a good coloration and in which you can see the shining golden band along the upper edge of the wedge-shaped

marking, which is more intensively coloured in males than in females.

There is a second *Rasbora* species with a wedge-shaped mark. It is similar to the Harlequin, but, with an overall length of 3.5cm (1.4in). It remains 1cm (0.4in) smaller. It is considerably slimmer too. This fish is called *Rasbora hengeli*. As this species is not built as high as the Harlequin, the wedge appears smaller. Generally speaking, this species is of a more glowing orange-red colour.

NATURAL HABITATS

Harlequins are inhabitants of small flowing waters of open as well as densely overgrown regions, ie jungle or plantation areas but can, in many cases, also be found in swampy parts. In the dry season they can also sometimes be found in very dirty and cloudy waters which are the remains of dried-out brooks and streams.

Harlequins are known to live in transparent, light water, as well as in cola-brown coloured water. In cola-coloured water, these fish can display such an intensive red colour that it appears almost black. This appearance is one that we know from *Rasbora kalochroma* which lives in near-identical water. (This latter fish is less commonly offered in the aquatic trade and is, in contrast to the Harlequin, by no means a "beginners fish").

The water in the wild is always soft and slightly acidic; the water temperature depends on the geographical situation of the locality and, especially, on the time of the year. In general, the temperature will vary in the biotopes of the Harlequin between 25° and 28°C (77°-82°F).

In the natural environment one can see *Rasbora heteromorpha* in the company of the following species, among others: *Rasbora einthoveni*, *Rasbora dusonensis*, *Trichogaster trichopterus*, *Dermogenys pusillus*, *Barbus pentazona pentazona*, *Rasbora meyeri*, *Rasbora taeniata*, *Betta pugnax*, *Trichopsis vittatus*, *Aplocheilichthys panichax* and *Rasbora elegans*.

PLANTS IN THE BIOTOPE

The waters where the Harlequins live, can show a very varied plant growth; this con-

cerns species as well as the density. One can find the fishes in densely-growing *Cryptocoryne*, as well as in totally plant-free streams where the only growth is along the bank, where we can find swamp growth or among plants which are suspended into the water from the bank (like grass or branches from bushes).

Harlequins are always found among plants or in the immediate vicinity of these. In light and transparent water, these fishes are seldom seen swimming about.

DISTRIBUTION

Rasbora heteromorpha is widely distributed in Southeast Asia, in particular in the South of Thailand and the Malaysian peninsular up to East-Sumatra.

AQUARIUM MAINTENANCE

To buy Harlequin fishes one should know that these are shoaling fishes, which should be kept in a swarm of six specimens — if possible, more. As the fish are very gregarious and lively swimmers, they should be maintained in an aquarium of no less than 80 x 40 x 40cm (c 30 x 15 x 15in) in size. They can also be kept in smaller tanks, but they will not be as lively under these conditions. These fishes appreciate a sufficient, but not too strongly lit, swimming space which is surrounded on the outer edge by a good amount of plants.

The best coloration of the fish can be achieved in soft and slightly acidic water; in hard water they will be less beautiful. It will be worth the effort if one pays attention to the water quality and adds a little peat extract to the aquarium water.

SUBSTRATE

For optimum coloration of the Harlequin a dark substrate is important. This can be achieved in various ways. One possibility is to obtain dark gravel direct from your specialist dealer. This is mixed into the top layer of the usual substrate or, if the aquarium is already furnished, it can be sprinkled between the plants and across all open spaces.

The plants covering the aquarium bottom should consist of low-growing species, ie:

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Cryptocoryne x tallini, (which is also known as *Cryptocoryne neriifolia*) and *Echinodorus tenellus*. One or two pieces of bogwood will guarantee the decorative effect. In larger tanks I use Java Fern (*Microsorium pteropus*) or *Anubias barteri* var *nana*, and let these grow on several pieces of bogwood. Especially the *Anubias* leaves will offer ample opportunity for the fishes to deposit their eggs.

Along the outer perimeter of the aquarium I use plants such as *Myriophyllum* or Giant Vallisneria (*Vallisneria spiralis*) and let the leaves or shoots drift on the water surface, to diffuse, in a simple way, the incoming light. Don't worry, the *Cryptocoryne*, the Java Fern and the *Anubias* will all grow under diffused light without any problems, as they are less light consuming than most other species. Nevertheless, one should take care that the plant growth on the water surface does not become so strong that it takes away all available light.

WATER QUALITY AND TEMPERATURE

These two factors are equally important and, not only for the Harlequin, but for fish in general. It is of advantage if one regularly changes 20% of the water every two weeks, replacing it with fresh water to which is added something like Tetra Safe, Sera Aquatan... or an equivalent.

The filter must be maintained in good condition so that it contributes towards keeping a healthy and crystal-clear aquarium. Additionally, provide a minimum temperature of 25°C (77°F); this is just right for the Harlequin.

FOOD

Rasbora heteromorpha is an omnivorous feeder i.e. it will eat flakes as well as livefood. One should keep the "menu card" varied and not feed one food only. If we keep within these guidelines, we will have years of pleasure with our Harlequins and will discover how easy it is to keep these fish.

REPRODUCTION

One can observe pairing behaviour even in a community tank but for this to happen, one must take care to choose suitable co-inhabitants only. The best way is to select a shoal of Harlequins for the middle of the water, and then add some representatives which occupy the top region and the bottom areas as company. For this, species which live together with the Harlequins in the natural environment are the most suitable.

When courting, the male will first swim around the female and stroke her along the flanks. It will then swim above the female as if trying to ride on its dorsal. A female which is ready to spawn will then select a large leaf under, or above, which she would like to deposit the eggs. While mating, the male will strike the female behind the dorsal fin with his tail. The female will then, as a rule, turn under the leaf with the belly upwards and will stick the eggs onto the leaf.

Two to 10 eggs will be deposited in one go but not all are very adhesive and some will sink to the bottom. As the eggs are light-



Rasbora hengeli looks similar to *R. heteromorpha* but is slimmer overall and has much narrower cone-shaped body markings.



Left, an adult pair of Harlequins (male above). The male (nearest the camera) will often fold his caudal fin over the female's back during egg-laying.



sensitive, there is seldom a chance in a community tank of seeing any fry. For breeding purposes, therefore a separate tank should be prepared.

BREEDING

A pair of well-conditioned Harlequins will produce between 200 and 400 eggs, requiring a breeding tank of at least 40 x 25 x 25cm (15 x 10 x 10in) in size.

With wild-caught specimens, this tank has to be filled with very soft (1-3DH), slightly acidic (pH 6.6) water. If one wants to breed from aquarium-bred stock, then it will be possible to do this in water of 13°DH and a pH value of 7. It is, however, recommended to lower the pH as this will lead to quicker reproduction.

Nearly more important than the composition of the water is the presence of a breeding pair, since not every willing male and female will form a pair. Not only should the female be heavy with eggs, but the eyes of the male should shine red.

This is a matter of experience, so the best way to select breeding pairs is to put a shoal of Harlequins into a large breeding tank and separate the fish which do not take part in the spawning activities.

As spawning plants all coarse-leaved plants will be accepted, eg *Hygrophila*, *Ludwigia*, *Echinodorus* or *Anubias* species but

Harlequins have a preference towards horizontally growing leaves.

The breeding tank should have diffused light, the water temperature can be around 24°-26°C (75-79°F); higher temperatures are not necessary at all. Preferably choose the lower temperature as the water will remain richer in oxygen that way.

After the spawning act is concluded, the breeding pair must be taken out and the aquarium must be darkened as the eggs are very light-sensitive. Do not come to the quick conclusion that the eggs are mouldy, though, as these have a natural cloudy centre. At 24°C (75°F) the eggs will hatch after around 30 hours, at a temperature of 27°C (81°F), after about 18-20 hours.

After 4 to 5 days the fry will be free-swimming and will prefer to keep in shaded places. Depending on water quality and temperature, the young will eat freshly-hatched nauplii of *Artemia salina*.

After three to seven days, it is important, as far as possible, to change 20% of the water on a daily basis. This will influence the growth rate and the Harlequins will colour up after 4-5 weeks. Growth is, given good maintenance and roomy tanks, very fast and the fish are sexually mature at above seven months. The breeding pair can, with good feeding, and a rest period of around two weeks, spawn again on a repeated basis.

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Naturalist's notebook

By Eric Hardy

Clicking goldfish

"I've just bought two goldfish for my son" writes a correspondent. "The other night my wife and I were watching TV when he heard a strange clicking sound. So we turned the sound down and it was the goldfish. Could you explain what it means or why they do it?"

There are two possibilities. Were the fish in too small a container they could have been gulping for air at the surface; but there is another possibility, the early stages in the evolution of sound. A variety of fish make sounds by several methods, many based on the swim-bladder. Carp, to which the goldfish is closely related, sometimes produce a sound described as a "long, drawn-out wet kiss," (though what that is like I wouldn't know, excepting that the cat licked me once while I was asleep!) The "carp" sound is made by air passing from the air-bladder into the gut and the mouth.

Goldfish are phystostomes in which the air-bladder, in addition to being connected with the digestive tract, is also connected with the ear by means of the special Weberian duct enclosed in a bony canal formed by the first four vertebrae, facilitating sound-reception. The air-bladder may thus function as a resonator for sound production, by contracting its muscles.

Elodea threat

Well known to aquarists as a fish-tank aerator, the water-plant, *Elodea nuttallii* seems set to replace common Canadian pondweed (*E. canadensis*) in most of Britain, as it has already done in much of Lakeland and southern England, as well as Holland.

Whether or not aquarists were responsible for the introduction of this North American plant in modern times is not known. It could even have been a long-overlooked native, but whatever the case, it is here to stay. In recent years I have watched its increase in Prescot reservoirs and other waters in south Lancashire, after first appearing in Hillingworth

Lake, Rochdale, then the Leeds and Liverpool Canal, Wigan Flashes and canals around Manchester.

It is increasing faster than Swamp Stonecrop, *Crusula helmsii*. It was first claimed at Esthwaite Water in south Cumbria in 1950, but another plant, *Hydrilla verticillata*, had been confused with it, and that is probably extinct and is wrongly given as a synonym for it in Keble Martin's *Concise Flora*.

It differs from common Canadian *Elodea* by its whorls of short, thin, light green leaflets curving downwards and being pointed at the end. It is easily confused with Curly Water Thyme or 'Crispa' *Lagarosiphon major*, but the latter's whorls of leaflets are closer together and more numerous.

Field guides vary confusingly in their description. Allister Fitter's recent *Collin's New Generation Guide* gives it only four leaflets to a whorl, but his father's better *Wild Flowers of Britain and North Europe* correctly gives three to eight. My Prescott plants have three. Sutton's recent *Field Guide to Wild Flowers* draws its leaflets

far too thin and wiry.

Only female plants grow in Britain, except West Sussex, reproducing in bits and pieces carried by waterfowl, not by seed. This also applies to many other foreign water plants escaped into British lakes and streams like Canadian Pondweed. A fertilised plant flowered in Amberley Wood Brook, West Sussex in June and September 1975. It grows in Coniston Water, Brotherswater, Derwentwater and Bassenthwaite and from Derbyshire to the Home Counties. It was also found in Connemara but apparently has not reached Scotland. It has been in Welsh canals at Talybont and Llangatlock in Brecon, since 1980. Unlike other members of the frogbit family, its ripe male flowers don't rise to the surface by elongating their stems, but by a gas-filled blister, opening their buds at the surface to float into contact with the female flowers. Their pollen floats on the water too. Though it comes from North-East America, neither this nor Canadian *Elodea* are included in Barry James' excellent little *Guide to Aquarium Plants*, though it is a good tank-aerator. Also known as *Elodea occidentalis*, it appeared in Germany, probably from aquaria rejects, in 1963.

Nuttall, after whom it is named, was a Yorkshireman who achieved fame as a botanist at Harvard USA, at the end of

the last century and is buried at Eccleston, St Helens.

Dr J W Eaton, who is researching water-plants tells me he finds *E. nuttallii* favours more alkaline water than *E. canadensis* which seems to be recovering from it in some more acid waters. It is more eutrophic, and well established in the Kendal Canal.

Some botanists contend it may have reached our east coast from Holland in the pond and fish trade. It was discussed in March's seminar of West Midland and Northwest Water-botanists on alien water plants, at Liverpool University. More details on this when I receive them.

Coypu extinction

For the second time the Ministry of Agriculture announced the extinction of the South American Coypu, or Nutria, the ugliest of rodents, which for years plagued our fieldwork in the East Anglia Broads. Reaching a peak population of 200,000 in the 1960's, they burrowed extensively and devastated plantlife.

Over 24 full-time trappers destroyed over 34,000 and the last colony was exterminated from the Great Ouse near St Neots. Thus the Coypu followed the North American Muskrat which was finally exterminated from the Shropshire meres before the war by similar scientific trapping, working from a surrounding of their haunts, inwards. A previous announcement of the demise of this pest was followed by the discovery of an isolated survivor near Marham, north Norfolk. A small field team will keep baited rafts and automatic monitoring equipment this year in case a survivor is found. If you see one, phone details to the Norwich Office of the Nature Conservancy (0603) 504990.

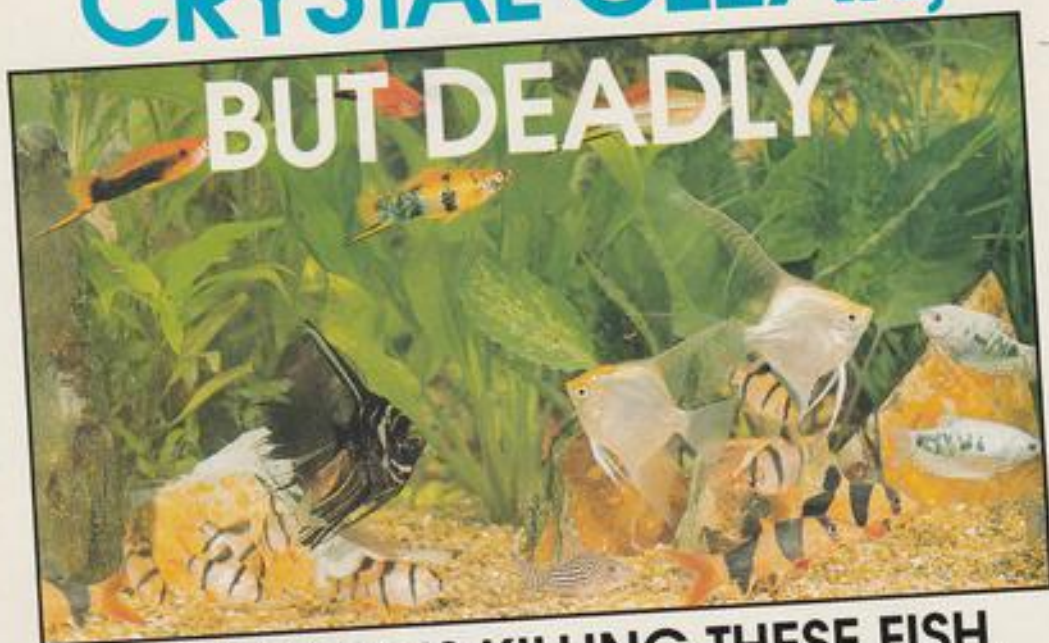
More concerned with natives, the Nature Conservancy granted £17,000 for a study of the Char population in Loch Doon, which is similar to Windermere Char and those in Kirkcubrightshire lochs.

Coypu have done inestimable damage to wildlife in the Norfolk Broads. Now, this foreign species seems to have been exterminated once and for all.



ERIC HARDY

CRYSTAL CLEAR, BUT DEADLY



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A WEEK IN THE LIFE OF AN AQUATIC CONSULTANT

Jerzy Gawor kicks off our brand new series with a fascinating account of a typical week in his ever-changing and absorbing career.

Making the break from running my own aquatic retail shop in London after almost seven years, was quite a personal career leap. My retail business had acquired a strong reputation and good local following over this time, and many of my customers had become more like friends. It was rather sad to be saying farewell to so many people over those last few days. However, I knew that they would be in capable hands, as the new owner Joe Daniells, was an expert aquarist and herpetologist.

My incentive to change the direction of my aquatic career could be blamed on those blessed phone calls from interior designers, architects, fish farmers, film studios (yes, I designed and installed that tank system with Rift-Lake Cichlids in the 1986 production "Highlander") and aquatic entrepreneurs who started to buzz through my telephone lines from late 1985. These had shown me that aquatics was not about to allow me to rest on my laurels behind my retail aquatic counter. There was a world of water for me to explore — ON DRY LAND!

Once the decision had been made, and with some assistance from a local estate agent, I had sold the retail shop by late summer 1987. I was on my own.

Having established an office and small fish laboratory unit at home (a new extension had to be built) I was ready for business.

I had taken the early precaution of ensuring I had some contract work in hand to tie over the business financially for the first few months and, fortunately, it was not long before the phone began to ring.

A typical week runs something like...

MONDAY

After the morning chaos is over and the children are safe at school, I and my business partner (Elizabeth — my wife) discuss plans for the week over a cup of tea. Tuesday is already accounted for — visiting a new fish-farming enterprise specialising in Koi that we have been assisting all year. Friday morning is booked for a site visit/survey and water analysis for a planned Trout Fishery in Sussex — must make a note to set the alarm clock early.

Monday morning is generally a day to sift through the correspondence, deal with letters, queries, bank a few cheques (hopefully).

Telephone rings. Can we assist at the

design stage of display ponds for a new office development in Central London? Yes, I reply, adding a few details about our work. A meeting with the architect is arranged for the following Tuesday. Work continues throughout the rest of the day after a short lunch break. We are preparing drawings for a new retail store design for clients in Kent. We finish early, by 5.30 pm, to prepare for the evening.

TUESDAY

Site visit to Koi farm. The drive into the heart of the Kent countryside is picturesque. Lush green trees, bushes and meadows all around, dotted here and there with grazing sheep and cattle. Morning dew sparkling in the sunshine.

The car takes a sharp right into the farm drive. I am met by my clients, a farming family who have devoted part of their land and precious time to a new enterprise — farming Koi. Nothing easy here, otherwise everyone would be farming these beautiful fish, but with their land, fresh well water, running stream and sheer hard work they are going to do well. The fact that keeping Koi and garden ponds in the UK is a fast-growing trend will help too!

Today, we are checking over the new

The original public aquarium at the Horniman Museum — London SE23. The curator at this time corresponded with P. H. Gosse (around 1912). The Horniman Library holds many original 'Gosse' manuscripts, plates and drawings from early studies on Aquatic Biology. A visit is recommended! P.S. the aquarium section has since been modernised!



COURTESY OF HORNIMAN MUSEUM LIBRARY



hatchery building and systems, broodstock health, discussing markets for next season and monitoring the growth rates/food conversion rates of the fry spawned semi-artificially a couple of months earlier. Watching the thousands of inch-long Koi dashing around while feeding is one of those little pleasures in life. Looking at these tiny Koi, it is almost beyond belief to think that, in a few short years, they will be over one and a half feet in length!

By about 6 pm, with little short of ten minutes break for a coffee all day, I pack my briefcase, notes and rubber wellington boots and head for home.



JERZY GAWOR

An aquarium display installed at the offices of a large computer company. The director says that the fish and plants help the staff relax while visitors in the reception area are kept entertained. Aquaria span a wall 18 feet long with 2 feet of water and act as room-dividers between reception area and office. Filtered via Tunze and Osmolator systems with mercury vapour and fluorescent lighting on timers. The stock is a mix of peaceful community fish.



JERZY GAWOR

Perfect Koi-farm site in the Kent countryside.

WEDNESDAY

Postman delivers mail. Among the usual pile of bills, reminders, mail-advertising, etc... is an Air Mail letter from Gibraltar. A horticultural company is looking to expand into the aquatics industry and is seeking assistance with this new venture. Can we help? By mid-morning a letter of affirmation and "Company Profile" are on their way back to the Rock.

After lunch (usually it's during lunch) a fish wholesaler phones, hoping that we can conduct a post mortem examination on several Koi from a customer's pond today. Within one and a half hours six 12in fish are delivered to our door with brief details of their recent history. The rest of the day is taken up in the lab conducting the disease analysis. By 7 pm, a fair idea of the problem and its causes has emerged and I call the client. By 8.30 pm telephone conversation ends and a well earned "Chinese Takeaway" meal fills the rest of the evening.

THURSDAY

The computer is working flat out this morning to produce two design briefs for large display aquaria, while I am going through the A4 size photograph album to find appropriate illustrative prints. It still amazes me to see how far aquarium tech-

nology has come since the word "aquarium" was coined by P. H. Gosse.

Second post brings, among other letters, an information pack from the National Aquarium at Baltimore, N.Y. — Thank you, Robert L. Jenkins — Director of Operations and Husbandry. I am currently collating information on all aspects of Public Aquaria for a series of articles (if you happen to be the Curator of such an establishment I would be very grateful for any information you can spare, c/o A & P).

The design of Baltimore Aquarium, itself, is fantastic, especially the 335,000-gallon Atlantic Reef Exhibit. Some fish-tank! The lists of activities, both fun and educational, for children and adults alike, is almost endless.

I am particularly interested in the reprint from "The Wall Street Journal" that looks at public aquaria as being a means of reviving depressed city areas and stimulating urban renewal in their vicinity. An interesting point for British inner city planners and architects to ponder. I am sure the Prince of Wales would approve of such a scheme. No-one could ever call a display aquarium "a carbuncle!"

Why not look to such displays among our steel, concrete and glass city jungles so that 20th century "city" stresses can be relaxed by

watching the silent, magical and colourful world of fish and aquatic invertebrates?

Perhaps, one day, the UK will fund a project on par with Baltimore's National Aquarium.

The afternoon brings a 'phone call from a coldwater fish wholesaler regarding aspects of fish health, worried in particular about Spring Viraemia of Carp "Will SVC virus reappear in the UK in the spring of 1989?", I am asked. "I sincerely hope not, and only time will tell," I say, somewhat nervously. I add that the Ministry of Agriculture, Fisheries and Food worked exceptionally hard last year (1988) to halt the spread of, and eradicate, this problem from our waters. I only wish our European ornamental fish farming colleagues would work towards an SVC-free status on their fish exports to the UK, as there is no other way this appalling fish disease could have spread to this country.

FRIDAY

Alarm clock rings at 7 am. By 7.30 am I am in the car with "field laboratory" ready to set off into the Sussex countryside. Rather wet and overcast today. Twenty miles out along the motorway I remember that my rubber wellington boots are left by the door at home!

Arrive at site for proposed Trout Fishery. My clients greet me and show me the central attraction; a beautiful Old Mill dating back to the 14th century complete with original and still working water-wheel, set in several acres of grounds with ponds, paddocks, a small gorge and fast running stream. I pack my mobile lab on my back and trudge across wet fields to my sampling points.

Within half an hour my shoes, socks, trouser bottoms and feet are soaked through! The oxygen content of the pond water is well up at 8.2 mg/l and, judging by the crystal clarity of the ponds and previous experience, the Biological Oxygen Demand (BOD) will be very low. Still, better reserve judgement until the lab results are through. I feel positive about the proposals for the fishery and assure my client of a complete report within the week.

Looking across the field and bubbling stream flanked by meadows and trees I think of nothing more pleasant to finish the week than to spend the rest of the day fly-fishing for trout, followed by a late afternoon dinner at the Old Mill Restaurant. Sloop day-dreaming Jerzy! Instead, I bid farewell to my clients, pack my sample box and notes, empty my shoes of water and drive back to the office.

I walk through the door and kick the dry wellington boots across the hallway! Having dried off and downed a much-needed mug of hot coffee, I return the morning's phone calls and settle down to listing odd bits of work that need completing before next week. Saturday morning is usually a good time for this, as there are few distractions.

My aquatic career is light years from the stability of running an aquatic retail shop, but the beauty is that I never know what is going to turn up next. Suffice to say that if it involves fish and water, I'm interested!



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Letters

Drowned Rat Threat

In December's edition of *A & P* John Cavelier asked if there was any danger to fish from poisoned rats dying in a pond. In fact, the threat to the health of his fish is far less than that presented to his own health.

Between 50 to 70% of wild rats carry *Leptospira icterohæmorrhagica*, the organism responsible for causing Weil's Disease. Traditionally, this disease has been found among sewer men, rat catchers and farm workers. More recently, there have been a number of cases, some unfortunately fatal, among fish farm workers and also water sportsmen (250 cases between 1978-85, with eight deaths recorded in ten years).

The causative organism is carried by rats and passed in their urine. As rats have no control of their bladder, they continually discharge infectious urine. Thus, water-side vegetation, and the water itself in areas of high rat populations, may present a hazard. Infection usually occurs through cuts and abrasions, though sometimes through swallowing contaminated water as well.

After an incubation period of 7-10 days the sufferer develops a flu-type illness. Up to 10% of sufferers go on to develop a jaundice, and fatalities can occur.

It is therefore not a disease to be taken lightly. The risk can be minimised by following these simple guidelines:

1. Do not encourage rats by leaving fish food — which they also enjoy — around the pond. Fish farmers have to use metal containers to stop rats, as cardboard or plastic present little barrier to a hungry rodent.
2. If rats do visit any pond, then be especially careful to dress any cuts and abrasions before working on it. Afterwards, you should wash your hands before eating, drinking or smoking.
3. Rats are unpleasant and unwelcome visitors — they are agile swimmers and able to catch fish. Eradication can be carried out by your local council or a private com-

pany. The use of poisons and traps in the open is a specialised task which is best left to professionals.

4. Contact your GP and have a note put on your medical file (and your staff's) as an aide-memoire to your doctor if (s)he is treating you for flu.

K. E. Davenport
Department of Fishery Management and Game Sparsholt College Hampshire



The Clown Knife Fish or Featherback — difficult, but apparently not impossible, to breed in captivity.

Featherback Spawnings

First of all, I would like to congratulate you on the good quality material published in your magazine.

I was very disappointed, though, when I read *The Tale of a Featherback* by Jason Endfield in the December '88 issue of *A & P*. Although I believe that there are no detailed records of the successful captive breeding of this fish, it has nevertheless been spawned in aquaria.

My reference for this information is Dr Herbert Axelrod's *Encyclopaedia of Fish Breeding*, published by TFH Publications, Inc. and I would be happy to supply any interested *A & P* reader with further information on the subject.

Turning to another subject. I am desperately looking for information about the breeding of *Clarias batrachus* in aquaria and would be pleased to hear from any readers who might be able to help me.

Charles Grima
Fgura
Malta

Editor's Note:

First of all, thank you, Charles, for your flattering comments. I hope this month's issue lives up to your

expectations.

If any *A & P* readers have the details you require on *Clarias*, I'll be only too pleased to pass them on. I will also (of course) gladly forward any requests I receive for information on the captive breeding of Featherbacks.

John Dawes

Suitable versus Unsuitable Species — Who Decides?

I feel I must make some comment on the *Guest Editorial* by Dr Chris Andrews (*A & P* February 1989). While generally agreeing with his points on endangered species, I take considerable exception to his statement that some species should not be kept at all by private individuals.

As a fellow zoologist I feel strongly about the welfare of animals kept in captivity, but cannot agree that zoological gardens are any more adept at maintaining their stock than serious aquarists.

In fact, the opposite is more usually the case. Thus I know of private aquarists keeping and/or breeding South American Catfish (including the huge species that Dr Andrews suggests should not be kept by individuals) with a great deal more success than that obtained by professional institutions, including, I dare say, the Zoological Society of London. I wonder whether this is one reason why some Zoo staff are intent on restricting large and/or rare species to their own collections — the success of private individuals is an embarrassment to them!

Dr Andrews should also know that supporting restrictive legislation on the keeping of any species is suicidal. One has only to consider the ludicrous situation where all parrot species (except budgerigars and cockatiels) are C.I.T.E.S. listed on Appendix I or II (as rare or endangered), irrespective of how common they actually are in the wild, to realise that once the protectionists have a foothold, they do not retire until practically all species are restricted in one way or another.

Aquarists should unite to ensure that no such foothold is given, instead of some professionals endeavouring to allow the "enemy" a legislative say in the affairs of our hobby.

Dr J A Collins
Tunbridge Wells
Kent

Chris Andrews Replies

In reply to the letter by Dr Collins, I would like to make the following comments:

I am among the first to agree that some serious aquarists are more adept at keeping and breeding certain fish, and that these efforts must not only be applauded, but also encouraged and supported. Embarrassment clearly does not come into it!

Unfortunately, the fact is that a greater number of hobbyists purchase (for example) the juvenile forms of potentially very large freshwater (and marine) fish, and are then quite surprised when their local Public Aquarium are not particularly interested in a donation of their (say) two-foot-long Giant Gourami some two or three years later.

I am offered this kind of "unwanted pet" several times a month, and know instances of species of tropical fish and reptiles being released (perhaps in desperation) into very untropical British waters. A large *Pseudorasbora* catfish released into a tributary of the River Thames is a case in point.

Dr Collins also misinterpreted my point regarding legislation. Laws regarding the importation and trade in animals (including fish) already exist, and more will follow. What we must all do is ensure that such laws (which can be very constructive with regard to conservation, disease control, etc.) are formulated in a rational way, with full consultation between all the interested parties.

Finally, I would like to point out that we must all strive for greater, mutually beneficial co-operation between private aquarists and Public Aquaria, and not foster feelings of a "them and us" situation.

C. R. Andrews
London Zoo Aquarium

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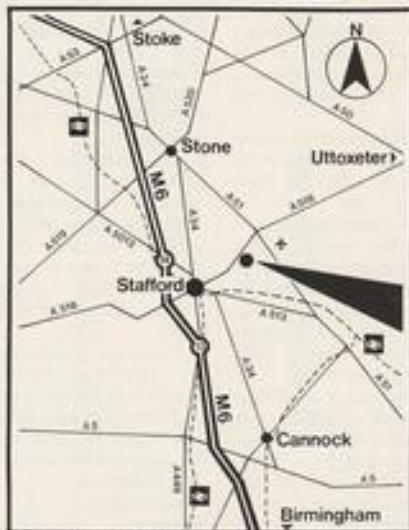
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Graham Cox



DISCUS
Eberhard Schulze

Coldwater Pond-hardy Sterlets?

On a recent visit to an aquatic shop I saw a fish labelled "Sterlet - *Acipenser ruthenus* - Coldwater/Tropical". I was told that it was probably "pond hardy." Is this so ... and what is the fish in question?

Acipenser ruthenus, or Dwarf Sturgeon or Sterlet, can reach an adult length of 4ft (1.2m). The Sterlet is a "dwarf" in the sense that it is small for a sturgeon. Some, like the Beluga, the source of Russian caviar, can reportedly reach a length of almost 30ft (over 9m) and a weight of 1½ tons!

With proper care, sturgeon have been known to live for at least twenty years. However, to do well they must be given a large aquarium because they need a lot of room to move about and, though slow-moving, are fairly active. Cramped conditions will cause a great deal of stress and inevitable early death.

Sturgeons are coldwater fish and have little tolerance of high temperatures. It has been found that they seem to do best at 50 to 65°F (10-18°C). The water should be hard and somewhat alkaline. They are peaceful fish and therefore not a threat to other coldwater fish though I personally think that smaller fish could be seen as a prospective meal.



Acipenser ruthenus, the Dwarf Sturgeon or Sterlet (but "dwarf" is a relative term!)

Feed a good variety of foods such as adult Brine Shrimp and Tubifex worms, chopped earthworms and diced fresh fish.

I suppose, because of their relative rarity, they can be priced rather highly and are not often offered for sale by the aquatic dealers. I would not think them suitable subjects for the outdoor pond. Even in the summer months, they would be difficult to see. Therefore, keeping them outside seems a pointless exercise.

Koi Filtered Facts

My present pool is 12ft x 7ft 3in x 4ft (3.7 x 2.2 x 1.2m) and I wish to extend it by 6ft (c 2m) and include

an undergravel filter. Would you advise me on the depth of gravel required and how deep the water should be over the gravel?

With undergravel filters it is advisable to have a gravel bed 250-300mm (10-12in) in depth made up of an aggregate of approximately 10mm (0.4in) diameter. The water depth above the surface of the gravel is not too important but should be sufficient to allow the fish to swim above the filter and not disturb the surface too much.

One general point with undergravel filters is to try to make sure that the pump is never switched off for any length of time. Aerobic bacteria rely on the pump to draw enough oxygenated water through the gravel to keep them alive. Switch off the pump for any length of time and anaerobic bacteria will begin to take over, and these are harmful to your fish.

Marine Long-lived Marines

I have a 48 x 15 x 15in (120 x 37 x 37cm) marine aquarium. Filtration is by means of undergravel filters powered by two powerheads. The tank holds two Common Clowns, one Electric-blue Damsel, one Saffron-blue Damsel, one Bowtie Damsel, one juvenile Koran Angel and one *Stoicactis anemone*.

My query is how long can I expect these animals to live for? I have had the two Clowns for eight years and seven years, and they have now spawned three times over the last ten weeks. I've had the Anemone for six years, the Bowtie for seven years; the other two Damsels I've had for three years and the Koran for one year.

It is very difficult to answer this question with any degree of accuracy owing to our present lack of knowledge concerning the longevity of coral reef creatures. I have kept Damsels and Clownfishes for eight-ten years and it seems probable that the larger fishes such as Angels, Butterflies, Groupers, Surgeons/Tangs, Batfish, Lionfish, Wrasse, etc, probably have lifespans well in excess of this ten-year period.

In our 100,000 gallon living reef display tank, we have a White-tip Shark which was an 18in (45cm) long juvenile when imported and has now been

eight years in our care. We also have a French Angelfish which was clearly a full adult when imported and has now been with us for just over seven years and a school of *Monodactylus argenteus* which is also eight years old! Apart from a few scars of wounds made by the shark during the night-time, these Silver Dollars (or Malayan Angels) are still in the prime of health and showing no signs whatsoever of impending senility. The majority of the coral fishes in this tank have been with us for more than six years.

Some invertebrates such as the coelenterates (anemones, corals, etc.), may live for considerably longer even than coral fishes. I remember reading some years ago a report from a Dutch public aquarium which claimed to have on exhibition an anemone which had been continuously in their care for over 50 years!

If any readers have any longevity claims for their own coral fishes or invertebrates, please write in and let me know. I will then print details of all these cases so that we can build up some concept of what maximum life spans of reef creatures are under aquarium conditions.

Plants

Best Bloomers

What tropical aquatic plants are the most likely to flower in an aquarium? What are their requirements in terms of light, water chemistry and rooting medium?

The plants most likely to flower under aquarium conditions are those growing from a tuber. Most Aponogetons need no excuse to flower, whatever the conditions. The long, white rat's-tail-like flowers are borne above the surface, in the case of

the Asian species.

Water lilies need heavy basic fertilisation nitrogen, phosphate and potassium, and abundant light.

However, flowering will also mean abundant floating leaves so, as the main purpose normally is to encourage underwater foliage, then fertilisation should be avoided under normal conditions.

Tropicals

Aggressive Checker Board Female

Recently two of my "Checker Boards" paired off and spawned on a leaf at one end of my community tank. After spawning, the male was chased away by the female — so were most of the other tankmates. By the next day all 150-200 eggs had disappeared. If the pair decide to spawn again what should I do with the eggs?

Crenicara filamentosa is actually called the Checkerboard (Chessboard) Lyretail Cichlid. It is the female that guards the eggs, including driving away the male, as you noted. Checkers are relatively easy fish to keep and feed, requiring no special water conditions and accepting flake foods. The fry are also easy to raise on a diet of newly-hatched Brine Shrimps followed by crumbled flakes.

You cannot expect to succeed in breeding the fish in a community tank. Isolate them in a separate breeding tank and return the male to the community tank after spawning is complete.

A male *Crenicara filamentosa* beautifully exhibiting the characteristics which give it its common name.



BILL TOMEY



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1. Write your answers on a postcard or stuck-down envelope.
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4. Please specify whether you require an adult or a children's ticket on your entry.
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NOTE: For further details of Fishworld '89, contact: **Fishworld Exhibitions Ltd., Cliveden House, Priors Way, Maidenhead, Berks SL6 2HP. Tel: (0628) 38912/770500; Telex: 848794; Fax: (0628) 29942.**

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PAGE 37
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PAGE 42
SINGLE TAIL FAVOURITES

PAGE 49
TWIN-TAIL FAVOURITES

PAGE 57
FAVOURITE PLANTS

PAGE 67
THE NEW FAVOURITES

PAGE 71
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HOODED FAVOURITES

All Fancy Goldfish varieties have their fans, and Orandas are no different — except that they are cherished with equal enthusiasm by beginners and experts alike. *A & P* editor **John Dawes** picks out some of the characteristics that have raised Orandas into such an exalted position

(Photographs by the author)

Go into any shop that sells coldwater fish, and you are bound to find Orandas of one kind or another.

Although most aquatic retailers happen to like Orandas, personal preference has little to do with their virtually ubiquitous presence in shops worldwide. If a type of fish doesn't sell, then it is hardly likely to find its way into more than a handful of shops. The fact that Orandas are so widely available can therefore be taken as a sure-fire sign that they are top sellers.

THE REDCAP

There are many reasons for this, but top of the list must be the undoubted grace and beauty of the most popular of all varieties of Oranda, the Redcap — so often (incorrectly) referred to as the Red Cap Oranda.

The combination of a gleaming silvery white body and vivid red "cap" or hood give this fish the sort of overall impact that is hard to resist. Add to this its long flowing fins, some of which are double (the belly, or anal, and the tail, or caudal), and you have a fish of majestic stature.

OTHER TYPES

In the past, Orandas came in three main varieties: the Redcap, the Red Oranda and the Calico (multi-coloured) Oranda.

However, such is the attraction of this fish's combined body and fin characteristics that long-running, intensive breeding programmes have led to a plethora of forms in recent years including, among others, Chocolate, Red and White, Blue and even Black Orandas. Further, other characteristics have been added to produce ever-more-elaborate forms, like the fairly recently developed Pompon Orandas which have the typical Oranda hood, body and fin characteristics, plus the over-developed nasal growths of the Pompon.

WHAT IS AN ORANDA?

So, what is an Oranda? Basically, it is a variety of Fancy Goldfish that has a well-rounded body (though not as rounded as, say, a Pearlscale), a cap or hood, and well formed fins. Of these the anal and caudal are double, as in other varieties like the Fantail and the Veiltail. All other fins are as found in other types, though the dorsal (back) is higher than in some of the more basic forms such as the Common Goldfish, Shubunkin (both Bristol and London) and Comet.

The presence of the dorsal is very important, particularly in view of certain similarities that exist between Orandas and other



Above, this young Chocolate Oranda may not have the short fantail-type caudal but it's still a very decent fish.



Left, The Redcap, undoubtedly the best-known type of Oranda.

Far left, the typical hood and caudal fin are clearly shown on this Red and White Oranda.

varieties, especially the Lionhead.

The most obvious characteristic which these two varieties possess is the raspberry-like growth on the head known as the hood. This can sometimes lead to some confusion where the combined and misleading name, Lionhead Oranda, can result in quite embarrassing slip-ups. I speak from experience here, having asked the publisher of one of my books to secure a photograph of a Lionhead (after the appropriate figure caption had already been written) and ending up, instead, with an Oranda on the final printed page. On pursuing the matter further, I learned that the picture in question had been submitted to the publishers as that of a Lionhead Oranda. They, for their part, were not fully aware that all Orandas have Lionhead-type heads!

So, beware of photographs that either show a dorsal-less hooded fish and call it an Oranda, or a fully finned hooded specimen and call it a Lionhead!

As far as the correct nomenclature of these varieties is concerned, there is no controversy. Regarding the caudal fin, though, there is some difference of opinion. Some purists believe that certain Orandas should possess shortish caudal fins, more like those found in Fantails, rather than the long-flowing types found in Veiltails. Chocolate

and Blue Orandas are thought of as examples of the former group, while most of the older types are generally regarded as belonging to the Veiltail category.

The vast majority of Orandas found in the hobby seem to know the rules, however, with long veiltail-like specimens far outnumbering their shorter-finned counterparts, irrespective of colour. Further, from most hobbyists' point of view, the main attraction of an Oranda lies in its overall effect. Therefore most aquarists do not lay any great emphasis on the length of the caudal fin. And, in many ways, it doesn't really matter whether your Oranda has a short or a long tail fin. As long as it's got the general features outlined above, it's a "valid" Oranda and, as such, is a hardy, statuesque, colourful and very worthy inhabitant of any Fancy Goldfish aquarium.

NOTE:

Comprehensive details on how to look after Orandas and other varieties of Fancy Goldfish can be found in numerous books. Two inexpensive, and very useful, ones are:

1. *An Interpet Guide to Fancy Goldfishes* by Dr Chris Andrews, Published by Salamander.
2. *Keeping Goldfish* by Dick Mills, Published by Blanford Press.

FAVOURITE SIN

Twin-tailed and other fancy varieties of Goldfish all have their attractions and followers, but to **Dr David Ford** of the 'Aquarian' Advisory Service, there's nothing to touch the elegance and beauty of single-tailed varieties.



AQUARIAN FISH FOODS



DAVID FORD



DAVID FORD

Top, an excellent and colourful collection of Goldfish including common Goldfish (both Gold and Gold/Silver), Shubunkins (Blue/Red/Orange/White), Comets (Sarasa - Red/White and "American" - Gold/Black), as well as a few twin-tailed varieties.

Left, my brilliantly patterned young Sarasa Comet - against a background of equally brilliantly coloured artificial plants.

Above, pride of place in my living room goes to my "jazzy" colourful Goldfish tank.

GLETAILS

Now that is what you call a fish! The single-tailed Goldfish, that is. As sleek and swift as nature intended. The Oranda may be pretty, the Lionhead colourful, the Ranchu cute, but all are pot-bellied and clumsy at the side of the Bristol Shubunkin, the Comet or even the Common Goldfish.

Most aquarists first started as children owning a Common Goldfish in a bowl. It is testament to the survivability of the species that it can swim around that bowl, with occasional, catastrophic, tapwater changes, for 20 years — the child-owner growing up and leaving home and probably returning with another generation to see the same Goldfish. One of the family.

Man has bred the original Chinese Goldfish into many varieties, some beautiful, some bizarre, but only the Singletails retain that perfection of shape that gives "swimability." The streamlined shape and large, friendly eyes are also special to the group; so, too, is their excited response when the owner approaches the aquarium.

If you want the friendly Goldfish in a garden pond (rather than the stately Koi) you should go for the Singletails. Wobbly Twintails or swirling Veiltails might survive a summer, but not often a British winter (even the greenhouse effect milder variety).

In over 40 years of fishkeeping I have kept large tropical and rare tropicals, coral fish and invertebrates, bred killies and live-bearers, built palladiums and ponds — you name it, I've done it... but the one tank that can always be found in my home is the Goldfish one. With a jazzy scene of colourful plastic plants and flowers behind an ever-active shoal of Goldfish, Common and Shubunkin (and perhaps a Moor, just for contrast) it outshines all the others as a living decoration.

History

Historians, even aquarists, accept that the first records of red-scaled Carp are to be found in the Chinese Tsin Dynasty around 1600 years ago. The first record of Goldfish as pets in ponds is documented in the Sung Dynasty of China (960-1279AD). Red, silver, black and mottled varieties of the Goldfish are to be seen in many art forms from the Ming Dynasty (1369-1644).

In fact, the Twin-tail is quite a newcomer: there are no records before ca. 1590. The Japanese got into the act then with "no dorsal" fins and enlarged "nostrils" varieties. I suppose their ultimate Fancy Goldfish will look like a golf ball (they are nearly there with the bizarre Meteor, that is egg-shaped).

Editor's Note: Despite repeated pleas, no-one, as yet, has been able to supply us with a photograph of a Meteor. If anyone reading this can provide unequivocal evidence that Meteors exist, please drop us a line, enclosing the photo and we'll publish it in A&P — John Dawes.

In addition to shape, the Goldfish has been bred into various colour groups, a metallic lustre or a dull matt, multi-coloured or self-coloured, ranging from mother of pearl to black, violet, red, brown, yellow, silver, white, blue (almost), as well as good old gold. What a fish!

VARIETIES OF SINGLETAILS

Wakin

The Japanese have bred the Common Goldfish back to its original Carp shape and colour. Called "Iron," the colour is a mix of brown, blue and black but it fades with age, often irregularly, to give a piebald effect. This fish is the most hardy of the Goldfish race but is rarely seen outside Japan.

The Common Goldfish

Any judge will tell you that the main feature of the prize-winning Common Goldfish is sturdiness. It must be well proportioned with moderately curved back and equal ventral curve, plus a short and wide head.

The fins must not be large but paddle-like and held stiffly. The eyes must be clear and bright and the scales visible and complete. Colour should be gold, but yellow, through orange, to red, is acceptable, providing it is a uniform self-colour. By crossing with other Singletails such as the Wakin, a chocolate-coloured variety is now available.

London and Bristol Shubunkins

Goldfish are divided into three groups by the specialist Societies — Metallic, Nacreous and Matt.

The Common Goldfish is Metallic, with the normal sheen of the scales. Over many years breeders selected for transparent scales which reveal the underlying colour of the fish. These colours are natural pigments of red-orange, yellow and black. The resulting fish, with all these pigments revealed, is called a Shubunkin (Anglicised version of the Japanese name).

The first ornamental Goldfish to reach Britain in the 1920's was a multi-coloured form bred and distributed from London and became known as the London Shubunkin. The Bristol Aquarist Society in the 1930's bred a Shubunkin with enlarged, but rounded, caudal fin which became a very popular variety. Since then, a further famous variety has been developed with a predominant blue colour, a difficult goal because the natural pigments are red/yellow. It is called the Bristol Blue.

American Goldfish

Chinese and Japanese Fancy Goldfish reached the USA about the same time as they arrived in Britain and American breeders set about producing their own varieties.

It is fascinating how much the fancy varieties reflect the nationalities of the

individual countries. The Chinese with their class-worship bred celestial-eyed Goldfish to gaze up at their Emperor; the Japanese with their love of form and colour bred the colourful Shubunkin; French breeders perfected the Veiltail with its fine fins like a negligée; but the Americans chose "speed and drive," and so, bred a long tail fin in a form called the Comet. This fish requires a large aquarium or a pond to swim fast through the water with its powerful tail.

Fairly recently, a vivid red form, called the Sarassa Comet, has been developed in the USA and is mass-produced by the Far East Farms. It has the long, pointed fins of the Comet and red splashes of colour on a pale background. Good specimens can even rival Koi.

HUSBANDRY OF SINGLETAILS

The pond is the best home for the Singletail Goldfish, so it can lazily swim around in its constant search for titbits to eat. Small Goldfish will settle in the home aquarium, but small they will remain. An external hormone-like substance, called a pheromone, is excreted by the fish and the dilution factor tells the fish what volume of water it is living in. Growth is then regulated and it doesn't outgrow its home. If you want big Goldfish you need a big container.

The Comet obviously requires a pond or tank at least 36in (90cm) long. The traditional Goldfish bowl is nothing short of cruel for such a fish. The beauty of the Shubunkin is best seen in the home aquarium where the side view reveals the subtle colour pattern.

Singletails do not suffer from swimbladder problems or gaseous indigestion like the round-bodied Goldfish, so a diet of earthworms (mild laxative) is not essential (but appreciated). Nor is purging required with Epsom Salts. My Singletails get a daily pinch of flake food (guess which one!) and nothing else. To give a little variety, to the Goldfish, carnivore and vegetable flake foods are used in rotation. The advantage of this diet is convenience and no water pollution, the aquarium is crystal clear, there are no algal growths despite only plastic plants being used, and the fish are colourful, active and healthy.

A small internal power filter is used to polish the water, but it is also used to give the fish a "chase" for their food. The flakes are inserted edgewise (to wet them for sinking) over the filter. As the flakes sink into the outlet area, the water jet shoots the flakes across the tank and the fish give chase and swallow their "victim" with obvious excitement.

It is no coincidence that the Goldfish, especially the Singletail Gold form, is the most popular pet in all the world. In fact, more Goldfish are kept than dogs, cats or birds added together!

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TWIN-TAIL FAVOURITES

If you've never kept twin-tailed varieties of goldfish Pauline Hodgkinson will soon make you realise just what you've been missing.

When the editor invited me to write about my six favourite twintail goldfish the first choice was easy because the very first "fancy" I started the hobby with has remained my favourite.

FANTAILS

The Fantail has always been more easily available than the more exotic types and, because they are relatively hardy, they are more easily cared for. They are active and attractive, and so appeal to the majority of goldfish enthusiasts. Almost everyone with a smattering of interest in coldwater fishkeeping will be familiar with this fish.

The Fantail is said to have first appeared sometime during the sixteenth century, along with many others which have been described as the egg-shaped fish. There is some evidence that the Japanese had them at this time for they are depicted in paintings from that period.

There is some slight difference between the British Show Standards for the Fantail, some societies favouring the relatively shorter caudal finnage. The tail should always be carried stiffly, never trailing, always be deeply forked and the "twin-tail" finnage completely divided. The body is roughly egg-shaped and there must be no indentation or "stop" at the junction between the head and the body. Pectoral, pelvic and twin anal finnage should be rounded and paddle-like.

I have kept and bred both the nacreous and metallic types though, without doubt, the nacreous one is my own particular preference.

It was during the early seventies, while making a chance visit to an aquatic shop, that I spotted a tank containing a batch of really super youngsters. My heart sank when I remembered that I wasn't carrying much cash, but on hastily counting up the coppers, much to my relief, I found I had just enough money to purchase two.

Though they were quite small I felt sure they were young adults, mature enough for me to select a pair. Two weeks later, after a diet of *Daphnia*, chopped earthworms, flake and porridge, they spawned. Their offspring were as good as, if not even better than, the parents, and though the pair were small, the spawning gave me several hundred fertilised eggs.

I have continued to breed this strain and have had some beautiful fish which are a delight, either swimming in the pond or an aquarium. Of course, all credit in the early days must go to the talented Japanese breeder whose skills created and fixed the



High-grade Veiltails such as these are difficult, and expensive to produce.

line which made it so easy for me to have so much initial success. However, I do like to think that I can claim some small credit, after all these years, for their present quality.

I believe that this is one variety you can purchase good breeding stock of from general aquatic retailers because many of the imported fish do have good body and finnage shape and are highly coloured.

One very important point to take into account if you are looking out for potential breeding stock, is the overall look of the entire batch of fish which you select from. It is pointless choosing a pair from, say, a batch of long-bodied fish and hope to produce offspring with short, rounded egg-shaped bodies. You must look for the fish which are displaying the characteristics you hope to produce in your youngsters, you can't hope to get out what isn't there in the first place.

LIONHEADS

Jostling for first place in my book is the Lionhead, a fish which has always been held in the highest esteem in most societies, and a variety not quite so easily available here, while the quality specimens still remain (price-wise) out of reach for many casual fanciers.

I think the Lionhead is one of the most fascinating and majestic of all the Fancy Goldfish. In fact, I believe that, in times gone by in Japan, only the nobles of the land were allowed to keep them. Even now they are still seen as the most regal, and exhibitions are devoted entirely to this one variety.

British Show Standards demand for so many difficult points for the breeders of this fish to achieve, that it is little wonder so few really first-class Lionheads are ever seen.

Make no mistake, this fish is a real challenge to breed if the aim is to produce

show-quality fish. The overall look of the fish must be good, well balanced, with a large hood covering the cheeks, as well as the top of the head.

The hood, a fleshy, raspberry-like growth, will, from time to time, secrete a white mucus-like substance, often mistaken by the unenlightened for fungus. A great deal of stress can be caused to the fish in an attempt to find a "cure." This condition is, in fact, part and parcel of the hood development; only the better growths secrete excessive mucus.

While we are on the subject, it is also important to note that fish with hoods are also prone to eruptions along the lateral line, usually in the form of fearsome-looking red pimples, but these conditions do clear up by themselves without treatment.

A smooth, broad back, gently curving from the head to the caudal, without blemish, is pleasing to the eye. Lumps, bumps and spikes look ugly on fish which are supposedly free from any sign of a dorsal fin.

The elimination of the dorsal fin is so far removed from nature that, to produce fish without this fin, is quite an achievement. So, it is obvious that there will be many youngsters in every spawning that will have spikes and blemishes where the dorsal fin would normally be. Consequently, after culling these badly faulted fish from the better specimens, the numbers will be distinctly reduced. Anyone who has bred any types of goldfish without a dorsal fin will be well aware of the difficulties involved in producing fish with clean, smooth backs, and will really appreciate the considerable effort involved in achieving success.

The caudal is carried high in Lionheads, though not as high, or as spread, as the caudal of the Fantail. It must, however, be

The mound-like scales which give the Pearlscale its distinctive name can be clearly seen in this photograph
JOHN DAWES



A smooth, curving back, coupled with a short tail and developing hood are good signs to look for in growing Lionheads.
PAULINE HODGKINSON

Bubble Eyes are dorsal-less, twin-tailed fish with characteristically fluid-filled eye sacs
PAULINE HODGKINSON



A very good specimen of Fantail, its tail in text-book fashion.
PAULINE HODGKINSON

fully divided. Other finnage should be rounded and paddle-like; the anal fins should be paired.

The hood will continue to grow and develop throughout the life of the fish, though not all Lionheads will develop a hood. Some strains produce fish with only limited hood development though, even from strains with the better growths, there will be many fish that will never develop a satisfactory hood.

It must be remembered that each fish is an individual and, therefore, even brothers and sisters will vary in the extent of their development. It has often been said that only the fish fed solely on livefoods can develop a hood. I have found no truth in this claim.

I suppose the easy part when breeding this fish is the culling, because faults are obvious from a very early age. This type of goldfish produces many individuals of poor body shape in each spawning which are not worth the effort and expense to raise, thus making selection of what to discard and what to retain to grow on simple. This helps to avoid the temptation to try to rear too many fish, so giving the better examples the space they need to grow and develop properly.

I obtained my first breeding pair from the much-respected, late Frank Orme, and was also fortunate enough to purchase a pair of Japanese imports which turned out to be worth their weight in gold when taking into account the quality of their offspring and subsequent generations which followed.

Most Lionheads, unlike many other goldfish varieties, improve with age; reasonably attractive youngsters can blossom into magnificent adults. It is little wonder that such high prices are expected for potential top-quality specimens.

BUBBLE EYES

My next favourite is the Bubble Eye, a fish

which, I know, has only limited appeal to the majority of fanciers.

I will admit that those wobbly "Balloons" situated beneath each eye give these fish a strange, if not ugly, appearance, but, for me, they are quite fascinating.

I prefer the nacreous type, though it is the metallic fish which are more commonly found in dealers' tanks.

Generally, there is a difference in body and finnage shape of imported fish, depending on which part of the world they originate from. Those coming from Asia have longer bodies and finnage, with large well-developed bubbles. The imports from China have bodies more in keeping with our British Show Standards which is egg-shape, finnage rounded and paddle-like, but with the bubbles less well-developed than in their Asian cousins.

The bubbles are filled with fluid and begin to develop when the young fish are two or three months old and will continue to do so throughout the fish's life.

Large bubbles have thin skin, and, so, are rather delicate. Careless handling can therefore burst them easily. Care should be taken when siphoning waste from the tank because accidental damage can be caused with a siphon tube. I am afraid to say that I speak from experience. However, the punctured skin gradually, over a period of days, will die back; the area will quickly repair itself and a new bubble will form. Unfortunately, the new bubble never grows back to its original size.

This, again, is a variety without a dorsal fin and, from my own experience, gives fewer problems to produce more fish per spawning with clean, smooth backs than, say, the Lionhead. This, of course, is entirely due to the breeding skills which have gone into producing generations over many, many years.

VEILTALS

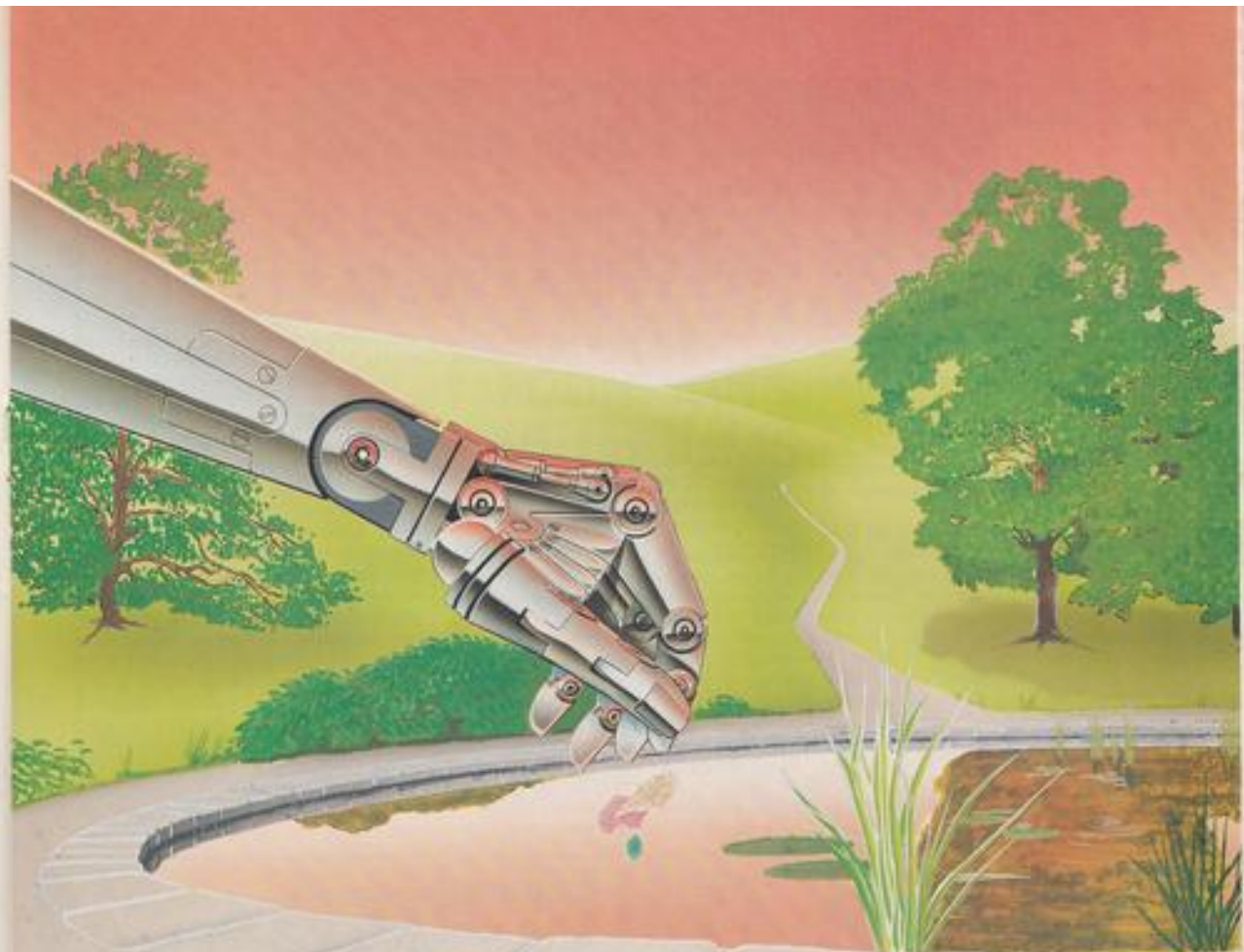
My fourth choice is the Veiltail, a fish perhaps only seen by many fanciers in photographs, but one which most enthusiasts long to own, and the fish which probably first attracted them to the hobby.

Veiltails are not widely available which, I suppose, is in one respect, probably a good thing because they are definitely not a suitable choice for the novice fishkeeper.

Veiltails are beautiful, their broad, flowing caudal finnage falling in graceful folds. They should have (if they are to attain show quality) a straight edge to the tail. This, in itself, poses a real problem for those who breed this variety, for the trait is so far removed from the original design. Therefore, while nature it is continuously turning back the clock, reverting to the original, it is a constant battle to progress in each generation rather than fall back. Sometimes the breeder wins, sometimes (s)he loses. Sometimes (s)he will be successful and produce a few really good Veiltails from a spawning, but, often, (s)he will be less happy with the youngsters when they fail to match both ideals and expectations. Since there are usually so few youngsters among a brood with the desired Veiltail finnage, producers often decide to keep these fish for themselves, hence the limited number of fish available for the rest of us.

The Veiltail is not a good proposition for the commercial breeders and you can see why. They aim to produce thousands of saleable fish from their spawnings, while the amateur has the time and patience to try to achieve perfection and, therefore, produce quality rather than quantity.

Goldfish with broad, flowing finnage are prone to fin congestion which can progress to Fin Rot and Fungus infections. This can be attributed to a number of causes; poor water quality, poor diet, rough handling; in



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Planting a coldwater aquarium always poses problems because of the boisterous nature of the fish. Goldfish (especially the more streamlined varieties) being bottom feeders, tend to 'root about' in the gravel strongly upsetting the plants in the process. Many goldfish also develop vegetarian cravings from time to time and strip the leaves off the more succulent species.

However, the principal problem is that of lighting. Plants native to the temperate areas of the world are known as "Long Day Plants". This is because the daylight hours are between 14-16 hours long during the growing season. As one moves towards the equator, although the intensity may be greater, the sunshine hours decrease to around 10. Therefore, unless our native plants are given long photoperiods they become etiolated.

The best compromise is to use plants from sub-tropical areas which will grow well under the 10-hour lighting period we normally use in aquaria. Sub-tropical species have another advantage in that they do not need the "hibernation" period that temperate plants require in order to retain their vigour.

MYRIOPHYLLUM

Myriophyllums are always popular on account of their delicate hair-like foliage and many species do well in aquaria. *Myriophyllum elatoides* has a wide distribution in the Americas and is also found in the Antipodes. An undemanding plant suitable for temperate and tropical aquaria, it has dark to light-green whorls of leaves on slender stems. It can reach 4-5ft (1.2-1.5m) in length if left unpruned. Other *Myriophyllum* species worth trying are:

M. verticillatum is a native plant to the UK and is also found in a broad band stretching from North America through Asia to Siberia and south to Africa.

M. spicatum, another native species, is almost cosmopolitan and races of this species are also found in tropical areas. It has wine-red stems and olive-green foliage.

NUPHAR

Nuphars are invaluable as they are probably the only specimen plants available for temperate aquaria. Related to water lilies, they will, if undernourished, produce only submerged foliage in aquaria.

Growing from a thick, fleshy tuber,

Barry James of Everglades Aquatic Nurseries presents a guide to the best coldwater plants and their cultivation.

(Photographs by the author).

Nuphars have thick petioles (leafstems) which support light-green, almost lettuce-like, foliage. The shape of these varies with the species.

Nuphar tubers are very buoyant and will need weighting down with a flat rock until they have had time to root firmly. *Nuphar luteum* is a native species and is best purchased when quite small. The leaves in this species are almost circular. *Nuphar japonicum* is frequently available. The leaves are broadly arrow-headed.

SAGITTARIA

Sagittaria is a large genus with a great diversity of shape and form. This polymorphism is nowhere better displayed than in our own *Sagittaria sagittifolia*. Overwintering as a tuber, the plant throws up long strap-like leaves in late spring. Later, oval floating leaves are produced. As the water level falls, stiff arrow-headed leaves are produced, accompanied by spikes of white flowers.

While this species performs poorly in aquaria, other species are superb. The most frequently available species is *Sagittaria subulata* formerly known as *S. nanans*. This grass-like plant is virtually identical to *Vallisneria spiralis*. However, its foliage is somewhat stiffer and it grows faster at lower temperatures than the latter species. Reaching a height of 18in (45cm) *S. subulata* has dark-green leaves that attain a size of up to 1/2in (0.6cm) broad. It increases rapidly by runners.

Sagittaria platyphylla is a much larger species from the southern area of the USA. The leaves are up to 3/4in (1.9cm) in width and 15in (38cm) in length. Two or three plants grouped together make fine accent plants for the middleground of a coldwater aquarium.

HOTTONIA

The genus *Hottonia* contains only two

species, one of which *H. palustris*, is native to Great Britain. This plant is my favourite oxygenator for garden pools, but it performs equally well in aquaria. Unfortunately, it dislikes very hard waters or pH levels above 7.2; otherwise it has no vices.

The simple pinnate (feathery) leaves give the impression of being arranged in whorls. The foliage is pale green and clumps beautifully. The pale pink flowers, the shape of which give the plant its folk name (Water Violet) are unlikely to be produced in aquaria. Best planted in groups of 5-6 stems, this plant is often offered commercially as pot grown specimens.

LYSIMACHIA

Another native plant is *Lysimachia nummularia*. A very versatile plant, it performs well over a large temperature range and is suitable for both cold and tropical aquaria. The golden-leaved form is sold in its terrestrial phase as a rock garden plant. A natural trailer in this form, it grows bolt upright when transferred to aquaria. The tough wiry stems have simple decussate (paired) leaves arranged oppositely. The lamina (leaf blades) are slightly wavy-edged and pale green. If pruned regularly, this plant will form dense stands.

HIPPURUS

Hippurus vulgaris is all alone in the world, being the sole representative of the genus. Not an easy plant, it is seldom cultivated in aquaria, but is common enough in ponds where it is cultivated for its stiff emergent foliage which resemble stands of miniature fir trees.

However, its submerged foliage is quite unique. The thick segmented stem is crowded with soft, linear (thread-like) leaves up to 2in (5cm) in length and pale-green in colour. This plant needs good light and the gravel should be re-inforced with a little aquarium substrate additive.

FLOATING PLANTS

Although floating plants are somewhat difficult because of the dietary requirements of carp-like fishes, *Ceratophyllum demersum*, one of our native Hornworts, will normally be successful on account of its brittle, stiffish foliage. Where other more carnivorous species of fish are kept, *Riccia fluitans*, or Crystalwort, should be tried.

Feature continued on Page 58



Milfoils (*Myriophyllum* spp) are finely divided plants which make impressive clumps.



Crystalwort (*Riccia fluitans*) is a floating liverwort suitable for both tropical and coldwater environments.



The underwater leaves of the Water Violet perform a useful oxygenating role both in tanks and ponds.



As this photograph of a *Sagittaria platyphylla* shows, the submerged leaves of these plants are very similar to those of *Vallisneria spiralis*.

Right, *Hyppurus vulgaris* — the sole representative of its genus — is an attractive, tough, difficult, plant for coldwater aquaria.

Left, *Ceratophyllum demersum* (the denser of the two plants shown), is a rootless plant that can be used as surface cover.



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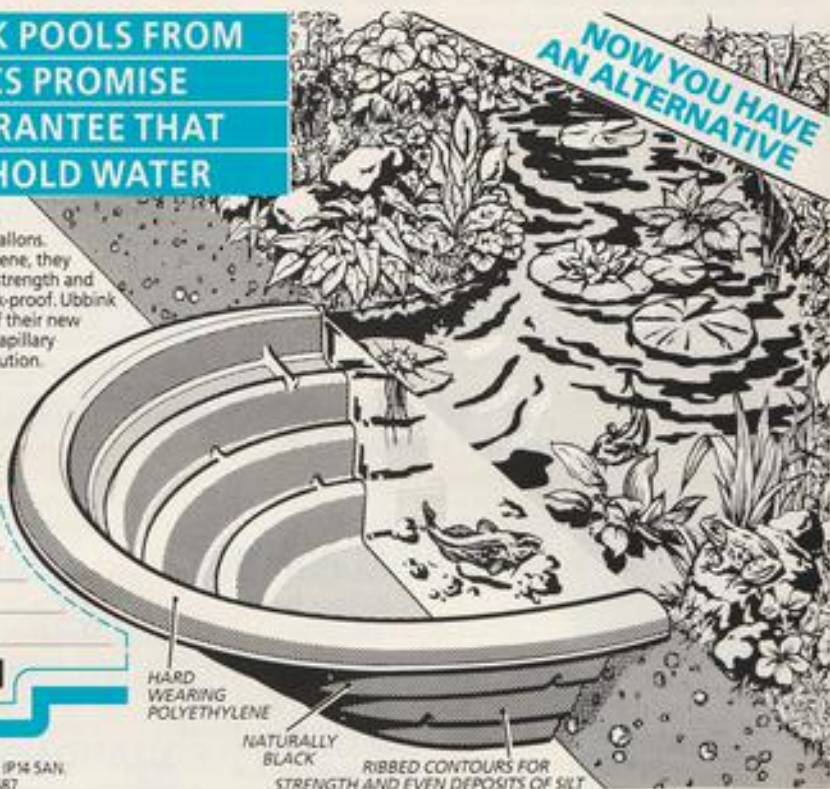
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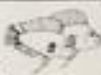
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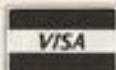
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THE NEW FAVOURITES

In a relatively short time, some of the newer varieties (at least, newish to the UK scene) of Fancy Goldfish have already won a place in the hearts of many specialised goldfish-keepers. **Stephen Smith** takes a look a few of these "new favourites".

It really doesn't seem that long ago that the coldwater hobbyist was learning to come to terms with new strains of Goldfish, such as the Bristol Shubunkin — yet that was over a quarter of a century ago!

Since then, individual favourites have become consolidated into the hobby. The Oranda is a particular favourite and, as well as its regal veiltail variety, has developed additional forms, such as the Chocolate, Blue and Redcap.

In addition, the Lionhead, Moor, and even the Pearlscale have become regular showpieces at Goldfish events throughout the UK, along with their singletail tank-mates the Bristol Shubunkin, Common Goldfish, and Comet (though, incidentally, it would appear that less is seen these days of this more pond-suited Goldfish).

So, what of the newcomers to the scene? Will the "old favourites" remain in their specialised standard forms, or will the next quarter-century bring a plethora of new and unusual strains and varieties to replace those we have come to know and love, and in some cases, dare I say, despise?

The Far East is considered by many to be the world's capital of the fishkeeping hobby — few can dispute such a claim. As the world becomes a smaller place, and cultures become more open and less divided, it is inevitable that, with this aquatic "Glasnost", hobbyists on this side of the globe will be introduced to piscine varieties not previously imagined.

Pure

None more so than with the Goldfish. China, its ancestral home, must contain the world's purest and most varied breeding stock: the result of several generations of dedication to individual strains.

Contemplation of such refinement sends shudders of excitement along the spine of this humble aquarist.

Meanwhile, Japan has adopted the cult of the Goldfish and developed its own individual strains, with their own nomenclature — often, it would seem, more suited to their larger Crucian brethren, the Koi.

Such open sesame presents new and mind-boggling challenges to the European Goldfish enthusiast. While there is every good reason to seek to refine the Bristol Shubunkin, Oranda, or Lionhead further, what challenge awaits the new generation in the Hamanishiki, Jikin, or Rainbow Phoenix?

Hamanishiki

Already, the Hamanishiki (pronounced Ham-an-ish-kih), has found a place in the



NOBUE TAN

Above, Hamanishiki (*Ham-an-ish-kih*) or High-head Pearlscale is a most attractive aquarium fish.



Right, This new variation in a traditional "theme" is a Chocolate Pompon Oranda

DAVE LEWIS

Goldfish scene in Britain, with English-bred specimens sweeping top honours at major shows.

I have myself witnessed a great deal of enthusiasm for this most pretty of aquarium Fancy Goldfish whenever I have included the Hamanishiki in one of my "roadshow" displays.

Very much reminiscent of the Pearlscale — and, who knows, it must surely owe its lineage to the Pearlscale specialist — the main feature of the Hamanishiki is the pair of "bubbles" which develop almost like inflated eyebrows, on top of the head.

The specimens which I have seen to date are yet young, but I would anticipate that a mature Hamanishiki could be an arresting sight: if only to the specialist.

The origin of the Hamanishiki is, I understand, Japanese — hence its *Koi*-sounding name. A similar fish emanates from China, but with a name which, when translated, is "High-head Pearlscale" (which everyone can understand!)

Jikin

A further relative newcomer to the scene is the Jikin (*Gee-kin*). Again, this is a Japanese derivative and one which I personally find one of the more sensible of the "new wave".

This most attractive Goldfish variety certainly presents a major challenge to even the most ardent enthusiast — and you'll need to be.

I understand that the Jikin made a brief appearance in Britain some ten to fifteen



STEPHEN SMITH

The Jikin (pronounced *Gee-kin*) promises to become a firm favourite with British enthusiasts. The challenge to breeders lies in the refinement of the main features: clean, pinky-white metallic body, equally-matched and paired perpendicular "butterfly" caudal finnage, and solid red colour exclusively on the fins and outlining the lips in adult fish (these are youngsters).

years ago, and offspring from that original strain may well be still around. A small number of breeders in this country have rejuvenated enthusiasts' interest in the Jikin by producing the first generation from imported broodstock, and I would anticipate that several shows throughout Britain over the next years will see the beginnings of the refinement required within the strain in this part of the world.

In my opinion, the Jikin could possibly become a cult almost as strong as that which the Bristol Shubunkin has developed over the years. And before the traditionalists

shudder and shake their heads, remember the Bristol was once "new".

ET AL

And the third variety chosen to introduce this piece — the Rainbow Phoenix? Representative of a hundred-and-one varieties of pretty-beautiful (to some) and ugly-pretty (to others). Whatever they may be, Topaz-capped Tiger-Head, Rose-lily Bubble-eyes, Pom-pom Oranda, et al, may the great British Goldfish-breeder take them to their hearts.

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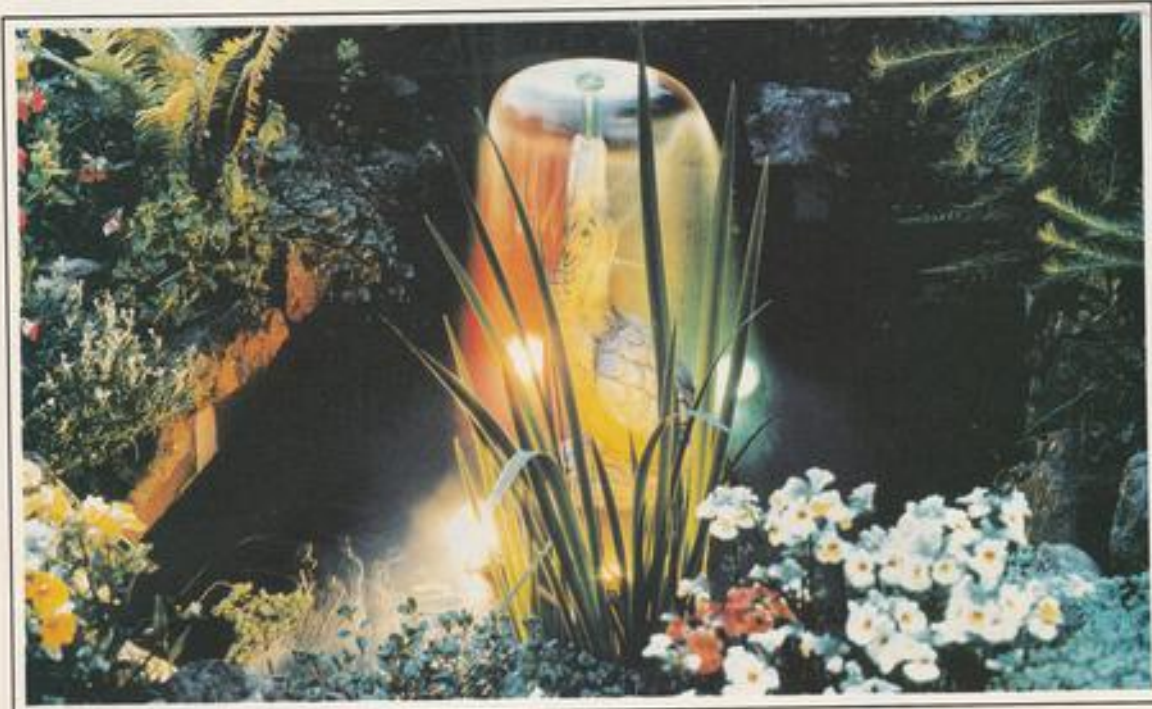
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OTHER COLDWATER FAVOURITES

The do's and don'ts of keeping fish other than Goldfish —
courtesy of Tetra's Dr David Pool.

Goldfish and small Koi are by far the most popular fish kept in a coldwater aquarium. In the last one to two years, however, there has been increasing interest shown in some of the other fish which can be kept in a "coldwater" environment.

In many aquarist shops, at the present time, it is possible to purchase a range of species, including the Sunfishes (*Lepomis* and *Etheostichus* species), Red Shiners (*Notropis lutrensis*), Rice Fish (*Oryzias latipes*), Bitterling (*Rhodeus sericeus*) and Weather Loach (*Misgurnus fossilis*) to name but a few. To this list we could also add some of our native British species, such as the Stone Loach (*Neomacheilus barbatus*), Gudgeon (*Gobio gobio*) and Stickleback (*Gasterosteus aculeatus*).

As you can see, the list is a long one and each species has a lot to offer if you can provide the correct conditions within your aquarium. In the following paragraphs I will look at just some of the species available.

BITTERLING (*Rhodeus*)

The Bitterling is, perhaps, best known for its unusual method of breeding. Unlike many coldwater fish, which scatter their eggs and leave them to hatch unattended, the Bitterling uses a freshwater mussel as a fry minder.



DENNIS DARBETT

Right, *Notropis lutrensis* is a very active and attractive choice for the coldwater aquarium. This magnificent specimen is a prize-winning male produced by Ekkwill Tropical Fish Farm in Florida.

Right, above, the Bitterling is now a well-established favourite among coldwater hobbyists

Above, the Rice Fish (*Oryzias latipes*) is a hardy and attractive little fish that does well in unheated tanks



JOCK MULLIS



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This is achieved by laying the eggs inside a freshwater mussel where they are safe from most predators. To achieve this, the female develops a long ovipositor (up to 2cm — nearly 1in — in length and brown in colour) which she inserts into the ex-current siphon of the mussel.

Once the eggs are released the male releases his milt in the vicinity of the in-current siphon and it is drawn in with the water to fertilise the eggs in the gill chamber. The fry remain in the mussel until they become free-swimming when, in the course of their activities, they get too close to the ex-current siphon and are washed out into the open to fend for themselves.

Keeping Bitterling in an aquarium is relatively straightforward as they are hardy fish and can tolerate a wide range of conditions. For the best result, keep a shoal of at least four individuals in a 60x30x30cm (24x12x12in) aquarium (or larger). Filtration and regular water changes will ensure that they remain bright, active and able to resist any diseases. Feed the Bitterling on a staple goldfish flake food, together with a vegetable-based flaked food in order to recreate their natural diet.

The breeding behaviour described above occurs throughout the summer months in coldwater aquaria. However, in houses with central heating, breeding can occur in the winter due to the gradual temperature increase caused by the heating being switched on.

During the breeding period the males are easily recognisable by their bright coloration. Breeding will occur readily if a freshwater mussel is present. One word of warning if you have a mussel in the aquarium: inspect it daily to ensure that it is still living, because, when dead, it will quickly pollute the water and kill the fish. A good indication is given by the position of the two halves of the shell. When dead, the muscle holding them together relaxes, and the shell falls partly open.

RICE FISH (*Oryzias latipes*)

The Rice Fish is the common name given to a number of the *Oryzias* species, of which *O. latipes* is the most commonly imported. The species is, in fact, a semi-tropical fish that will thrive in an unheated aquarium, particularly in a warm house. Ideally, the water temperature should be 18-24°C (64-75°F) although they can tolerate lower temperatures down to 14°C (57°F) for short periods.

The Rice Fish, so-called because they often inhabit rice fields in Southern Asia, make ideal aquarium inhabitants. They are small fish (maximum size 5cm-c2in) and can be kept in 60x30x30cm (24x12x12in) aquaria (or larger). To observe their natural behaviour, the Rice Fish should be kept in small shoals. Individuals kept on their own will often fail to develop to maturity, become diseased and die.

The aquarium can be planted or decorated with rockwork, but an area near to the water surface should be left free, as these fish are surface dwellers. Water quality is not critical if you just wish to keep the fish but, for breeding, it should be soft and slightly



Almost cichlid-like in some of its habits, the Pumpkinseed has become very popular over the years.



Among the smaller Sunfish species is *Elasmoma evergladei*. This photograph shows two males shaping up to each other.

acidic. As such, the water quality reproduces that in the rainy season when the Rice Fish spawn naturally.

As with the Bitterling, the breeding behaviour of the Rice Fish is one of their most interesting attributes. Mating normally takes place in the morning as the light intensity increases. Following a period of chasing and displaying, the male wraps his large anal fin around the female's belly, forming a hollow. The female releases her eggs into this hollow, where they are fertilised.

The eggs are surrounded by sticky threads, which attach them to the female like a bunch of grapes. The eggs remain attached to the female until they hatch, or until they become entangled in any plants in the aquarium.

When first hatched, the fry are darkly coloured and swim around on the water surface. Initial growth is slow, perhaps due to the incessant activity. The fry can be fed on newly-hatched Brine Shrimp, followed by commercial fry foods. The adults will readily accept flaked foods.

Sunfishes (*Lepomis*, *Enneacanthus* and *Elasmoma*)

Perhaps the most widely available of the North American coldwater fish are the Sunfishes of the genera *Lepomis*, *Elasmoma* and *Enneacanthus*.

Pumpkinseed Sunfishes

The Pumpkinseed Sunfish (*Lepomis gibbosus*) is the largest and most aggressive of the Sunfishes, growing to a length of 24cm (9.5in) in large aquaria and ponds. They should only be kept with members of their own kind or other similarly sized fish. Despite these "problems", Pumpkinseeds are popular because of their bright coloration, particularly when young and during breeding period.

The water quality in a particular region is usually the factor governing whether the Pumpkinseed can be successfully kept. If the water is soft or acidic, the fish become very restless and susceptible to disease. This also occurs if chlorine is present in the water. Therefore, regular use of a good quality dechlorinator at each water change is important. Feeding is straight forward — they will eat anything, but should be given a basic diet of staple tropical fish food or cichlid food to ensure that they receive sufficient protein.

The Pumpkinseed spawns in a typical cichlid fashion, with the male excavating a shallow hollow in sand or fine gravel into which the eggs are laid. The male then guards the eggs and fry until they become free-swimming. Because of this territorial behaviour the Pumpkinseed should not be kept with Fancy Goldfish varieties, as their finnage will quickly be reduced to tatters.

Dwarf Sunfishes

The *Enneacanthus* and *Elasmoma* species are smaller and less aggressive than the Pumpkinseed. All species: *Enneacanthus chardon* — the Black-banded Sunfish, *E. gloriatus* — the Blue Spot Sunfish, and *E. obesus* — the Banded Sunfish, and *Elasmoma evergladei* — the Pygmy Sunfish, are ideal specimens for an unheated aquarium.

In the wild, they are sometimes found in the same waters in Florida and the Atlantic coast of America, and can also thrive if kept together in a properly furnished aquarium. Some aggressive behaviour may be observed from the males, particularly when breeding, but this is usually short-lived and relative peace will soon return to the aquarium.

An aquarium for the "Dwarf" Sunfishes should not be brightly lit and should contain areas of dense plant growth where they can hide. Failure to provide these conditions will result in the fish remaining pale and very nervous.

As with the Pumpkinseed, water quality is not critical, although sudden changes should be avoided. Apart from this they are very hardy and are rarely affected by parasites.

Breeding for *Enneacanthus* is as described for the Pumpkinseed and appears to be particularly successful following a cold winter, or period, when the aquarium water temperature is allowed to fall (this also applies to the Bitterling). *Elasmoma* are egg scatterers.

In this article I have drawn attention to some of the many alternative fish for an unheated aquarium. As you can see, you are not limited to Goldfish and Koi, so next time you are in an aquarist shop, have a look to see what is available... but check on what it eats, how big it grows, etc before considering purchasing it!

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- Water management — filtration, treatment, purification of both fresh water and sea water in tropical/temperate pond and aquarium environments
- Reproduction and genetics of fresh water and marine fish; and farm management

The objective of the conference is to provide a platform for aquarium traders from all over the world to discuss current key issues pertinent to the industry. It is expected that some 300-400 delegates will attend the conference in Singapore.

An international fish compe-

tion will also be held during the exhibition. An international panel of renowned judges has already been invited to the event. Return air fares to Europe, USA and Asia are some of the prizes to be won.

Preferential rates have been negotiated for exhibitors at a number of luxury hotels within easy access of the exhibition venue. For details of these, plus any other matters concerning Aquarama '89, please contact Irene Gob, Academic Associates Pte Ltd, Blk 808, French Road, #03-185 Kitchener Complex, Singapore 0820. Tel: (01065) 2926166; Fax: (01065) 2924625.

Industrial support for the National Aquatic Training Centre

In early 1987 Sparsholt College sent a questionnaire to a cross section of the aquatics industry asking if they considered there to be a requirement for trained retail staff. The response was immediate and very positive.

After consultation with members of the industry the College prepared and submitted a syllabus to the National Examination Board, which was approved in December 1987. Last September the National Certificate commenced, only 18 months after the original questionnaire was sent out, a remarkable achievement in itself.

However, the launch of the course was only possible because of the universal help and support offered to the College by the Aquatics industry. Below is a list of the companies from whom special support and help has been received, many having donated or loaned goods to enable the National Aquatic Training Centre to be equipped with a wide range of

both fish and dry goods to enhance student training.

The College would like to thank these companies publicly, in particular for the help received, since it reflects a most positive and helpful attitude which augurs well for the future.

Amazon Aquatics Ltd, Wimborne; Algaed Enterprises Ltd, Basildon; Aqua-Labs, Letchingdon; Aquatics, Hoddesdon; Allen Plastics Ltd, Salisbury; John Allan Aquariums Ltd, Bury St Edmunds; Aquamagic Ltd, Watford; Amphill Aquatics, Chingford; Anglo Aquarium Plant Co Ltd, Enfield; Beaver Water Plant & Fish Farm Ltd, Wrotham; Batsford Products, Atherton; Bennetts Water Lily Farm, Weymouth; BP Nutrition, Cheshire; Cell Systems Ltd, Cambridge; Bernard Crook Garden Services Ltd, Newport Pagnell; Cyprio Ltd, Peterborough; Midland Waterlife Franchising Ltd, Bromsgrove; The FBAS, Wembley; Mr Fish, Bedford; B. Y. Foden, Huddersfield; Giant Tiger, Ghana; Rolf C. Hagen (UK) Ltd, Leeds; Hobby Fish, Milton Keynes; Interpet Ltd, Dorling; JMC Aquatics Ltd, Sheffield; King British Aquarium Accessories Co Ltd, Bradford; Kent Koi Ko, Sevenoaks; Lotus Water Garden Products Ltd, Bucks; Langley's Fish Farm, Essex; Gordon Low Plastics, Coxes, 10W; Magicure Aquariums, Northants; Michelmerch Bricks, Hants; Millor

Ltd, The Waterlife Studio, Marlow; Medcalf Bees Ltd, Peters Bar; Minireef Aquarium Systems, Alton; N.T. Laboratories Ltd, Tonbridge; NCS Shopfitters, Yate; Norline Nets, Norfolk; Prosto Pets Ltd, Essex; Pettech Electronics Ltd, Cornwall; Rosewood Pet Products Ltd, Shrop; C.J. Skilton Aquatic Wholesalers, Chelmsford; Roboff Ltd, Barking; Romsey Water Gardens, Romsey; Swallow Aquatics, Rayleigh; Silverpet Manufacturing Ltd, Harrogate; W.H. Smiths Distributors, Leicester; Stapley Water Gardens, Cheshire; Sea Life Centres, Portsmouth; Seabray Aquariums, Basildon; Tahiti Aquariums, Manchester; Tetra, Eastleigh; T.F.H. Publications, Maidenhead; Thringston Aquatics, Coalville; T.A.P. Ltd, Filton; Stuart Turner Ltd, Oxon; Thomas's, Bristol; Underworld Products, Loughborough; Uno Products Ltd, Norwich; Tropical Marine Centre, Boreham Wood; Ultra Violet Technology Ltd, Dorling; Creature Comforts & Aquatic Centre, Totton; Water Techniques, Esher; Waveney Fish Farm, Diss; Waterlife Research Industries Ltd, West Drayton.

For further details of Sparsholt's National Certificate in Aquatics & Ornamental Fish Management contact The Principal, Dr Len Norman, Sparsholt College, Sparsholt, Winchester, Hants SO21 2NF. Tel (096 272) 441.

BAF — advance news

The 38th British Aquarists Festival will be held at Bowlers Conference Exhibition and Leisure Centre, Longbridge Road, Trafford Park, Manchester on Saturday and Sunday 28 and 29 October, 1989.

The BAF Committee would like to thank all those who supported the 1988 Festival and look forward to seeing new and familiar faces at the forthcoming 1989 Festival.

Trade enquiries to Alan Darby, 1 Perrin Street, Hyde, Cheshire. (Tel 061-368-4868).

All other enquiries to the show organiser, Arnold Chadwick, 9 Bronville Close, Chadderton, Oldham OLI 2RH. (Tel 061-652-6207).

Fish Fayre

**DONCASTER
RACECOURSE
SATURDAY 15th APRIL -
SUNDAY 16th APRIL**

Opening Times

**SATURDAY 9.30 am — 6.00 pm
SUNDAY 9.30 am — 5.30 pm**

The once a year
chance to see the very best displays of
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Plus don't miss the
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fish for your own tank from
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**YORKSHIRE
AQUARIST
FESTIVAL**

*Further Details
Contact YAF Secretary
Marie L Harrop (0484) 666591*

News from the societies

Association of Aquarists

"The Association of Aquarists are to sponsor a new series of regional open shows. The first show is to be hosted jointly by Havant & District Aquarist Society and the Co-operative Aquatic Social Society.

Southern Aquatic Show '89 — incorporating a unique "Superbowl Competition" Venue: — Merchistown Hall, Horn-dean, Hants: date: Sunday, 2 April.

With the cost of putting on an Open Show becoming increasingly higher, coupled with the general decline in club membership, fewer clubs are able to afford to run major shows. There has, as has been frequently highlighted, a significant reduction in the number of people actually showing fish, although trade figures would not indicate a comparable reduction in the number of people who actually keep fish.

Perhaps the reason behind this is that newcomers to the hobby are either not suffi-

ciently aware of Open Show events through those individual clubs who are still able to run them not having the resources to widely advertise their show, or through there now being areas of the country where this type of show does not occur locally at all.

In an effort to redress the situation, the A of A have taken the initiative in proposing to sponsor a series of regional Open Shows. The Association will be responsible for all the necessary judges, awards and show publicity, while providing back-up and advice to the host society.

To encourage a higher level of fish entries, and hence public interest, there will also be an ongoing "Superbowl" competition for the fishkeeper with the highest aggregate points score from all of the regional shows.

Obviously the Association will be seeking publicity for this first regional show through the local media, however, any coverage in the form of editorial in your magazine would, undoubtedly, reach not only the

society aquarist but also those perhaps new to the hobby, for whom a magazine such as yours is an invaluable information source.

Naturally, the Association extends a cordial invitation to you to join us at the show, but in the meantime if you would like any further information please do not hesitate to contact the writer.

Mike Shepherd, 4 Well Meadow, Leigh Park, Havant, Hants PO9 4LW Tels: (0705) 474404 — Home. (0705) 455443 — Office (Monitor Business Magazine)"

Editor's Note
Thank you for your letter, Mike. Delighted to give a full word-for-word publicity. We wish you great success with your planned events for 1989.

John Dawes

Macclesfield Aquarium Society

The new committee of the above society is as follows:
Chairman: A. Goddard, 7 St Andrews Road, Macclesfield, SK11 8HA

Vice Chairman: K. Lawn, 29 St Johns Road, Macclesfield
Secretary: Mrs K. Hayter, 96 Gawsforth Road, Macclesfield, SK11 8UF
Show Secretary: J. Merriman, 10 Grange Road, Macclesfield
Treasurer: Mrs S. Macdonald, 74 Thornton Avenue, Macclesfield



Reigate & Redhill Aquarist Society

Following the society's AGM, the main elected officers of the 1989 committee are:

Chairman: Syd Fewtrell
Secretary: Ivon Stempé
Treasurer: Dick Gush
Further details of R.R.A.S. from Jeremy Spence (PRO), 60 Railey Road, Northgate, Crawley, West Sussex, RH10 2BZ.

Diary dates

Bishop Auckland Aquarist Society

The 21st Open Show of the above society will take place on **Sunday 2 April**. For full information, contact the Secretary at 44 Ridgeside, North Close, Spennymoor, Co Durham DL16 7HG. Tel: (0388) 816666.

Ilford & District Aquarist's & Pondkeepers' Society

A major talk entitled **Know Your Garden Pond** will be given in two installments on **10 and 24 April** at the Wanstead Library, Spratt Hall Road, Wanstead, London, E11. Topics covered will include maintenance, care and upkeep of fish, plants, marginals, water quality, etc. Visitors will be welcome to attend both sessions which are scheduled for an 8 pm start.

For further information, contact R. Downer, 93 Brian Road, Chadwell Heath, Romford, Essex,

East Kent Aquatic Study Group

For details of the E.K.A.S.G. Open Show scheduled for **16 April**, contact the Secretary, Miss S. Edwards, 14 Upper Dane Road, Margate, Kent, CT9 2LX.

Reigate & Redhill Aquarist Society

There will be a Bring and Buy Sale at Strawson Hall, Albert Road, Horley, Surrey, on **Monday 17 April** at 8 pm. Further details from Jeremy Spence (PRO), 68 Railey Road, Northgate, Crawley, West Sussex, RH10 2BZ.

Catfish Association of Great Britain

Three dates for the diary:
1. **Open Show: 23 April** at Amersham Community Centre
2. **Auction: 24 June** at the same venue
3. **AGM and Convention: 5 November** at the same venue

Details from Chris Ralph (Show Secretary), 610 Abbey Road, Basingstoke, Hants. Tel: (0256) 63220 or Gina Sandford. Tel: (0737) 69339.

Merseyside Aquarist Society

The annual Open Show of the M.A.S. will be held on **Sunday 23 April** at Rainhill Village Hall, Rainhill, Prescot, Merseyside. Further information from the Secretary, Mrs K. King, 28 Sark Road, Liverpool, L13 6QU. Tel: (051) 259 5013.

Haringey Aquarist's Society

Haringey A.S. will be holding its 1989 Open Show at Crouch Hill Recreation Centre, Crouch Hill, London, N19, on **Sunday 30 April**. Benching: 9.30 am-12.30 pm. All enquiries to Bert Stern (Show Secretary), 100A Ferme Park Road, London, B8 9SD. Tel: 01-341 0361.

Wrexham Tropical Fish Society

The 5th W.T.F.S. Open Show will be held on **Sunday 30 April** at Rhosddu Community Centre, Wrexham. Full details from Peter Jones (Secretary), 1 Hope Street, Caergwle, Wrexham, LL12 9AA. Tel: Wrexham 761829.

Tongham Aquarists

The 1989 Tongham Aquarists Open Show will take place on **Sunday 7 May** at Ash Council Recreation Hall, Ash Hill Road, Ash, Aldershot. For further information contact Adrian Worley (Public Relations Officer), 10 Maple Close, Blackwater, Camberley, Surrey, GU17 0PX.

Stafford Aquatic Society

The SAS 3rd Open Show will be held on **Sunday 14 May**. Full details from the Secretary, L. F. (Larry) Lainton, 280 Sandon Road, Stafford, ST16 3HP. Tel: (0785) 44406.

Coldwater jottings



Stephen J. Smith

On the carpet!

Although my main interest in coldwater fishkeeping is in Fancy Goldfish, I derive great pleasure from other coldwater species — especially my collections of diminutive, but rapidly-growing, Golden Orfe and a handful of unimpressive Koi.

Unimpressive maybe — to the connoisseur. But ask the average hobbyist about their own "average" fish and they will rightly tell you they are their pride and joy! Thus, with my own — two Oghon, a Sanke, an anaemic-looking Kohaku (well, almost!) and a poor-man's Asagi.

However, my pond set-up was designed specifically for rearing and keeping Goldfish, and comprises half-a-dozen tanks ten foot by five, constructed by using roofing joists to provide height above ground, and graduating from nine inches to eighteen inches in depth.

Not really suitable for Koi, but then, I have for the past three years, every year, promised myself an elaborate ornamental pond... next year! The larger specimens really have begun to outgrow their quarters over the past year or so — despite the Koi being accommodated in a pond to themselves, which was the deepest I had.

In addition, one of the problems encountered by Koi-keepers with shallow ponds is that, as the Koi grow, they begin to develop "flat bellies".

This would appear to be the result of the fish receiving too little exercise vertically, compared with the amount of lateral movement maintained by the fish. Depth is essential for the healthy development of Koi, and it is not unheard of for Koi ponds to be built to depths of up to eight feet.

A further benefit of a deep pond is that, during the colder weather, the water at the bottom of the pond is actually warmer than that above, and is therefore the warmest place for the fish. Hence, you may often see your own fish apparently "sulking", motionless at the bottom of the pond: just the aquatic equivalent of us curling up in front of a log fire in a cosy living-room. So a major project was called for to deepen my existing pond used for Koi, to improve their conditions all round.

Having resited the Koi in an alternative pond which had been lying "fallow", the existing pond was pumped out and the old liner removed. Here, one the advantages of using heavy-gauge polythene was perfectly illustrated; try digging up three inch thick concrete as part of the project!

A depth of five feet was the target. But, multiply that depth by the area of soil which had to be removed, and we have a large volume of clay on our hands! Granted the topsoil was perfect for the borders of the garden, but where do you put several hundredweight (or was it tons?) of thick, wet clay?

It always pays to check this out before you start digging, and do try to make sure that the "dumping site" is not at the other end of the garden: there is a limit to how much a wheelbarrow can hold, and several trips to dispose of the contents can be more tiring than actually digging the stuff out!

In forming the internal shape of the pond, I chose to have the two long sides fairly steep, with the short sides "stepped". Not only do these steps provide shelves for plant baskets, but they are also useful for climbing in and out of the pond as the depth increases.

Now, the reason for the title to this missive: I have always found two materials of considerable use in pond construc-



Left, the "Red Carpet" treatment solves the pond cladding problem. Right, the heavy gauge polythene is fitted and the pond filled ready for the Koi.

tion, as a base for the liner and to protect it from any sharp edges or stones which could pierce the liner from below. One is a two-to three-inch thick bed of builders' sand, especially useful for irregular pond shapes: while the other is a thick layer of old newspapers.

However, neither option would be worthwhile with this project. The sides of the pond were so steep that neither sand nor newspapers would begin to hold fast while laying new liner.

The answer, although a long time coming, was simple — domestic carpet. Having purloined a couple of old carpets

from a neighbourhood carpet fitter, it was a relatively simple matter to cut this into manageable pieces and staple these to the timber frame at ground level, until the whole area of the pond was covered.

Finally, a new sheet of heavy-gauge black polythene to the correct size was positioned cut over the hole and eased into position while the hose was running.

Having allowed a further couple of days for the water to stabilise, the Koi were introduced to their new quarters.

Now, some six months later, I do believe they've grown...!

NEXT MONTH

Don't miss the second in our series of spectacular, colourful giant posters. It's absolutely FREE with the May issue of *Aquarist & Pondkeeper* and features a golden Veiltail Goldfish in a stunning setting.

There are other reasons why next month's issue of *A & P* is very special, of course. For example, it's the next in our **Spotlight** series which is receiving rave reviews from new and established readers alike. This time the chosen subject is **CICHLIDS** and included in an unbeatable line-up of specially commissioned features we have:

● **The Peacock Review** — Part 1 of the most comprehensive and authoritative review of Peacock Cichlids ever published — written by **John Ferguson** of the British Cichlid Association and world authority **Dr. Ethelwyn Trewavas** of the British Museum (Natural History).

● **Golden Mozambique Mouthbrooders** — the secrets of how to breed them from **William Ross**.

● **Foster Cichlids** — ingenious ways of safeguarding your cichlid fry, by **Jeff Challands** of the British Cichlid Association.

● **First Steps to Discus** — how to make a successful start, with full guidelines from Tetra's **Dr. David Pool**.

● **Setting up for South American Cichlids** — all the basic rules from **Allen Brellig**, President of Petvision/ASPC Inc.

Coldwater, Koi, marine, reptile and amphibian fans will also find a great deal in our packed and colourful May issue, from Cypriot herpetiles to Lipstick Gobies... and lots more in between.

See you in May!

**MORE
PRODUCTS
FROM**

Dupla 

LAST MONTH WE TOLD YOU ABOUT THE NEW FOOD, DUPLARIN — AND ABOUT DUPLA'S RANGE OF PLANT FERTILISERS. THIS MONTH, WE WANT TO TELL YOU ABOUT DUPLA PUMPS, AND WATER TREATMENTS.

DUPLA TURBO PUMPS

THESE HEAVY DUTY, MAGNETIC DRIVE PUMPS ARE AVAILABLE IN SEVEN DIFFERENT CONFIGURATIONS, FROM 840 TO 2980 LITRES PER HOUR — (DIVIDE BY 4.546 TO GET GALLONS!) AND ALL ARE SUITABLE FOR FRESH AND SALT WATER. ALL PUMPS FEATURE BALL-BEARING AXLES WITH CERAMIC SHAFTS, AND FEATURE PARTICULARLY LOW RUNNING COSTS — THE LARGEST PUMP CONSUMES ONLY 84 WATTS! WITHOUT A DOUBT, THIS IS THE MOST VERSATILE RANGE OF SERVICE PUMPS IN THE AQUATIC INDUSTRY.

DUPLA CARBON

ANOTHER GREAT ADVANCE FROM DUPLA! THIS FINE GRADE PELLETTED CARBON IS SUITABLE FOR FRESH OR SALT WATER USE. WE THOUGHT OUR CENTRALISED MARINE SYSTEM WAS PRETTY CLEAN UNTIL WE INSTALLED DUPLA CARBON — NOW YOU CAN SEE CLEARLY THROUGH SIX TANKS END TO END — 12 THICKNESSES OF GLASS AND 15 FEET OF WATER. IF YOU USE CARBON — BUY THIS ONE!

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DUPLAGAN IS A WATER CONDITIONER. IT IS **NOT** A DECHLORINATOR — THAT WOULD BE TOO EASY! TO CONDITION WATER PROPERLY IT IS AN INCREDIBLY COMPLEX BUSINESS. DUPLAGAN IS BORN OF A CO-OPERATION BETWEEN EUROPEAN AND AMERICAN SCIENTISTS, WHOSE TASK IT WAS TO PROVIDE A PRODUCT THAT WOULD CONVERT TAP-WATER TO AQUARIUM WATER IN ONE GO — WITHOUT AFFECTING THE NITRATE CYCLE, AND WITH SUBSTANCES WHICH HAD NO SIDE EFFECTS, WOULD NOT COLOUR THE WATER DEGRADE OVER TIME INTO UNDESIRABLE ORGANIC SUBSTANCES. DUPLAGAN IS A TESTAMENT TO THE SUCCESS OF THESE SCIENTISTS. WHEN CORRECTLY ADMINISTERED, DUPLAGAN HAS NO EFFECT ON PH, CONDUCTIVITY OR PLANT FERTILISATION AND IT IS COMPATIBLE WITH ALL DISEASE AND ALGAL TREATMENTS. DUPLAGAN INCREASES APPETITE, PROMOTES HIGH BACTERIAL RESISTANCE, AND IS INDISPENSABLE WHEN ACCLIMATIZING NEW FISH, TRANSPORTING FISH, AND INDUCING THEM TO BREED. IT IS **NOT** SUITABLE IN MARINE SYSTEMS.

DUPLA BIOBALLS

OUR LAST PRODUCT THIS MONTH IS A FILTER MEDIA — OF PLASTIC CONSTRUCTION, EACH BIOBALL IS ABOUT THE SIZE OF A PING-PONG BALL, AND RESEMBLES 2 CHANDALIERS BACK TO BACK! THIS JOKEY DESCRIPTION BELIES SERIOUS PURPOSE, HOWEVER. 20 LITRES OF BIOBALLS HAVE A SURFACE AREA OF 80,000CM² — THE LARGEST SPECIFIC SURFACE AREA OF **ANY** OF THE PLASTIC FILTER MATERIALS AVAILABLE — AT THE RECOMMENDED LEVEL OF 5 - 10% OF AQUARIUM VOLUME, 20 LITRES OF BIOBALLS CONTAINED IN A TRICKLE FILTER WILL PROVIDE FOR THE BIOLOGICAL FILTRATION AND OXYGENATION NEEDS OF AN AQUARIUM (6ft x 2ft x 2ft) WITH ALL THE BIOLOGICAL FILTRATION YOU NEED IN A 5 GALLON BUCKET! WHAT ELSE COULD DO THAT? BY THE WAY, BIOBALLS ARE MANUFACTURED FOR INDUSTRY BY CIBA-GEIGY, AND MARKETED FOR THEM BY DUPLA — PEDIGREE INDEED!

FOR MORE INFORMATION ON ALL THESE PRODUCTS, ASK FOR YOUR RETAILER — OVER 300 IN THE UK HAVE OUR INFORMATION PACK — OR CALL OUR INFOLINE ON 0234-59333 AND ASK FOR ALAN

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INFOLINE 0234-59333**

PRODUCT ROUND-UP BY DICK MILLS

HEATING AND LIGHTING FOR VIVARIA

Vital requirements for amphibians and reptiles are ventilation, a temperature-controlled environment and correct lighting. The provision of these is quite straightforward but the need for efficient use of the readily-available products might not be quite so obvious. Using a custom-built vivarium, as opposed to a 'converted' aquarium, is by far a better solution, as its construction not only allows for better viewing and maintenance, but has better heat retention and fewer condensation problems.

Although heating is mandatory for tropical species, it is not simply just a question of warming the whole atmosphere: various animals also require additional zones of differing temperature. It is a natural assumption that these are extra-warm, spot-lit basking areas, but what is not always realised is the equally necessary provision of cooler areas, away from

the permanent 'sunshine.'

If the room containing a number of vivaria is not to be space-heated, then individual vivarium heating is necessary. Background heat may be needed for small vivaria but larger installations will require more powerful systems.

Like aquarium-heating equipment, that for the vivarium must be chosen carefully. An overlarge heater will cause severe problems in the event of thermostat 'stick-on.' Likewise, a heater chosen to cope with winter ambient temperatures will promptly overheat the vivarium in summer. Choose a heater which just fits the job in hand.

Internal heaters (bar or conical design) must have covering guards to prevent animals from contact burns; always use the correct holders in conjunction with heaters. Heating pads are increasingly used but, although 'splashproof', they are not sub-

mersible; they can be used either within the vivarium itself (on walls or ceiling) or externally underneath it. Sub-soil heating cables are popular too, although their use depends on the type of animal to be kept.

To maintain the heat within the desired temperature range, reliable thermostats must be used; not all external aquarium types are suitable (and they may be harder to locate). Modern solid-state thermostats with remote heat sensors should meet most requirements, while those of even more sophisticated design allow greater flexibility with proportional control.

To make the best use of light, especially where necessary UV has to reach the animal, lights must be fixed inside the container beneath the cover-glass or lid. The type of lighting can also be critical, lizards and tortoises requiring sunlight-approximating light for calcium con-

version for instance.

UV tubes are cool-running and should not be relied upon to provide sufficient heating, so a separate 'ordinary' spotlight will be necessary to provide 'basking spot' heat. UV sunlight bulbs are ideal for lighting and heating animals such as desert species where temperatures vary widely from day to night-time. Where more constant-heat loving species are kept, a heating pad must be used to continue the 'daytime' temperatures overnight. The light spectrum from some UV tubes approximates very closely to natural daylight, but the UV output may be relatively low and animals need to be able to get really close to these tubes to benefit from them. UV tubes emitting less light should be used in conjunction with white spotlight bulbs during daylight hours. Use UV tubes specifically designed for vivariums — those used in marine aquar-

NEW PRODUCTS

GLOBALCUSTOM

Hot on the heels of their very successful launch of HSP Frozen Fish Foods and relaunch of AQUARIUM MUNSTER Remedies and Filter Mediums, GLOBALCUSTOM LTD announce that they have acquired distribution rights of PROMIN FISH FOODS, the popular granular alternative to flake foods. The HSP frozen range was initially launched with its 19 different foods sold in 50gm packs, but now 100gm and 300gm sizes have been added.

Bulk storage of food (or any other stock held in the aquatic store or fish-houses for that matter) brings its attendant problem, DAMPNESS. Globalcustom Ltd have introduced a dehumidifier easily capable of

extracting 2 gallons of water from the atmosphere in a 24 hour period. This will combat the risk of ruined stock and peeling decorations easily and cheaply.

Globalcustom are actively seeking distribution through wholesale outlets, but if any difficulty is experienced in obtaining any of the products mentioned above, full source details are available from: GLOBALCUSTOM LTD, Barton Stacey, Winchester, Hampshire SO21 3QL (Tel: 0962 760515 Fax: 0962 760692).

ARMITAGES

Whatever your taste, there will be something in the new 1989 range of AQUARIUM ORNAMENTS from ARMI-



TAGES. They all share one vital characteristic — being ceramic, they won't deteriorate, even after long periods under

water, unlike their real-life originals.

Together with 4 air-action models — Water-wheel, Noah's



CHRIS MATTISON

iums may not be as suitable. Infra-red rays are equally important to the animals and these can be provided from a ceramic emitter acting as an overhead heater.

A slight deviation from the vivarium is the paludarium. This can also be described as a fully-enclosed 'aquascape' (for those aquarists familiar with such a term), or an aquaterrarium. It contains both terrestrial and aquatic life — above and below the water — and many hobbyists will be aware of

the popularity of these on the continent, particularly in Germany and Holland.

Here again, many of the previous comments of the use of heating and lighting are pertinent. There are also similar condensation and heat loss problems; any gap left open to combat the former, not only lets out the latter too, but also provides an irresistible escape route for the animals!

Finally, don't be tempted to modify aquarium equipment to use in the vivarium in an

attempt to economise. There has been a great increase in the interest and associated technology in keeping reptiles and amphibians. Surely they deserve the care that only specifically-designed equipment can provide?

Most reptiles, like this Granite Night Lizard (*Xantusia henshawii*) require additional heating & lighting . . . but not in uncontrolled, excessive amounts.

Ark, Treasure Chest and Cannon (they all stimulate children's interest in fishkeeping) — designs range from Roman Ruins and Amphoras to Rock Piles and, reflecting an unfortunate but true aspect of modern life, some piles of Tyres! With logs and Driftwood too, there are plenty of hideaway places for your fishes, but if you really want to catch the eye, then how about some Spectral Blue to Flaming Orange, only two colours in a multitude of fluorescent ornaments, in three shapes too. Prices start at £1.10.

To 'back up' your ornament-furnished aquarium (literally), there are three styles of aquatic backgrounds available 'off the roll' at 75p per foot. Further details from: **ARMITAGES PET PRODUCTS**, Armitage House, Colwick, Nottingham NG4 2BA (Tel: 0602 614984 Fax: 0602 617496).

ROLF C. HAGEN

Like the flowers in the garden, **HAGEN's AQUASCAPERS** have sprung into welcome early life: not only that, but the prices for this new range of plastic plants is usefully advantageous, ranging from 59p for a 5 inch specimen, 99p for 8in, £1.59 for 12in and £2.49 for 15in.

The range of species is very



comprehensive too with "Ambulia", Anacharis, Foxtail (*Myriophyllum*), Hornwort, *Hygrophila* and Red *Ludwigia* available in all sizes just for a start. Others include: 8in and 12in — Water Sprite and Moneywort; 8in, 12in and 15in — Cardamine and Jungle Vallisneria; 12in and 15in — Amazon Swordplant; 15in — Dwarf Lily.

There is also a range of six

foreground plants: Pigmy Chainsword, Micro-Sagittaria, *Cryptocoryne beckettii*, Four-leaf Clover, Pennywort and Willow-moss.

VIBRASCAPERS provide even more brilliant colours: "Ambulia", Anacharis, Foxtail (*Myriophyllum*), Hornwort, *Hygrophila* and Red *Ludwigia* are all available in the four sizes. See Aquascapers and Vibrascapers displays at your aquatic dealer. Details from: **ROLF C. HAGEN (UK) LTD**, California Drive, Whitwood Industrial Estate, Castleford, West Yorkshire WF10 5QH (Tel: 0977 556622).

INTERPET

The new 1989 **INTERPET AND PETLOVE PRODUCT INFORMATION GUIDE** has recently been published, featuring the company's latest and widest range of pet products.

The aquatic sections have been aimed at both beginners and experts alike, and explain how to set up an aquarium for the novice, and how to look after a tank, right through to tables to help the expert to make the right decisions on keeping a healthy aquarium.

The Interpet and PetLove



Product Information Guide, with 68 pages in full colour, photographs and illustrations, is available absolutely **FREE OF CHARGE** from aquatic, pet stores, and some garden centres, or by sending stamps to the value of 46p to cover postage, to the address below. Please print your name and address clearly on a separate piece of paper, and send to: **INTERPET LTD**, Vincent Lane, Dorking, Surrey, RH4 3YX. (Tel: 0306 881033; Fax: 0306 885009).

COMPETITION NEWS FLY TO ORLANDO WITH 'AQUARIAN'

Fancy a week for two in Orlando, Florida? How would you like to fly out to the **International Cichlid Conference**, staying at the Orlando Hyatt Hotel, with the chance to visit Seaworld and Disneyland, plus much, much more? Well, this luxury American trip in the sun could be yours courtesy of 'Aquarian' Fish Foods, who have put together a special, free-to-enter competition for *Aquarist* and *Pondkeeper* readers. The International Cichlid Conference is set to become one of the biggest events on the hobby

ever staged in the USA. Heiko Bleher, Ad Konings and 'Aquarian's' own Dr David Ford will be among the eminent list of international names who will speak at the three-day conference.

A special tour of Seaworld has even been planned on the Wednesday, before the official start of the conference on **Thursday, 10 August**, to get the event off to a flying start. So keep your eyes open for the fantastic 'Aquarian' competition in our **June** issue, and you, too, could be on the way to Florida.



Aquarian's Dr David Ford has already been to Sea World and can't wait to go back for a return visit. You too, could be there in August if you enter our fantastic, not-to-be-missed competition in June.

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CONSERVING FISH SPECIES

(The Role of Zoos and Aquariums)

Part 3

In the concluding part of his conservation series, Dr Chris Andrews of London Zoo Aquarium looks at the part that organisations such as his own can play in ensuring the survival of threatened fish species

(Photographs by the author)

The basic needs of wildlife conservation are not difficult to appreciate: we must preserve more natural habitat, and prevent over-exploitation, of the species we seek to conserve. An indication of some of the problems currently facing fish populations around the world has been provided in a previous article, and illustrates that the conservation of fish is, at least, as urgent and complex as the conservation of other forms of wildlife, and that effective fish conservation may often lie with the careful management and exploitation of wild stocks in their natural environment. What, then, is the role of zoos and aquaria in the conservation of fish? This can be discussed under three headings: education, research, and captive breeding.

EDUCATION

The main role of zoos and aquaria in the conservation of fish has been, and probably always will be, education. Perhaps more than any other display of live animals, aquaria can present truly stunning exhibits that illustrate the problems and inter-relationships that occur in an unseen, underwater environment of which most people have little knowledge or appreciation.

In England, even small coastal aquaria may attract 100,000 to 200,000 people during their short summer 'season', and at London Zoo, most of the 1.5 million annual zoo attendance visit the 64-year-old aquarium. The new or modernised aquaria in continental Europe (eg. Berlin Aquarium, Dusseldorf's 'AquaZoo') are attracting very large numbers of visitors, and the startling successes of the North American aquaria in, for example, Boston, Baltimore, Monterey and Vancouver, are well known. As a result of their incredible popularity, aquaria are very powerful educational tools which can publicise widely Man's influence on the aquatic world, and seek support for rational conservation measures.

The immediacy of these problems can often be enhanced if the exhibits reflect some aspect of on-going involvement at the aquarium in question. Furthermore, by combining attractive displays with colourful graphics and inter-active exhibits, the educational process can be carried out in a pleasant enjoyable atmosphere, allowing aquarium managers to admit freely that their

facilities are both entertaining as well as educational.

RESEARCH

Modern aquaria have excellent facilities which can be used for research into a range of aquatically related subjects. Although some aquaria have a research laboratory of their own, most aquaria are under-used in this respect. Up-to-date technology allows the successful maintenance and breeding of a large range of aquatic animals (including fish), and permits observations and controlled experimentation that would be impossible, or very difficult, to achieve in the wild.

In addition to research into the husbandry and captive breeding of threatened fish, such research could include other conservation-orientated investigations, such as studies on the genetic management of small populations of fish, and the cryopreservation (deep-frozen preservation) of fish gametes and/or embryos. Bearing in mind our lack of knowledge on the fish faunas of tropical regions, zoos and aquaria must also actively support, and participate in, field research.

CAPTIVE BREEDING

Although some captive breeding of threatened fish species is underway, zoos and aquaria have had relatively little involvement. A small number of zoos and aquaria have undertaken their own captive breeding programmes and although there is some interest at the international level in co-operative breeding programmes involving, for example, Lake Victoria cichlids and the Asian Bony Tongue (*Scleropages formosus*), no such project has yet been undertaken.

The reason for this lack of co-operative involvement by zoos and aquaria may become apparent if one considers the development of the role of zoos and wild animal parks in the captive breeding of other endangered animals, especially mammals and birds.

During the 1950's there arose a new awareness that the world's resources were limited. Over the ensuing twenty years, it became more difficult to obtain certain animals from the wild for a variety of reasons, including a genuine reduced availability of the animals, protective legislation in their countries of origin, and stricter health regulations concerning the importation of

exotic species. During the same period the science of the care of exotic animals in captivity developed so that captive environments were created where wild animals not only flourished but also reproduced. During the 1970's increased restrictions on the trade in some wild animals, along with new techniques and expertise, encouraged zoos to develop their own, and eventually co-operative, captive breeding programmes.

However, although there have been significant advances in the management and display of aquatic organisms in captive environments over the last twenty years, there has been no significant and coincident increase in the legislation surrounding the acquisition of most fish species, and the transport of fish, and the availability of an increasing range of exotic species, has been facilitated rather than made more difficult.

There has been a great deal of research into the aquaculture of a diverse range of aquatic organisms as food resources for Man, and although fish are bred in zoos and public aquaria, there has been (as yet) little impetus to develop co-operative captive breeding programmes.

Of course, one of the problems facing zoos and aquaria in this respect is a familiar one: too many threatened species and not enough space for captive breeding. Therefore, as with the initiation of any captive breeding programme, it is vital to identify aims and objectives before committing long-term support.

Unless the aim is the production of a 'domesticated' variety of fish, likely future reintroduction to the wild must be an important factor in choosing a threatened species for a large-scale zoo or aquarium captive breeding programme. Other factors which influence this choice include the status of the species in the wild, its taxonomic uniqueness and its suitability for captivity.

In addition, certain species may be particularly important candidates for captive breeding as a result of their individual conservation (or other educational) message, which can be conveyed via zoo or aquarium displays. Economic or commercial value should not, of course, be a major factor influencing the selection of a species for concerted conservation efforts. The fact that most threatened fish species are of no obvious economic value to Man, is likely to make their conservation all the more challenging.

However, some species of fish that are threatened in the wild are already bred in large numbers by amateur and professional ornamental fish specialists. Thus the future of, for example, the Golden Skiffia (*Skiffia francesae*), the Cherry Barb, (*Barbus nana*), and the Combtail (*Belontiopsis signata*) seems assured for the time being.

However, some ornamental fish enthusi-



Attractively displayed graphics can help educate the public on all manner of subjects, including conservation.

ists (either deliberately or accidentally) can exert quite severe selection pressures on the fish they breed, which can have significant implications for the conservation of the wild form. Similarly, amateur ornamental fish breeders, although often dedicated, cannot always provide long-term assurances with regard to their fish breeding programmes.

There are also species of threatened fish which, as a result of their large size at maturity and/or their specific environmental requirements, will be best suited to captive breeding in their country of origin, perhaps on fish farms. Osteoglossids like the Arapaima (*Arapaima gigas*) and the Asian Bony Tongue probably come within this category.

In fact, before undertaking any coordinated captive breeding programme for fish, zoos and aquaria will need to liaise closely with the conservation agencies in the home of the threatened species, to ensure that the best possible use is being made of the available resources to ensure a worthwhile and successful outcome. With this in mind, it may be that zoos and aquaria should devote more of their time and effort to the investigation of the techniques needed to breed the fish, with large-scale captive breeding undertaken on, for example, properly managed fish farms in its country of origin. The National Fish Hatchery (Dexter, New Mexico) has achieved notable successes with the breeding and reintroduction of some native North American fish species, with the captive breeding of the Asian Bony Tongue also underway in semi-intensive conditions in Singapore.

It is vital that there is co-operation between zoos and aquaria and outside organisations in the captive breeding and conservation of fish. Zoos and aquaria are in an excellent position to coordinate the conservation research activities of (for example) local



Touch pools are becoming increasingly popular as a safe way for people to observe marine organisms at close quarters.

universities and colleges, with the large-scale aquaculture activities of farms specialising in threatened fish, while they, themselves, develop the techniques needed to breed and rear the fish. In this coordinating role perhaps zoos, and especially aquaria, can use their considerable public appeal and popularity to tackle a problem facing all conservationists — fund-raising.

CONCLUDING THOUGHTS

Habitat alteration and over-exploitation are threatening aquatic environments across the world, and the fish of many African



Zoos and aquaria are in an ideal position to bring people and fish together in a way that few other institutions can.

lakes, coral reefs and the rivers and streams which flow through tropical forests are among those under particularly intense pressure at the present time.

Zoos and aquaria must continue to play a major role in publicising the plight of these environments, and the animals and plants they contain, and also encourage and participate in relevant conservation-related research. While more captive breeding programmes need to be developed for threatened fish species, these schemes must have clearly defined objectives, and be carefully coordinated with other conservation efforts.



A male Neon Betta in full colour

THE NEON BETTA

Unusual ancestry, plus gorgeous colours and a rather placid temperament are just three reasons why Stephen Clark finds the Neon Betta such a desirable fish.

In the spring of 1985, after being informed that a new type of *Betta* had been imported into West Germany, I departed by train from Doncaster for the long journey to Frankfurt. After 18 hours I arrived at my destination of Aquarium Rio, Kelsterbach and immediately searched for the tank containing the mysterious fighting fish.

In a dimly lit corner I could just make the outline of a fighting fish shining through the hazy water. Its metallic green body resembled that of *Betta splendens*, the long flowing finnage mirroring the familiar Siamese Fighting Fish. But, contained in this fish tank measuring approx 36x18x10in (90x45x25cm) were about 30 males and females (!) and on close inspection, although there appeared to be some fin damage, there was not one dead fighter.

At the incredible price of £8 per fish, I selected a healthy looking pair and, after some refreshment, started on my weary journey home.

On my arrival I carefully selected a 24x12x10in (60x30x25cm) partitioned tank and acclimatised the fish to my water conditions. They began to settle down to normal

coloration and the male soon set about displaying to the female.

On close inspection, I observed that the iridescent green completely covered the head and gill cover region and, as it progressed laterally along the body towards the tail, each individual scale shone like a pearl. The male, with the longer fins, had painted in streaks of shining green and red in the dorsal (top) fin, while the anal (bottom) fin hung like a tapestry displaying different shades of greens and pastel blues with a splash of red inset. Lastly, the caudal or tail fin had a large splotch of red on the oval shaped fin. The pelvics (ventrals) were red. Although the female did not share the showy colours of the male, her short subtly shaded body and fins also carried similar shimmering pigments, unlike her drab cousin, *Betta splendens*.

TRUE IDENTITY

So what was the name of these mysterious Bettas in my aquarium? First impressions of this fish purely on colour, would associate it with the Emerald Green Fighting Fish, namely *Betta smaragdina*, but this fish lacks the overall iridescence; the body is green and with no red blotches. It is, however, quite true that *B. smaragdina* is peaceful and several males can be kept together in a large enough tank. But finally, *B. smaragdina* is excluded from the identification on account of a shorter depth in the anal fin (with a variation also in fin counts), and a different shaped dorsal fin.

Therefore, it might be suggested that, perhaps, the closely related *B. smaragdina* and *B. splendens* hybridised to 'create' this new form. This theory, though, has been

disproved by other aquarists and researchers by cross-breeding, which only produced an infertile pale blue fish lacking in vigour. After further investigations it was found that the mysterious *Betta* was another variant of *Betta splendens*, but what crossed with this fish to create this new fighter?

Betta imbellis, commonly known as the Crescent Fighter (owing to its red border in the caudal fin), overlaps the geographical range of *B. splendens* in Peninsular Malaya. This fish was first described from a blue-scaled specimen from the region around Kuala Lumpur and it is distinguished from *B. splendens* by having a shallower depth to the anal fin, along with a more compact and shorter body.

As in *B. splendens*, there are numerous varieties of *B. imbellis*. One, in particular, comes from the island of Phu Ket, some 300 miles north of Kuala Lumpur, and has a stockier, longer body than the 'blue form'. Further, it shows a brilliant green on the scales of the body and opercula (gill covers). Also, in some cases, there is a green iridescence to the tip of the anal and caudal fins.

All the above fish breed true and it has now been proved that *B. splendens* x *B. imbellis* (blue) x *B. imbellis* (Phu Ket) do all interbreed and produce fertile offspring. Authorities studying *Betta* nomenclature suggest that *imbellis/splendens* could be varieties of the same fish, but further genetic research is needed.

The Neon Betta was created by crossing a male black strain *B. splendens* (achieved artificially through exposure to radiation) with a female Phu Ket *B. imbellis*. Hybrids were also obtained from black *splendens* x blue *imbellis*. Careful selection of fertile offspring produced the strong strain I purchased in West Germany. Spawning in this fish is the same as in *B. splendens*, and between 50-200 eggs are produced, dependent on how reproductive the female is. My first three generations produced a limited amount of Neon males along with Phu Ket males and females, but I am now up to my sixth generation and the strain is stabilising.

NOTE This article is largely based on a report prepared by Stephen Clark for *Labyrinth No.38*, the official publication of the Anabantoid Association of Great Britain. For further information contact (enclosing a stamped addressed envelope) Tim Groom (Secretary - AAGB), 44 Springwell Gardens, Balby, Doncaster, Yorkshire.

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In photographs of similar-looking *Ictalurus* species, the anal fin can sometimes be used for identification purposes. Using this criterion, our "invited" expert, David Sands, concluded that Sandra's fish are probably *Ictalurus nebulosus* (20-24 anal fin rays). As the picture demonstrates, though, identifying fish on this basis is an incredibly difficult job. Our most sincere thanks go to David for his efforts.

BULLHEADED SURPRISE

The story of a surprise rare spawning of a pair of Bullhead Catfish, as experienced by newcomer to the hobby,
Sandra Witter.
(Photographs by the author)

A couple of months ago while shopping for coldwater fish for our aquarium, we spotted a lovely 6in (15cm) black catfish lurking in a tank full of cold-water pond fish. We were told that it had been sold to the shop because it had been chewing the finds of its owner's fish.

So taken were we by this cute be-whiskered fish, that we promptly bought him home, where Cuthbert, (as he quickly became known) soon made himself at home among our collection of 4in (10cm), Mirror and Leather Carp and Koi, Rudd, Tench and Cruican Carp, coming out, usually in the dark, for an exploration, or nipping to the surface when food was about.

One day, while venturing further afield on our eternal search for the more unusual coldwater fish, we found a 4in and an 8in (20cm) catfish, lying side by side, quite happily, in a 24in (60cm) aquarium. Of course, we had to buy them. Catherine, (the smaller of the two, referred to by its ability to turn perpetual catherine wheels) was placed

into a 48in (120cm) tank of smaller fish; Carp, Tench, Rudd, Orfe, Weather Loach and our beloved Bitterlings, where it immediately made its home under the internal filter, and cavorted about quite happily, living up to its name. The larger of the two, (I never did get fond of that one, so it didn't get a name initially!) was placed in with the larger fish and Cuthbert. For a while, peace reigned.

Suddenly one day, it was noticed that a small Golden Orfe had disappeared! The following day, another small Rudd was found on the floor under the tank, (despite the fact that all the tanks are covered) and yet another was found, limping around the tank, terrified by any movement within the tank. We reluctantly blamed Catherine for the murders and so the story really begins.

Another 48 x 15 x 12in (120 x 38 x 30cm) aquarium was set up, with gravel, hidey holes and plants, and our three catfish introduced into it. Peace reigned for at least a week, until, arising one Saturday morning, I was horrified to find "Biggun" (it was now given a name!) with its cavernous mouth firmly

fixed around Catherine's neck (from the back!).

We rescued poor little Catherine from the monster, and transferred her to a hospital tank, where we did everything in our power to save her. So badly mutilated was she, that instead of being shy of us, she allowed us to lift her by hand to the surface for air, and also allowed us to spoon-feed her. No fish has even been as lovingly cared for, or as much cried over, as Catherine, when, three days later, she gave up her fight for life.

I was heartbroken. I swore then I would not go near the monster Biggun, nor would I feed him... He could starve for all I cared! We just could not understand, in our naivety, how Biggun could have so blatantly murdered little Catherine, when we'd found them living side by side in such a small tank!

All is revealed

A few days later, we understood. Biggun and Cuthbert(?) had, in the meantime, rearranged the gravel in their tank. Biggun shovelled it madly from the undergravel filter plate, until he had a hole bored (about 4in - 10cm in diameter). He then, as we thought, proceeded to fight with Cuthbert, chasing him around, and turning catherine wheels about him. Eventually, exhausted, they both settled in the gravel hollow and lay there motionless for a couple of days.

Some days later, I was roused from a very peaceful sleep by my other half... "Wake up San", he shouted into my sleep-dosed ears.

"They've laid some eggs! Jumping out of bed and dashing into the living room (fish house), I was stunned to find Biggun, proudly hovering an inch from the ground, gently fanning a mass of several hundred sticky milky white eggs.

Cuthbert (no, we haven't changed his/her name yet!) was swimming around a deep rich black as if to say "Look what I have done!"

Over the following week, Biggun would swim out from his security duties, and gently herd mum back to the nest, and then swim about, fins proudly erect, his body glowing with pride, to all effect, the proud father-to-be.

But then, the eggs started to disappear. Day by day, the mass grew smaller, until in desperation, we managed to rescue the last couple of dozen and re-house them in the cleaned out hospital tank. We watched avidly as the eggs began to wriggle, until seven days after spawning, the first ones began to hatch. For three days this continued, every last one revealing a minute pale grey fry, complete with tiny whiskers.

Repeat performance

By now Biggun and Cuthbert had lost all of their eggs. We thought that perhaps, they'd hidden them, or that they had hatched and the fry were hiding under the gravel, or perhaps, had even been sucked into the internal filter. A thorough search of both revealed nothing, except a couple of fungussed eggs, so we came to the conclusion that one or both of the parents must have eaten them.

This however, did nothing to discourage them; within a couple of days, they were



Deceptively peaceful Bullheaded close-up

back on form; the pair were courting again (we had thought they were fighting before!). Cuthbert's belly also became swollen, something that we hadn't noticed before. So romantic was the drama unfolding before us that we both sat glued to them for hours on end.

Again, on crawling out of bed one morning, we found yet another mass of several hundred sticky eggs. These only lasted two days before vanishing. Over the next three weeks, there was a total of five spawnings, each one consisting of fewer and fewer eggs, until the fifth one, which was only a couple of dozen.

In each case, one or other parent ate the eggs before we had the chance to save them. A couple of weeks after this disappointing sequence without any signs of more eggs, another mass appeared. Cuthbert(?) must have recovered sufficiently to produce another couple of hundred eggs. Unfortunately, we weren't quick enough to save any of these either.

So it doesn't look as though we are to become a catfish breeding centre just yet! The pair still occasionally courted, and their nest was continually repaired. We would have liked to have allowed them to spawn, hatch and raise a brood of their own, but it looks as though it isn't to be.

Therefore, owing to lack of space, they were returned to the main tank with the big fish. The amazing thing is, that they soon reverted to a pale mottled grey during this period.

However, within two hours of allowing them their privacy in their own tank, yet again, they both became glowing black once more in no time at all. Perhaps, the story isn't finished yet... We'll see.

Eggs and fry

However, back to the original eggs. As I have already said, they were minute pale grey at birth. Within four days of hatching, the fry had all but consumed their egg sacs and had turned a solid rich black (but if we remove the fry from their tank into a bowl, they almost immediately change to a pale grey. Within minutes of returning home, however, they are solid black again.)

At four to six days old, they were not really free-swimming, but were wriggling madly around the floor of their tank. They were fed, four times daily on Liquefy No 2, on which they grew very well. At three weeks old, they were perfect miniatures of their parents, swimming around their home and hiding under the artificial fern.

We have since tried to feed them on Microworm, (which pollutes the water something awful) and Biodin PL. We are now trying them on the occasional crumbled flake. It is only now, after a month, that they can obviously be seen to feed. Nothing seems to draw them to food, though they must be eating. All we can hope is that they continue to eat and grow. Only five of the original twenty four are left, but all appear healthy.

Identity Parade

To describe our catfish, Biggun is about 8 inches (20cm) long, a deep rich solid black and a pure white underbelly. Cuthbert is identical although only about 6 inches (15cm) long.

When not courting, they both turn a pale mottled grey. Their whiskers consist of two upright ones from their "nostrils", two long and thick ones down from the edge of their mouths, and four smaller ones under their chins.

[Note: Identifying fish from photographs can be extremely difficult indeed. Our most sincere thanks, therefore, to David Sands who has helped us to arrive at the conclusion that Sandra's fish are almost certainly *Ictalurus nebulosus* — one of the American Bullhead Catfish species. John Dawes (Ed).]

All our fish are kept in water at room temperature (between 70-84°F (21-29°C) depending upon the weather) in 48 x 15 x 12 in tanks (120 x 38 x 30cm). The pH is around the 7.5 mark and the hardness is about 16 DH.

Both catfish are mainly nocturnal, and shy of humans, although they do come out for a swim around when the lights are on, especially when food is about. They will both rise to the surface to take Tetrafin flake, and also like fishing maggots. They are also tempted by live *Daphnia*, swimming round in a cloud of it with their mouths wide open. In addition, they are given tablet food for bottom feeders and sinking pellets.

Predatory female?

After talking to many fish dealers, it has been suggested that it is most probably the female that is eating the eggs. So, if anyone else finds their pair spawning, I'd advise them to remove, at least, the female, once the eggs are laid. The male guards the eggs, and is also supposed to herd and guard the young, but we haven't witnessed this yet. If you definitely want to raise the fry, it then seems reasonable to remove the majority of the eggs altogether from their parents' nest.

We consider ourselves extremely privileged to have witnessed this rare happening in our purely amateur tanks. After all, we've only been keeping fish for approximately four months, which just proves that you don't need to be an expert.

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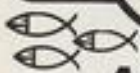
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BRITISH NATIVE MARINE AQUARIA

(Advanced Techniques)

Andy Horton provides an up-dated guide
to the safe maintenance and stocking of
unheated marine aquaria.

(Photographs by the author)

In my series of articles published in *AC&P* during 1987 introducing the elementary techniques of keeping British marine life in aquaria, I recommended the following:

1 that an undergravel filtration system with powerful air pumps or powerheads is satisfactory for tanks of 20 gallons (90 litres) or more;

2 that high temperatures (above 19°C (66°F)) can cause problems, and are a likely cause of death of sensitive fish and invertebrates;

3 that 20% water changes should take place every month during summer;

4 that stocking levels be kept slightly higher than normally considered desirable for marine fish from tropical habitats.

All these suggestions remain substantially true, and are based on ten years of experience. However, in many cases, the explanations could be described as too simple for experienced aquarists. In this article I will go into more detail about these and other matters which, I hope, will be of interest to marine aquarists.

BIOLOGICAL FILTRATION

Biological filtration (the conversion of ammonia to nitrite and nitrate by bacteria) still remains the most important and essential filtration function. For years, the only alternative to the undergravel system would be to pump the water through an external filter bed. This system has been used by the London Zoo Aquarium since it was built.



Sea Anemone, *Anthopleura balli*, with Rock Goby (small) *Gobios paganelus*. This uncommon sea anemone is only found in south-west England. (SIZE CHECK: base diameter of anemone = 2.5 cm - 1in, fish = 4.5 cm - 1.8 in).



Above, Blenny *Lipophrys pholis*, resting on a rock above the water level of the aquarium. The Common Blenny (or Shanny) from British coastal waters, will frequently leave the rock pools and bask on rocks out of the water at low tide during the summer months. To ensure success, it is necessary to mimic these conditions in home aquaria. (SIZE CHECK: length = 5.5 Cm — 2.2 in).



Above, left, Corkwing Wrasse, *Crenilabrus melops*, in breeding colours. Juvenile Wrasse are common in summer months. In 2 years they will outgrow a 20 gallon aquarium. (SIZE CHECK: length = 13 Cm — 5.1 in).

Left, Hairy Crab, *Pilumnus hirtellus*. The left claw always larger than the right. This species is found under stones in rock and sand coasts. (SIZE CHECK: width, incl. claws = 4.5 cm - 1.8 in).

It certainly makes it easier to keep the tank clean, but, despite siphoning off debris with the water changes, the accumulated dirt eventually clogs up the internal system, requiring increasingly powerful pumps to maintain the water flow.

Many aquarists use external charcoal filters, and, to a lesser extent, protein-skimmers, to remove organic matter before it turns to ammonia.

AMMONIA TOXICITY

Ammonia is the most lethal natural poison in the aquatic environment. It is produced by decaying organic matter and the excretory products of aquatic animals.

It is both a direct and indirect cause of death. Many diseases, especially Fungus and Pin Rot, will only occur in ammonia-polluted waters. Minor cases can often be cured by removing the sick fish to cleaner waters.

Decaying organic matter arises from uneaten food, and dead animals which should be removed immediately. Dead organic matter can also include bacteria, algae, and the invisible plankton that are present in real seawater.

Compared to ammonia, nitrite and nitrate are only mildly toxic to British marine life. A

high nitrite reading is often indicative of an excess of harmful ammonia.

Solutions:

- Add an external filter which includes activated charcoal to your powerhead-operated undergravel system.
- Add new stock gradually.

EFFECT OF HIGH TEMPERATURES (ABOVE 19°C-66°F)

This is not the simple correlation I first thought and explained in my earlier articles. Many fish and invertebrates can withstand a gradual increase in temperature.

However, if you can maintain a constant low temperature, your success rate is likely to be dramatically improved.

Dissolved oxygen levels decrease as the temperature of the water rises.

At 15°C (59°F) the saturation level of dissolved oxygen in seawater is 8.1 ppm, decreasing to 7.2 ppm at 20°C (68°F). The minimum limit is 5.00 ppm. Below this level, fish, especially free-swimming shoaling fish, like the Mackerel and Sand Smelt, are liable to die.

Nitrifying bacteria are great consumers of oxygen. This can considerably reduce the carrying capacity of the aquarium.

HEAT STRESS

Heat stress is characterised by increased respiration, and internal damage, especially of the ovaries. Death may occur in species that reach the southern limit of distribution in the British Isles, eg Montagu's Sea Snail (*Liparis montagu*). For other fish, like the Bullhead, (*Enophrys babilis* [*Taurulus babilis*]) it may cause the fish to refuse to feed, and become increasingly susceptible to disease. However, both the Corkwing Wrasse and the 5-Bearded Rockling will survive in high temperatures, provided there is sufficient oxygen. If these fish die, another explanation for their demise will have to be found.

A rise in temperature can result in an increase in food consumption by the fish and invertebrates, which in turn results in:

- 1 Surges in ammonia levels, before the nitrifying bacteria adjust to the new nitrogen input;

- 2 an increased nitrifying bacteria activity, resulting in reduced dissolved oxygen levels, and an increased load on the aquarium and its ability to support life.

Solutions:

- Keep temperature stable in the range 15° to 17°C (59-63°F), if possible.
- Consider buying a cooler unit (beer cool-

ing unit, or equivalent) if you wish to keep fish in the smaller, 20 gallon (90 litres) tanks.

- c) Increase surface agitation to improve dissolved oxygen levels.
- d) Keep in large tanks, species known to survive in higher water temperatures.
- e) Take special care over feeding and the introduction of species, especially in hot weather.

STOCKING LEVELS

I previously recommended stocking levels considerably higher than the 1 in (2.54cm) for every 2 gallons (9 litres) of water suggested for tropical marine fish.

It is pertinent to outline the important factors influencing the carrying capacity of aquaria (Spotte 1979):

1 nitrogen input into the water system (food);

2 the rate of nitrogen excretion by the animals;

3 the rate of nitrogen conversion by the filter bed bacteria;

4 the effect of environmental variables: temperature, pH, dissolved oxygen, and salinity on the first three steps.

If you standardise points 3 and 4 as far as possible, you can see that it really depends only on what animals you keep in aquaria.

I now recommend stocking levels for a 20 gallon (90 litres) aquarium as follows:

6 x 8cm (3.2in) (excluding tailfin) rock pool fish = total 48 (c19in) of fish. Alternatively one could introduce an equivalent length of smaller fish, plus 12 anemones (which consume relatively little food), plus a handful of crustaceans: hermit crabs, prawns, and their ilk.

This is a reduction in the number of invertebrates that I previously published. The substrate is 6cm (2.4in) deep, and the artificial water is circulated by powerheads. This stocking level was arrived at after 10 years of experience, (maximum temperature 22°C-71.6°F).

Six Blennies or Rockling (8cm-3.2in long) will consume a maximum of about four small mussels (6cm-2.4in, shell length) between them in two feedings every day, and this rate of consumption remains approximately true of most of the elongate fish found on British shores (in cool temperatures feeding activity may be reduced).

The invertebrates will consume one mussel altogether, and can often be regarded as scavengers, cleaning up the food that the fish miss. Exceptions are the voracious Starfish *Asteria rubens* and the Dahlia Anemone *Urticina felina* which have to be fed individually.

The major exceptions on the fish side are the Bullhead (*Etophyris bubalis*) whose mouth is bigger than its stomach (which it undoubtedly is, until it has eaten its own weight in food!) and the various species of Wrasse, of which, for example, a Corkwing (*Crenilabrus melops*), of 8cm-(3.2in) length will consume two mussels every day, and can be regarded as the equivalent of two Blennies. The fry and juvenile stages of fish such as Bass, Pollack, Plaice, Sole, Black Bream, and Grey Mullet, can eat considerably more

than the shore-dwelling species, and an allowance must be made for their food requirements and future growth.

Solution: With active free-swimming wide-bodied fish like the Wrasse, the stocking levels of tropical aquaria apply. But with the more sedentary and elongate bottom-dwelling shore species, twice as many fish inches can be included in the aquarium — ie 48cm (c19in) in a 20 gallon (90 litres) tank.

OTHER SUITABLE ORGANISMS (BUT REQUIRING SPECIAL ATTENTION TO THEIR FEEDING REQUIREMENTS)

Invertebrates:

Plumose Anemone, *Metridium senile*. Sea Anemone, *Sagartia elegans*. Daisy Anemone, *Cerastrodactylus*.

Fish:

Worm Pipefish, *Nerophis lumbriciformis*. Lesser Pipefish, *Syngnathus rostellatus*.

ORGANISMS BEST SUITED TO TANKS LARGER THAN 20 GALLONS (90 LITRES)

Invertebrates:

Dahlia Anemone, *Urticina felina* (= *Tealia felina*). Spiny Starfish, *Marthasterias glacialis*.

Fish:

5-Bearded Rockling, *Cilasa mustela*. Corkwing Wrasse, *Crenilabrus melops*. Goldsinny Wrasse, *Ctenolabrus rupestris*. Tompot Blenny, *Parablennius gattorugine*. Grey Mullet fry, *Chelon labronus*. Black Bream fry, *Spondylisoma cantharus*. Dragonet, *Callionymus lyra*. Black Goby, *Gobius niger*.

ORGANISMS SUITED TO SMALLER SUPPLEMENTARY TANKS

Invertebrates:

Long-legged Spider Crab *Macropodia rotunda*. Brittlestar *Ophiothrix fragilis*.

ABUNDANT SPECIES THAT CAN BE KEPT IN TEMPERATURES ABOVE 19°C (66°F), BUT THRIVE ONLY IN COOLED TANKS

Invertebrates:

Common Starfish, *Asterias rubens*. Hermit Crab, *Pagurus bernhardus*. Squat Lobster, *Galathea squamifera*.

Fish:

Bullhead (Sea Scorpion), *Etophyris bubalis* (= *Taurulus bubalis*). Sea Stickleback *Spinachina spinachia**

*This species has a short lifespan of just over one year

BEST ORGANISMS FOR UNCOOLED TANKS UP TO 20 GALLON-90 LITRES. (WHERE THE TEMPERATURES MAY APPROACH THE WARMTH OF MEDITERRANEAN WATERS)

Invertebrates:

Beadlet Anemone, *Actinia equina*. Snakelocks Anemone, *Anemonia viridis* (= *Anemonia sulcata*). Short-legged Spider Crab, *Pisa armata*. Hairy Crab, *Pilumnus hirtellus*. Prawns, *Palaemon* species. Shore Urchin, *Pyramischinus miliaris*. Cushion Star, *Asterina gibbosa*.

Fish:

Blenny, *Lipophrys pholis*. Cornish Sucker (Clingfish), *Lepadogaster lepadogaster*. Small-headed Clingfish, *Apletion microcephalus*. Rock Cook, *Centrolophus exoletus* (Rock Wrasse). Rock Goby, *Gobius paganellus*. 2-Spotted Goby, *Gobius flavescens*. Common Goby, *Pomatoschistus microps**. Sand Goby, *Pomatoschistus minutus**

*These species have short lifespans of just over one year

The abridged selections which accompany this article include only the common species that are often caught and kept by aquarists.

DISEASES: In bad water conditions Fin Rot and Fungus infections can occur. If the conditions are improved immediately, these should clear up. Corkwing Wrasse will invariably harbour a white spotted parasite on the fins. In good water conditions these will often disappear, and they do not seem to harm the fish. The same spots probably occur on Clingfish and can look unsightly. If anyone has cured this, please write to me.

Butterfish host a parasitic worm, *Cryptocotyle*, which encysts to form black blisters. It is found mostly on specimens found on the shore, and will occasionally infect Rockling. One record of a larger black-spotted parasite has been observed on a Sand Smelt.

Amblyodinium, or a similar disease, seems to be endemic in some British shore fishes, typically the Blenny and the Bullhead. Fatalities will only occur when the aquarium conditions are poor, something that is often associated with hot weather. If some of the fish die, and an epidemic is suspected, I suggest changing the aquarium water, and keeping the tank clear of fish for two complete months, keeping only invertebrates during this time.

FURTHER READING

Keeping Marine Fish By Graham Lundegaard (Blandford 1985).

Interpet Encyclopedia of the Marine Aquarium By Dick Mills. (Salamander 1988).

Marine Aquarium Keeping by Stephen Spotte (Wiley-Interscience 1973).

Seawater Aquariums By Stephen Spotte (Wiley-Interscience 1979).

Mari-News, the journal of the British Marine Aquarists' Association.

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FROM THE ARMCHAIR TO THE

Aquascaping aquaria with a priority for catfishes, tetras and cichlids can provide aesthetically attractive layouts and an ideal home for the fish, as David Sands explains.

One of the most exciting recent advances made in the fishkeeping hobby is in the area of design and layout of aquarium interiors. This facet of fishkeeping can be taken very seriously or casually; there is something for everybody. My expeditions to South America have given me an excellent insight in the native habitats of catfishes and some of this knowledge can be mirrored in interior aquarium design.

THE SUBSTRATE: GRAVEL OR SAND?

Aquarium gravel has long been accepted as the best substrate for freshwater tropical aquaria. The gravel or aquarium compost is like a fine beach-like stone. In the North it seems more colourful, hard and nicely rounded, while in the South a finer, less rounded gravel is used but this variation might just be a case of "what is available." Northern gravel does not appear to affect the pH or hardness but I am not sure about the Southern type. Without doubt gravel is

great for filtration, although the porous "plant drainage" medium is good but expensive.

I have experimented with the use of sand for many years because all the creeks where I collected catfishes had a sand/silt substrate. Catfish barbels have evolved as sensory organs and to be ideal for raking into the silt and mud in search for food. I have incorporated sand into special catfish aquascapes in various sized systems and have learned about the successes and the pitfalls.

The main problem with sand is related to filtration. Sand tends to pack tight over a short period of time and it is almost impossible to keep a constant flow of essential oxygenated water running through it. An undergravel filter quickly blocks and becomes useless. Planting in sand also provides difficulties; plants love sand as a medium to drop roots into but the roots eventually create packing and can lead to poor plant growth.

I found one way round these two major problems and, as a result, developed the

"almost ideal" layout for certain types of catfish. In a 48x20x24in (120x50x60cm) tank I placed two undergravel filters (17x11in - 43x28cm) one at either side of the aquarium, banking mature, well-used gravel severely towards the back of the tank. By using mature gravel I promoted the biological cycle to begin earlier; otherwise it takes a good six weeks.

I restrained the gravel by creating a wall with large round boulders on the right bank, and at the left, by setting wafer-thin sandstone at an angle in the gravel. By positioning the gravel in this way I was left with an open, bay area at the front of the aquarium. I placed a two to three-inch (5-7.5cm) layer of boiled sand (a fine honey colour, not coarse builders sand) into this empty space. This area was raked once a week to prevent packing.

Java Fern solved the "plants in sand" problem. This beautiful green, thick-leaved plant does not require planting and it has the extra benefit in that it is self-propagating, the juvenile plants growing from the parent leaf. I planted a large *Cryptocoryne* and a "hedge" of *Hygrophila* to hide the undergravel-uplift and heater. On the right, I planted a large potted specimen of Amazon Sword. The final touch to this catfish layout came with two twisted pieces of beechwood which inter-twined. One length originated

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from the rounded boulders on the right and the other piece I weighted among the *Hygrophila* on the left.

LIGHTING

I experimented with a combination of GroLux and Trulight which could be switched on and off independently of each other. This was important to darken down the aquarium over the day time (GroLux only in the evening, on until 10.30 pm)

STOCKING

I stocked the experimental aquarium with the following catfish: — 6 *Brochis multiradiatus*, 8 *Corydoras acutus*, 4 *Corydoras barbatus*, 4 *Corydoras nattereri*, 4 *Corydoras paleatus*, one pair of *Ancistrus* sp., 4 *Bunocephalus amazonis* (Banjo Catfish). For top swimmers I chose 6 *Chilodus punctatus* (Spotted Headstanders), 10 assorted Dwarf cichlids *Aptinogramma agassii*, etc., and 12 *Hemigrammus* sp. (Glass Tetras).

All these species originate from South America, so the aquarium gives me the satisfaction of being near to a theme or 'natural' biotype.

Brochis multiradiatus have long snouts so they settled in with the experimental sand substrate very quickly. Together with the group of *Corydoras acutus* and *barbatus* they dug into the sand for Tubifex, bloodworms and soaked flake food. They seemed to draw in the sand, together with the food, and somehow separated the two. Then they would pass out the sand through their gills.

The four *Bunocephalus amazonis* (Banjo Catfish) immediately buried themselves completely in the sand as soon as they were introduced to this new aquarium environment. They reappeared when the aquarium lights were out for the night. The continual activity of these fish in the sand meant little raking was needed. Despite this, during water changes I removed some of the sand which I washed in the aquarium water drawn out and then returned it with fresh water.

The Spotted Headstanders and Dwarf cichlids fed on the sand. Both seemed to "peck" and graze on food, sometimes also drawing in sand which they also rejected through the gills.

SUBSTRATE PROBLEMS

The problems developed when the gravel slowly poured through the "boulder" wall and mixed with sand. Once the two substrates mingled, the siphoned-out routine became difficult. The fish seemed to thrive, even though the filtration appeared to have deteriorated and water quality had visibly become poorer. The lesson learned was to keep the substrates apart. The details relating to the use of sand in aquarium is as follows: coastal sand, if well-washed, does not affect the pH or the carbonate hardness of the water, but it does affect the general hardness. The pH and the carbonate hardness are the most important areas of water



A most attractive aquarium laid out with catfish very much in mind.



The advantage of a sandy bottom are clearly shown in this photograph of a pair of *Corydoras barbatus*.

chemistry, but for the dedicated aquarists, tests made on experimental tapwater had a general hardness of 7-8 degrees. Tests carried out on a daily basis showed this to be doubled by the fine shell in the sand.

I completely removed the sand and a large amount of water by siphon pipe so that I could check the bottom layers for signs of stagnation. There was none of the tell-tale blackness which shows stagnation has occurred and the sand was generally clean; I rinsed the sand and returned it to the aquarium.

Silver sand, sometimes used in marine systems, was too reflective. The strong white seemed to scare the fish and they would not remain on it for long, unlike river sand.

LARGER SYSTEMS

1. African tank A larger aquarium (60x18x18in — 180x45x45cm) designed to accommodate bigger fishes, utilised PVC piping covered with gravel (this can be achieved by coating the pipe with silicone sealer and adding layers of gravel each time). This aquarium used undergravel and external power filtration. The gravel was contained in two glass trays with a three-inch depth (7.5cm) and the front edge was hidden by "siliconing" a layer of gravel onto it. Sand was spread between the two undergravel plate trays and across the front.

The lighting combined a 100 watt spotlight and a five foot GroLux. Sometimes,



This rare underwater shot in the Orinoco shows beautifully the ease with which some species of catfish (this is a *Parachanna*) can be caught.

more so at night, only the spotlight was lit over the open aquarium and the rippling flashes (almost a strobe-like effect), were beautiful.

The aquarium was planted with hardy *Elodea*, an ideal bunch plant which can withstand poorer lighting, changes in temperature and pH and the close attentions of some of the larger catfish (if allowed to float, these plants also create an excellent diffused lighting effect).

This aquarium was an attempt to create an African theme "biotype" with the following fish: 6 *Synodontis nigricentris* 3-6 *Synodontis decorata*, *S. brichardi* or *S. ornata*pinis, 6-12 *Micralestes interruptus* (Congo Tetras) or *Brycinus longipinnis* or *Arnoldichthys spilopterus* (Red Eye Tetras).

This community worked well and the extra external filtration kept the water quality constant. The *Synodontis* squabbled over territory and often fin and body damage prevailed, no matter how much bogwood or caves I created.

The larger catfishes came onto the sand at night and constantly grubbed around for food, digging deep into the sand. They soon stirred the gravel into the sand.

2. Two-storey tank

We admire the Dutch and German style of aquaria that contain non-aquatic bog-plants, where they have the water level ending half-way up the aquarium and have terrestrial plants trailing down into the water. The main difficulties with this type of "Floraarium" is that the front views can be marred with condensation.

I constructed an aquarium in which the upper section was open at the front to allow viewing. A glass extension was siliconed to an existing tank, effectively creating a second storey to the aquarium. Here, two glass shelves, complete with front lips to accommodate drainage gravel, were added. These shelves held potted plants at two distinct levels.

The back, inside of the aquarium and the left hand side were cork-tiled and a frosted glass canopy was placed on the top. This extension was then siliconed onto the existing aquarium. The wooden hood, complete with Grolux and Trulight tubes was then elevated onto the top to create a truly subdued lighting effect in the tank. (An extra light in the form of a spotlight was fixed onto the wall to beam down into the tank.) With the front-most cover glass removed, the house plants enjoyed a certain amount of humidity and thrived on the warm non-chlorinated aquarium water.

This combination provided an ideal climate for semi-tropical ferns and African violets. Other houseplants also thrived; some grew and trailed down towards the water surface. A large spider plant occupied the left hand corner with African violets and ferns growing upwards from the lower shelf. Most of the fish inhabitants proved successful in this environment; only the Hatchetfish found a way to escape by leaping straight out of the tank because the cover glass had been dispensed with.



A good Southern Brazilian "Corydor-type" creek with sandy bottom.

NATIVE HABITAT

We are all familiar with the much photographed coral reef scenes, but very few of us have viewed underwater in the Venezuelan Orinoco river bed! If, however, you saw the freshwater film by Wolfgang Tins and Walter Sigl produced in South America some time ago, you enjoyed a rare and superb insight into the natural habitat of the tropical fishes in our keep; a world of submerged boulders, leaves and waterlogged bark littering the substrate.

The area I found amazing is that the type of aquascape I have used in aquaria could have been a mirror of the real thing, but, of course, I had the advantage of seeing the real thing in Brazil and Guyana. In the German filming, submerged branches lay at oblique angles to the water surface; they appeared to have crashed down and lay where they had fallen.

There, surface light filtered through but was "shaded" and less bright, and this is where many fishes sought refuge from the natural struggles of life or to prepare spawning sites. Here proved to be secret natural hiding places for *Parasuchemipterus*, *Goeldiella eques* and *Rineloricaria*. It was so "refreshing" to see freshwater tropicals photographed in nature.

"NATURAL" AQUARIUM AQUASCAPES

It is extremely important to tie your aquascaping with other aspects of tropical fishkeeping, even community set-ups. It would be difficult to lay out a South American river because the oblong limiting-shape of an aquarium does not lend itself to recreating of the shallow "bowl" effect of receding pools. Another problem in recreating the tropical waterway is that these are seasonal, shaped by droughts and floods, whereas the aquarium environment is more or less constant. (Although a lounge full of fishtanks, mud and buckets of water fringing an enormous aquarium does set the mind boggling!)

This does not mean aquarists cannot attempt to imitate nature. Let's assume you are adventurous and intend to experiment with a reasonably large aquarium, filtered with good undergravel and power filters. To simulate the bright lighting, try putting the

aquarium underneath a South facing window and supplementing the natural daylight with several 100-watt spotlights. Plenty of forest-sized wood debris such as bogwood or dead beechwood, taken from the tree and stripped of bark, could give the "pool edge" effect; boulders would provide natural-looking hiding places. Smooth and hard river-worn boulders are best; try to avoid sandstone or sharpened slate.

Perhaps, the dry season could be simulated by increasing the temperature by a few degrees every day or two. Providing the aquarium is open to fresh air and there is good aeration from a power filter venturi and an air pump, then there are no difficulties in raising the temperatures to 90°F (32°C). Then, after a couple of months (say July, August and September) complete a major water change of around 75% (providing you have facilities to store water for 24 hours to rid it of chlorine — still use a de-chlorinator — and allow it to settle).

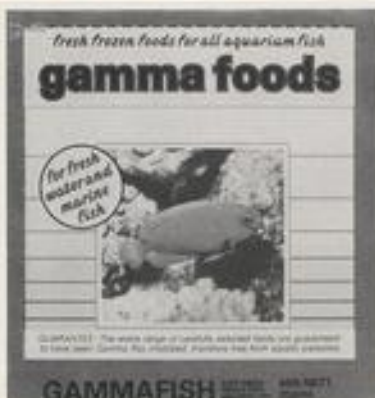
Give your power filter medium a thorough clean-out (in aquarium water!) — and lower the temperature by five degrees each day. If you can collect rainwater, mix it 50-50 with tapwater during the water change and do not be afraid of the drop in temperature, providing all the occupants of your aquarium are well settled. This would recreate the rainy season influx of fresh, slightly cooler water; often the stimulus fish require to spawn! It might be a good idea to increase feeding amounts or frequencies at this stage because the rainy season carries with it much fresh food, and a general increase in the number of terrestrial animals swept into the water.

The final experiment would be to add habitat-sharing fish such as *Geophagus* and *Aequidens* (cichlids), *Hoplosternum*, *Pimelodus* and *Sturionoma* (catfish) and, perhaps, some of the larger tetras: *Hyphessobrycon*, *Asynxax* and *Hemigrammus*. General water temperatures outside of the experiment should be between 80-85°F (27-29°C) and the pH range from 6.6 to 6.9 and a water hardness under ten degrees (German) would be ideal. Fish should be given shrimp, flake food, worms, bloodworms and *Daphnia*.

With the right aquarium layout and a correct feeding and filtration plan, who knows what fun aquarists can have recreating the Amazon in their front rooms.

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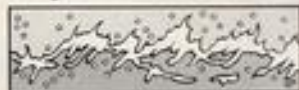
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The Javanese Rice Fish (*Oryzias javanicus*) is a delightful, though relative rarity, that does not currently enjoy the popularity it deserves

GEISHAS WITH A DIFFERENCE

Whether you regard them as Medakas, Geisha Girls or, simply, Rice Fish, the two species of *Oryzias* found in the hobby have a great deal to recommend them, as Peter Capon reveals.

Until as late as 1966 the genus *Oryzias* was included with the killifish in the family Cyprinodontidae. In that year, Dr P. H. Greenwood of the British Museum of Natural History erected the family Oryziatidae containing the single genus *Oryzias*. This separation was based on the lack of two bones in the skull, the vomer and the supracleithrum in *Oryzias* when compared with the Cyprinodontidae.

Originally the Rice Fishes included the *Aplocheilichthys* genus. Some authorities claim that there are just seven species in the *Oryzias* genus, whereas others list nine species, namely *O. celebensis* (5cm), *O. javanicus* (4cm), *O. latipes* (4.5cm), *O. hoganianus* (4cm), *O. marmoratus* (4cm), *O. melastigma* (5cm), *O. minutulus* (2.5cm), *O. timorensis* (4cm) and *O. mathesonis* (4cm), although possibly at least two of these may be synonyms.

The Rice Fish is one of the few fishes

known to the aquarium world where the common name and scientific name mean the same; *Oryzias* is derived from the Greek word *Oryza* which means rice.

Only two species are known to enter the aquarium trade regularly, *O. latipes* and *O. javanicus*, and it is the golden variety of *O. latipes* that is commonly offered by aquarium dealers.

Oryzias javanicus

O. javanicus comes from the Malay Peninsular and Java and grows to about 4cm (1.6in). The body is elongated and slightly compressed, but a little deeper than the usual killifish; the dorsal fin is set well back on the body.

The male's body is olive green with a reflected iridescence. The back of the male is darker and, often, a stripe is in evidence along the dorsal ridge. There is a dark line along the body with a second one sometimes visible on the anal fin. The vertical fins are

slightly yellow and the dorsal is pointed.

Females are basically olive green fish and have a shorter dorsal fin.

Oryzias latipes

O. latipes comes from Japan and grows to about 4.5cm (1.8in). It has been given several common names over the years such as Rice Fish, Medaka, Coldwater Aplocheilichthys and Geisha Girl Fish.

The wild form males are green to bluish, with a blue to violet iridescence under reflected light. The dorsal is pointed and the anal has individual rays extended to give a fringed effect; occasionally this fin has a yellow border. The female is olive with a rounded dorsal and an unfringed anal fin.

This species has been kept in Europe since 1897 and has a temperature range of 50 to 80°F. (10-c27°C). Since its native waters can be subjected to frost on occasions, it probably can stand even lower temperatures than those stated here.

Breeding takes place towards the upper end of the temperature range. A few eggs are laid and remain attached to the female's vent by thin filaments. The male displays to the female and the eggs are fertilized either at his close approach or when his body comes into direct contact with the female's flanks.

Depending on the conditions the eggs can remain attached to the female for several days, but are usually left in the plants when they snag on the leaves. In the absence of plants or other suitable obstructions, the filaments disintegrate and the eggs float away freely in a day or so.

As soon as one batch of eggs is left behind or floats away, another clutch is laid within the next 24 to 36 hours. The group of eggs, which can range up to fifteen in a clutch, is encased in a mucus-like sheath.

It should be remembered that since only a small number of eggs are laid at any given time, if all the fry hatching are housed in a single tank they will be at different stages of development and cannibalism is a possibility. The parents do not actively seek out the eggs, but they are best removed to a separate tank for hatching and rearing.

The wild variety is rarely seen for sale, the usual variety available being the golden one which was first developed in Japan in 1895. There are reports of a red strain, but I have never seen it. Before World War II there were also reports of a black strain, but it appears that this was lost during the hostilities and no longer exists.

Since black and red strains existed in the past, a close watch on fry could possibly lead to the re-establishment of these varieties.

Closing remarks

None of the *Oryzias* species are real community fishes. They are not, themselves, at all aggressive, but because of their relatively small size, they should be kept with other small and peaceful species.

In fact, because they are quite happy at relatively low temperatures it is quite easy to keep them in their own tank without the need for any heating in the average home. In addition, they are quite undemanding as far as water conditions are concerned.



Oryzias latipes is known by a variety of exotic names such as the Golden Medaka or Geisha Girl Fish.

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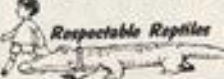
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