

AUGUST 1986 95p

AQUARIST

AND PONDKEEPER

FISHKEEPING AT ITS VERY BEST. ESTABLISHED 1924

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IN WEST GERMANY
COURTESY OF
Tetra**

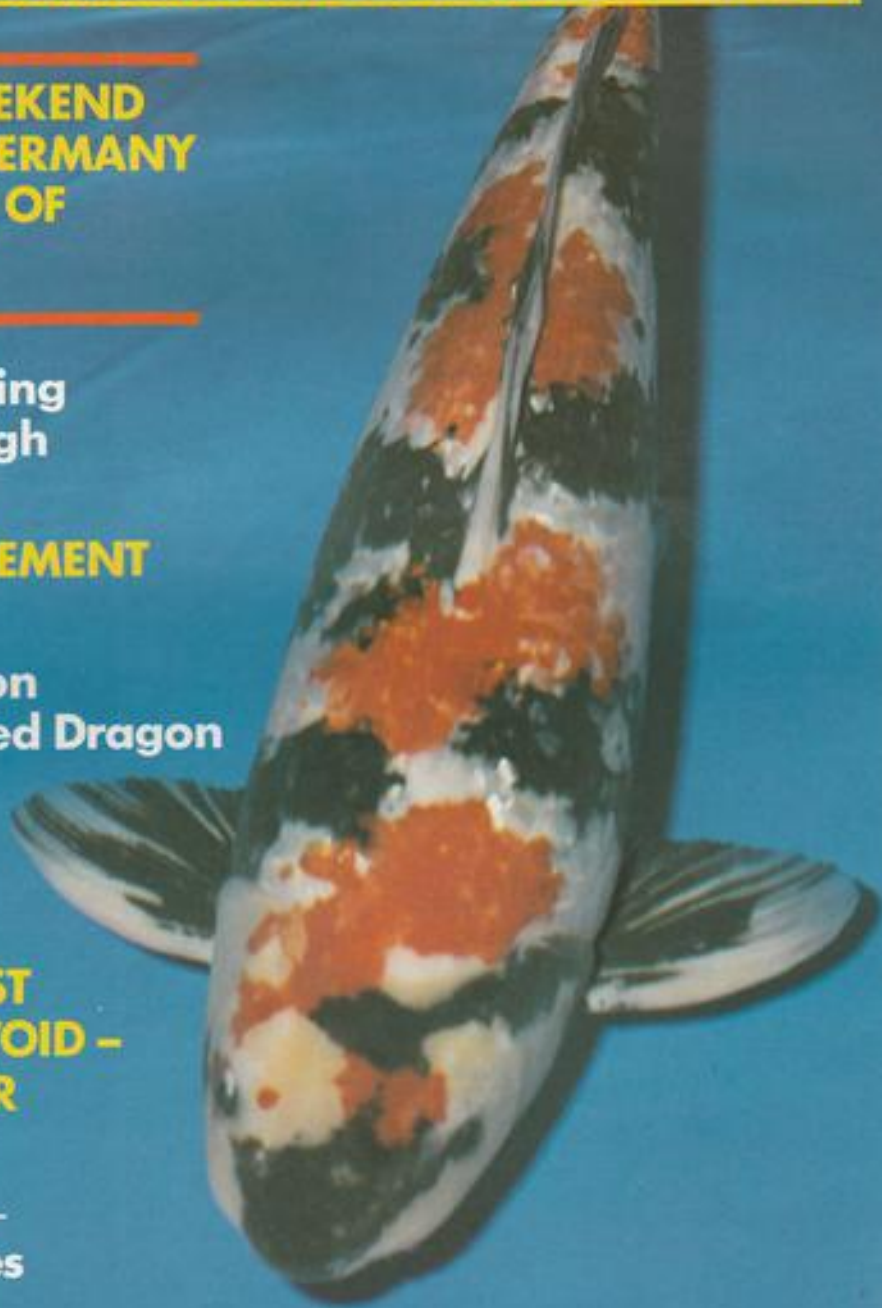
**Fish breeding
in Edinburgh
Prison**

**KOI SUPPLEMENT
INSIDE**

**Spotlight on
the Bearded Dragon**

**THE RAREST
ANABANTOID –
IN COLOUR**

**Product
round-up –
a new series**



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PUBLISHED BY Buckley Press Ltd.
58 Fleet Street, London EC4Y 1JU
TELEPHONES: ADVERTISING
AND PRODUCTION (0732) 884564
ACCOUNTS 01-583 0175

SUBSCRIPTIONS
£15 per annum (UK only) including postage, overseas and airmail rates on application. All subscriptions are payable in advance. Cheques or International Money order should be made payable to Buckley Press Ltd. and sent to:
Aquarist Subscriptions
Subscriptions International Ltd.
92 Queensway
Bletchley
Milton Keynes MK2 2QV
Telephone: 0908 70761

ISSN 0003-7273
Printed by Buckley Press Ltd.

Cover Story

Gin Rin Showa Sanke
(Photograph: Kent Koi Ko)

The superb specimen shown on our cover is a very special fish indeed, as the list below demonstrates. It is proclaimed in Japan as one of the most prized and famous Koi in the world, having won more major awards than any other individual fish.

Major Prizes Won:

- All Japan Nishikigoi Show
 - 1976 Best Kin Gin Rin—size 6
 - 1977 Grand Champion Kokugyo—size 6
 - 1977 Supreme Champion Young Koi
 - 1979 Grand Champion—size 8
 - All Nippon Combined Nishikigoi Show
 - 1980 Best Overall Koi—size 6
- This fish is now on view, for the first time outside Japan, at Kent Koi Ko.



AQUARIST

AND PONDKEEPER

AUGUST 1986 Vol. 51 No. 5

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A pair of 'commandoes' circling, just prior to spawning

LOVE THY NEIGHBOUR

By Amanda Grimes

When setting up my community tank, I must admit to complacency. After all, the species of fish that are meant to be compatible are numerous and there is a wealth of advice on stocking such an aquarium. It all seemed so straight-forward. I bought some bottom-feeders—*Corydoras* and *Botia* species; a few surface feeders—Gouramies, Mollies and the like—and two shoals of mid-water swimmers—Zebra Danios and Cherry Barbs. For breeding interest, I also acquired some cave-breeding Cichlids—Kribensis—and some open-spawners—Keyholes.

That, I thought, was not a bad combination. I had colour, activity and a broad cross-section of characters. Naturally the tank did not remain static, and although some of the originals are still in residence, the tank has played host to many different occupants. Which is why I now no longer call it the 'community' tank but simply the 'com' tank. This is not to shorten the word but rather to sum up the various adjectives I have found to describe the aquarium's history. Have you ever noticed how many words begin with 'com'? In these two paragraphs alone, I have already used four of them. Let me illustrate a few more:

Commandment—love thy neighbour. The fish in my tank subject their neigh-

hours to every emotion going; love is not one of them. Tolerance is about the best they can achieve.

Commotion—each member working according to his capacity and receiving according to his wants. Have you ever watched Rosy Barbs feeding?

Commodious—the mouth of a Butterfly Fish. A friend (?) gave me one of these as a special present. Its mouth opened like the stern of a cross-Channel ferry and three young Danios sailed happily in.

Commutable—another word for exchangeable, which is what the Butterfly Fish became...

Company—this is what a loan striped Headstander is meant to have. At great expense I bought him his heart's desire. Three innocent bystanders were injured in the ensuing fight and one of the Headstanders ended up with a black eye. Both fish promptly became commutable.

Compatible—the description for a pair of Gouramies until they have bred. Not in my tank—I have tried Blues, Golden and Pearl. The males I've had are such bullies that the exhausted females have remained indifferent to breeding—can't say I blame them. The only exceptions seem to be the Dwarf and Honey Gouramies.

Commando—Without question, a Zebra Danio. I have watched a shoal of these wind-up a Keyhole until it doesn't know where it is. They're beautiful fish and I

can never resist buying them but the havoc they cause makes them short-stay visitors.

Commotion—two *Botias* fighting over land rights. This is very common in my aquarium, as I have two Skunks and two Zebras. Sounds like high-speed knitting...

Commit-suicide, which is what a Red-finned Shark did when it tried to take over a Kribensis' cave.

Compensation—the other side of the coin. The rewards of my community tank far outweigh the problems I've had. It seems to me that there are a fair amount of 'rogue' fish around and I seem to have had my fair share of them. On the other hand, I've enjoyed the sight of Chain Loaches shoaling with Danios and Rosy Barbs queuing up to jump in and out of the flow from a freshly-cleaned power filter, like kids on a roundabout. I've learned that *Corydoras julii* spend more time perched on the plant leaves in mid-water than they do on the gravel and that Banjo Catfish have a disconcerting habit of playing dead. And so the 'coms' continue:

Competent—the way in which a Keyhole Cichlid threatened and then went on to 'kill' a dark red lily leaf which he misguidedly took exception to.

Commiserate—meaning to 'reduce to small fragments', which is what the fish did to the lily leaf.

Complaints—the body language I get from one of my male Honey Gouramies every time I want to clean the power filter and he's built his bubble nest round the outlet pipe.

Comfortable—what the *Tubifex* feeder must be for one of my Chain Loaches, who spends most of his time in there in spite of my efforts to evict him.

Comical—the sight of a female *Nannacara anomala*, in full brood care colours, herding *Daphnia* around the aquarium.

Compromise—something fish never do, but fishkeepers do all the time, like letting them play with the thermometer for a day before sticking it back, once again, on the front glass.

Compassion—the race to replace a male Siamese Fighter's dead mate, only to find he dies the next week and now you must find a new male to keep the hastily-bought female company.

Committee—what *Corydoras* were obviously born to form, judging by the secretive huddles in my tank.

Composure—lost by a Honey Gourami when he finally realised he was displaying to a juvenile *Nannacara anomala*. Reward offered.

Compelling—the sight of an *Ancistrus delichoptera* male escorting his first offspring around the aquarium...

Complication—realising the female *Ancistrus* has thrown them out of the cave to lay more eggs...

Commendable—my lack of hysterics when I looked *Ancistrus* up and found that they can lay up to 200 eggs at a time!

Compos mentis—something I seriously doubt that I am any more...



The trade stands all did brisk business throughout the weekend



Tongham's impressive ski-slope tableau complete with models of mountaineers and skiers took first prize in the competition



Living Jewels, by Hendon A.S., received much deserved praise and the Su Pollard trophy from Dr. Chris Andrews of London Zoo Aquarium

Crowds flock to 'Aquarian's' Sandown show

The third 'Aquarian Fishkeeping Exhibition' was transferred this year from Kempton Park, to just down the road at Sandown Park Racecourse at Esher, because of its large exhibition area. What a good job it was! Thousands of aquarists and members of the public flocked in through the turnstiles for the two-day show held on

By Adrian Blake

Saturday and Sunday 7-8 June.

Visitors were treated to a wide array of club tableaux and trade stands of all shapes and sizes. Tableaux have become slightly smaller over the years as increasing material costs take their effect.

Tongham A.S. took first prize with a

beautifully constructed ski-slope, with models of ski-lifts, skiers, mountaineers and men sitting drinking in a bar, all working. Even the dog's tail wagged. The fish were not going to be outdone either and Ray Cooke, one of the Tongham members, won best fish in show with a tremendous specimen of a *Synodontis notata*, an African Catfish. Ian Legge and Dave Caesar were the driving force behind a wonderful effort.

Second place went to **Havant A.S.** whose Jumbo Book of Fish display included a television showing videos of fish subjects. It was the best placing Havant have ever achieved in the competition.

Scorpion A.S. from Manchester won third place with a very individual working organ complete with sound effects. Completing the places was **Sudbury A.S.** from North West London, with a Theatre Display with full internal viewing enabling the visitor to peer at the stage as though from the back of the stalls.

Basingstoke A.S. castle, complete with turrets, and **Bracknell's** topical football stadium, complete with two fishy teams and referee posing as a Moor, went close for the prizes.

On entering the show the sponsor's stand—'Aquarian' Fish Foods—provided a good start for visitors to see and buy a whole range of aquatic goods and fish. L.M.B. of Manchester provided a whole array of hardware plus a large selection of fish. Also selling fish were J.M.C. Aquatics, Belton Fish Farm, Neptune Aquatics, John Allan Aquariums, Keith Barraclough, Airport Aquaria and Ornamental Wood, all doing a brisk trade. In fact, all the traders at the show said they were very happy with the business done.

Lynwood Enterprises' stand, displaying three large aquaria with very large fish in them, proved a big hit.

For many, however, the high spot of the show must have been the Learning Maze built by Aquarian and manned by Dr. David Ford and John Dawes of the Aquarian Advisory Service who gave conducted tours through the maze which included 10 tanks holding all types of fishes from coldwater to marines. The children loved it, and the queue to get in was endless.

Comments from the people I spoke to were very favourable. One chap said he got his family's entrance fee back on the purchase of one power filter!

Dr. Chris Andrews, assistant curator of London Zoo Aquarium, dropped in to present the Su Pollard Trophy to **Hendon A.S.** for their beautiful Music Box.

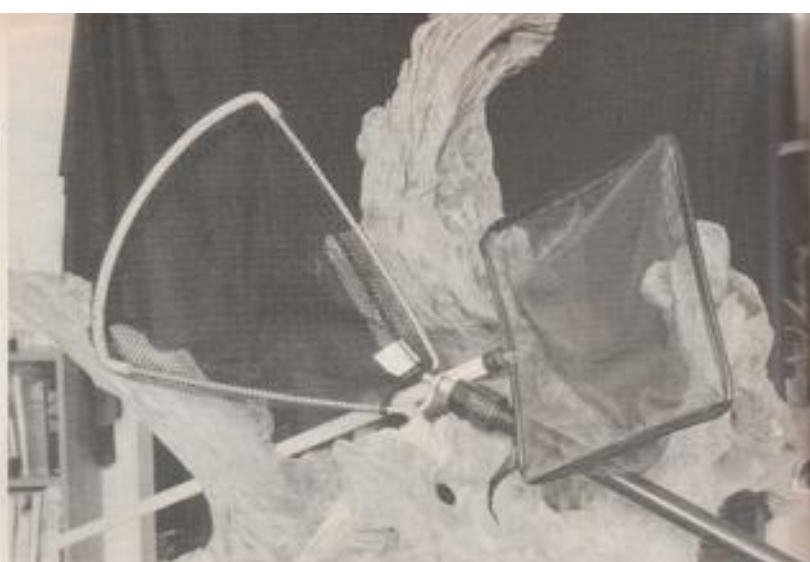
The Association of Aquarists, who helped organise the show and provided the stewards, judges and officials, are to be congratulated on a job well done. The show may be a two-day event, but it involves three days to set up and dismantle. It attracted more than 11,000 visitors. "It's like the Ideal Home Exhibition for fishkeepers," one of them said.

Water gardening having become such a widely practised aspect of the horticultural revolution, there are now no end of accessories that can be used to help transform a still puddle of water into a veritable living centre-piece to the garden.

Moving the water around is usually the first thing that is done, and there is a colossal range of pumps to do the job, whether you want to power a fountain or recreate Niagara Falls in the rockery. Ever-Flo is a name currently gaining prominence with a range of three pumps rated at 250, 450 and 700 gallons per hour. The 450 we have tested—a mains pump with a magnetically coupled impeller—has performed adequately, with minimal drop-off in flow with time. Providing a 5 foot fountain through one of the six spray heads provided with the pump, there is still enough water pressure to drive nearly 150 gallons an hour down a 3-foot head waterfall.

The Amphibious water garden pump P700 at £89 from Better Water Gardens is extremely powerful, with a slightly different version of the normal magnetic drive. It has a huge copper with steel inset rotor that is induced to turn by the windings the other side of a stainless plate in the pump body. I was a little concerned by the copper in contact with water. However, for pond use, where the water volumes tend to be large, I foresee no problems. The pump can also be used outside the pond, as well as submerged in it, although non-submerged use requires a £25 kit of parts. It performs at 700 gallons per hour at 3 foot head, and will still produce a creditable 280 gph at 12 foot head. Other pumps in the range are the P250 and P380, the figures relating to gph at 3 foot head.

For those who don't like mains electricity in the water garden, there are a number of low voltage pumps and accessories. The Hozelock-ASL Cascade Super 400 is one of these; a 12 volt, 54 VA pump that is supplied with a transformer. The pump is moderately powerful and provides a good fountain up to about 5 feet high. A novel fountain head allows the fountain pattern to be set as desired, as eight of the outlets can swivel from vertical to 45°, giving a wide range of possibilities. The transformer must be sited indoors as it is not waterproof, with the pump connected via a rather ungenerous 10 feet of cable. Although it is easy enough to extend low-voltage cable (the cable specifications are given in the handbook with the pump), I should think virtually every customer for this pump will need to do so. Hozelock are not the only culprits on this front, it must be said. Total pump output at about 430 gph can be achieved at zero head. The filter is off centre to the impeller intake, which seems to leave much of it unused, and you can get by-pass if you are not careful in placing the sponge in its cage.



Telescopic handled net and wood handle net for ponds as distributed by C. J. Skilton

PRODUCT ROUND-UP

Ian C. Sellick describes a selection of items to improve your pond this summer

POND ACCESS

Stuart-Turner is a name long associated with quality pond pumps. Their range of external pumps has recently been joined by the Water Nymph submersible, a powerful little newcomer. The traditional range, mounted in sumps alongside the pool, extends from the small No. 9 model, rated at only 95 gph at 3 foot head, to the massive No. 117 model, which will deliver 4,750 gph onto the roof of most houses! It costs £220 plus accessories (which will add at least another £50 for foot valves, strainers, taps and unions) and is superb for providing the 'oomph' for a large Koi filter system.

Getting more enjoyment out of your pond, fountain and waterfall could involve longer hours at the pool-side, easily achieved by the addition of pool-side and underwater lighting. Pool-side and garden lighting is available from Hozelock-ASL, and a particularly comprehensive range

from Better Water Gardens. Lighting in the water is the thing, though.

The Hozelock-ASL 'Aqualow' at around £40 is a low voltage, two lamp system. Permanently fixed with 5 feet of cable between them, the lamp lenses are orange and blue and held in a silicone-type soft casing. The white plastic reflector holds standard car bulbs, and the units float unless weighted with a rock.

The Lotus light fountain, with a 35W sealed beam unit, is a particularly effective way to light a small fountain. Mains voltage underwater lighting is supplied by OASE with brackets to fit their pumps, but can be used separately. The stainless steel casings take 150W spotlights, so these are powerful lamps for really dramatic effects. They are available with red, blue, yellow, green or clear lenses at about £80 each.

With all this electricity in the water,



Amphibious P700 pump from Better Water Gardens



'The Water Garden' an excellent new book on the subject



Low voltage lighting and pumps by Hozelock-ASL



Above, two examples from the new 'EasyCare' range

ORIES

you must use waterproof cable connectors to make any cable joins. Skilton distribute to the trade one that can even be used underwater with screw-in gland seals. It is rated up to 5A and is excellent value at about £7. You should also use overload trips on the power feed to the pond (or any electrical appliance used in the garden). An outlay of less than £25 can save lives.

Should you be unfortunate enough to drop a foek in the pond (as I once succeeded in doing), then you will welcome the Lotus Pool Repair Kit. At only £1.79, keep one in the house just in case. For polythene and butyl pond liners (PVC kit also available), the pre-glued patch just needs cutting to size and sticking on. The pond can be refilled an hour later.

Getting fish out of the pond always presents a problem. There are several excellent pond nets on the market, with

Norfine producing a wide range of pond and aquarium nets of excellent quality and softness for the fish's safety. I also liked House and Co.'s nets. On telescopic handles extending to over 8 feet, there are a variety of heads to screw on, including 20, 24 and 30 inch circles, and a triangular 18 inch black coarse-mesh net, 15 inches deep, that is good for lifting those elusive carp. Supplied through Skilton, they will cost £15 to £25 depending on net head. The cheaper alternative on a 3 foot wood handle, with a 9 x 10 inch terylene mesh net on plastic bound wire, quite sufficient for the smaller pond, will cost a mere £4.50.

Keeping out herons, cats, children and other unwanted visitors is always a problem. Norfine have an excellent range of pool cover nets on frames for rigidity, or you could do the job cheaply with $\frac{1}{2}$ inch netting in 2 x 3 or 4 x 6 metres pegged around the pond for just over

£4 or £6 respectively (through Skilton or Better Water Gardens).

The final accessory for the pond must be the ornament. Ranging from a 17 inch Seal water spout at £22.50 to a 26 inch Cherub holding a sea shell at £33 in artificial stone, they can give the finishing touch. Better Water Gardens sells a mermaid for just £628, but I think my 'finishing touch' would come from my wife if I bought one! Actually part of their Henri range, the mermaid is a rather pleasant free standing, self contained water feature ornament.

Finally, as with every aspect of fish-keeping, there is a plethora of books about ponds and pondkeeping. I particularly enjoyed the newly published 'The Water Garden' by Anthony Paul and Yvonne Rees (Windward £9.95), not because I entertain any hope of ever creating some of the lavish water gardens they depict, but because their ideas are not just ideas, they are there for real, in superb photographs. If you want to see what can be achieved by using water in the garden, buy this book.

This selection of accessories should give some ideas for improving your pond in the final months of the season and should be available from most retailers, but especially the Water Garden Centres advertised in the pages of *A&P*. Among these, I would like to thank King Fish of Avonmouth, Bristol for providing much of the equipment featured in this review.

Meet the societies

Thorpe & District Aquarist Society

Thorpe & D.A.S. was formed in January 1978. Meetings are held on the first Monday of each month at the British Legion Club, Aylsham Road, Norwich, starting at 8.00 p.m. In addition to the



very popular licensed bar(1), club nights offer members a varied collection of attractions. There are lectures from a wide spectrum of speakers, table shows, a large library with books available on a free loan basis to members, auctions, a raffle and much more.

The table shows are always strongly supported with no fewer than 20 trophies being competed for.

Thorpe & D.A.S. is affiliated both to the F.B.A.S. (Federation of British Aquatic Societies) and its regional section, the E.F.A. (Eastern Federation).

A two-leg, inter-club quiz between Thorpe and Bury St. Edmunds A.S. is also run and receives enthusiastic support from all members.

Trips are organised to local and London aquatic centres, London Zoo Aquarium, Colchester Zoo, major shows and other venues every year.

Local arrangements also include dis-

counts at aquatic shops on presentation of a valid membership card. News of these shops, plus other items of interest and information, are published in the society's comprehensive monthly magazine.

The Editor would welcome swapping magazines with other societies or exchanging ideas with other Editors in order to produce an even better magazine. His name, address and telephone number are: N. Ripley, 83 Friends Road, Earlham, Norwich, Norfolk. Tel: Norwich 501135.

If you think you might wish to join this very active society, you will be made most welcome any first Monday at the British Legion Club (address above).

Subscription Rates: Adults, £2.50; Family, £4.00; Juniors, £1.00.

Apply to: Mr. Paul Sparks (Secretary), 259 Drayton High Road, Hellesdon, Norwich, Norfolk NR6 5BP. Tel: Norwich 406276.

Solent Aquarist Society

Solent A.S. is a relatively young society, formed about three years ago to fulfil the needs of aquarists, novice or expert, in the Solent area.

Although still in its infancy, the club



Solent Aquarist Society

has already achieved great heights. For example, it now holds the A.S.A.S. trophy (for the third time in succession). It also held its first Open Show last September, an event which proved an exhausting success. The A.S.A.S. show (Association of Southern Aquarist Societies) takes place annually in October and is open to members of the F.B.A.S. (Federation of British Aquatic Societies).

The Society's own Open Show attracted no less than 250 entries and plans are already in hand for this year's Open Show scheduled to take place on Sunday 21st September.

Other activities include tank-making, mini-auctions, lectures, fish photography, slide shows, quizzes, raffles and the occasional trip. The society also has a more social side which brings together members and families for a relaxing, fun-

packed evening. This has included a fancy dress 'Country & Western' dance, a beer and skittles evening and a Christmas 60's disco.

S.A.S. has its own shop which enables members to buy food and equipment at a much reduced price. There is also a library and a monthly newsletter/magazine entitled 'Fish Forum', provided free to all members.

Meetings are held every first and third Thursday of the month at Portchester Community Centre, Westlands Grove, Portchester, starting at 8.00 p.m.

Subscription Rates: (annual)—Adults, £6.00 (inclusive); Children, £3.00.

Apply to: David Richardson (Secretary) 36 Langford Road, Buckland, Portsmouth, Hants PO1 5RJ. Tel: (Ports) 732107, or James Handley (Chairman), 41 Park Walk, Fareham, Hants. Tel: (Titchfield) 47274.

Diary dates

Northern Goldfish & Pondkeepers Society

The N.G.P.S. 1986 Open Fish Show will be staged on **Saturday 16 August** at Trinity United Reform Church, Delamer Road, Altrincham, Cheshire. Full details from Ron Hodgkinson, 9 Stratford Close, Farnworth, Bolton.

Yorkshire Koi Society

The 1986 Yorkshire Koi Festival will be held at Harewood House, near Leeds, on **Bank Holiday Monday, 25 August**. Contact Stuart Bent, 58 Broom Crescent,

Rotherham, S. Yorks. Tel: Rotherham 372671.

Preston & District Aquarist Society

The P.D.A.S. Open Show is scheduled for **Sunday 31 August** at Catherine Beckett Club, Deepdale Road, Preston. Contact Jane Caunt (Secretary) for more details at 3 Douglas Drive, Freckleton, Preston, Lancs. PR4 1RY.

Wellingborough Fish Keepers Club

The 1986 Open Show will be held at the Polish Club, Winstanley Road, Wellingborough on **Sunday 31 August**. Details from Nigel Chillett (0933) 228754.

Evesham Fishkeeping Society

This year's E.F.S. Open Show is taking place on **Sunday 31 August**. Contact

the Show Secretary, K. Harrison, 3 Manor Farm Cott., School Lane, Middle Littleton, Evesham, Wores. WR11 5LN.

Ashby Fishkeepers Society

The A.F.S. 1986 Open Show will take place on **Sunday 31 August** at the Grange Farm Hobbies Centre, Bellingham Road, Scunthorpe, South Humberside. Details from Terry Nelson (Show Secretary)—Scunthorpe 850525.

Edinburgh Aquarist Society

The date for the Edinburgh A.S. Open Show which will, once again, be held at St. Bride's Community Centre, Orwell Terrace, Edinburgh, is **31 August**. Full details from R. H. Cook (P.R.O.), 2 Longstone Gardens, Edinburgh.



Left, the full-grown *Tilapia zillii* male in this photograph is about 12 inches (30 cm.) long. The female, seen below the male, is considerably smaller but can, nevertheless, produce many thousand eggs in a single spawn

Right, this male wild-type *Oreochromis niloticus* is in full display and is leading a female to his chosen spawning site

THE FISH BREEDERS OF EDINBURGH JAIL

The University of Stirling and Edinburgh Prison are co-operating in a unique fish-breeding project designed to combat famine in developing countries. John Dawes reports on this remarkable venture

Three long-term prisoners are making a unique and valuable contribution to the fight against hunger in the Third World.

They form an essential part of an unusual relationship between the academic world (represented by the University of Stirling) and the penal system (H.M. Prison, Edinburgh) which is producing results that any self-respecting fish breeder would envy.

In 1984, for instance, the prison

Stirling University's elegant campus houses the Institute of Aquaculture, whose close links with Edinburgh Prison are helping produce top-quality 'Tilapias' for fish farms worldwide

Behind this door cichlids are bred in their thousands all year round

Aquarium produced over 151,000 cichlid fry which were distributed to research institutions and fish farms in places as far apart as the UK and Thailand.

The unique university/prison link began in 1978 when Professor Roberts of the Unit of Aquatic Pathobiology at Stirling (now the Institute of Aquaculture), was anxious to establish a steady supply of young 'Tilapia' for research which the Unit was carrying out on behalf of the Ministry of Overseas Development.

Angus Whyte, the prison's Education Co-ordinator, got to know about this and approached one of the Prison Officers, Jim Herkes, who was responsible for the fish club in the prison. The idea was enthusiastically received by all parties concerned and, within a short time, the project was underway.

A room was set aside at the prison, tanks were constructed by the prisoners themselves, and suitable 'Tilapia' broodstocks were delivered by the university.



The challenge which the prisoners had accepted was not only exciting but also difficult. The team at the university had been unable to get the fish to breed successfully and the prisoners could find very little published data on the breeding behaviour of the species concerned.

By trial and error, they gradually developed their own formula for success and were soon breeding all the species required by the university. By 1981, production had increased to 40,000 fry per year—it could have been even higher had it not been for the lack of space.

As demand increased further, pressure for a larger fish breeding unit within the prison grew. The Rowntree Trust stepped in with a substantial grant and an unused basement in one of the prison halls was allocated by Mr. Charles Hills, the Governor of the prison at the time, and the Scottish Home and Health Department.

The grant made it possible to provide facilities for 50 large aquaria (some others were acquired later) and the new unit started production in January 1982, with one prisoner working full time on the project.

This has now increased to a team of three, Willie, Alex and Charlie, who co-ordinate everything from water changes to record-keeping. The meticulous nature of the latter has to be seen to be believed—there are records for every fry produced by every female going back, at least, for four years—a mindblowing exercise in dedication and attention to detail rarely encountered in general fish-keeping and which could contain new and important information relating to the reproductive biology of the species concerned.

The breeding successes which Willie, Alex and Charlie are achieving are all the more remarkable because of the species they are working with. These are all large, 'awkward-to-handle', aggressive at times and demand a lot of space. The current full list of species kept by the university and passed on to the prison as part of the project includes *Oreochromis andersoni*, *O. aureus*, *O. macrochir*, *O. mortimeri*, *O. mossambicus*, *O. niloticus*, *O. spilargenteus*, *Sarotherodon galilaeus*, *Tilapia buttikoferi*, *T. mariae*, *T. rendalli* and *T.*

niloti.

At one time or other, all the above were regarded as members of the genus *Tilapia* but changes in nomenclature over the years have resulted in a number of splits. However, because of their original name, some people still regard the work being carried out at Stirling and Edinburgh as the 'Tilapia' project.

The university part of the link consists of a group of scientists headed by Dr. Brendan McAndrew, supported by a three-man technical team, Iain MacGowan, Keith Ransom and William Hamilton, who, together, carry out the various research experiments and handle all requests for fish from outside bodies.

The work is extremely varied and includes such projects as research into the genetics of colour determination, which is of particular relevance to some Third World countries where golden (or light-coloured) forms of certain species are deemed better eating. Other research includes work on optimal growing conditions, diet, hybridisations and so on.

The Institute of Aquaculture is one of only a few academic establishments carrying out this type of research. Its reputation has deservedly grown over the years and is truly international having distributed pedigree 'Tilapia' stocks to research units in Aston, Bristol, Plymouth, Swansea, St. Andrews and Grimsby in the UK, and fish farms and research establishments in Israel, Jordan, Sweden, Denmark, Holland, Göttingen (W. Germany), Tromsø (Norway), Mexico, Thailand, South East Asia, Egypt, Panama, Kenya, Saudi Arabia and Bangladesh.

At any one time, the Institute holds around 10,000 fish at its university premises. Despite this, and despite the outstanding success of the breeding unit at the prison, the aim of the project is not to supply fish farms with stocks for them merely to grow on and sell. What the Institute can do, however, is send guaranteed pedigree broodstock to these places, supply them with all the necessary professional guidance required to set up a successful on-site breeding unit, and advise them on the best culture methods available.

With an ever-increasing demand for fry, it is hoped to expand the prison unit to twice its current size. This will also allow it to contribute to other research projects that the Institute is becoming involved in and which currently form part of the discussions held every fortnight when staff from the university travel to the prison, or when the prisoners, in turn, pay their monthly visit to the Institute.

These regular meetings serve a number of very useful purposes. On the purely practical front, they enable fry and broodstocks, as well as food and equipment, to be collected. On the more personal side, they provide excellent opportunities for the exchange of ideas and information. They also allow the prisoners a regular insight into the discipline required to work on controlled



Jim Herkes, the Prison Officer in charge of the Fish Breeding Unit (seen here in a lab coat), supervises the prison-based side of the project. Alex is one of three long-term prisoners responsible for the unit's remarkable record of success

experiments.

As Alex said: "The project is interesting and challenging and allows us to restore contact with people. We feel proud to be doing something really worthwhile and helping in some way to fight hunger in the world".

Jim Herkes agreed and added that the fish breeding project allows long-term prisoners to recover feelings of worth and self-esteem which they may have lost, helps them develop a sense of responsibility and may even enhance their employment prospects when they leave. For my part, I left Edinburgh with the feeling that I had experienced an exceptional venture carried out by an exceptional group of people.

I had spent an absorbing day in the company of some extremely knowledgeable, dedicated fishbreeders who, incidentally, were responsible for the first-ever 'natural' spawning of *Clarias* Catfish in the UK. They taught me a great deal about technique and record-keeping, put my fish breeding achievements (which, until then, I had believed to be quite respectable) into true perspective, and made me feel grateful for it.

Acknowledgements

I would like to thank Dr. Brendan McAndrew and his colleagues at the Institute of Aquaculture, the Scottish Information Office, Mr. Brownlee (Governor), Angus Whyte (Education Co-ordinator), Jim Herkes (Prison Officer in charge of the Aquarium), and Willie, Alex and Charlie at H.M. Prison, Edinburgh for their generous co-operation in preparing this article.



Books

Definitive guide to reptiles and amphibians

A Petkeeper's Guide to Reptiles and Amphibians*

By: David Alderton

Published by: Salamander Books Ltd.

Price: £4.95

ISBN: 0-86101-212-7

(*Available through the Pet Trade as 'An Interpet Guide to Reptiles and Amphibians').

The subtitle of this superb book reads: "A practical introduction to keeping and breeding a wide range of these fascinating creatures." This, David Alderton's book does magnificently; but it also does much more—something that should, perhaps, have been taken account of and included in some form or other in the title.

It is difficult to envisage a book for beginners (or even for established herpetologists) containing more useful information in just 30,000 words and 117 pages of text than this one does.

The contents list includes the following subjects: Basic biology; Obtaining and handling reptiles; Accommodating reptiles; Heating and lighting; Furnishing the vivarium; General maintenance; Feed-

ing; Breeding reptiles; Health care; Species section; Further reading and Useful addresses.

I found this book interesting, informative, colourful and extremely well written from beginning to end and can recommend it without reservation to anyone sharing my love of, and enthusiasm for, amphibians and reptiles. **John Dawes**

Impressive book on fish reproduction

Fish Reproduction—Strategies and Tactics

Edited by: G. W. Potts and R. J. Wootton

Published by: Academic Press

Price: £29.50

ISBN: 0-12-563660-1

Every once in a while, a book appears on the market containing significant articles (papers) on a subject of fundamental importance. Usually, books of this kind include a number of 'review' papers which bring together scattered bits of data and knit them into coherent, up-to-date accounts aimed, not at the extreme specialist, but at the more general, 'informed' reader.

Unfortunately, from the point of view of many who participate in any activity at the hobbyist/enthusiast level, these

books are, almost by definition, academic in origin and style. For others, this type of publication is precisely what they are looking for.

Fish Reproduction—Strategies and Tactics is such a book. It is an impressive collection of papers based on a number of essays presented at a symposium of the Fisheries Society of Great Britain held at Plymouth Polytechnic between 19 and 23 July, 1982. The list of contributions reads like a Who's Who of the ichthyological world.

Some of the papers are indeed specialized but many others (there are 20 in total) are more wide-ranging. Those of particular relevance to aquarists because they involve familiar species of fish include:

Genetics of Sex Determination in Fishes; Sex Reversal and Sociodemographic Processes in Coral Reef Fishes;

Patterns in the Evolution of Reproductive Styles in Fishes;

Behavioural Aspects of Cichlid Reproductive Strategies.

At £29.50 it is easily affordable, so if your local library does not yet have a copy, why not urge them to obtain one without delay? After seeing the book itself, you may well decide to go a step further and obtain your own personal copy.

John Dawes

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Spotlight

THE BEARDED DRAGON

David Alderton* introduces a spectacular lizard rarely seen by UK herpetologists and offers advice on the upkeep of Bearded Dragons in vivaria. Photo. by David Allison

This striking agamid lizard, *Amphibolurus barbatus*, is not common outside Australia since the exportation of native fauna from this country is strictly forbidden, except to recognised zoological collections. The Bearded Lizard shows the typical features of the Old World family Agamidae, with its triangular shaped head, long legs and tail. Nineteen species are recognised in the particular genus *Amphibolurus*, which occurs throughout Australia except for areas of rainforest. The Bearded Lizard itself is found over the whole continent, apart from some northern areas. These lizards can grow quite large, reaching a maximum total length of about 2½ feet. They are frequently seen sunning themselves on or close to the ground, being essentially terrestrial by nature. Bearded Dragons feed mainly on insects, but larger individuals may take rodents and even other lizards.

Bearded Dragons are not shy by nature, being well-protected against potential predators. They possess a formidable array of spikes on the sides and top of the head and, as with the iguanids which are found in the New World, the Bearded Lizard has evolved an inflatable flap known as a dew-lap on the underside of its throat. This, in fact, can be expanded to cover the whole of the throat area, being supported by the hyoid bones; the spines which normally lie flat as shown here in the photograph, are raised as a result, and can inflict a nasty wound on a potential aggressor. Like other lizards, notably the chameleons, the Bearded Lizard is able to change its colour, and this helps not only to conceal its presence, but also serves to regulate its body temperature.

Reptiles are unable to control their body temperature independently of the environment. Yet, studies have shown that these particular lizards have evolved an unusual means of thermoregulation, ensuring that they can remain active even when the temperature is outside the range that they normally prefer. As the temperature starts to rise during the morning, the body temperature of these lizards tends to rise relatively quickly, compared with that of their environment. The Bearded Lizard uses the bulk of its body to expose as much

of its surface area as possible to the sun's rays, by lying flat on emerging from its retreat in the early morning before seeking prey. Once the temperature climbs as high as 40°C, it retires to seek shelter, as the ground itself warms up. Then after midday, the lizard again emerges, but now tends to avoid close contact with the hot ground, so as not to gain excessive body heat.

Bearded Dragons are capable of running fast when necessary, but tend to be rather sluggish for the rest of the time. Interestingly, their body temperature falls less rapidly than it rises, because of alterations to the pattern of blood flow to the skin, so they can remain active even when their environmental temperature is relatively low.

It is not difficult to sex these lizards when they are in breeding condition. Males develop a green area at the base of their tails, and have dark underparts; whereas females, in contrast, turn reddish rather than green. The display of the male is quite elaborate, and includes foot-stomping in front of a potential mate. The inflatable throat patch is extended to its maximum extent, with the yellow interior of the mouth also being displayed. Following mating, the female lizard excavates a deep hole, where she buries her eggs, which may number from eight to twenty or more. The young lizards start to emerge about three months later.

The *Amphibolurus* lizards are not difficult to maintain successfully in captivity, but require a hot, arid environment in excess of 30°C. There is some evidence to suggest that they could be prone to fungal disease, which is more likely to arise if these lizards are kept under humid conditions.

In view of their size, they need fairly spacious surroundings, with adequate areas for retreat being incorporated into their enclosure. This applies equally to the African species of agamid lizard, which are commonly available in Britain. It may well be necessary to construct a large purpose-built vivarium, using melamine-covered chipboard, which can be later cleaned as necessary simply by wiping the surface over with a damp cloth. The

joints can be filled using an aquarium sealant, and clear acrylic at the front of the enclosure ensures the basis of an attractive yet functional vivarium once the other elements such as heating, lighting and decor are included.

A basking area, provided by a spotlight, is essential for these lizards. While some branches can also be included, these should not be positioned so close to the heat source that the lizards could burn themselves. In addition, care must always be taken when housing agamids together, as males tend to be aggressive towards each other in a confined space, and subordinate individuals are likely to suffer accordingly.

A variety of insects should form the basis of their diet, although a small amount of vegetable matter may also be taken. Mealworms are often the obvious choice as a readily-obtainable source of livefood, but they should not be fed exclusively. They tend to be relatively low in calcium, but it is possible to improve their feeding value in this regard by using chicken meal rather than bran as a food source for these invertebrates, prior to offering them to the lizards. Crickets of the appropriate size can be useful, while larger agamids may also consume locusts. Spiders are taken readily, and the regular but not excessive use of a vitamin and mineral preparation is to be recommended. This can be sprinkled on livefood prior to feeding if required. While the Bearded Dragon is likely to be seen only in zoological collections, their less flamboyant relatives can be frequently obtained, and make interesting vivarium occupants.

*The Author

David Alderton has kept and bred a wide variety of reptiles and amphibians, as well as studying them in the wild. He has observed Bearded Lizards and other Australian species in their native habitat, and has also written articles and books relating to herpetology. His latest title, *A Pet-keeper's Guide to Reptiles and Amphibians*, has just been published by Salamander Books and is reviewed in this issue of *A & P*.

Tetra Question Quiz

Exclusive to the readers of *Aquarist & Pondkeeper*
SPECIAL PROMOTION

WIN a weekend for two in the beautiful Hartz Mountains, Germany; including a visit to Tetra's West Aquarium — Europe's largest fish breeding centre.

PLUS
25 second prizes of the Tetra Laborett Test Kits.



BETTER FOODS FROM DEEPER RESEARCH

The background story on Tetra's research into nature . . . to produce better natural fish foods

When you open a pack of Tetra fishfood and look at the contents, you're looking at the result of over 35 years research and development. Those TetraMin flakes or DoroMin foodsticks may look plain and simple enough but in fact they contain the results of a truly massive investment in modern technology, and a constant programme of research, development and testing on over one million fish.

Tetra is known to aquarists all over the world and has been the first choice of fishkeepers for generations. It is now part of the Warner-Lambert Group, but the modern production facilities are in Germany, where the company began. There, too, is the Tetra West Aquarium—Europe's largest fish breeding centre, and Tetra's Research and Development facilities. These represent the world's largest commercial aquatic laboratories and are manned by over 50 highly qualified research staff. Besides being a testing centre for all Tetra's products, West Aquarium operates as a separate commercial enterprise, supplying tropical and freshwater fish primarily to the European market, but also sending fish to all corners of the world.

West Aquarium enables Tetra to combine laboratory research with real practical research on a vast scale. They feed all the fish at West Aquarium on Tetra foods, so every Tetra product that you buy has been well and truly tried

and tested. It all adds up to a research and development programme that, Tetra claims, no other manufacturer of fishfoods and treatments can match.

Millions of fish

Some of the statistics relating to Tetra's West Aquarium are quite awesome. They permanently keep between 1.2 and 1.5 million fish there. They sell about 4 million fish, covering 600 different species, throughout the world every year. The scale of the operation is massive. There are 6,000 tanks which together hold enough water to fill an Olympic-size swimming pool, with a daily consumption of 150 cubic metres of water—which, incidentally, comes from their own natural well. And even though it's pure spring water, it's centrally filtered by biological and UV processes.

West Aquarium is situated in Bad Lauterberg, a little town set in the pine forests of the Hartz Mountains. It's a superbly scenic area and well worth a visit on its own account.

You have a unique opportunity to try to win a visit to West Aquarium by entering our competition on page 30. And if you're lucky enough to win, you're in for a treat.

You won't need British woolly underwear, for a start.

Entering West Aquarium is like walking through a door into the Amazon jungle, because the room temperature is kept at 28°C (82°F) with a humidity of 70%. It's the total environment which is controlled and there is not a single in-tank heater to be seen. It creates the perfect environment for the 60 or so species that they breed there.

Some fish at West Aquarium are still imported, from Singapore, Thailand, Hong Kong, Indonesia, Colombia and Brazil. But Tetra's aim is always to preserve natural stocks, and West Aquarium now breeds 70% of the fish it sells. They consider that each bred fish is one more that need not be taken out of its natural habitat—and is therefore a contribution to conservation. For example, *Parachanna innesi* (Neon Tetra) need no longer be taken from its home in Brazil; West Aquarium breed all the stocks they need. The popular *Barbus tetrazona* (Tiger Barb) are also totally bred in Europe, rather than imported from Sumatra.

Such a scientific breeding system means that Tetra can exercise total quality control. The captive bred specimens are the progeny of carefully selected stock, and they bear the best characteristics of their kind because only those fish which are deemed perfect from every point of view are used for breeding purposes. What's more, Tetra has been successful in introducing new colour variants such as *Barbus conchonus* (Veil), and *Barbus conchonus* × *ticto*.

Imported fish are quarantined for a minimum of 10 days for systematic diagnosis and treatment of any problems. Tetra keep the quarantine area so hygienic that everyone who enters has to have hands and feet disinfected. The health of all fish is constantly monitored and the highest importance is placed on quality control, so that the dealer (and the hobbyist) receives only healthy, first-class fish.

In addition to tropical species, you'll also find coldwater fish at West Aquarium. They handle Goldfish, Koi and other pond species, which, it seems, are perfectly happy in the tropical environment!

At any given time, there will be enough ornamental fish in West Aquarium's tanks to stretch a distance of over six miles if placed end-to-end! And naturally, they're all fed (5 times daily) on Tetra foods. This means that all new Tetra products or new formulations of existing products are based on an unrivalled knowledge of what produces healthy fish . . . and keeps them healthy.

At the outset, nutritional trials are conducted in tanks of fish specially set up for the purpose in the extensive Tetra laboratories. Batch testing of sample production packs is also conducted in the laboratory aquaria. But it's nice to know that, subsequently, every one of the Tetra foods (and treatments) is used in the very much longer term in the breeding systems at West Aquarium.

Tetra find the knowledge and constant feed-back they gain from the breeding of such vast quantities of fish invaluable. It means that specific foods for specific breeds and specific purposes can be developed to a point of superlative refinement. Today, Tetra market a total of over 100 products in the UK, and more are in development. As the Tetra men put it: "By researching nature, we produce better foods, naturally". As you look at the rows upon rows of tanks at West Aquarium, you can see what they mean.

Making the flakes

The way that Tetra actually make these foods is a fascinating story in itself. Have you ever wondered how a flake of fish food is produced? Read on.

To start with, up to 40 natural ingredients are used in



Above, one section of Tetra West Aquarium showing some of the 6,000 breeding tanks

Right, the Biological Control Department where feeding tests and quality control testing is performed on all Tetra's products



Below, part of the extensive Tetra Quality Control Laboratory



varying quantities to achieve the various different types of flake—from staple food to colour enhancer. Every single ingredient is quality-tested and analysed before being mixed and dried in large hoppers for two hours. Then, the crucial quantity of water is added and the resultant mixture applied as a coating to the surface of giant drums 20 feet long and 3 feet across. These drums are heated with steam, which dries the mixture so that it can be peeled off as the drum rotates. That gives rather large flakes—about a foot across—which are again laboratory and quality control tested. (Tetra really do take the matter of quality control very seriously indeed). Subsequently, the different colours of flake, each representing a different nutrient purpose, are accurately sized and mixed in computer controlled machinery in appropriate proportions to make up

**SPECIAL
PROMOTION**
Exclusive to the readers
of *Aquarist & Pondkeeper*



Above, Computerised Controlled Production is used to guarantee the quality of Tetra's fish foods



Left, continuous controlled laboratory tests are a feature of every production stage

Below, Tetra's Care and Remedy Modern Production lines would be the envy of many pharmaceutical companies



the various Tetra varieties. Each pack is then sealed airtight with a metal foil. After packaging is complete, there is further batch testing performed to ensure perfect nutritional balance before the foods are despatched to everywhere from Alaska to Australia.

Special foods specially made

Tetra tablet foods are *not* made from dust or waste from the main processes, but are produced from flake specially made for turning into a highly compressed tablet form. The same goes for foodsticks, like DoroMin and TetraPond, which are made by a special process of extrusion. Foodsticks are an idea uniquely developed by Tetra which has the virtue that the foodsticks float on the surface until they are eaten, and so minimise potential water pollution. Unlike traditional pellet foods Tetra floating foodsticks do

not contain indigestible 'ballast' to make them float.

All of these procedures, right through to the packing, happen with mechanised efficiency on computer controlled production lines that would do justice to a Japanese car manufacturer! If you had visions of people filling packs by hand, you couldn't be more wrong. This is big business and Tetra conduct it with great efficiency. It is this efficiency and the scale of production that brings down the price of the products even though they contain expensive and esoteric ingredients of the very highest quality. Tetra insist that quality is always the first consideration, but also maintain that they offer unequalled value for money with a product in a totally different class to many cheaper brands on the market. Tetra will not use ingredients which are waste from other food manufacturing processes. Nor will they use protein from sources foreign to the fish—such as offal or vegetable material. Tetra place great store on the 'naturalness' of their foods, which, they say, contain only those good things that the fish would find in its natural habitat.

Not just foods but treatments too

Over the years, Tetra have developed a whole range of foods, treatments and remedies. Most recently, they have introduced TetraDelica—a range of high quality freezer dried 'treat' foods for tropical and marine fish, to introduce variety into their diet. Also their new TetraMedica treatment range has been introduced to give effective and controlled treatment of virtually all the fish diseases hobbyists will ever encounter. There's also a wide range of water conditioner and treatment products for tropical and coldwater aquariums and ponds, and a complete range of highly accurate test kits.

Tetra is a specialist company putting *all* its efforts into the care and treatment of ornamental fish, and they're vehemently proud of their claim to lead the industry and set the standards for others to follow. For the purpose behind all the technology and the research is to produce products that give the aquatic hobbyists the world's best. Because, at the end of the day, the Tetra people are enthusiasts of the hobby themselves.

Back at the beginning in 1950, Tetra was started by a keen hobbyist, Dr. Ulrich Baensch. He began making fish food because he wanted an alternative to live food that was as good, but avoided the danger of introducing pathogens into the aquariums—which is always such a potential problem with live foods. At the same time he wasn't satisfied with 'artificial' or substitute foods, and wanted a combination of natural foods that was also a perfectly balanced diet. In fact, the name 'Tetra' comes from the Greek for the number 'four', and Dr. Baensch named his tropical fishfood 'TetraMin' because originally it contained four particular and essential minerals.

Now, 36 years on, the story's much the same—but on a somewhat larger scale. So next time you open a pack of TetraMin, you might like to remember the good doctor all those years ago—not to mention the millions of fish that are still testing.

Tetra Question Quiz

**SPECIAL
PROMOTION**
Exclusive to the readers
of *Aquarist & Pondkeeper*

WIN a weekend for two in the beautiful Hartz Mountains, Germany; including a visit to Tetra's West Aquarium — Europe's largest fish breeding centre.

PLUS
25 second prizes
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Win a Holiday Weekend for Two in Germany
at Tetra's 'West Aquarium' breeding centre at Bad Lauterberg in the Hartz
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You and your partner will be the guests of Tetra on a two day package which will
include . . .

- Return air and rail travel to a holiday centre in the Hartz Mountains.
- Luxury hotel accommodation, with full board.
- £100 spending money.
- A personal guided tour of 'West Aquarium' itself.

All you have to do is answer the following six questions and complete the sentence
in box 7.

1. How many cubic metres of water are used daily at 'West Aquarium'?
2. In what year was Tetra founded?
3. How many species are bred at Bad Lauterberg?
4. What is the name of Tetra's flaked food specially formulated and prepared for coldwater fish?
5. What is the name of Tetra's water conditioner that neutralises the chlorine in tap-water?
6. Name one of the three products in the TetraPond Treatment range.

7. Complete the following sentence in not more than ten extra words—

Tetra foods are better because . . .

HOW TO ENTER

1. Write your answers to all seven questions clearly on a sheet of paper.
2. Write your full name and address at the top of the paper in **BLOCK CAPITALS**. If possible, add your telephone number.
3. Send your completed entry to:
Aquarist & Pondkeeper, Tetra Competition, 58 Fleet Street, London EC4Y 1JU.

Closing date for entries is 31st August 1986.

RULES

- (1) The competition is open to all residents of the UK other than employees (and their families) of Tetra, any person connected with the Pet Industry or anyone connected with this competition.
- (2) Proof of Posting will not be accepted as proof of delivery. Responsibility cannot be accepted for entries lost or delayed in the post or offered for delivery insufficiently stamped. Damaged, defaced or illegible entries will be disqualified.
- (3) Prizes will be awarded in order of merit. In the event of a tie the best caption, in the opinion of the judges will decide the winner.
- (4) The judges decision as to the winners shall be final.
- (5) Entries will not be returnable, they and the copyright in them will become the property of Tetra.
- (6) It is a condition of entry that the rules of the competition are accepted as final and the competitors agree to abide by the rules.
- (7) No correspondence will be entered into.
- (8) All prize winners will be notified by post.
- (9) Entries must be received by 1st September 1986.
- (10) The winning solution and the names of the prize winners will be made available after 30th September to anyone applying to the competition address and enclosing a stamped self-addressed envelope marked 'results'.
- (11) Parents or Guardians signature must be obtained by all entrants under 18 years of age.
- (12) Weekend Holiday must be taken by 31st October 1986.
- (13) Prizes must be accepted as offered.

Watch out for the result in the October issue of *Aquarist & Pondkeeper*. And a future issue will report
on the winner's fabulous weekend in West Germany.



KOI SUPPLEMENT

SIX OF THE BEST
GOOD HOUSEKEEPING
GROWTH OF KOI AND CARP

Photograph courtesy of Staffordshire Waterlife

Coldwater jottings



Stephen J. Smith

Koi— a better understanding

"Koi are undoubtedly the most beautiful and entertaining of pond fish, frequently described as 'living jewels' and cherished as such by thousands of hobbyists throughout the world."

These words provide a fitting introduction to "Understanding Koi" by David Hulse and Michael George—a moderately-priced volume which will be of interest not only to the serious Koi hobbyist but also to goldfish keepers and other coldwater aquarists, as well as those who wish to get just a little more out of keeping a pond as part of a larger garden scene.

The authors continue their introduction by expressing their intent not "to delve . . . into the highly technical or scientific aspects of Koi keeping."

Thus the text is easy to understand but nevertheless manages to provide a rich source of information. All but the most obscure of questions facing the Koi keeper will be answered by this book: from pond construction to buying Koi; filtration to feeding; treatments to seasonal changes.

Key elements in Koi keeping are undoubtedly the pond and its filter system, and the construction of both is explained concisely; with a special chapter devoted to *understanding* filtration.

Varieties

Most books on Koi attempt to describe the many varieties available, with varying degrees of success. Some people still find identification something of a mystery—it is one thing identifying the type of Koi, then another trying to remember its Japanese name!

"Understanding Koi," however, gives an explanation of some of the component Japanese words before describing the more common Koi varieties.

I was extremely impressed by the several pages which followed, each comprising a colour photograph of Koi in pond settings. A keyed outline drawing beneath each photograph provides an ideal way of self-testing your own abilities of identification.

Appeal

One of the most appealing aspects of coldwater fishkeeping is the pond. As with people, no two ponds are alike and each expresses different sets of characteristics.

So, naturally, my favourite section of this book is that (eleven pages) illustrating a selection of Koi ponds.

The sparkling colour photographs are supported by concise descriptive text: my imagination was fired so much that I am thinking of cancelling this year's holiday to grapple instead with shovel, barrow and cement mixer!

I am loathe to pick fault with this publication. However, as a keen goldfish breeder I would have been pleased to see a section devoted to breeding and successful rearing of Koi. In addition, an index is, in my opinion, an essential feature in any book such as this.

Welcome addition

For its price, "Understanding Koi" is a welcome addition to the range of publications available to the coldwater hobbyist.

Whether you are an enthusiast or have just a passing interest, do get hold of a copy. I would guarantee that you won't put it down. Until, that is, you also don wellies and overalls and disappear into the garden with your shovel over your shoulder!

Understanding Koi by David E. Hulse and Michael I. George. Published by M. I. George and distributed by Staffordshire Waterlife, Rugeley, Staffs. Price £4.50.

I am indebted to Shirley Aquatics, West Midlands who kindly donated my review copy of Understanding Koi.

Problems with filtration

I have just concluded a lengthy telephone conversation with a fellow enthusiast who has recently experienced problems with his undergravel aquarium filter.

He explained that it did not appear to be working despite having been set up for about four months.



'Understanding Koi'—a rich source of information

As the conversation developed, three main factors began to emerge which, it would appear, may have combined to cause the problems:

- (i) Overstocking—approximately eight fish in a three-foot tank, including a couple of Koi;
- (ii) Overfeeding;
- (iii) Gravel too fine.

Looking at the first point, I always feel that fish thrive best when given the most space possible. As a general rule, I allow no more than one fish per square foot of surface area. Overcrowding fish can lead to stress, which in turn leads to disease, death and disappointment.

By giving fewer fish more space you will improve their growth, vigour and your subsequent enjoyment.

Overfeeding must surely be one of the most common causes of fishkeeping problems. "A little and often" has always been the golden rule. Feed very sparingly and allow the fish ample time to pick among the gravel. I also refrain from feeding them for a day or so every week. You will rarely lose fish from underfeeding!

Fine gravel is unsuitable for undergravel filters as this will soon become clogged with mulm (and uneaten food!). Gravel the size of large peas should enable water to pass through the filter bed and break down solids.

Also, when setting up an undergravel filter system, at least two or three inches of gravel is desirable. In addition, by introducing the fish at stages over a period of about four to six weeks this will enable the bacterial colony to develop gradually.

SIX OF THE BEST

KOI

Roger Cleaver faces the impossible challenge and selects six favourite Koi varieties

The task of choosing six varieties of Koi is not an easy one. In other families of fish there are usually several different species of fish all with differing habits, growth rates and methods of breeding which can attract your interest.

Koi on the other hand, although classified under differing names, are all the same fish. Their breeding, keeping and care is the same whether you have a Kohaku, Sanke or a Bekko. The interest in keeping different types lies in their great variety of colours and patterns. You can

see a pond with several of one variety of Koi in it but none will be alike; each is a unique fish.

At present there are about 100 varieties of Koi for you to choose from but the following are some of my own personal favourites.

Kohaku

Without having to stop and think my number one choice is the Kohaku. The Japanese have a saying that "Keeping Koi begins with the Kohaku and ends with

the Kohaku". In this country, however, beginners seldom appreciate the beauty of these simply coloured red and white fish, but after keeping Koi for a few years, Kohakus grow on you and you are always on the look out for 'the good one'!

Several factors have to be taken into consideration when looking for 'the good one'. The first is colour. The white base should be as pure as possible, like freshly fallen snow. The colour of the pattern, the red, should be as intense as possible. In recent years the Japanese seem to have a liking for a strong orange-red but most people in the UK still prefer the traditional crimson-red types. The edges of the pattern should be sharp and clear, and this is the second point that you should be looking for in a good Kohaku.

Next, the pattern itself. With every fish having an individual pattern, there is no ideal standard to look for but there are certain points which do make for a good Koi. First, it should have a marking on the head. This mark, however, should not reach to, or below, the eyes and should finish short of the nose. The body pattern should finish before the tail so that an area of white is visible. Except in a few instances, body patterns which are in the form of patches or steps are more highly regarded. It used to be thought that this pattern should only be above the lateral line but, nowadays, it is permissible for a good Kohaku to have a pattern which spreads below this point. A final point to be looking for is that on no account must Kohakus have red markings in any of the fins.

All around the world in Koi-keeping circles a good Kohaku is what people want to own. The contrast of the red and white has always been appreciated by the Japanese as they are their national colours



Kohaku
(Photo: Kent Koi Co)



Aigoromo
(Photo: Kent Koi Co)



Tancho Sanke
(Photo: Kent Koi Co)

and they regard the Kohaku as one of the three great varieties of Koi. Probably more Kohaku exist than any other variety of Koi today. Many people believe that a pool, to look right, should have two or three Kohakus for each other Koi housed.

Aigoromo

Second in my choice of Koi would be the Aigoromo. It is only in the past few years that these beautiful Koi have been seen in the UK. In Japanese 'Ai' means reddish-blue and 'goromo' means robe. Koi of this variety are similar to the Kohaku in that they are white fish with red patches, but with this one, there are also blue markings on top of any red body pattern. The points to look out for when considering Aigoromo are that the 'Hi' or red pattern should be a deep red in colour and that there should be many large blue or indigo coloured spots within the red markings. Any red on the head will not have the blue spots on it. This Koi is obtained from breeding a male Kohaku to a female Asagi, which is a blue fish.

Tancho Sanke

Another tri-coloured Koi is next in line; this time the Tancho Sanke. Tancho is taken from the national bird of Japan, the Tancho Zuru, the Red Crested Crane. This crane is completely white except for its red crest and any Koi having only one red patch on its head and none on its body is called Tancho. Sanke means tri-colour, therefore a Tancho Sanke has a white body with black patches on it and a single red patch on its head. The points to look for are: A good pure white body as in the Kohaku.

The black markings should be intense and not too large or too many, although a large shoulder patch is quite acceptable. The pectoral fins should both have stripes on them but, again, pure white ones would still be acceptable, one striped and one white is not. The red marking on the head should be large and a deep red in colour. None of the red should extend onto the shoulder and it should ideally stop just above the eyes and just short of the nose. Good Tancho Sanke are very hard to find but are well worth the search.

Shiro Utsuri

Shiro Utsuri is my fourth choice. Shiro means white and Utsuri means reflection. This then is a black Koi with white markings. The white should be a snow white and contrast clearly with the black. The black wants to be very intense and the white patterns should be fairly large, un-speckled and evenly distributed along the fish. The head, ideally, should give the impression that it has a black lightning shaped marking running across it, or if not, then a 'Y' shaped one. Both pectoral fins need to have 'Moto Guro' on them. This means that they should have black at the base where it joins the body. These Koi have become very successful in shows in Japan recently, almost rivalling the Kohaku, Tancho Sanke and Showa Sanke, the great three, in popularity.

Hariwake

The four Koi mentioned already are all varieties which are non-metallic, but my final two are both metallic types. Firstly I would choose the Hariwake. These are two-coloured fish of the Oghon

strain of Koi. Usually they are yellow and white in colour but both orange and white and gold and white forms exist. The main requirement of these Koi is that, whatever colour the head is, it should have no blemishes on the colour. The yellow pattern on the body should have clear edges and be well distributed across the whole body. These Koi look especially good if they have Doitsu scaling. Doitsu means German scales and this type of Koi has only rows of large mirror-type scales either along its dorsal line and lateral lines or just along its dorsal line. This type of scaling was produced when the Japanese introduced some German Mirror Carp into their breeding programmes. Doitsu metallic Koi have a very rich metallic lustre.

Kujaku

My final choice is the Kujaku, which translates as 'peacock'. These Koi are particularly varied in their appearance but are all highly metallic multi-coloured fish. Usually they are a combination of white, silver, grey, black and either orange or red. Again you are looking to see that any colours on the head have no blemishes on them and that all the body colours are bright and intense. With such a variety of colour it is hard to be specific about how a Kujaku looks but when the colours are bright Koi of this variety really stand out in any collection.

Having chosen my six varieties there is one final point I would like to make. All Koi are the same, as I stated at the beginning, and although I have been describing what makes a 'good Koi' you should always remember that any healthy Koi, of any variety, if it gives you pleasure, is a good Koi.



Shiro Utsuri
(Photo: Kent Koi Co)



Doitsu Hariwake
(Photo: West of England Aquatics)



Kujaku
(Photo: Kent Koi Co)

KOI SUPPLEMENT

GROWTH BIOLOGY OF KOI AND CARP

Growth is a complex affair, as Dr. Peter Miller of Bristol University demonstrates in this fascinating insight into the processes involved in Koi and their nearest relatives

Koi and the Common Carp seem pools apart but, under the skin, they are one and the same species, *Cyprinus carpio*, and the wealth of biological data for wild and farmed carp deserves the attention of Koi (ornamental carp) enthusiasts.

One essential of carp biology, as in all living things, is growth. Its value for Koi goes back to their wild ancestry, when reproductive success depended on reaching a certain body size. For their keepers, Koi growth is obviously a vital component of prize-winning appearance as well as tangible proof of pet well-being. To improve the result, we need some understanding of the process and its control.

There are scientific definitions of growth but the popular ways to monitor fish size are by stretching the arms (length) or giving at the knees (weight)! Both are related but not simply, so that, when a carp gets longer, a progressively smaller addition to length will produce the same increase in weight, other things being equal. This is an 'exponential' relationship between length and weight. Actual values in the technical formulae connecting the two usually differ between stocks of carp and have to be determined by

'Clarissa' lived for twenty years in London Zoo Aquarium. She did not grow significantly in body length but lost about 40% of her body weight during this period. (Photo courtesy of London Zoo Aquarium)



measuring and weighing a goodly sample of fish. In carp, these studies show that body proportions will change with size, so that larger fish have relatively deeper bodies but smaller heads. Carp which stay slimmer may reach a greater maximum length.

The relationship between body length and weight also indicates 'condition' which can vary for the individual carp over the year, most notably in females maturing heavy ovaries, but also as a reflection of feeding and fattening success, and is usually highest in autumn. The practical point behind all this is that larger carp may suffer considerable condition loss without actually shrinking in length. 'Clarissa', the rod-caught record carp kept at London Zoo, was much the same length after twenty years in a tank but only about 60% of her original 44 lbs. So, to chart a fish's progress, one really needs to know weight as well as length.

Limits to growth

Once started, must carp stop growing? Despite tradition, modern views on fish growth envisage a limiting size which is approached at a progressively diminishing rate. However, species vary and carp seem among those where maximum size is set more by environment than by genes, so differently sited populations show very contrasting growth patterns. Thus, in Nigerian carp culture, two-year-old fish have reached a mean weight of 3.6 kg while, in a Japanese farm, carp of the same age averaged 0.93 kg, in turn very different from a local wild value of merely 0.23 kg. Similarly, maximum sizes for the carp vary over its geographical range in nature. Although no rival to a legendary 125 lb Dnieper carp, one of over four feet in length and 50 lbs weight is reported from Clarissa's home, Redmire Pool, Herefordshire, where the capture of a number of large carp suggests a very favourable growth environment.

To consider how carp growth is influenced by the overall environment, we need to think of our favourite Koi as a transducer which receives energy and material (food) and then converts this into work (such as swimming) or structure (body and reproductive organs, fat stores). There is also a requirement for systems maintenance, so that scope for growth may

be affected by both input and other body commitments. It is important to remember that all the life-processes of a carp—build-up (growth) and break-down (work)—are made faster by increasing temperature, within the tolerance limits of the species. Nevertheless, an initially enhanced growth-rate may not necessarily result ultimately in the biggest fish, which might be among carp growing more slowly but doing it for a longer time.

A balanced diet

Starting at the beginning, growth needs food in both suitable quantity and quality. In domestication, Koi are not deliberately underfed but carp growth in the wild may be affected by seasonal changes in food supply. Lake soil texture is believed to influence growth by limiting the availability of food obtained by grubbing on the bottom, since carp can penetrate over 12 cm into a silty deposit but not more than half this depth in a more clayey substrate.

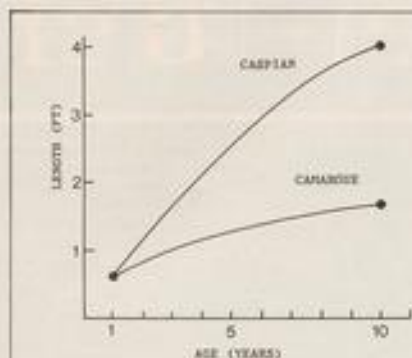
Food quality is a problem which Koi-keepers often solve by devising their own recipes. It should be borne in mind that carp are naturally omnivorous, not purely vegetarian, and that the best build-up of body tissue in carp has been found at diet protein levels of almost 40% (dry weight of food). Young carp grow better on varied live-food such as Infusoria, *Daphnia*, and brine-shrimps, not to mention bloodworms and even water-boatmen. Any balanced diet should contain moderate protein, such as egg yolk and casein, to give the carp the ten or more amino-acids required, as well as fats, such as soybean and cod-liver oil, vitamins and minerals.

Some artificial mixes are easily digested and absorbed but, if carp are left to satisfy their hunger on algae and detritus, protein gain is low and as little as 10% of the food swallowed will be absorbed into the body. Under natural conditions in summer, daily food intake can be about 4% of body weight but, given the chance, carp will guzzle almost 20% of their body weight in a delicacy like fish-roe within a few hours.

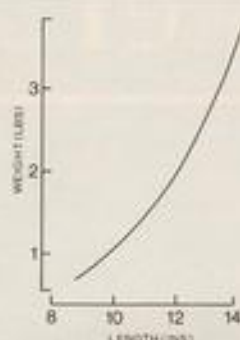
Temperature and stress

Carp hunger depends on fullness of the gut which empties much more rapidly at higher temperatures. However, although

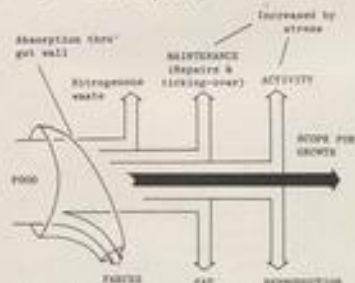
KOI SUPPLEMENT



Growth differences between carp stocks from the Caspian area (average 4 ft. at 10 years) and the Camargue (1.6 ft. at 10 years)



Relationship between length and weight in carp from a Polish stock. Note that stocks vary, so don't use this to read off weight from length for your Koi



How the energy and material of food eaten by carp may be diverted from scope for growth. Width of arrows not in proportion



The Koi environment—a view near Nagaoka, Niigata Pref., Japan

carp will eat more in warmer water, this greater quantity of food may not be converted so efficiently into carp flesh despite an obviously boosted growth rate. You will get more Koi for the same amount of food, albeit more slowly, in rather cooler water. They might live longer, too.

With a system primed, before growth can take place, some of the absorbed nutrients must be used for body maintenance and carp may need more calories for this in captivity than in the wild. To survive, the carp also needs to do both mechanical and chemical work in feeding, swimming, gill ventilation, blood circulation, osmoregulation, etc. The energy required for all these purposes is increased, and scope for growth decreased, as temperature rises towards the uncomfortable warm.

A stress factor, too, can form an energy drain. For example, carp from the same parents may be 5 g or 3 kg at the end of a year, depending on stock density, and growth is affected by ammonia levels, especially above pH 7. Having seen turbid rearing ponds in Niigata, Japan, I wonder how much growth is lost by keeping Koi in crystal clear water?

Reproduction and growth

Apart from building fat rather than flesh, perhaps the most obvious diversion of energy and material from growth is caused by reproduction, which needs nutrients for maturation of eggs and sperm and for fuelling the activities of spawning. Growth rate declines noticeably at sexual maturity and may be negligible during the breeding season. In ripe female carp, the ovaries, taking precedence over body growth, can reach at least a quarter of the fish's total weight.

As carp get bigger, their physiology changes. The speed of body processes, including growth rate, diminishes and larger fish seem more susceptible to stress—gill movements fluctuate more with temperature and tolerance of warmer water is somewhat reduced. At the other extreme, very small carp may attain a growth rate of 35% per day, eating more than body weight each day

to do so.

However, being big must help reproductive success. Larger carp can push harder in a spawning shoal to reach the most desirable mate and mix their gametes. For females, number of eggs produced increases exponentially with body size. Thus, in one population, carp of 35-40 cm had about 180,000 eggs while those at 65-70 cm, not more than twice the length, yielded almost three times the number of eggs (about 525,000).

Improving growth rates

Improvement of carp growth can be made by altering the growth control system and by making the existing system more efficient. In theory, the system can be changed by picking carp of different genetic stock, but the genetics of carp growth has still to be unravelled, although certain stocks do seem to show heritable traits in this respect. Chinese carp grow better than European carp under severe competition for food and vice versa. Hybrids grow best and inbreeding has been found to reduce growth by 10-20% in offspring. In Koi culture, any selection for good growth potential may have to compromise with that for coloration.

On a shorter time-scale, the growth system can also be modified by use of hormones. Bovine pituitary growth hormone has greatest effect on carp when administered above the optimum temperature for growth (said to be 30°C), suggesting that the carp's own growth hormone is less effective at high temperatures. Anabolic steroids, as used in human body-building, also enhance growth in carps.

Selective breeding and hormone courses are lengthy and expensive. For various reasons, the only practicable way for the amateur to promote Koi growth is by trying to maximise the scope for this in the fish to hand. One aim must be for optimal food quantity and quality, relative to temperature and activity of the fish, remembering that carp may wish to feed several times a day if temperature is raised to encourage growth, and that the diet should be balanced, not just spinach or best steak!

Reduction of stress from crowding, poor water quality, or other factors, will mean that less energy is dissipated and scope for growth thereby increased. Maturation of the reproductive organs, and other breeding distractions, as a drain on growth potential, is more difficult to curb. Theoretically, one could embark on the major constructional effort of covering the pool and controlling day-length, or the outlay and stress of hormonal treatment of the fish. Perhaps having grown so well on an ample and sensible diet in peaceful and clean surroundings, the Koi should be left to their natural pleasures.

KOI SUPPLEMENT

GOOD 'HOUSEKEEPING' FOR KOI-KEEPERS

Building a Koi pool is one thing—keeping it in tip-top condition is another. John Cuvelier provides some practical suggestions for trouble-free pond maintenance

Having got your pool built, stocked, and working correctly, there are many ways in which you can maintain this happy state. Most of the following suggestions are based upon simple common sense, and hopefully some will be completely new to the less experienced among our readers.

Probably the most important but often sadly overlooked 'housekeeping' task is that of regular waste removal both from the pool and the filter system. Heavy fish waste, uneaten food which settles on the floor of the pool, (there shouldn't be any of the latter, but usually some gets missed), the odd bit of dead vegetation, etc. can decompose with unbelievable speed and, if not removed, will lead to all kinds of problems. What's more, there are no carpets to sweep the rubbish

under! It has to come out!

Many Koi-keepers labour under the impression that having fitted bottom drains to their pools, their waste removal problems are over. Not so! I have yet to see a bottom drain with sufficient suction to remove waste matter more than a maximum of three feet distant. What bottom drains do in an excellent fashion is to remove the so-called 'dead water' from the deeper parts. Efficient waste removal calls for rather better methods.

If the geography of your pool permits the use of a syphon for cleaning purposes, well and good, but a more efficient and 'user friendly' method is by using a vacuum pump, but care is advised in selecting the one most suited to a particular situation. Some available are cumbersome in the extreme, consisting, as they do, of a heavy pump with priming pot and strainer basket, plus aluminium pole with a separate suction hose connected to a brush, the whole thing weighing a ton and a half, and that's before the hose fills with water! If your pool has a healthy growth of algae or blanket weed, you will find it necessary to shut down the pump several times during the cleaning period just to clean out the strainer pot—not funny!

The pump I have used for some six or seven years went under the name of 'Jabsco' when purchased, but I believe these are still available under another name. Throughout the summer months, this pump is in daily use and has not yet required the fitting of the spare impeller I bought with it! How's that for reliability? The impeller is made of neoprene and is quite capable of sucking up and spitting

out small pieces of gravel, and, of course, this pump is self-priming; just stick the pipe in the water and switch on! This type of pump also makes the task of cleaning settling tanks and filter voids absolute child's play. The water removed during cleaning is replaced by mains water which takes care of the water change function at the same time.

Talking of water, I have always made a practice of having a continuous 'top-up' supply running; not a lot, perhaps 150 gallons per day into 8,000 gallons. Owners of small pools should reduce the amount considerably as the dilution 'buffer' in the event of a slug of chlorine (or other undesirable additive which can appear from time to time in our mains) shrinks in proportion to pool size. One interesting point about mains water supplies: during winter, the temperature of mains water is always a few degrees above air temperature and in summer, the reverse applies; good news for pool and Koi!

My next topic is one which never ceases to create controversy whenever Koi-keepers get together: **Algae and Blanket Weed!** When the weather is very sunny and there is no shade in the pool, Koi can become very distressed and even suffer from sunburn! No, I'm quite serious. For this reason, I always favour water with the merest tinge of algal green to it as this undoubtedly filters out the more harmful elements from sunlight. Careful balancing of filter flow rate will assist in obtaining the correct 'mix', though it must be said that the majority of calls for help received every year are from folk who cannot see more than an inch or so into their pools! Perseverance is a blessing. You might struggle for months trying to get the water just right, then virtually overnight, Bingo! as if by magic, all is perfection. The process cannot be hurried.

My concrete pool has a six-to-eight-inch growth of blanket weed on the side walls

My long-serving 'Jabsco' pump, still available, I believe, under another name



KOI SUPPLEMENT

all year round, (but not on the floor!) I would not have it any other way. For one thing, it looks and is, perfectly natural and is teeming with animal life, a perpetual source of natural food for my Koi. In fact, you can almost see them grin after they've completed a 'dig' amongst it! If your only interest is the visual appreciation of Koi, by all means clean the weed away, but I feel there is more pleasure to be derived from a natural-looking pool than is to be gained from a clinical tank sunk into the ground! There are chemical products for removing the weed, but take care. You are, after all, upsetting nature's balance. Do so at your peril, or rather at the peril of your Koi. All dead weed must be removed before decomposition sets in or you could have a major pollution problem!

If during the designing of your pool, you were perceptive enough to include a watercourse in your design, a very prudent bit of 'housekeeping' is to plant some Watercress along your stream. Not only does the rooting system of this plant act as a superb filter, it grows very rapidly and helps the human's food budget at the same time, seeming to taste far superior to the shop-bought stuff. Just come along and ask my neighbours!! Even if you don't possess a stream, it is possible to plant Watercress in your filter, but be



Watercress and other plants in a watercourse are good consumers of nitrates and act as a superb natural filter

warned, it is remarkably invasive and can quickly take over the complete system. It feeds, incidentally, on the very chemicals we wish to get rid of from pool water, as does the Water Hyacinth, but does not cost around 90 pence per plant,

as does the latter!

These have been just a few hints and tips to make the hobby of keeping Koi the pleasure it should be. By getting to know as many fellow hobbyists as possible, you will learn much, much more.

Gordon Low

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Discus

A question of hardness

I intend setting up a Discus tank. Our tapwater is in the 120-150 hardness range. Because rainwater is on the scarce side, I will have to supplement it with other water.

To alter the hardness to the correct level, I want to make use of the resin that is available for ordinary home water softeners.

Could you please give me your opinion on this matter.

Although you do not say whether the 120-150 range of your tapwater means ppm or uS, I presume that you mean ppm. At 120 or so ppm the water is certainly 'soft' enough to keep or raise Discus fish to adulthood.

Resins used in home water softeners are not suitable for fishkeeping; they are ideal where a great deal of detergents are used like laundries, dishwashers or even a lovely bubble bath. This 'neutral' exchange does in no way alter the salt content of the raw water and often makes a 'bad' water even worse.

There are a great number of ion exchange resins available but not every resin is suitable for fishkeeping. The often-used systems in Europe are either a mixed bed cartridge which, when exhausted, is

either discarded or exchanged by the manufacturers/distributors for a new one, or a two-column unit which can be regenerated by the user.

The first column usually contains a strongly acidic or weakly acidic cation resin which will exchange any hardness for an acid and the second column contains usually an isoporous or macroporous weak base anion resin for the removal of the acids from the water. Although these units are often very expensive, they have almost an unlimited life.

I suggest that you get in contact with one of the water softener firms in your county and they should be able to offer you a resin suitable for fishkeeping.

Marine Starting up

I have several years experience as a tropical freshwater aquarist but now wish to start my first tropical marine aquarium.

I intend using a 48 in. x 15 in. x 12 in. all-glass aquarium and undergravel filters covered by coral-sand. The U/G filters will be operated by two power-heads, each having a turnover rate of 250 gallons per hour. Heating will be by two 150-watt heater/thermostats set at 76°F. I shall decorate the tank with large dead

coral-heads. Aeration will be by two wooden diffusers.

Please would you answer the following questions:

- (1) As a beginner, I understand that my first fishes should be either Damselfishes, Snappers, Triggerfishes or Dragon fishes. From this choice I have decided for the first six months to keep only one common Dragon fish. Is this a good choice?*
- (2) Could I add a Royal Blue Trigger or Picasso Trigger and one or two Snappers at a later stage?*
- (3) Would a protein skimmer help?*
- (4) What lighting do I need?*

(1) I normally recommend Damselfishes as the hardiest of all coral fishes and, therefore, the most likely to survive a newly matured filter-bed in the hands of a raw beginner. The reason for this is that even after maturing your coral-sand filter bed, toxic nitrites are still likely to put in an unwelcome appearance in the early weeks of the new system's life due to the beginner's unwitting tendency to overfeed—in both the amounts of food offered and frequency of feeding alike. However, as you have already been advised, there are some larger show fishes which are almost as tolerant of nitrites as are Damselfishes—and to your list one could add most species of Groupers. Provided that the new *Pterois volitans* (Common Dragonfish or Lionfish) is treated with a

protozoicide during the early nitrite-toxic period and that feeding is kept to the minimum level necessary to sustain the Dragon fish's basal metabolism, all should be well.

(2) Additional stocking

You must bear in mind the fact that your aquarium only has a gross capacity of 30 gallons. After making due allowance for seawater displaced by the filter-bed corals and any calcareous rocks (e.g. Tufa) which you may add, you are unlikely to have more than 27/28 gallons of actual seawater. The normal stocking ratio recommended for beginners using undergravel filters only, i.e. not using an external or internal power-filter as well, is 1 in. of fish (measured from the tip of the nose to the tip of the tailfin), to each 4 gallons of seawater. From the above, you will see that you only have room in your aquarium for a maximum of seven inches of fish. Even in an aquarium of only 28 gallons, a *P. volitans* could quickly grow to five inches long. You would, therefore, only have room for one other 2 in. fish and a Picasso Triggerfish (*Rhineacanthus aculeatus*), which has the ability and the wits to hide from a hungry 5 in. Dragonfish by locking its dorsal and ventral spikes into a crevice, would be the best answer. Both these fishes are voracious feeders however, and until you obtain a powerfilter, I strongly suggest that you use

each 25% partial water change as an opportunity to flush away from the coral-sand filter bed as much of the non-biodegradable material as possible.

(3) Protein skimmer

These devices use micro-diffused air to float off nitrogenous wastes as a foamate into a detachable cup. The cup is emptied periodically as it fills with the dark-brown concentrated wastes. Ultimately, with two heavy feeders such as a Dragon fish and a Trigger fish, you would find a protein-skimmer extremely helpful in reducing the frequency of partial water changes. In terms of the savings to be made on the cost of synthetic seawater purchases alone, you could expect to recover the cost of the protein-skimmer over 18 months to two years.

(4) Lighting

All Dragon fishes quickly become very tame and fearless in captivity. This quality, linked with their predator's voracious appetite, means that every time you or anyone else in the family goes anywhere near the aquarium, the hungry fish will go to the surface of the water eagerly expecting some food. This behaviour, i.e. floating head up just below the meniscus of the seawater, is totally abnormal and never occurs in nature where the fish is accustomed to trapping its prey in mid-water and never



Damsels, such as this Yellow-tail, are among the hardest species available and are, therefore, ideal for beginners

at the surface. If, therefore, you were to use a fluorescent tube having a relatively high ultra-violet light component, damage could be done to the fish's retinas and blindness could result. For this reason I recommend the use of two 36 in. 'Northlight' tubes only. More light than this is unnecessary in a 15 in. deep fish-only marine aquarium.

Koi

Koi deaths

I am keeping both my Goldfish and Koi in 60 gallon tanks at about 56 degrees. Recently I have bought 8 new Koi which are now with the other 30 to 35 fish. After 3 days one Koi died and a week later 2 more. I then started

to lose my Goldfish on a regular basis. The symptoms are that they are weak and swim on their sides bumping into objects and slowly die after about a week. When the fish are removed scales are missing.

I have treated for both flukes and bacterial infections but the fish continue to die.

The tanks are filtered and a 450 g.p.h. garden pump is used to run the filter.

I would appreciate any advice as I do not want to buy more fish until I know what caused the high death rate.

I am sorry to hear about your problem with fish losses. Unfortunately, it is not one which is easy to diagnose from the information in your letter, but I hope I can give you some ideas to investigate.

You state that the fish are kept in 60 gallon tanks but

you do not say how many fish (nor what size) are kept per tank. The first thing that I would check is the water quality in each tank, especially the nitrite level of the water. It is very easy to poison fish if they are kept too many to a tank. Even with filtration, I would not recommend that you keep more than 3 in.-4 in. of fish per square foot of surface area when keeping fish at the temperature of 55° and above. Overcrowding is one of the most common faults when keeping fish indoors and it can be a big killer.

If the water is at fault then a change of water is called for immediately. Regular changes are a must when keeping fish in tanks in order to keep the water healthy.

Your letter also states that you are using a 450 gallon per hour pump on the tanks. This pump must be creating an extremely quick turn-over of the water and I would imagine that the fish are being subjected to stress due to this action. Stress is also one of the biggest killers of fish. Large turn-overs of water in small containers will cause the fish to suffer through being buffeted about, which could be the reason for scales to be missing from your fish.

Another problem of fish in confined spaces is that infections will tend to multiply more quickly. In your letter you state that you have treated for flukes and bacterial infections, but you do not say how or with what. Are you sure that the correct level of treatment was used? Although it may sound obvious, if the correct dosage is not given then little or no effect will be made on the trouble and it will continue to multiply and attack your fish.

The symptoms you describe of being aimless and bumping into objects can apply to a great many fish problems, including the ones named above and the ones you have treated for. I am sorry that I cannot be more specific. Your local aquatic shop may be able more readily to identify your particular trouble if they could see your set-up; it is worth asking them to come and have a look as all good aquatic businesses will try to help out customers if they can.

Next month

COMING UP IN SEPTEMBER

- Glen Melhuish recalls his eventful fish-collecting trip to Lake Tanganyika
- Derek Lambert of the Southern Livebearers Aquatic Group (UK) throws new light on guppies, past and present
- Dr Michael Benjamin writes about one of his favourite fishes, the much-loved and often maligned stickleback
- Part 1 of a super competition sponsored by John Allan Aquariums Ltd

Specially commissioned features including useful tips for beginners round off our information packed issue



This photograph is almost certainly the first one ever taken of a living *Ctenopoma nobilis*

CTENOPS NOBILIS

THE RAREST ANABANTOID

A small consignment of this rare anabantoid was imported into the UK in May 1986. David Armitage of the Anabantoid Association of Great Britain was fortunate enough to obtain some specimens and presents the first report ever published on this species in a UK magazine, accompanied by what is probably the first-ever colour photograph of a living specimen

This photo is possibly the first to be published of a living *Ctenopoma nobilis* in colour. Reputedly very hard to obtain in their natural habitat and difficult to transport, over 100 specimens of this species were imported into England in May 1986. These preliminary notes are therefore designed to assist those lucky enough to have obtained stocks.

The fish was first described by McClelland in 1845, calling it *Ctenops* or 'comb face,' because of the perforations in front of the eye. Its specific name means 'well known' which is scarcely appropriate in view of its current obscurity. Before 1965, the Croaking Gouramis, *Trichopsis* were also known as *Ctenops*, but Liem at Illinois decisively separated *C. nobilis* from the species of *Trichopsis*, based on his X-ray studies. He, nevertheless, recognised the close relationship of the two genera.

Ctenops is normally described as coming from the Brahmaputra basin and the Ganges delta, with the limits of Dibrugarh in the north east and Calcutta in the south west. Ladiges was more specific, listing Assam, Raimona, Goalpara district and River Janali. Like most anabantoids, it was said to favour thickly planted habitats, occurring near river banks. How-

ever, Mayland said he found them in rivers with a stony bed and mentioned that they would hide away between large pebbles. He quoted a temperature of 18-22°C, a pH of 7.5 in water of very low hardness and conductivity, and guessed these fish must be quite adaptable as the high water brought with it much higher temperatures.

Ctenops grows to 10 cm; my specimens are 5-7.5 cm. It has a long, narrow body, a short-based dorsal fin which is situated toward the rear of the body and a pointed snout. The overall colour of the fish is brown with a silver chest and a silver line running from the eye to the tail. All the fish I have seen have a red or dark brown margin to the fins and a more or less distinct black spot surrounded by a clear area just in front of the tail and above the mid-line of the body. It has been suggested that the colour of the fin margin and the presence or absence of the spot may be indicators of sex. Certainly, in both my fish and those of Anabantoid Association members Chris and Denise Brook, it appears to be the smaller fish with red fin margins and clear dark spots that dominate the larger individuals with blotches rather than spots and with a brown fin margin. The colour of this species can darken and then it has the

marbled pattern of the Chocolate Gourami or *Ctenopoma oxyrinchus*. It can also turn very pale so that only an irregular pattern of spots is visible on the body. These spots are also visible on the fins at all times. Older specimens have serrated (saw-edged) tails.

Ctenops is reputed to make jumps of up to 25 cm out of the water after aerial insects. Apparently, it treads water then curves its body into an 'S' before leaping. My fish haven't displayed any aerobatics yet, but they do spend a lot of time swimming just below the water surface, back arched. They tend to drift in the aquarium in the manner of many predators and, when netted, offer hardly any resistance, appearing to be weak swimmers. As if to compensate, their eyes are highly mobile, constantly swivelling in their sockets like those of that other stealthy hunter, the chameleon. In the aquarium, they take flake, frozen food and livefoods, including *Tubifex* and earthworms, from all levels.

As to behaviour in the aquarium, after keeping the fish for only a month, I can, as yet add only a little to the current lack of knowledge. I can, however, testify to the extreme territoriality of the species in confinement. In a 60 cm tank, one small specimen soon claimed it for its own. In threat display, one fish initially approaches on its side and a little below the other and the usual lateral display follows, with body flexed and fins flared, as occurs with the Croaking Gourami. As for breeding, you'll have to wait for a future article. For the moment we can only guess it may build a nest for its sinking eggs, under a leaf or at the surface, like *Trichopsis*. It may turn out to use bubbles, it may build out of vegetation only, it may even be a mouthbrooder. If we can keep this species in captivity long enough, we are bound to find out and make another hobbyist's contribution to the science of ichthyology.

I can't finish this article without thanks to Chris and Denise Brook for information on their fish, to the Pet Shop of Pests Wood, Studio One, Southend, and Thames View Aquarium for supplying specimens, and to Allan Thompson for his review in the Anabantoid Association's Newsletter. Further information on related fish is available with S.A.E. from Ron Wright, 141 Military Rd., Colchester, Essex. I will round off with a complete set of references from the draft bibliography on the Anabantoidi by Steve Norris of Oklahoma.

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Company profile

There can be few sights more likely to stir the emotions of coldwater fishkeepers than a collection of large, healthy, colourful, tame Koi circling peacefully and elegantly within arm's reach.

If this describes how you feel about these majestic fish, there is a real treat awaiting you at Kent Koi Ko. Deri and Glyn Evans have, literally, hundreds of pedigree Japanese Koi, selected personally by them, on show in three large crystal-clear pools at The London Koi Centre near Sevenoaks in Kent.

It is next to impossible to select a clear favourite from the collection of two- and three-foot fish swimming leisurely and gracefully in these ponds, but if there is one, it must be the strikingly beautiful Gin Rin Showa Sanke that graces the front cover of the magazine this month.

This fish has become so famous, owing to the number of major awards it has won in Japan, that most serious Koi-keepers in the UK at least know of its existence and will, no doubt, visit Kent Koi Ko just to see it 'in the flesh'. (See Cover Story).

There is, of course, much more than just pedigree Koi in this specialist centre. You can, for instance, buy colourful small specimens for under £4. The chances are, though, that you will soon embark on a life-long association that will lead from one thing to another until you end up with a fully kitted out Koi pond.

If that is the case, then the centre can supply you with everything you need from books and food to complete pond systems. You might even succumb to temptation and go for one of the pedigree specimens valued at several thousand pounds! There certainly seems to be no shortage of takers—most of the fish in one of the pools were already sold when we visited and were just awaiting collection once the buyers had finished their ponds.

Kent Koi Ko is one of three companies owned by Koi (UK) Ltd. The other two are: Kent Koi Construction and Nishikigoi Holdings.

The former runs a pond and filter design service incorporating pond installation anywhere in the UK. This company has its own GRP (Glass Reinforced Plastic) unit capable of producing fibreglass laminate on site. The great advantage of this facility is that Graham Raper and his team at Kent Koi Construction can coat any hole, irrespective of shape or size, on the spot and can, therefore, tailor the product to fit a client's exact requirements.

Nishikigoi Holdings owns a four-acre farm, run by Roy Johnson, set aside exclusively for breeding and growing on Koi under British climatic conditions. While the farm is already producing stocks for sale, it will be some time yet before

Kent Koi Ko

Part of the large pool at Kent Koi Ko brimming over with quality specimens. All the numerous multi-coloured types of Koi in existence today have been developed from single-coloured Magois such as this one. This magnificent specimen measures 3 feet in length and is, therefore, nearly full-grown.

'Japanese-quality' fish can be produced on a regular basis.

As many people know, and others suspect, Koi farming is a slow, patient, painstaking business. You really can't hurry it along. Glyn Evans points out: "The Japanese have been doing it for generations—we (Europeans) are just beginning."

Kent Koi Ko has come a long way since it started life just over four years ago. 1984 was a particularly good year—the company moved to its present site, adjacent to Polhill Garden Centre, and won the two top awards at the national show, Koi '84.

Further developments since then include membership of the All Japan Nishikigoi Dealers Association, achieved as a result of Glyn's growing reputation built up through his four-times-a-year visits to Japan. A rather prestigious spin-off from

this is that Glyn has recently been invited to judge at the All Japan Nishikigoi Show in Tokyo next January—an offer he really can't refuse.

Once he comes back from that trip, alterations will be made to the present premises to cater more comprehensively for disabled visitors. At the moment, things can be a bit awkward, although help is always at hand. Even before next season begins, though, there will be all-round access for wheelchairs. This will, of course, increase the already considerable number of visitors even further and will represent the fruition of improvements that the company has been wanting to implement for some time. Hours of opening will, however, remain unaltered i.e. 10.30 a.m. to 6.00 p.m. seven days a week.

For further information, contact Deri or Glyn Evans, or Nicola Chapple, at Kent Koi Ko, London Koi Centre (adjacent to Polhill Garden Centre), London Road, Badgers Mount, Sevenoaks, Kent. Tel. (0959) 33567.



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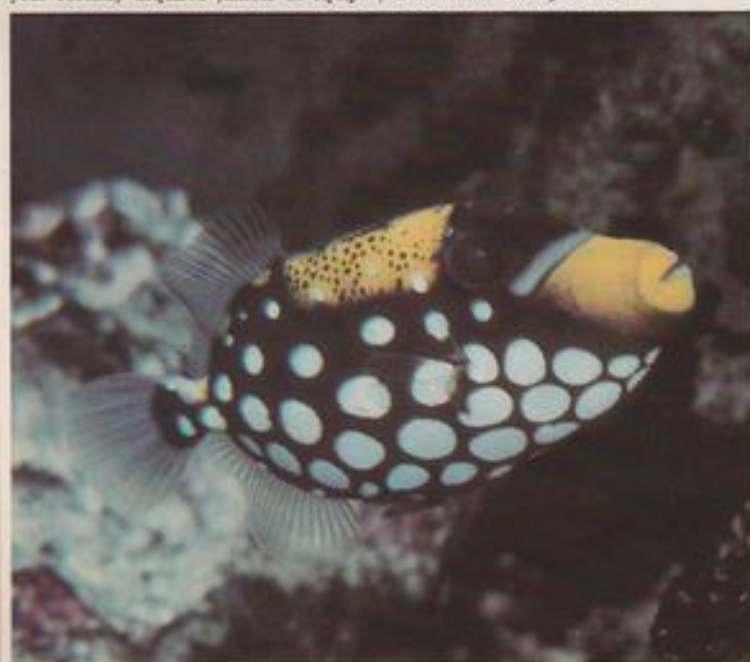


ARE YOU STILL **AFRAID** OF MARINES?

Gordon Kay and Dave Garratt of the B.M.A.A. and W.M.M.A.G. embark on stage two of their occasional series aimed at beginners to the tropical marine hobby

In our first article (*Are you afraid of marines?*—*A & P*, April, 1986), we discussed some of the basic principles and laid down some simple ground rules for the successful culture of marine animals. Now is the time to transform your recently acquired jumble of equip-

ment into a home befitting those colourful beauties which captured your imagination in the first place. Hopefully, along the way we will dispel further the myth that marine aquaculture is for scientists and millionaires but way beyond the scope of mere mortals like you and us.



Once a tank is fully mature, even expensive, spectacular species such as this Clown Trigger (*Balistoides niger*) can be kept successfully

SETTING UP

1

Before we can even start on the tank we need to begin the lengthy process of preparing coral skeletons and shells for safe use in the aquarium. First leave them in a bleach solution for three or four days then soak them in clean water for about a week, changing the water daily. After this they should be boiled until all smell of bleach is gone.

2

When the corals and shells are ready, place the tank on its stand—which should be capable of carrying the tank, water and rocks etc.—using $\frac{1}{2}$ in. thick polystyrene tiles beneath the tank to minimise any stress on the glass. Bear in mind that a gallon of water weighs about ten pounds and an average 36 in. \times 15 in. \times 12 in. tank will hold 18-20 gallons! Fit the filter plates and uplifts. If you have decided on air-operated undergravels, it is a good idea to fit the airlines into the uplifts at this stage but these need not be connected to the pump. If powerheads are to be used—and in our opinion these are preferable—they can also be positioned on top of the uplifts.

3

Thoroughly wash the crushed cockleshell or Calcium Plus and spread it evenly over the filter plates. The coral sand should also be washed and placed on top of this first layer, building it up towards the back. We recommend the use of a Gravel-Tidy, which is a fine plastic mesh placed between the two

layers of the filter bed. This keeps the two sections of the bed separate while still allowing the through-flow of water. When the time comes to strip down your set-up you will appreciate being able to take out the two media separately.

4

All of the electrical equipment can now be placed into position, following the manufacturer's instructions and making life easier with a cable tidy. Airlines can be connected to the pump and the cable tidy fitted with a plug, ready for the mains. Just one more thing, don't forget a thermometer—one of the stick-on digital type.

5

At this point your own artistic 'bent' can be brought into play—it is time to decorate the tank! Decoration is a matter of personal choice. One can use coral skeletons, rocks, shells and even plastic decorations to achieve one's own little scene. For the back of the aquarium, you can either use a piece of dark coloured card or a printed marine background.

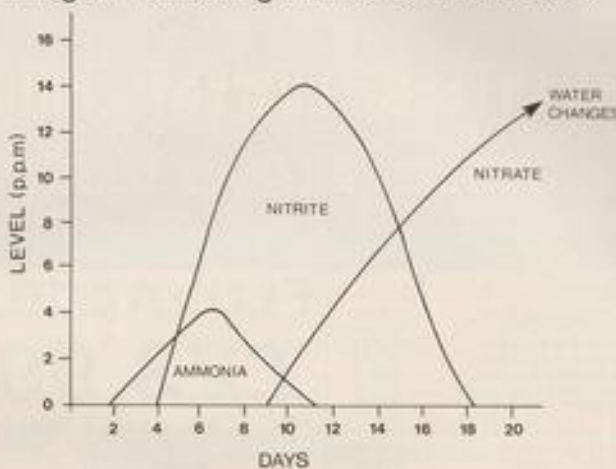
Any attractive rock can be used providing it is not soluble, but the usual choice is either slate, tufa or imitation living rock. Tufa is soft enough to be cut and gouged to create caves for the fishes to use as hiding places. Do not use any rock which has metallic streaks which could dissolve into the water. Coral skeletons come in all shapes and sizes and there are many different shells one can use but they must be thoroughly cleaned beforehand.

When arranging the decor, be sure to create plenty of hiding places so that the fishes feel secure but bear in mind that the more rockwork you use, the less water your tank will actually hold, which means a smaller fish-carrying capacity, as will be shown later.

6

When you are happy with your arrangement, pour sufficient salt for the gallonage of your tank onto the sand and slowly pour water onto it until the aquarium is almost full. Now switch everything on and let things run for 48 hours, after which time the water will have reached the desired temperature and all the salt will have dissolved. Now check the specific gravity with your hydrometer, adding more salt or more water as needed until the salinity is correct. When setting up, you can get away with dissolving the salt in this manner but, of course, the salt should be dissolved in a plastic bucket when carrying out water changes. Water of the right salinity will have a specific Gravity (S.G.) of around 1.020-1.022.

Diagram showing events of Maturation



THE MATURING PROCESS

By now, you should have a nice clean-looking aquarium with all of its components working and with the correct specific gravity and temperature. Before the tank can be stocked, the filter bed must be matured i.e. the colony of Nitrifying Bacteria cultured. This maturation period is vital.

The easiest and most successful method is to use a proprietary maturing agent. Add this to the tank daily as directed. After two days or so, start checking the Nitrite level daily with your nitrite test kit. You will find that the nitrite reading will rise gradually until a 'Nitrite Crisis' (approx 15ppm—bright pink on the test kit) occurs. The reading should

fall rapidly as the bacteria colonise the bed, feeding on the nitrites. Stop adding the maturing agent a week after the reading has gone back to nil. Only when the nitrite level has been stable at nil for a week or so can fish be added. The graph shows what happens during the maturing process. At this point, change about 20% of the aquarium water. This may seem a little extravagant, as you have not kept any fish yet, but all this activity will have led to a decline in the pH, making it more acidic and out of the range tolerated by many fishes. Now, if your specific gravity is correct, temperature stable, pH within the required range (8.0-8.3) and nitrites at zero, you can buy that first fish. We will go into that in the next article.

MAINTENANCE

When your marine aquarium is running smoothly, you need to keep it that way with regular maintenance. Test weekly for nitrites, specific gravity and pH, taking action to correct any changes from the required parameters.

When feeding the fishes, watch them closely for any signs of disease or injury and treat accordingly. Use an algae magnet each week to clean the front glass. Check daily that all equipment is working.

Do regular partial water changes of about 20% every month. Mix the salt-water the day before doing the water change and aerate it overnight to get rid of the chlorine. Bring it up to tempera-

ture with boiling water and make sure that the salinity and temperature are identical to that of the main tank before you add it. Stir up the sand in the tank using a rod or, preferably your hands—eliminating any sections which may have clogged. The result of this stirring will be a cloud of grey mulm which will settle after a few minutes. Hoover this up using a siphon tube when extracting the old water out of the tank. Now add the new water. It should be noted that, if this mulm or detritus, as it is called, is allowed to accumulate it will not only clog the filter bed but will also be colonised by nitrifying bacteria, becoming part of the bed so that when it is eventually removed—then part of the filter, is effectively taken with it.