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both of Ashford, Kent**SUPERB
MINI REEF
COMPETITION
SEE PAGE 21****COVER STORY**

(Photograph: Bill Torney)
Cichlasoma citrinellum,
sometimes appearing as
*Heros (Ampholophus) cit-
rinellus* in cichlid literature,
is commonly known as the
Red Devil or as the Midas or
Lemon Cichlid. This is a rela-
tively large Nicaraguan
species in which males can
attain a length of around
10in (25cm). Their size,
added to their fiercely terri-
torial tendencies at spaw-
ning time, means that only
aquarists who can provide
adequate accommodation
should attempt to maintain
this majestic fish (in which
adult males exhibit a char-
acteristic nuchal hump), on
a longterm basis.

"IMPROVING... BUT COULD STILL DO BETTER"

Ten years ago, one in ten UK households owned fish. Today the figure is 14-15% — around the 2.8 million mark. This means that at least 5 million people — and probably close to 7 million — are involved in aquarium and/or pondkeeping, to a greater or lesser extent.

Now that's a lot of people — enough to support an industry that is expected to have grossed about £200m between December, 1988, and the end of December, 1989. Not bad for a so-called "minority interest" hobby!

The long hot summer proved beyond all doubt that interest in the coldwater hobby continues to grow apace, so it may not be too long before we hit the 3 million mark. And as we approach that figure, what are the prospects facing the hobby?

Well-informed opinion, added to the concerted efforts of dedicated enthusiasts and members of the aquatic trade are, of course, tremendous plusses which have been, and are, improving our prospects in a number of ways. For instance, recent years have witnessed an ever-expanding range of captive-bred stocks. Then there are the "new" fish coming in from China and other Far Eastern countries (some of these species were seen for the first time on the Belton Fish Farm stand at the British Aquarist Festival at the end of October). Regular interchange of ideas between the trade (via OFI) and government departments is also bringing about a welcome and growing mutual understanding and respect that just wasn't there a few years back.

Hard graft and commonsense are indeed producing some encouraging results and, in this respect, 1989 has proved to be "a pretty good year" for the UK.

Not so for German hobbyists who have seen large numbers of tropical marine species banned without any real consultation to speak of between the trade and authorities... and with a possibility of more of the same to come.

In view of this, our marine hobbyists may seem to be doing considerably better than their German counterparts, but, before anyone begins even to dream of becoming complacent, it's worth bearing in mind that all this could change overnight.

It might, therefore, be a good idea to approach 1990 having taken the decision to adopt an even more genuinely responsible attitude towards the plants and animals in our care. We may have made some strides in several directions, but there is still a long, long way to go.

We are certainly doing better, both on the hobby and trade fronts, than we've sometimes done in the past, but we can still improve considerably... and must!

For our part, we at *A & P* will continue to do everything we can to help bring about the desired improvements and we look forward to your continued support in our efforts to do so.

We also wish you all the very best during the coming Festive Season and invite you aboard for an exciting 1990.



John Dawes
Editor

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WE'RE OFF TO SEE THE FISHES ... THE WONDERFUL FISHES OF OURS

Thankfully, for Jason Endfield, Christmas, complete with filleted fish joke, comes but once a year!

Christmas comes but once a year, and isn't it just as well for fishkeepers?! Well, for me, at least, it has proved more than a little tiresome on several occasions.

This festive time means, for many of us, a full house — full of relatives and "friends," many of whom turn up — as Christmas does — but once a year ... generally to eat and drink and be merry, at someone else's expense (I'm a real Scrooge aren't I?).

Having little in common with some of these guests invariably means that, after Christmas dinner, topics for conversation dwindle away and heated discussions begin as to how many times everybody has seen "The Wizard of Oz" or "The Sound of Music." Between the great Julie Andrews debate and the grand long-awaited entrance of the mince pies, someone generally pipes up with those dreaded words, "Why don't we go and see Jason's fish?"

Ugh! My heart sinks. It always seems that nobody can think of a better idea and the suggestion proves popular with the bored gathering. I actually like to show off my fish to interested parties, but at times like this, I know that the observers are not genuinely interested in the fish and are probably more curious to see the house outside the dining room. Anyway, off we tramp, toddlers in tow, to see the fish.

What's the real problem I have with the situation? The main irritation is the joke that seems, thankfully, to be restricted to this annual pilgrimage: I cringe every time I hear the wise-guy jest, "What a lovely big fish — wouldn't it be lovely filleted and grilled!!!!" How original ... I smile through gritted teeth. Why does everybody say it? Even my fish are not offended by it any more, they just tut and shake their heads in resignation.

Then there's the person who refuses to

look, declaring that they "think it's cruel to keep them anyway"; it's no good trying to convince them — after all this is the same person that has just laughed at the filleted fish joke.

In fact, I find the most natural response comes from the toddlers in the audience. Two young relatives of mine who joined us last Christmas, long overstayed the adults and gazed at the tanks for some considerable time, totally fascinated by the spectacle; that's the type of observer I like — with no preconceived ideas, they lap up the natural beauty which is unique to our very special hobby. And it's so much more absorbing than watching Dorothy following the Yellow Brick road ... again ...

We had a welcome break from the Christmas ritual a few years ago when we spent Christmas away from home, although this entailed one or two new dilemmas, a major problem being what to do with the fish? The only people I trust with looking after my fish are my family, as they have had the responsibility of "fish-sitting" when I've been away on holiday on occasions in the past. The perils of overfeeding by some well-intentioned, but inexperienced, minder far outweigh the possibility of underfeeding if the fish are left to their own devices, so I thought it would be safer to leave the fish to look after themselves, particularly as we

were only away for a few days.

I did invest in a timeswitch for the lighting units, but other than that, plus the provision of one of those "holiday food blocks", I left them — uneasily. I needn't have been worried — they were probably glad to see the back of me, and I'll bet they were disappointed when I tentatively opened the door on our return home.

On reflection, I don't really know just what I was anxious about — the heaters and air pumps were well tried and tested and I had carefully "auditioned" the timeswitch for several days prior to our departure; they weren't the sort of fish to eat each other, and they could hardly have thrown wild parties, but nevertheless, I was glad to see everything safe and sound; and I expect that the fish were grateful for the lack of festive observers that year.

One thing they did miss, however, was their favourite treat of left-over turkey. All my fish love turkey and they get it on the fourth day of Christmas after the family have "enjoyed" turkey sandwiches, turkey salad and turkey everything else for three days.

And so it's Christmas time once again. We're not, alas, going away this year so we're entertaining again. And I'll probably have to wince through the filleted fish joke ... again.

I do find it hard at times like this to follow Shakespeare's no doubt wise advice to "be bright and jovial among your guests tonight" (he obviously wasn't a fishkeeper). Mind you — if it wasn't for the guests then I'd probably be sitting in front of the television watching "The Sound of Music" or, worse still, "The Wizard of Oz" (and wishing that the whirlwind had carried Dorothy off into oblivion ...).

Hmm, what a dilemma. I think I can manage to feign delight at the filleted fish joke again. Best get practising my false festive laughter ... Ho, Ho, Ho.



A SCHOTT IN THE ARM FOR BIOLOGICAL FILTRATION

Is it possible to have a filter medium that will perform both the normal ammonia/nitrite/nitrate conversions associated with biological water treatment and convert the nitrates back to harmless nitrogen at one and the same time? *A & P* editor John Dawes investigates.

It sounded too good to be true. A filtration medium that can nitrify and denitrify... all in one go! This I had to see. After all, it's not every day that someone claims to have come up with an easy solution to the problem of nitrate build-up in aquaria.

I duly asked for a sample of the product in question — Siporax (featured in *Product Round-up* in March '89 and November '89) — and incorporated it into several of my own set-ups at home late in October of this year. Useful though this approach may well turn out to be in the long term, it has a major drawback in the short term in that mature biological filtration systems can take up to six months or so to develop their full functional capacity.

One obvious way of speeding up any evaluation process is to find and talk to those people and/or organisations who have already been using the product in question for some considerable time and have therefore been able to assess its effectiveness thoroughly.

Did Schott Glass (the manufacturers of Siporax) know of any such people or organisations — preferably with more than one year's experience using the product? Further, would I be able to talk to the Schott scientists who had been involved in the research and development of the new product? If so, would Schott allow me to visit their factory to see the Siporax production line for myself?

The answer to these questions was an immediate "Yes." So, armed with pen and pad, plus a brainful of questions, I flew out to Frankfurt and thence to Mainz where Schott Glass have their headquarters, factories and research departments.

The nitrate problem

Before reporting on my main findings and conclusions, though, it seems appropriate to provide a brief summary of the so-called "nitrate problem" which will, hopefully, help those who are not already familiar with it, to interpret the figures and charts that accompany this article.

Basically, any effective biological filtration system will convert toxic ammonia (one of the waste products of fish metabolism) into nitrites (also toxic) and, subse-

quently, into nitrates. *Nitrosomonas* and *Nitrobacter* bacteria are the main agents of this biological detoxification process.

Nitrates are considerably less toxic than either nitrites of ammonia, with even the more sensitive freshwater fish being able to tolerate nitrate concentrations as high as 300 parts per million for a time. In marine conditions, corals can begin to suffer above 50ppm and seaweeds at the relatively low concentration of about 30ppm.

Nitrites are generally considered to become dangerous at levels of 10-20ppm, while ammonia levels as low as 0.2-0.5ppm or less can kill, its toxicity being affected by pH (in general, the higher the pH, the higher the toxicity), and by the susceptibility of the species concerned.

Despite the potential dangers posed by ammonia and nitrites, these can be easily kept under control through normal biological filtration (biological purification would be a better term). However, a natural consequence of any efficient biological purification process is a build-up of nitrates, so, unless some method is found of bringing these under control, nitrate toxicity problems will develop sooner or later.

Some solutions to the nitrate problem

Regular partial water changes have, traditionally, provided a quite effective way of keeping nitrates in reasonable check. Unfortunately, nitrate levels in tapwater is now so high, at least, in certain parts of the UK, that one can end up putting in more nitrates than one can take out!

Remote algal filters, adequate plant stocking levels and de-ionising resins provide useful ways of tackling nitrates, the first two by using nitrates as one of their basic "foods," the last through absorption.

An alternative approach, and a particularly good one for those who have difficulty establishing algal filters, or growing good plants, or buying a de-ionising resin filter, would be to go for *denitrification*, i.e. the biological conversion of nitrates into free (non-toxic) nitrogen.

This can be achieved by creating oxygen-deficient conditions (nearly, but not fully, anaerobic) in which the relevant bacteria can feed off the available nitrates and eventually release free nitrogen.

In fact, this already happens to an extent within some "standard" biological purification systems — often by accident — in those (usually small) areas where water flow is restricted for one reason or other.

Wet trickle filters also perform a denitrification role. So does Interpet's excellent Nitrex Box which is specially designed for the job and even provides the extra carbon source required by anaerobic bacteria to convert nitrates to nitrous oxide and, finally, to free nitrogen.

The Siporax approach

Siporax is one of over 50,000 products manufactured by Schott Glass.

Superficially, each piece looks a bit like a ceramic cylinder — but that's where the similarities end. For a start, the cylinders are not ceramic in composition; they are made of open pore sintered glass. This totally new product is manufactured in an ingenious way that involves mixing of high-purity glass powder with a very fine top-grade compound, followed by compression of the mixture into the cylinders, followed by firing under intense heat and then a lengthy process during which the added compound is removed. When the cylinders are dried, the spaces occupied by the compound remain as minute open pores and it is in these that the bacteria settle and grow... and go about their business.

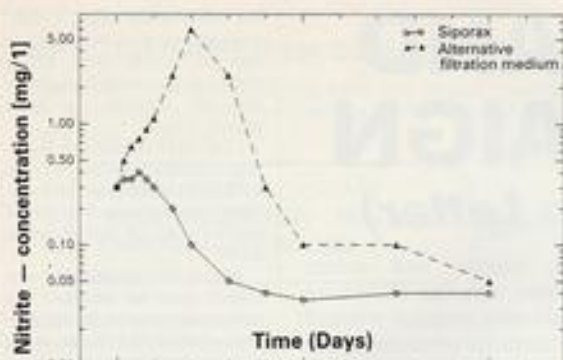
This "business" is two-fold. Those surfaces in direct contact with the external environment (water) receive an ample supply of oxygen under normal aquarium use and therefore serve as sites for the establishment of immense numbers of aerobic bacteria. These are the ones involved in converting ammonia to nitrites, and nitrites to nitrates.

Deeper inside each cylinder, conditions are relatively depleted in oxygen. These are precisely the conditions required by the anaerobic denitrifying bacteria responsible for converting nitrates to nitrous oxide and, eventually, to free nitrogen.

Each cylinder is so porous that it provides a surface area of about 40 sq ft — approximately the same floor space as a 7 x 6ft fish house! Multiply this by the number of cylinders of Siporax required for an average-sized power filter (several hundreds) and you can begin to appreciate the huge active surface area that can be made available for bacterial colonisation and, as a result, for biological water purification.

Range of applications

Dr Norbert Greulich who has been involved with the Siporax research and development programme since its early days, is not the sort of man who would make outlandish claims about any product. He is,



Graph 1
A comparison in nitrite levels between Siporax and an alternative filtration medium.

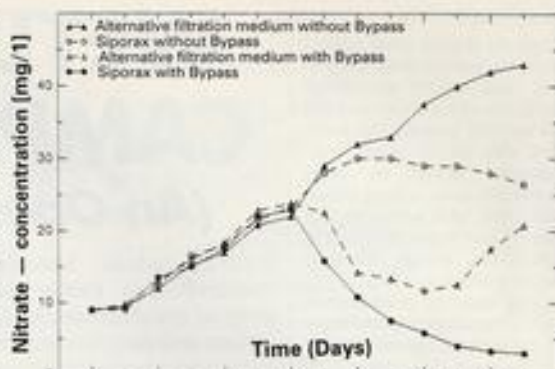
however, extremely enthusiastic about this new filtration medium, especially since documented reports that were sent in from several European Zoo Aquaria show just how efficient the product can be.

Among those institutions that have supplied data are the likes of Osnabruck Zoo, Basel Zoo, Berlin Zoo and the Wilhelma Zoo and Botanical Garden in Stuttgart. I saw the various reports and all claimed significant

successes, even using the medium in a straightforward "aerobic" way in power filters.

The readings were most interesting. They showed, for example, that:

1 In a new aquarium, Siporax did not exhibit the large nitrite peak usually associated with these set-ups. Instead, after a small initial rise, there was a dramatic reduction in nitrites, even in the absence of water changes



Graph 2
Nitrate levels compared, with and without Bypass.

(see Graph 1).

2 Nitrate levels increased initially as with most other biological media. However (and this is the significant point), the nitrate concentration either levelled off after a time, or actually began to show a decrease. Either way, such results show that some denitrification is taking place (See Graph 2).

3 If a bypass is included in the system, ie, if a second, smaller power filter is introduced and part of the filtered water is channelled through it at a slow rate prior to returning it to the aquarium, then the nitrate level drops off very significantly. Further, if the anaerobic bacteria are supplied with a carbon source as a supplement, eg, by dripping in ethanol, then the drop-off brings the nitrate level almost down to zero (See Graph 2).

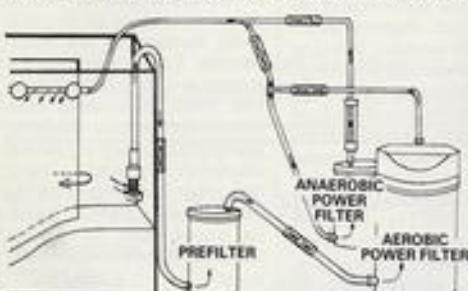
This method (minus the ethanol) had been chosen by Christoph Schäfers who I visited during my brief stay. Christoph is a researcher working on the behavioural biology of Zebra Danios (*Brachydanio rerio*) at the University of Mainz.

My sincere thanks to him for allowing me to reproduce his diagram depicting his method of filtration. This technique has made it possible for him to run his large experimental tanks without a water change for about 2½ years and with a single washing out of the filter medium during this time.

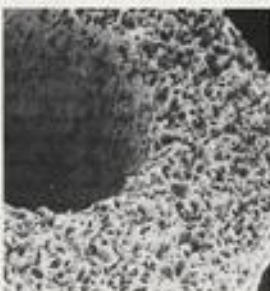
He felt that the environmental stability which he could maintain using Siporax was a tremendous help in his work, particularly since fluctuating environmental conditions affect both metabolism and behaviour and can have a profound effect on experimental results.

I would like to end by extending a most sincere vote of thanks to Dr Norbert Greulich, Klaus Mirsch, Hans Düroff and Thomas Nieraad, all of Schott Glass, Mainz, West Germany, for their time and willingness to answer my barrage of questions, and to Peter Oakes at Al Garden Aquaria Ltd, Michael Allen of Amphill Aquatics and Claus Roth of Schott — UK for responding so promptly to my requests for information and for supplying me with relevant literature.

NOTE: Siporax is a trade mark of Schott Glass, Mainz, West Germany, who have patented the product worldwide.



Bypass system used by Christoph Schäfers at Mainz University for his work on Zebra Danios.



Scanning Electron Micrograph of the surface of a Siporax cylinder



Different sizes of Siporax cylinders.



Above, experimental Rift Lake Cichlid tank at the Schott laboratories in Mainz. The water in this aquarium has not needed changing for over a year.



Dense colonies of various types of bacteria completely coating the pore surfaces.



A Scanning Electron Micrograph of a tiny section of the porous surface — highly magnified.

Dear Editor,

I wonder if your other readers share my worries about the serious (and rapidly worsening) pollution of our rivers, as I feel we are still treating this problem with far too much complacency. While we seem outwardly upset to learn almost daily that "this stream or that river" has been accidentally killed off, we do little or nothing about it.

Very few of our rivers are now totally unpolluted and we know it takes many years for the environment to repair itself after incidents of chemical pollution. It is obvious that in the not-too-distant future we will reach the point of no return, not just for our native aquatic life and freshwater fish species, but all mankind, as we too depend on water to sustain life. This situation is not difficult to understand. Many rivers are now polluted so repeatedly that it is very likely all of them could be either polluted or not-yet-recovered at the same time, resulting in the extinction of all indigenous species.

My lifelong love of "messing about on the river" encouraged me to enjoy and use our native waterways variously through the years, first as a fisherman, then later as a landscape painter and naturalist. The magnetic appeal of clear flowing water led me to spend four years painting and writing on the subject for my limited-edition book *Waterways and Wetlands*.

Working in such close proximity to water I began to notice rapid detrimental changes in the environment, especially to the habitat of water-related wildlife. Alarm bells warned me that far too little was being done to maintain or improve the situation. We didn't care enough so we failed to prevent damage being done. When damage was done we didn't rectify it properly or soon enough.

Moreover we failed to introduce legislation controlling the manufacturer, storage, transport and use of all manner of potentially lethal substances. I fear that many of the persons entrusted with the storage and use of these toxic cocktails have not been educated to standards commensurate with the deadly nature of the chemicals under their control. Neither are we doing enough, even now, to encourage people generally to become environmentally aware.

WETLAND CAMPAIGN

(An Open Letter)

Author, natural historian, painter and ardent conservationist, Philip Jackson tells the disturbing story of the destruction of his own personal wetland refuge and puts forward his plans for its restoration.

As no-one else seemed ready to take up the cudgel to hammer home the importance of clean water, my strong beliefs on the environment led me to think that, perhaps, it was down to me. Should I be the one to set the example for others? It seemed I would have to, the threat of water pollution seemed deadlier than the atomic bomb!

Bearing in mind my feelings, it will not surprise you that I used the profits from my book to develop a water wildlife haven on land near my home. I invited our local schools to use it for nature study purposes, but had another far more important role for the site too.

The naturally stream-fed pond I built became my way forward. Having developed it as a reservation for freshwater fish and waterbirds, I began to write and illustrate a book on how it was done. At last, I had found a practical way to aid the environment. I felt sure my five-year project and the resultant book would fire the public's imagination, encouraging them to "breed" thousands of similar water-orientated habitats. In turn, their own natural observations

could help to create a huge worldwide "ecology monitor."

Many thousands of pounds later — and after more than a year of hard work, the fish and bird sanctuary was teeming with life. I waited for newly-hatched moorhens to leave their nest, realising that in just a day or two, I would be able to use the underwater observatory I built in the middle of the pond, for the first time.

I was quite proud when the environmental department of the district council displayed photographs of the sanctuary, depicting it as a prime example of environmental improvement. Meanwhile the fisheries division of the local water authority congratulated me on the whole idea, commenting favourably on the water quality and suggesting I even introduce a few brown trout. They confirmed that they were using a set of prints from my original fish drawings as the ideal standard representations of our individual species for projection at seminars. This made me feel even better.

However, as if to underline my warning in the first paragraph, disaster was about to strike. I don't know whether it was vandalism, carelessness or lack of legislation,

but whatever the cause, a thousand gallons of diesel suddenly appeared in the pond, killing every fish and leaving those birds that still survived too badly injured to save.

I had experienced better mornings than this! I had encouraged wildlife to the sanctuary and now found myself putting those pitiful survivors out of their burning agony.

Almost four months have now elapsed since the sanctuary was completely wiped out by this massive industrial oil spill, and, as yet, no action has been taken by those who are meant to be concerned.

A few weeks after the disaster it seemed that prompt remedial action had been instigated and the cleaning up work began upstream from the site. However, just as suddenly, an apparent change of stance by the insurance company caused the initial fervour of the restoration campaign to fizzle out completely.

We all know that if oil stays in the water for a long period the environmental recovery will be slower, so not only are my plans totally frustrated by this inactivity, but I can't even hazard a guess as to when, or even if, I can ever restart. Meanwhile, those who, in my opinion, should be held responsible for restoration of the site, are now spending lots of time, effort and money haggling and squirming over NOT spending money, while the environment they claim to protect is left to rot!

Once again I have to shoulder the financial burden as the others involved obviously do not intend to. Lucky me! Here is my master plan to raise the money and therefore, hopefully, hasten the start of the massive clear-up that is necessary: —

Many of my paintings have been reproduced as limited-edition signed prints. Among these are several depicting wildlife, especially freshwater fish. The last six hundred sets of these prints will be put on special offer for three months at ridiculously low prices. In this way I hope to make the vast number of individual sales necessary to carry out my clean-up plan for the sanctuary. At the same time anglers and naturalists alike will be able to collect my prints at the unrepeatable prices listed in the separate advertisement elsewhere in this issue.

Philip Jackson
Somerton,
Somerset.



Reflections

by David Sands

HEADING FOR THE 21ST CENTURY

Over ten years ago I wrote a general piece for the *Aquarist & Pondkeeper* about the future of our hobby paying some attention to the vital equipment we need to sustain the fishes in our keep. I wanted some of the "much talked" about space age technology to overlap into fishkeeping and make the installation of an aquarium a little bit easier for the beginner.

At that time I worried about noisy air pumps (in severe cases, I've known people to have been driven out of the hobby by a pump sounding more like a pneumatic drill than an aeration device!) and poor heater thermostats that could boil an aquarium full of the most loved Discus fish (this happened to one of my customers and the importer suggested that the customer sue me so that I would sue him and he could sue the manufacturer... solicitors would have had a field day).

Equipment defence

In defence of equipment it is surprising how many fishkeepers imagine pumps and filters can run 365 days of the year without basic maintenance... I am guilty of allowing an air pump to run for ages and ages with nothing more than a filter pad change.

I tend to believe that if it's running all right, "don't touch it!". Of course this philosophy

could leave me stranded on the M25 one day...

I'm pleased to say that there has been a great deal of research and development by the leading aquatic manufacturers since I wrote that article.

During my recent involvement in *AquAdventure*, a new fish and display retail shop near Preston, I have had a first-hand look at current equipment. In particular the Atlantis range of products with Dr David Ford of Aquarist, and in another project (a unique waterfall aquarium I am establishing at Pier Aquatics), Algarde products.

The standard of equipment and the accompanying literature quietly pleased me. It is so important that equipment should be simple to use and reliable.

The hobby has come a long way when equipment literature, as in the Atlantis Powerflow leaflet, warns people not to wash the foam out under tap-water because this might suppress the all-important nitrifying bacteria (which are essential to the water quality balance). This shows that the hobby is backed by people who know the all-important basics and that basic fishkeeping

requirements have been looked into.

I can remember using products that I knew could only have been bench-tested in unrealistic environment rather than tested in a real aquatic situation; filter taps that didn't say whether they were open or closed, internal filters that emptied all the waste that they had marvellously collected back into the tank just as it was being removed for cleaning!

Algarde, Interpet and Atlantis provide excellent literature relating to their respective products and the equipment works! I tested the new Algarde "cylinder air pump" and it is superb. I know the style of pump and can say it is so reliable that a spare diaphragm may never be required. The Atlantis undergravel plates are tapered and persuade a more even flow-rate across the filter base as with Interpet's CV undergravel, all making for a more efficient product.

The beginner is well catered for by the large companies in the way of guidance and clear instructions and this is paramount. If only some retail establishments would remember that it is the enthusiasm of the "beginner" that is the most

refreshing and probably the best promotion for the hobby.

Costly R & D

It must be very costly in research and development, marketing and distribution to install new products onto the market. A good product will sell itself but it must be in the shops for fishkeepers to buy.

I'm not sure we are willing to pay for excellence in products because cost cutting does dominate fishkeeping. Equipment is the life support system for the fishes in our keep and I hope the hobby will support the manufacturers that support fishkeeping.

If you have praise for a particular product that has impressed you or has improved your fishkeeping please write to me, care of the editor, and let us know. I would want these to be unsolicited opinions and I think they should be known.

For example: The gravel-siphon sets on the market have made cleaning tanks a doddle... no more stagnant gravel and yearly full (complete) clean-out of tank and gravel!

Yes, I think the hobby is heading for the 21st century with a great deal going for it.

News

UK's first-ever trade and public aquatic show

For the first time ever in the UK, a joint trade and consumer show dedicated entirely to aquarium-keeping and water-gardening will be held next summer.

On 2 June 1990, *Aquaria and Watergardens 90* (staged in Hall 6 of the National Exhibition Centre, Birmingham) will attempt something completely new: to cater for both the trade and the public, in one place and at one time.

To quote the organisers: "No more wondering whether the person who you are talking to is a trade buyer or a hobbyist; at *Aquaria and Watergardens 90* you can talk to both, or choose to sell your products to one or the other — either by taking a stand within the trade pavilion

or the general exhibition.

"No more silly prices; instead, the opportunity for exhibitors to include special show offers, should they want them, alongside healthy competition, of the kind which benefits everyone and makes no one a loser."

Lots of special features are planned for the event, such as a supervised children's crèche, lecture theatres housed in a series of purpose-built auditoria, plus a Traders' Competition for the best furnished aquaria — open only to the trade, and free to all exhibitors.

In addition, there will be special watergarden features designed to show the public the sort of effects that they can create in their own gardens, to

suit their own budget.

There will also be a Children's Art Competition, with prizes available for individual entrants and the schools they represent.

The organisers believe that they have created an exhibition that will benefit the trade, the hobbyist and the newcomer to the industry, one which will enable them and the industry "to reach new markets and new customers, and which will complement the projected growth within the aquatics industry".

Further details available from: Concept Conferences and Exhibitions Limited, 27 Brandreth Avenue, Dunstable, Beds LU5 4JP. Tel 0582 601456. Fax 0582 609892.

Rich



Labyrinth Fish



Part of the display section in the 1,000 square metre exhibition hall.

HONG KONG DISCUS FAIR '89

Eberhard Schulze, our Discus expert, reports on this glittering event which, despite its official title, was held in Tokyo.

(Photographs courtesy of the author and Far East Enterprise, Inc.)

There are Discus Fish Fairs — and “there are Discus Fish Fairs”. The Hong Kong Discus Fair '89 held on 28-29 July at the Ryutu Exhibition Centre in Tokyo will surely be the largest specialist exhibition staged anywhere in the world this year. It was organised by K. Inouye, President of Far East Enterprise, Inc., of Narita, Japan, and partly sponsored by the Hong Kong Trade Development Council.

Bewildering variety

On display were some 3500 Discus ranging from 7-8cm (approx 3 inches) to 22cm (approx 8 1/2 inches) and included all the 22 different strains created by Lo Wing Yat and Ng Ching Yung of World Wide Fish Farm, in Hong Kong. The cheapest fish for sale were 8cm (3 inch) offspring from a wild-caught Royal Green Discus from Rio Tefe at only 16,000 yen (£71.00), whereas the most expensive single fish were in the region of 88,000 yen (£390) for 14-15cm (5 1/2-6 inch) Solid Blue Discus, high body form with long red fins, where 40% of males are without any markings or spots on the body and, almost always, have a red eye. The most expensive breeding pair was offered at 1,000,000 yen (£4,445) which, again, was of the solid blue, high body form with long red fins.

There were standard blue Turquoise strains with none or few markings or spots on the body; there were darker blue solid-coloured Discus, again, with none or very few markings or spots on the body; there were solid Turquoise fish with a metallic iridescence with a red edging to their fins; there were ‘almost’ solid Turquoise or Blue Discus with just a few spots or markings on their bodies; there were ‘almost’ solid Turquoise with faint red or yellow

spots or markings on their bodies; there were Red Turquoise Discus where the body base colour varied from a deep red to a blood red; there were Red Turquoise with wide straight lines or broken lines; there were Red Turquoise Discus where the base body colour varied from a turquoise to a blue with lines of various intensity of red colour or even red spots ... and several others.

Most of the fish on display had a nice round body shape. Some displayed the standard finnage, while others had larger finnage; some even had what could easily be termed ‘hi-fins’. Although there were quite a few fish with yellow eyes, there were also some with brilliant red eyes. Then there were some solid-coloured Turquoise Discus with a lovely round body, good finnage and brilliant red eyes.

As with any exhibition of this kind, the visitor will always find something which appeals to him or her; some fish will be of an average standard and there will always be some which one does not care for at all. This exhibition was no different in this respect.

What was different, however, at this exhibition, was that almost all the 275 or so aquariums housing these fish, contained crystal-clear water, in spite of the fact that the fish were only put into the tanks two days before the opening. I am sure that many hobbyists will have seen Discus display aquaria at exhibitions where the water turns rather milky after a day or so and the fish look very sorry for themselves.

To my mind, there is nothing worse than displaying one of the most beautiful and coloured aquarium fish in the world at an exhibition and have them turn black in colour with clamped fins as a result of mismanagement. I was therefore pleased to see that only one of the 275 tanks had ‘gone off’ by the



end of the exhibition. But then, Lo Wing Yat and the staff of Far East Enterprise, Inc. took great care to monitor the quality of the water on a regular basis.

Constructive criticism

If I had to criticise something about the Hong Kong Discus Fair '89, it would only be in the number of different strains being shown or offered for sale. Lo Wing Yat and Ng Ching Yung of World Wide Fish Farm offered the Japanese hobbyist 22 different strains of Discus. Are there really that many different strains available?

Should a batch of offspring be classified as a ‘different’ strain because 40 or 80% will be solid in colour, or should a fish with a red edging to



1. A Red Turquoise: 3-inch £125; 5 to 6-inch — £380.
 2. 70% of the males of this strain will be solid in colour; a 5-inch fish — £190.
 3. Second generation hybrid from two wild royal green strains.
 4. About 40% of this strain will be solid in colour. A 3-inch fish sold for approx £100.
 5. This almost solid-coloured Discus has a high form; a 5-inch fish — £245.
 6. Dr Eduard Schmidt-Focke's Brilliant turquoise; with tomato red eyes. Fully grown — £535!
 7. This fish is almost like Schmidt-Focke's early Red Pearl Discus.

the finnage be a different strain to a fish with a black edging? Would it not be more realistic or sensible to adhere to the common characteristics of colour, finnage or markings and ignore the slight changes in pattern, or body colour, or colour of the fins?

A question of percentage

For instance, are the differences between strains WB1 and WB12 real? Strain WB1 is a Turquoise fish in which, according to the information supplied, about 40% of the fish will be solid in colour; their eyes will be mostly red. In strain WB12 which is 'developed' from strain WB1, over 80% of the offspring will be solid in colour and their eyes will be red. Should a difference in the percentage really create a

different strain? It is, in fact, very likely that, with inbreeding or line breeding, a larger number of the offspring of strain WB1 will eventually end up solid in colour.

As with humans, individual Discus will exhibit slight differences, but their main characteristics will always be the same. Would it therefore not be more sensible to adhere to a standard and completely ignore the 'Designer's Label Classification' of Discus, thereby helping newcomers to the hobby of Discus keeping and breeding? Is the solid Turquoise Discus bred by Jack Watley really a different animal to the solid Turquoise Discus bred by Jo Brown? I don't think so! And the sooner some order can be created out of this confusion, the better it will be for the Discus hobby.

Finest ever show

Although I have seen many Discus displays at various exhibitions all over the world in the past 20 years or so, this one, consisting exclusively of Discus, must rank as one of the finest ever staged.

The Hong Kong Discus Fair '89 was well attended by visitors and hobbyists, in spite of the fact that one day was almost completely ruined by the after-effects of a monsoon which hovered over Japan and resulted in a downpour which no-one in Europe could possibly imagine. The Hong Kong Discus Fair '89 was considered a success by the organisers so will be repeated in Osaka, which seems to be the centre of Discus keeping in Japan.

Spotlight

BITTERLINGS

Frequently seen, but relatively rarely bred, Bitterlings have a great deal to offer adventurous aquarists like Dick Mills.

(Photograph of Japanese Bitterlings — *Rhodeus ocellatus* — by Kim Taylor/Bruce Coleman Ltd.)

At first glance, the Bitterling might be mistaken for a tropical species of Cyprinid, so vivid is its coloration when seen under good side-lighting. However, it is a coldwater fish which has its natural roots in Europe and Asia.

The common name, and the alternatives — Bitter Carp or Bitter Minnow — is said to refer to the bitter taste of the skin, and for this reason, anglers find the Bitterling makes a poor bait! (Aquarists reading foreign language fish books will also know that the similar name "Bitterlingsbarbe" refers to a separate species altogether, the Cherry Barb, *Barbus titzei*).

The most familiar species of Bitterling is *Rhodeus sericeus* which is distributed naturally throughout Europe with the exception of the British Isles, Scandinavia and Spain; to the east it reaches the Caspian Sea. Further east, a subspecies *R. sericeus amarus* is native to China, with other species being found in Korea and Japan. There is some confusion as to the correct scientific name but as *R. sericeus* was created by Pallas in 1776, the later appellation *R. sericeus amarus* (by Bloch in 1782), unless applied to a subspecies, has to give way to the earlier name.

Unfussy inhabitant

The Bitterling is quite at home in a coldwater aquarium, in water temperatures up to 22°C (c 71.5°F). Still waters with a muddy bottom (what an incentive for lazy aquarists!) suit it well and, while its natural diet consists of small crustaceans, plant debris and insect larvae, it will accept all the usual aquarium foods and cultured worm foods in captivity.

"Third party" breeding

As well as being a very beautiful fish (who needs words to describe it when the accompanying photograph says it all too well) and perhaps a very welcome addition to the somewhat limited range of aquarium-suitable coldwater species available, the Bitterling displays a much more interesting facet when breeding as it needs a "third party" for success, namely, a Mussel, a freshwater bivalved mollusc. Two species will co-operate in this respect — the Painters Mussel, *Unio pictorum* (apparently, medieval painters used their shells to hold their oils), or the Swan Mussel, *Anodonta cygnea*.

When in breeding condition, the male develops white tubercles immediately above the mouth and on the snout, while the female extends a very long ovipositor which snakes

about in the water as she swims. The Mussel now enters into the proceedings. Under the stimulation of the nearness of the fishes, the Mussel opens its shell and the female Bitterling uses her long ovipositor to deposit eggs into the Mussel's mantle. Next, the male sheds his sperm and this is drawn into the Mussel during respiration.

The fertilised eggs remain in the Mussel for two to three weeks before emerging or being ejected by the Mussel. Obviously, during hatching and early development, the Bitterling fry are well beyond the reach of predators, safe within the Mussel shell.

You may wonder what benefit the Mussel gets in return for this "safe-hatching" service. Well, it times its own breeding period to coincide with that of the Bitterling and, while the fish are in close proximity, it ejects its own young (called Glochidia) into the water, upon which they attach themselves by a sticky thread (byssus) to the fish.

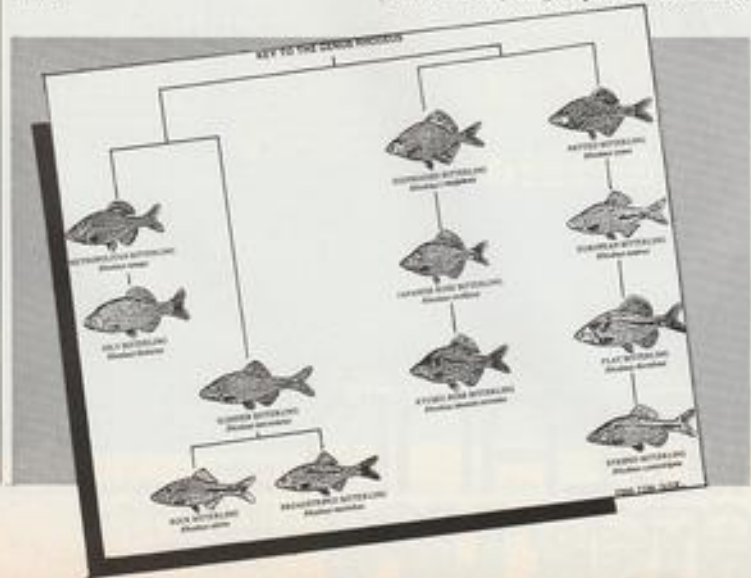
The Glochidia then establish themselves even more firmly by their shell teeth, and remain as a parasite on the fish for around three months, after which they drop off into whatever new territory the host fish has carried them to. Alternatively, the Glochidia may attach themselves to the developing fry within the Mussel to be ejected with them later. Hence, further distribution of the Mussel is assured in either event. Young Mussels appear as small black patches on the sides of fishes.

It is not necessary for Mussels to be kept permanently in the Bitterling aquarium. In fact, it would be quite a job to do so with any success (many fishkeepers say that keeping Mussels is more difficult than keeping fish!). The reasons for this are several: Mussels are active creatures; the Swan Mussel, for instance, lies semi-buried for much of the time forever ploughing across the substrate, subsequently destroying the good looks of the aquarium furnishings.

Mussels are also filter-feeders and depend on suspended algae, infusoria, etc in the water for food. Since the majority of aquarists keep their aquariums well-filtered at all times (don't they?) the life-span of the Mussel cannot therefore be guaranteed. Add to this the fact that a dead Mussel looks very much like a live one (until it begins to pollute the water!) and you will appreciate that it is best to introduce them into the aquarium only when their surrogate parent-hood services are required.

Types of Bitterling

Several species and subspecies of Bitterling have come to light in recent years and the accompanying chart (compiled by Vernon Hunt of Portsmouth A.S. for one of the Federation of British Aquatic Societies' Supplements, and published with permission), shows how they may be identified, or grouped, purely by their outward physical appearances. There is still some speculation as to the veracity of some of the names.





and fats. This was translated into practical advice with warnings on which foods are unsuitable for aquarium fishes. How a commercial diet is manufactured and tested was illustrated with photographs of the 'Aquarian' plant.

Speciality Group Meetings took place on the Friday evening where Study groups discussed Rainbowfish, *Apistogramma*, *Cichlasoma*, *Discus* and aquarium photography and literature.

THE TOURS

Those speakers who arrived on Tuesday 8 August at the Hyatt Orlando were taken on a behind-the-scenes tour at Disney World's Epcot (Experimental Prototype Community of Tomorrow) Centre. This included the research unit of "The Land" exhibition where NASA-sponsored work is underway on hydroponic gardens for use on the moon. Also visited was the filtration plant and computerised control unit of the 5-million gallon aquarium in "The Living Seas".

On Wednesday 9 August registered visitors and the speakers toured Sea World with its world-famous exhibition of Shamu, the Killer Whale. The speakers were also invited to an evening buffet with Sea World's directors held in the acrylic tunnel that runs through the aquarium of the "Shark Encounter" exhibit.

The Fish Farm tour on Friday 11 August involved 465 aquarists on a fleet of 11 buses travelling to two of the largest Florida farms

near Tampa. One was **Ekk-Will Tropical Fish Farm** who breed most popular tropical fish species. Tractors took the visitors on trailers on a tour of the mud ponds. The next farm was **Segrest** who stock saltwater and coldwater fish as well as many reptiles. The tour ended with an outdoor barbeque with chicken legs or beef ribs washed down with beer or tea (both ice cold).

THE OPEN SHOW

Several hundred cichlids were displayed in the Show room at the Hyatt Hotel. Facilities were offered by ACA to other specialist groups and the Betta Society of America had over 300 Siamese Fighters on display.

Prizes for the best fish in each division were presented at the President's Banquet held on the Saturday evening at the hotel. 589 banquet meals were served and the after-dinner speaker was **Horst Dieckhoff** who showed slides of underwater scenes and fish in Lake Malawi. Many were species seen for the first time.

The Americans have two **Best in Show** categories, the Judges' Choice, based on points, and the Peoples' Choice, based on votes by visitors. The Judges' Best in Show was an *Aulonocara audinae* owned by **Jim D'Antona** of Boston AS and the Peoples' Choice was a Blue Freckle Cichlid, *Cichlasoma umbriferum* owned by **Thomas P. Depiro**, Vice-President of the Central Florida AS.

The auction on Sunday 13 August was

conducted in American style with rapid talking by the auctioneer and many cichlids changed hands, some for hundreds of dollars. The auction grossed \$15,500 which raised \$3,500 for the Guy D. Jordan Fund, presented to **Dr Tony Ribbink** of the University of South Africa to help study wild cichlids. The sales table of show memorabilia and aquarium books raised \$35,000!

One photographic competition was sponsored by Sea World and the overall winner (showing Flamingos at dusk) will be turned into a Sea World postcard, so millions of that winning shot will be printed.

With sponsorship of the Pet Trade, the show was a financial success and, certainly, a huge success with the hobbyists. Everyone praised the conference and the organisation, which ran like clockwork. The ACA committee, which included such famous American aquarists as **Steve Somermeyer**, **Charlie Grimes** and Chairman **David Herlong**, are to be congratulated, and ICC No 2 is already being planned for 1992.

If any reader wishes to receive a copy of my paper *Cichlid and other fish nutrition* presented at the Conference, just send your name and address to me requesting "ICC paper". Write to: 'Aquarian' Advisory Service, Oakwell Way, Birstall, Batley, W Yorks WF17 9LU.

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MY TOP TEN CHRISTMAS BOOKS

Dr Chris Andrews presents a mouthwatering selection of aquatic books for the avid reader.

With the vast array of (often) excellent hobbyist literature which is now available, it is not very easy to come up with a short-list of recommended or favourite titles. I have taken a relatively wide look across the type of books which I think aquarists will enjoy reading or browsing through, even if they are not all on keeping fish. Approximate prices are indicated on the basis that: A = less than £10, B = £10-£15 and C = over £15.

Great Barrier Reef

Assuming you can't actually visit the Great Barrier Reef in January or February, the *Reader's Digest Book of the Great Barrier Reef* will, at least, give you a really good idea of what you are missing!

First published by the *Reader's Digest* in 1984, it has nearly 30 contributors and some stunning photographs, the vast majority of which you will not have seen before.

As well as explaining in clear detail just what a coral reef is, this book also looks at all of the major groups of plants and animals which live on the Great Barrier Reef in Australia, from algae to marine animals. There are even sections on diving and snorkelling holidays, and an island resort guide (Price C).

Conservation

Less aquatically-orientated, but fascinating reading all the same, is *State of the Ark* by Lee Durrell (published by **Bodley Head** in 1986).

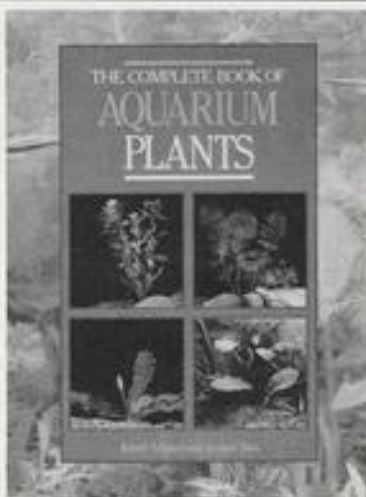
This is an atlas of conservation in action which looks in detail at Man's impact on the natural world. Thankfully, this book is not all about so-called "charismatic megavertebrates" (such as elephant, rhino and tiger) but also emphasises the importance of the ecosystem as a whole and discusses the problems facing, for example, terrestrial and marine invertebrates, fish, amphibians and reptiles.

Excellent colour illustrations take you on a conservation safari around the world, and although the news is not all bad, there is still an awful lot that needs doing (Price B).

Aquarium plants

There are not very many good books available on aquarium plants, but one exception is *The Complete Book of Aquarium Plants* by Robert Allgayer and Jacques Teton (published by **Ward Lock** in 1987).

The natural habitat of aquarium plants and their requirements for successful maintenance, are dealt with in an unusual amount of detail, as are tank decoration techniques. A 30-page synopsis of the care of around 150



of the most commonly-kept plants is rounded off by an excellent glossary.

The book is beautifully illustrated throughout and, although the editing is a little slack in places, I recommend this book wholeheartedly (Price C).

How, why and where?

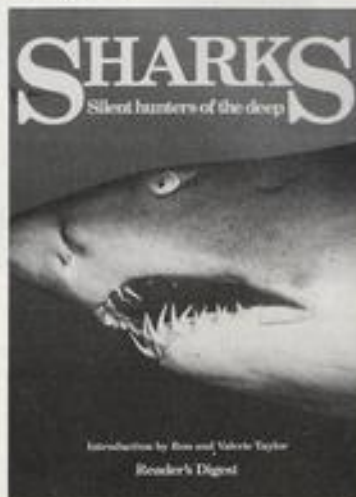
Are aquarists really interested in the how, why and where their fish live in the wild? I think so, which is why I also recommend *Ecological Studies in Tropical Fish Communities* by Rosemary Lowe-McConnell (published by **Cambridge University Press** in 1987).

This book is certainly not a "light" read, but a whole range of freshwater and marine fish biological phenomena are explained in simple, lucid terms. The illustrations are limited to black and white line drawings, so what you are getting is a 400-page textbook — but a good one (Price B).

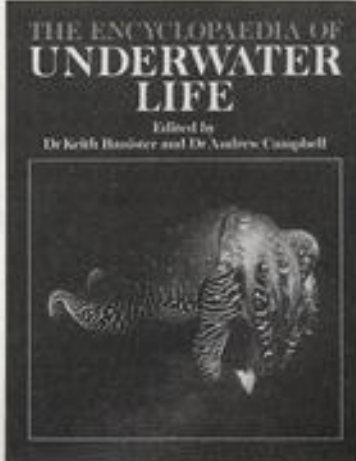
Sharks

Sharks: Silent Hunters of the Deep (published by **Reader's Digest** in 1986) is a shark book which goes beyond the blood and gore stories so familiar since the *Jaws* film appeared in the mid-1970s and, as a result, this book explores, in some detail, the natural biology of these fascinating animals.

Not that the opportunity is missed to include some pretty horrific shark attack pictures and some interesting statistics. Did you know that nearly one-third of all shark attacks take place within 50 feet of the shore, and nearly two-thirds of all shark attacks take place in water that is less than five feet deep?



This book also includes a listing of 344 known species of sharks with notes on their characteristics and distribution (Price C).



Great Encyclopaedias

The publishers **George Allen & Unwin** have produced a series of *Unwin Animal Library Encyclopaedias* and those entitled *Underwater Life and Reptiles and Amphibians* are likely to be of considerable interest to the readers of this magazine.

The editors of *Underwater Life* (Keith Banister and Andrew Campbell) tackled the almost impossible — and achieved it. In under 300 pages they have not only covered fish, but also a diverse range of aquatic invertebrates too. This book (which was first published in 1985) is eminently readable and lavishly illustrated throughout, and not with the same old photographs we've all seen time and time before. It is a marvellous book to

browse through (Price C).

The same can be said for the *Reptiles and Amphibians* volume which was edited by Tim Halliday and Kraig Adler, and published in 1986 (Price C).

Detailed Atlas

A more encyclopaedic text is the *Aquarium Atlas* by R. Riehl and H. Baensch (published by H. A. Baensch in 1987). With nearly a thousand pages, this book deals with the whole business of setting up and maintaining an aquarium and especially on the selection of fish and plants.

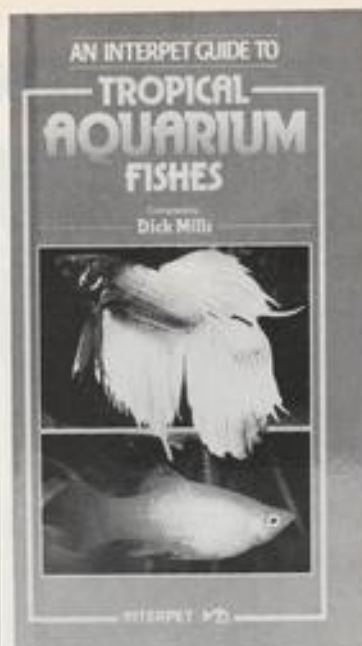
Over six hundred fish species are covered in an unusual amount of detail, making this book a wonderful reference book. The illustrations of the various fish and plants are in full colour and are excellent.

If your aquarist friend, partner or relation has not got this book, buy them one for Christmas! Take note however, you may not hear from them again until at least Easter — they'll be too engrossed in the book! (Price C).

Tropical Aquarium Fishes

A Popular Guide to Tropical Aquarium Fishes (compiled by Dick Mills and published by Salamander Books in 1988) is an excellent, concise volume covering a lot of the ground previously dealt with under some of the *Fishkeepers' Guide* series.

Like just about all of the Salamander books it is thorough, easy to use, easy on the eye and easy on the pocket (Price A). A great



Christmas present for a young fishkeeper or someone who is new to, or thinking about, joining the hobby.

Unputdownable treat

"Unputdownable," "compulsive reading" and "blockbuster" are often used to describe novels by Messrs King, Archer and Herbert.

Well, the paperback which gets my vote for 1989 is *Paddle to the Amazon* by Don Starkell (published by Futura).

It tells the true story of how one man and his son paddled a 21-foot canoe from Canada to South America and then down the Amazon to the Atlantic Ocean. The cover description says it all — "a journey that staggers the imagination... a courageously honest tale of daring, endurance and triumph".

There are some fleeting observations on fish and wildlife, but my real reason for choosing it was that it was unputdownable (Price A).

Well, if I did not have any of the above books I would like all of them for Christmas — I hope you enjoy them. By the way, I'm hoping for a subscription to the *Aquarist and Pondkeeper* for Christmas — either that or a *Pirelli* calendar!

Note from the Editor

As many of our readers know, Chris has written a number of excellent books himself. These include *A Fishkeepers' Guide to Fish Breeding*, *A Fishkeepers' Guide to Fancy Goldfish* (£4.95 each), and the *Manual of Fish Health* (£12.95) (all published by Salamander Books — and all super Christmas presents in their own right!)

John Dawes



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Letters

South Inch Thanks

It was great to see our two articles in print in the October issue of the *A & P*, which I personally rate above all other magazines.

I've been reading it since June '80, when I first got a small 24 x 12 x 15in tank which, true to form, bred into over 15 tanks in a relatively short space of time!

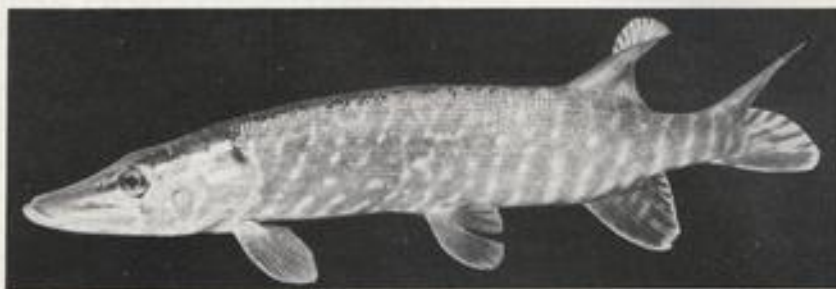
We, here, at South Inch AS, would like to express our gratitude to you and your magazine for making us welcome to the fishkeeping hobby.

The Secretary,
South Inch AS,
HM Prison,
Perth.

Live fish feeding

I write with reference to David Sands' article in the October, 1989, issue of *A & P*, in which he argues against the feeding of live fish to predators.

He argues that the fish used are terrified — obviously assuming that fish realise that their end is imminent. I find this argument incomprehensible. The reaction of fish entering a new tank, whether the tank contains a predator or not, is one of nervousness at being in new surroundings. I agree that feeding live goldfish to predators is not a pretty sight, but the ethics of live food versus dead food must be down to the individual fishkeeper's conscience.



Esox lucius

If David Sands thinks that dead food should be used preferentially, to avoid cruelty, may I suggest that he looks at the methods used to catch, kill, and gut, the fish that grace our tables? I can assure him that death by predator is far more humane than death by trawler. After all, cod, herring and even trout, do not usually die of old age or commit suicide on our behalf.

To continue the theme of feeding live food, if it is cruel to feed live fish, it must also — logically — be cruel to feed with *Daphnia*, *Tubifex*, etc, and to cull out poor breeding stock. Or is the size of the food animal to be the parameter?

David G. Wood,
Northampton.

Pike slap

I write with reference to "Problem Pike" a sub-heading of your monthly questions and answers column. While I have no argu-

ment with the general advice given to the questioner — I wholeheartedly agree that pike should be left well alone by aquarists — I should like to comment on a couple of points made by your coldwater expert.

Many people still have the idea that pike are ravenous, dangerous creatures that "...deserve their nick-name, Water Wolves."

The pike has attracted many nicknames over the centuries, most of which reflect the ignorance of our forefathers in matters of natural history. Such ignorance is still demonstrated today by irresponsible press reports making sensational claims about pike attacking humans, horses, dogs, cows, etc. As far as some reporters are concerned, a two-pound pike will have a go at anything that moves.

Your magazine is a magazine about fish, and while I appreciate that the piece in question says that pike have been "blamed" for attacking people and dogs, you should, I think, be careful of what can be inferred from the items that you print.

Secondly, it cannot be denied that Water Authorities strictly control the transfer of fish between waters. However, the implication given in *A & P* is that such control is enforced to prevent the rapacious pike from eating its way unhindered through Water Authority fish stocks. This quite simply is not the case. A responsible magazine such as yours should realise that very important reasons exist for preventing the uncontrolled removal of fish from one water system to

another.

Most aquarists will realise, without me having to point it out, that one fish, carrying one virus, can wipe out a complete underwater population. Two fish introduced with no regard for the local ecology, can reproduce fast enough to upset the balance of a water system for years. These are the reasons the Water Authorities (we are both being a bit out of date, using that title) enforce the law in order to stop careless people introducing fish to "clean" waters. It has nothing to do with pike; it applies to all fish.

The pike has had a very bad press since Izaak Walton called it the "Tyrant of the river." Much hard work has been done over the past 20 years, mainly by angling groups, particularly the Pike Anglers' Club of Great Britain, to preserve the pike and eliminate the prejudice and fear of centuries. It does not help either those hard-working individuals, or the pike itself, when a magazine enforces the old values and ideas. *Esox* has lived in our rivers and lakes since pre-historic times; support the view that pike are unsuitable for aquaria, but don't subscribe to old-fashioned out-of-date theories and ideas, based on centuries of ignorance and superstition.

Martyn S. Sharpe,
Peterborough.

Editors note

Thank you, Martyn, for an excellent letter. I am in full agreement with everything you say and consider my trout well and truly slapped.

John Dawes.

Derek



Coldwater jottings



Stephen J. Smith

Video choice

Two videos on Koi care are my top choice for this year's Christmas list. These are perfect not only for Koi-keepers but also as a fascinating reference for anyone with any interest at all in the aquatic hobby.

Both titled *Koicare*, part one covers anatomy and diseases, while part two provides information on treatment of Koi. Both volumes are presented in a practical and informative manner by **Helen Bentley**, though I must confess that I was not too impressed with the quality of sound and vision on my review copy.

But, more importantly in my opinion, the videos help to provide a clear understanding of some basic aspects of fish care. The faint-hearted may disagree, but I felt that the use of actual Koi specimens for dissection provided more instruction than any photographs, if only because the real scale of the fish's physiology could be better appreciated.

(I have never had the heart [sic] to dissect any of my own fish, so I suppose the video provides the perfect cop-out!)

In addition to the physical make-up of Koi, including internal and external organs, the diseases and parasites which affect and infect the fish are investigated. This provides the perfect opportunity for some impressive microphotography, which enables the viewer to see moving pictures of live *Trichodin* (a cartwheel-shaped para-

site which lives in the mucus covering of the fish) and *Gyrodactylus* (Gill Fluke), for example.

Part two of the set provides comprehensive advice on the treatment of Koi, both preventive measures, as well as treatments for existing ailments.

Recognising problems is the first step in the care of any animal, and instruction on this particular aspect of Koi-keeping is followed up with sections on use of chemicals, basic equipment, and disinfection of equipment.

These two videos run for a total time of just over an hour, and are a perfect choice for clubs and associations — or even individual Koi-keepers — and should form part of the library of every aquatic society; they are sure to be a popular addition to the libraries of many a Koi-keeper.

Koicare parts one and two

Dan Winter, visiting the GSGB open show in October following a tour of Bristol Aquarists' Society members, demonstrates his "handy carrying box" for importing personally-selected Bristol Shubunkins.



are produced by **D. J. Koi** in association with **Fishcare**, and are available at £28.95 each, plus p&p, by contacting **Helen or Ronald Bentley at Fishcare, 27/29 Vernon Avenue, Woodingdean, Brighton, East Sussex BN2 6BF.**

American visitor to GSGB show

This year's annual open at the Goldfish Society of Great Britain was marked by a special guest — all the way from the US of A!

Enthusiastic Goldfish hobbyist **Dan Winter** travelled to Britain in time for the show and to visit hobbyists in the Bristol area. Said Dan, "Goldfish hobbyists in Britain actually *breed* their own fish! That is something very rare in the USA".

According to Dan, the most popular varieties of Fancy Goldfish in the USA are the Oranda and Rancho, but he particularly wanted to return to his home country with some good-quality Bristol Shubunkins, so where better to look than to members of Bristol Aquarists' Society?

"Imports of fish into the US are of very poor quality," conti-

nued Dan, who is keen on all aspects of the coldwater hobby. "Pondkeeping is increasing in popularity, although chloramine is a big problem. Under US health codes, water is treated with ammonia to neutralise trichlorohalome-thanes, thought to be a cause of cancer, so pondkeepers have to use a separate tank specifically for pre-treatment of water for keeping fish."

Dan is a member of the Colorado Watergardens Society as well as the Goldfish Society of America; not to mention GSGB and Bristol AS. "I've certainly learned a lot about how it is done, and these Bristol Shubunkins will certainly turn a few heads when I get them home," he concluded enthusiastically. And his method of transporting his newly acquired fish "back home" is simplicity in itself.

The fish are housed in plastic bags in a cardboard box, which, itself, can be unfastened instantly for inspection at the airport. A carrying handle allows for ease of transportation, while an envelope on the side of the box contains all the necessary documents required.

Tailpiece

The opening of a new aquarium outlet is always an exciting occasion. Such a venture requires a vast amount of dedication, hard work and commitment, so I'm delighted to be representing *A & P* on the opening day of **Oasis Aquatics** at Ullesthorpe, near Lutterworth (Saturday 2 December).

Situated on a former "pick-your-own" fruit farm between the M1, M6 and M69 motorways in Leicestershire, and close to the main A5 Watling Street, Oasis Aquatics promises to be a hugely successful venture for proprietor **Tony Britain**.

A huge 7000 Koi pool is the centrepiece of the vast under-glass showroom which will cater for *all* areas of the aquatic hobby.

I will be on hand from 11 am to 3 pm to answer your cold-water and general aquatic queries, so do pop along for what promises to be an exciting day.

FACING THE FREEZE

As Dr David Pool of the Tetra Information Centre explains, adequate preparation, sensible feeding and internal "temperature clocks" help pond fish survive the rigours of winter.

With the onset of winter, the water temperature in our garden ponds starts to drop dramatically, often to values only just above freezing point. Pond fish are, in general, able to survive these low temperatures, but to do so, they have to undertake changes in their behaviour and bodily functions (metabolism).

These changes are necessary because fish are cold-blooded or 'Poikilothermic'; this is, their body temperature is similar to that of the water in which they swim. In cold conditions the chemical reactions which occur within the fishes' body, slow down. Therefore all of the bodily functions occur more slowly (eg movement, feeding, digestion and energy production). This results in a number of changes which can be seen if the fish are observed during the winter.

ACTIVITY

Throughout the winter the fish in a garden pond will be less active than in warmer, summer, conditions. During very cold conditions they may well lie on the bottom of the deepest part of the pond. This lack of activity is a result of the very slow metabolism of the fish at this time (as mentioned above). It also allows the fish to conserve their important food reserves, which have to last throughout the winter.

The fish congregate in the deepest parts of the pond because the water here is slightly warmer than elsewhere. The fish are able to detect this slightly warmer water, even if the temperature is only 0.1-0.5°C (0.18-0.9°F) higher.

To allow such areas to remain in the pond, it is important to reduce the water circulation, something that most pondkeepers do by removing their pumps in late autumn. If a pump is to be left running throughout the winter, the flow should be reduced and be directed against some underwater object to reduce circulation. Some Koi keepers add a bucket or dustbin to the pond or build a special "cave" to create a refuge which will contain still water.

Turning the pump off during the winter

will not have any adverse effect on water quality, since the fish are producing very little waste, and the filter bacteria are practically inactive.

Cold water temperatures result in all of the fishes' activities slowing down. This includes the respiration rate which can be observed in terms of the very slow movements of the gill covers. At times the gill covers appear not to be moving, and yet the fish are still obtaining sufficient oxygen for their needs.

If the fish are frightened, chased or forced to swim against a water current, the gill cover movement will increase to provide more oxygenated water across the gills. Such activity obviously requires energy, and the source of this, if the fish are not feeding, is their important food reserves.

NUTRITION

Nutrition for pond fish in winter can be divided into two categories; that originating from outside the body (ie food) and that from within the body (ie from the food stores).

External Food

An often quoted rule concerning feeding fish states that one should stop adding food to the pond when the water temperature falls below 10°C (50°F). Such a rule is a good one to follow — most of the time! It is not that fish

do not feed at temperatures below 10°C (50°F), because they certainly do.

At low temperatures, fish tend to feed irregularly, often when the water temperature increases, and only on very small quantities of food. The quantity of food that the fish require can be obtained from the pond in the form of algae, plant remains and insect larvae. If one feeds one's fish they may take a small amount, but this may well be inefficiently digested with the potential risk to water quality from the faeces.

Uneaten food will pose similar risks to the pond. So the answer, in most ponds, is not to feed at temperatures below 10°C (50°F). In bare Koi ponds, where there is relatively little natural food, commercial foods rich in wheatgerm are often given when the fish show signs of interest. The enzymes responsible for digesting such foods are more active at low temperatures, and so, the fish will get some nutrition from the food. Even with these foods, little digestion occurs below a temperature of 6-7°C (43-45°F), and they can still pollute the water if uneaten, so great care must be taken if fish are fed at low temperatures. Feeding Koi at these low temperatures often has more benefit for the Koi keeper than the Koi itself!

At the start of this section I suggested that there are times when the fish could be fed at temperatures below 10°C (50°F). Such times are generally in the spring when the water temperature rises to 8 or 9°C (46-48°F).

Throughout the winter the fish will have gradually acclimatised to the low temperatures but when the temperature increases, they will become more active and start looking for food. At these times small quantities of food can be offered and this will be digested by the reactivated enzymes.

Internal nutrition

Throughout the summer and autumn, pond fish will feed avidly and will put on a lot of weight. This increase is partly growth, but is also a result of the storage of certain nutrients in the fishes' bodies.

Carbohydrates are stored in large quantities in the form of glycogen in the liver and body musculature. Fat is stored as triacylglycerols in adipose (fatty) tissues around the body, particularly around the body cavity. Proteins, however, cannot be stored.

When the energy requirements of a fish

If a water flow is maintained in a pond during the winter months, it should be gentle and directed away from spots where fish are likely to be sheltering.



cannot be met by the food which it eats, the stored materials are mobilised and used. The rate at which the food reserves are used is dependent on a number of factors, of which temperature and activity are the most important.

At very low temperatures (less than 5°C - 41°F) fish tend to lie dormant on the bottom of the pond using very little energy. Consequently, little of the stored material is required. At higher temperatures, when the fish still are not feeding, they may nevertheless be more active, thus using up the supply more rapidly. Activity, in general, requires energy, which uses up the food store.

If the fish are allowed to remain dormant throughout the winter, the winter is not too long, and they have good food reserves, they will appear none the worse for their ordeal in the following spring. Where this is not the case, the fish may well use up their reserves of fat and carbohydrates, before using muscle proteins as a source of energy. Such fish would appear in an emaciated condition as the water temperature rises, and would be very susceptible to disease.

DISEASE SUSCEPTIBILITY

The immune system of a fish is also temperature-dependent, being virtually inactive at temperatures below 10°C (50°F) - depending on species. At low temperatures we might therefore expect the unprotected fish to become infected with a range of different parasites.

This does not happen, however, because the parasites themselves are also greatly affected by temperature, and are inactive at the temperatures often found in winter. Some parasites are, nevertheless, better able to withstand low temperatures than others. Fungi, for example, may slowly spread at temperatures of 8-10°C (46-50°F).

The main disease problems occur in the spring as the water temperatures start to rise to 8°C (46°F) and above. The parasites, like the fish, become acclimatised to the low temperatures, and a rise to 8°C (50°F) is sufficient for some species to start multiplying.

At temperatures from 8-12°C (46-54°F) the parasites can increase in numbers particularly as the fish are in a weakened state after the rigours of winter and because the immune system is not working effectively. Consequently, the parasites often reach dangerous levels on the weakened fish and this can result in their death in the spring.

Ensuring one's fish are in the best possible condition in the autumn, and ensuring they do not use up too much of their energy reserves during the winter, will help to prevent such problems.

ACCLIMATISATION

Earlier in the article mention was made of the fishes' ability to acclimatise to the lower temperatures of winter. This process may take several days, even for a 1°C (1.8°F) fall in temperature.

When the temperature drops several degrees in the space of two or three days, as it does in most small ponds, it can take a fish 30



POULINAWATIN



LEONARD J. T.

or more days to acclimatise. This does not mean that, once acclimatised, a fish can behave as it did at the warmer temperatures, of course. In practice, the rate of enzyme activity, and therefore, of fish activity, increases only slightly, but sufficiently for the fish to be better able to withstand the cold temperatures.

As the temperature rises a fish acclimatised to cold temperatures will become more active than, say, a fish which has just been placed in the pond.

COLORATION

Koi keepers are well aware of the fact that, in cold conditions, the coloration of a fish is more intense. This is, after all, why the Japanese Koi dealers hold their major shows when the water temperatures are low.

The cold water temperature concentrates the pigment tissues in the centre of the chromatophores (colour cells) and it is this that makes them appear very intensely coloured. When the water warms, the pig-

ment tissue is spread throughout the chromatophore and the coloration can therefore appear faded.

On a cellular or organ level, the ways in which pond fish adapt to, and overcome, low water temperatures is very complex. This article has necessarily skimmed over these areas, but I hope it has given some indication of what our fish have to contend with during the winter - and how they do it.

Top, abundant and adequate feeding during the warmer months of the year will help pond fish prepare for winter.

Above, although adequately prepared pond fish can survive quite satisfactorily in a suitably-deep pond, some of the more fancy varieties, like these Veiltail Goldfish, are likely to suffer, particularly in shallow water. In fact, the darker of these two fish (photographed through a transparent layer of ice) is beginning to show the tell-tale "pine cone" signs of Dropsy.

SURVIVING ANOTHER WINTER

How is it that barnacles can withstand winter exposure to temperatures that would be lethal to most other shore-living creatures? Terry Stephenson explains.

(Photographs by the author)

AS aquarists one of our main preoccupations is to provide a temperature regime for our pets that closely approximates that which they would experience in nature.

For those living in a temperate climate in the UK, this means warming our aquariums in winter and sometimes cooling them in summer. This is not only true for tropical

enthusiasts but also those of us keeping native marines.

All invertebrates, and most fish, have a body temperature that is determined primarily by external environmental factors. Having very limited physiological temperature regulatory mechanisms, fishes' core temperatures will tend to approximate that of the surrounding water with littoral (shore) invertebrates, such as crabs, having a body temperature also influenced by other factors such as air temperature, radiated heat, and wind chill.

However, confronted with temperatures outside those necessary for optimum survival, most animals will display behavioural responses in an attempt to ensure survival.

For example in winter, inhabitants of the British shoreline are noticeably absent.

Winter behaviour

As temperatures fall and winter takes its hold on the marine environment, those animals that can, react by leaving the cold environs of the shoreline and migrating to deeper and warmer waters offshore. Prawns, blennies, gobies and starfishes are among the many absentees. Even the common Shore Crab often found high in estuaries in summer, will leave, owing partly to the increased risk of ice formation, and head for the sea with colder temperatures taking them off into deeper waters.

The Common Periwinkle often found very high up on the shore in the splash zone becomes less active as the temperature falls, eventually falling off the rock and rolling down the beach. Burrowing animals such as shrimps, razor shells and cockles go deeper into the substrate to escape the cold. The problem of cold, however, becomes serious for those creatures that cannot perform either vertical or horizontal migrations and just have to sit it out.

Special adaptations

Barnacles, mussels and limpets are the most obvious and, of these, the barnacles must be at greatest risk, as they are the highest living non-motile creatures on the shore. Some individuals of the species *Chthamalus stellatus* actually live above the extreme high water spring tide mark in the splash zone and are never actually submerged. It is these barnacles that must sustain the greatest temperature extremes and for the longest periods.

As is usual in biological systems, an adaptation to a particular problem is complicated by its multifariousness. At least three factors are thought to initiate the barnacles' resistance to cold. They are, changing day length, reduction in food supply and reducing temperature.

Of the three, changing day length seems to be the primary stimulus, possibly because it is the first sign of approaching winter and potentially cold weather. As there is a delay in the acquisition of cold tolerance from its initial stimulus, a condition must be achieved that precedes the required result. The second adaptive stimulus is the reduction of food supply. The main food source of barnacles is plankton, and a reduction in day length would cause a corresponding reduction in the levels of phytoplankton and, therefore, a reduction in the levels of zooplankton which feed on it. Finally, with the actual drop in temperature, the already-primed system will become more able to cope with the changing conditions.

How then does this conditioning effect itself inside the barnacle? It is known that ice formation inside cells is generally lethal to living material by rupturing cells as it expands on formation. Some fish, particularly those of the polar seas, utilise proteins (inside their cells) which stop the formation

BARNACLES — SOME BRIEF NOTES

These notes refer to the common barnacles often encountered on our coasts and not the parasitic forms that differ in various aspects of their life histories.

Barnacles are the only sessile (fixed) free-living (ie non-parasitic) crustaceans. They are all hermaphrodites and cross fertilisation is the norm. Unlike most sessile organisms that employ external fertilisation shedding gametes (sperm and eggs) into the water, the barnacles still retain internal fertilisation. The "male" possesses a very long penis with which it probes its neighbours, finally depositing sperm between the shell plates into the mantle cavity.

In common with other crustaceans, barnacles brood their eggs, but, in this case, a sac within the mantle cavity is used.

Eventually, the nauplii larvae (very similar to the Brine Shrimp nauplius) are released into the surrounding water.

Larval numbers are high, reaching tens of thousands per individual.

The nauplius undergoes six moults, followed by a final cypris stage that cements itself, head-down, onto a suitable surface. The cypris is a non-feeding stage and, not until metamorphosis is completed, can the young barnacle begin feeding.

Growth of the shell plates is almost continuous, while the body grows by successive moults of the exoskeleton, which is pushed out of the cavity and discarded. Being filter feeders, barnacles rely on the water to bring their supply of phytoplankton which they actively push into their mouths using their protruding cirri (legs). Barnacles are intermittent feeders, spending periods inactive with the shell plates closed.

They are believed to live for up to six years, but this will vary greatly, depending on environmental factors.

Balanus balanoides — one of our cold-tolerant Acorn Barnacle species.



of ice crystals causing their destruction as they begin to form.

Other products used by plants and insects living in high latitudes, lower the freezing point of the cell contents, allowing them to become super-cooled without freezing. These products are based on glycerol as is the antifreeze used in car engines.

Unanswered questions

None of these methods, however, are utilised by the barnacles as it is known that up to 80% of body water is frozen under extreme conditions with no damage to the animal being sustained. It is therefore believed that the formation of ice takes place, not inside the cells, but between and surrounding them. This process also has the added effect of dehydrating the cells as the ice sets up an osmotic gradient with the cell contents. This ensures a flow of water out of the cell, across the cell wall, and into the spaces between.

The mechanisms by which barnacles can withstand such cold conditions are still not fully understood. For example, why the ice formation begins in the spaces between the cells and not within them is not known. Some agents must be present to encourage ice formation, but their presence has not been found.

The improved permeability of the cell wall to facilitate dehydration is another adaptation that needs researching.

The coastal environment is a continually changing one and, although the animals and plants that live in it are highly specialised



These submerged barnacles have their cirri ("legs/feet") extended to trap passing food items (largely, plankton).

and adapted to withstand its rigours, catastrophic events do occur that have a marked effect on populations.

It must always be remembered that whatever systems are utilised, there will always be a temperature and time profile outside of which survival will not be possible. It is here, then, that mass mortalities will occur.

This has happened in the past with various species. Tons of dead cockle shells were washed up on the Lancashire shores after the 1904-5 winter. Sting Winkles and Dog Whelks were killed in great numbers along

the Essex coast during the 1928-9 winter and razor shells were strewn along the Firth of Forth during the cold February of 1855.

Animals that may be a common sight on a beach one year may not be so the next. One must consider what conditions nature has presented them with to overcome, and whether their response is equal to the task. Generally, it is.

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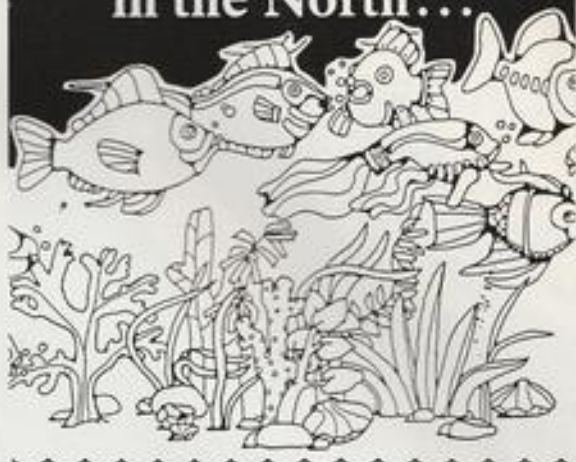
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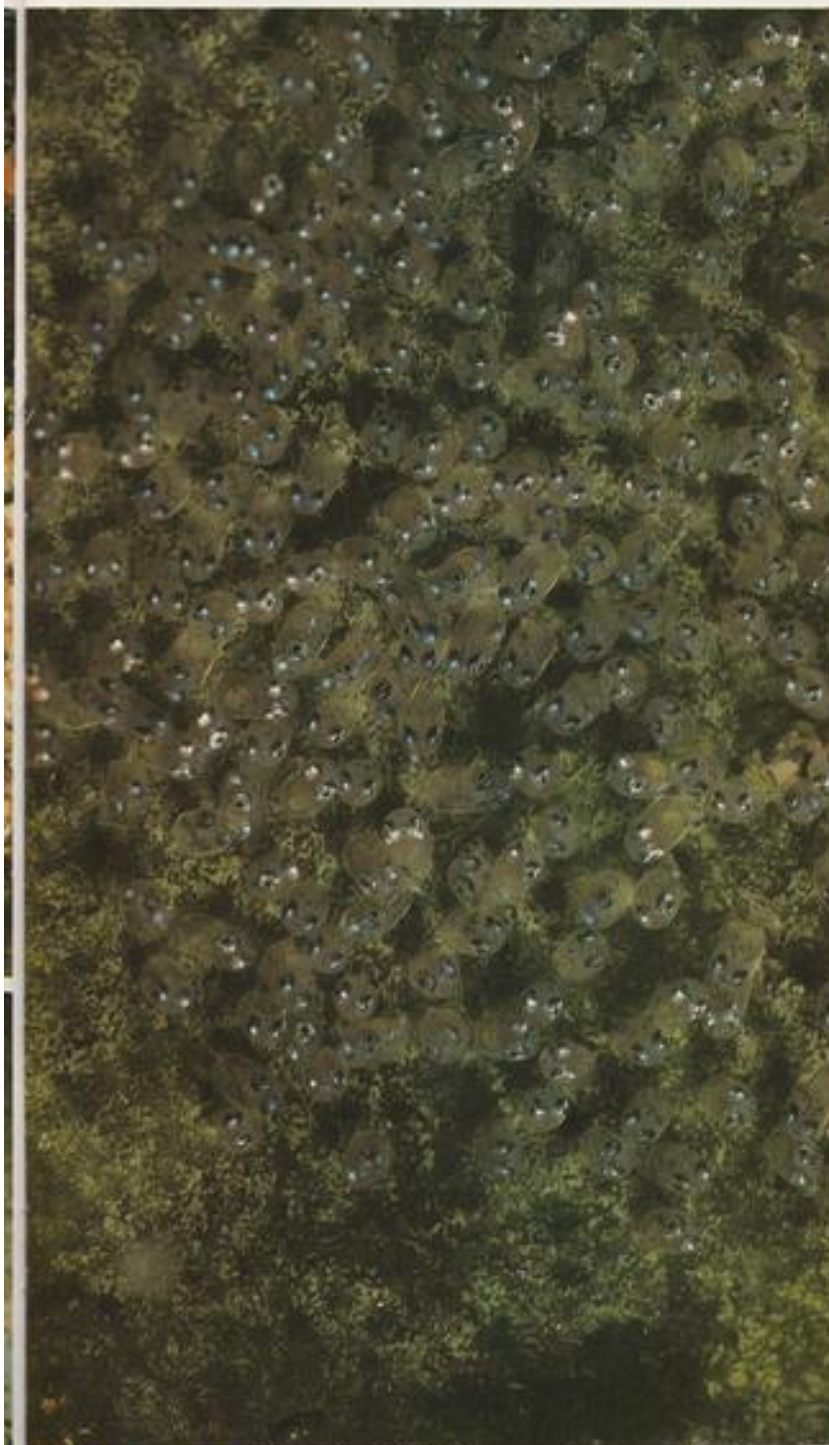
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CURIOUS CLOWN



Anemonefish will be familiar to anyone who has visited a tropical marine aquarium or has kept tropical marines. These colourful fish, often with striking patterns of bright orange, white and black, catch the eye as they dance and twist within the protective embrace of their anemone host.

These highly specialised Damselfish (Pomacentrids), also known as Clownfish, belong to the subfamily Amphiprioninae. They are a group of tropical fish inhabiting coral reefs, restricted in their distribution to the Indo-Pacific Ocean from which some 27 species have been described.

Anemonefish have several unusual aspects to their biology, two of which are described here: their intimate relationship with large sea anemones and their sex life.

Clownfish/anemone relationship

The association with anemones (often species of *Stichodactylus* or *Radianthus*) is a symbiotic one, a situation in which both partners gain some advantage.

It is not entirely clear how a Clownfish avoids being captured by an anemone which, after all, sometimes includes fish in its diet. Studies have suggested that immunity to the host's stinging tentacles is not inherent in the fish but must be gained over a period of several hours. For example, a fish isolated from its host for a time will lose its immunity.

Once they have found a host, fish swim tentatively in and out among the tentacles, appearing unwilling at first to submerge themselves totally. It is therefore thought that a mucus covering develops over the fish and that this does not trigger the nematocysts (stinging cells) which are normally discharged by the anemone on contact with its prey. Indeed, if you touch these large anemones yourself, the tentacles feel "sticky" with discharging nematocysts. These can actually cause severe pain if they adhere to sensitive parts of the body.

No other fish species live in such intimate contact with anemones as the Amphiprioninae, although some other fish are regularly found in close proximity to large anemones. One such is the Three-spot Damselfish (*Dascyllus trimaculatus*), another Pomacentrid, which is often found close to an anemone but rarely nestles among the tentacles. Frequently, these fish may "share" a host with a species of true Anemonefish.

The advantage to the fish in this symbiotic

Far left, *Amphiprion bicinctus* photographed on Sanganeb Reef in the Sudanese Red Sea.

Left centre, *Amphiprion polymnus* photographed in a sandy habitat off the east coast of Malaysia.

Top left, a pair of *Amphiprion ocellaris* with their anemone on a Malaysian reef.

Left, *Amphiprion ocellaris* fry just about to hatch.

INS

Dr Lin Baldock reveals some of the many attributes that make Clownfish such strong favourites with aquarists the world over. (Photographs — except where indicated — taken by the author in the wild).



Two *Amphiprion clarkii* in a different type of anemone, together with the black, Three-spot Damselfish *Dascyllus trimaculatus*.

relationship is clear. The otherwise slow-moving, vulnerable *Amphiprion* has won for itself a secure refuge, inaccessible to would-be predators. Indeed in one situation I have observed small individuals of *Amphiprion polymnus* actually disappear inside the body cavity of the anemone when approached too

closely, leaving only the two largest fish to defend the nest. The anemone in this case was a species with short, stubby tentacles living in an expanse of open sand which provided no other hiding place for the fish.

Benefits for the anemone are more obscure. I have watched individuals of *Amphiprion melanopus* in an aquarium unsuccessfully attempting to feed their host anemone. The largest Clownfish would swim into mid-water and grab another fish, in this case a Blue Puller (*Chromis aripetectoralis*), and drag it struggling towards the anemone. This actively explained the ragged tails of our unfortunate Pullers. Subjectively, this behaviour seemed more pronounced when the anemones had not been fed for sometime. Perhaps, as it became hungrier, the landlord was making life more uncomfortable for the tenants! The Anemonefish themselves are largely plankton feeders.

Two further possible advantages to the host spring to mind. Anemones are usually situated in areas of considerable water movement. In aquaria, the largest species, which can reach a diameter of as much as one meter (39in), do best when positioned in a strong water current. The acrobatic activities of the *Amphiprion* may therefore enhance water movement over their host's body. There is also some evidence that the fish remove waste material and dead tissue from the anemone.

Curious sex life

The sex life of these colourful Clowns is rather bizarre. They all start off male and, if they are lucky, become female in due course. This is known as protandry (or protandrous hermaphroditism), an unusual pattern among fish which change sex during their life cycle. The more common sequence is for the fish to start life female, becoming male

later on — protogyny (or protogynous hermaphroditism).

Within the confines of any one anemone the largest fish will be female, the second a mature male and the remainder small, immature males. If the female is lost to the little colony, she is replaced by the mature male, who changes sex. His position is, in turn, taken by the next in the pecking order among the immature males.

Eggs are laid on the coral rubble underneath a fold of the anemone and are tended by both the male and female who remove dead eggs, protect them from predators and prevent their brood from being swamped by algal growth. Once the fish hatch, about a week later, usually under cover of darkness, some of the juveniles are driven from their home and forced to find another anemone.

It is thought that populations of the fish within an area of reef are limited by the number of suitable anemones. Anemones are often seen without Anemonefish, but the fish are never seen in isolation and do not live long in the absence of an anemone.

Most Clownfish finding their way onto the British market are still taken from the wild. In some areas this has caused severe depletion of reef populations of these and other commercially valuable species. Problems arise, both as a direct result of over-exploiting the fish populations, and as a consequence of the sometimes destructive methods used to extract them from their reef hiding places.

Indiscriminate

Anaesthetics, and poisons such as cyanide, have been used on reefs to capture fish (more for food than aquarium purposes). Other methods often involve breaking up the reef structure. Indiscriminate use of such techniques has led in the past to the damaging of a much wider range of species (both fish and invertebrates) than those being sought commercially. Fortunately, there is now a greater awareness among exporting countries for the need to maintain a sustainable fishery for the aquarium trade, together with an intact reef, so important for the tourist industry. In order to achieve these ends, legislation has been implemented in many areas to halt reef damage through collecting.

The full extent of the size of the industry is not known. However, one company in Sri Lanka, reported on in a recent survey of the reef fish trade made by Liz Wood, was estimated to export annually 60,000 Anemonefish alone. Let us hope that conservation measures, plus large-scale captive breeding programmes, some of which already exist, are adequate to protect these entertaining fish in their natural habitat.

CLOWNFISH NOTES

Anemonefish are readily kept in aquaria and are suitable for a community tank, provided that the fish are not too large. It is important not to have two Clownfish of a similar size in any one tank as they will then fight violently until one gains dominance, (though, having said that, some species are more aggressive than others).

In my experience, *A. melanopus*, though difficult to photograph in the wild because of its timidity, is aggressive towards any fish sharing its tank. In contrast *A. periderision*, on average a smaller fish, is a much more peaceful species.

It appears that the presence of a host anemone in the aquarium is not essential for the well-being of the fish, and fish may be less aggressive towards one another in the absence of an anemone.

Anemonefish have been bred experimentally in captivity since the 1930's and some species are now available in Britain which have been "tank bred". One species, probably *A. ocellaris*, available from our local aquarist, had been imported from breeders in Florida. This is good news both for the fish and the marine enthusiast. Commercial breeding reduces the pressure on wild populations and makes the fish more readily available, and very likely cheaper, for the aquarist.

Further Reading

G. R. Allen (1974): *Anemonefishes: their Classification and Biology*. (Second Edition. T.F.H.), New Jersey. (Details of taxonomy and a mine of information on their biology).

E. Wood (1985): *Exploitation of Coral Reef Fishes for the Aquarium Trade. A Report to the Marine Conservation Society*.



The Flame Angel — a spectacular favourite.

FAVOURITE MARINE COMMUNITY FISH

Gordon Kay attempts the impossible — to select his six top community species — with considerable success.

Oh dear! To try to choose half a dozen or so favourite fishes for a two-page article is quite a task — two dozen would have been much easier but, as always, space is limited, and so I have to be ruthless.

Therefore, I shall take a more scientific approach and imagine that we are going to stock an aquarium from scratch. Our tank will be one of 50 gallons (225 litres) net capacity — that makes things nice and simple for me — and we shall assume that it has gone through the usual maturation periods. This means that we have a fish capacity of 12½in (31.8cm) for the first six months and 25in (64cm) thereafter (following Graham Cox's Golden Rules of stocking).

First choice

The first fish into a newly-matured set-up should be the one most likely to cope with the potential see-sawing of water quality. On the other hand, some fishes in this category

tend also to be rather aggressive as they mature, so we have to be careful.

My choice for this job has to be a small school of Green Chromis, (*Chromis cyaneus*). These lovely little fishes are damsels and, yet, they are totally peaceable, so they will cause no problems later.

Chromids live in huge aggregations above the reef, feeding on plankton. This means that they are easy to feed, gorging themselves on anything that's going such as brine shrimp, bloodworms (but not too often) and lobster eggs. Three or four will show very well in our tank, spending all day swimming as one and darting into the coral and rocks when alarmed. Lovely!

Lovable Hovercraft

Now, at this point, we have the perfect opportunity to introduce any shy, retiring species we want. Any ebullient types should be left until last, when they are least likely to cause bother.

My next choice for the next purchase would be a Hovercraft (*Tetraodon gibbosus*). I love

these whimsical-looking characters, which are members of the Ostraciontidae family and hail from the Indo-Pacific region.

You may recall a *Seaview* item earlier this year about the Boxfishes and their relatives being capable of releasing a toxin into the water when they are distressed in any way. This toxin is lethal enough to kill everything in the aquarium — including the Boxfish — but I feel that the desirability of keeping this species far outweighs the risk.

Everybody loves them too, and so, in it goes. Hovercrafts reach a length of about 4in (10cm) in the aquarium and are rather shy, so we can't house any bullies in our tank. Like the Chromids, they will eat any kinds of food, making life even easier.

Angel dilemma

No community is complete without an Angel. I'm sure everyone would agree with that, and so, we must have one in our aquarium. I am particularly fond of the *Centropyge* (dwarf) species, which is handy because we don't want to use up all the

FAVOURITE NATIVES

Andy Horton chooses his personal favourite native marines and adds other popular fish and invertebrates for the home aquarium.

(Photographs by the author)

Hard-headed scientists do not have favourites! In order to keep a detached and clear view, they must not be blinded or influenced by emotional or personal preferences. I do not believe this for one minute!

Certainly, I have my own favourites, and one of these is the querulous and hilarious Hermit Crab. It is difficult to imagine that anyone can fail to be amused by the antics of this Anomuran as it ungainly clambers over rocks and fights for the possession of gastropod (snail) shells.

Hermits

In the survey I undertook in 1987, this abundant animal was a narrow leader as the most popular (87%) species kept by British native marine aquarists. At least eight species of Hermit Crab are found in British seas. By far the most common is *Pagurus bernhardus*, the Common Hermit Crab, and it's this species which is most often found on the shore, inhabiting univalve (snail-like)

shells of the smaller molluscs, typically the Periwinkle. This is where the attraction lies. Most aquarists will be familiar with the need for this crustacean to adopt a shell of its own to protect its soft abdomen from attack by the aggressive fish and crabs found on the shore and in the shallow seas.

This species is first seen on the shore when it is about 8mm long, having curled into a very small Grey Topshell or the smaller species of Notted Dogwhelk shell. Very soon, it requires a bigger home, and will begin a process of continually searching for different shells throughout the formative years of its life.

On Sussex shores, this Hermit Crab is found in the disused shells of the Periwinkle, Grey Topshell, Notted Dogwhelk, Whelk, Flat Winkle and Stag Winkle in order of frequency. Eventually, the Hermit Crab will occupy the more commodious Whelk shell, and it will be much more common in deeper water. Occasionally, they will live in the shells of the less common Purple Topshell, and even occupy the unsatisfactory shell of a



TOP 20 NATIVE MARINE SPECIES

(Based on a survey which I carried out between 1986 and 89)

Common Name	Scientific name	% of bobbyists keeping the species
1. Hermit Crab	<i>Pagurus bernhardus</i>	87
2. Beadlet Anemone	<i>Actinia equina</i>	83
3. Dahlia Anemone	<i>Urticina felina</i>	71
= 4. Prawns	<i>Palaeomon</i> sp	67
= 4. Blenny (Shanny)	<i>Lipophrys pholis</i>	67
6. Butterfish	<i>Pholis gunnellus</i>	62
7. Bullhead (Sea Scorpion)	<i>Enophrys bubalis</i> (= <i>Taurulus</i>)	60
8. Snakelocks Anemone	<i>Anemone viridis</i> (= <i>A. sulcata</i>)	58
9. Shore Crab	<i>Carcinus maenas</i>	50
= 10. Common Starfish	<i>Asterias rubens</i>	46
= 10. Cocksing Wrasse	<i>Cremilabrus melops</i>	46
= 12. 5-Bearded Rockling	<i>Ciliata mustela</i>	42
= 12. Shore Urchin	<i>Phanerochinus milareis</i>	42
= 12. Common and Sand Gobies	<i>Pomatoschistus</i> sp	42
= 12. Squat Lobster	<i>Galathea</i> sp	42
16. Plumose Anemone	<i>Mitridium senile</i>	37
= 17. Rock Goby	<i>Gobius paganellus</i>	33
= 17. Sea Stickleback	<i>Spinachia spinachia</i>	33
= 19. Pipefish (various)	Syngnathidae	29
= 19. Grey Mullet (fry)	<i>Chelon labronus</i>	29



Slipper Limpet. It depends on the prevalence of the respective gastropod molluscs, which will vary in different parts of the British coast.

If more than one Hermit Crab is kept in the same tank, do not be surprised to hear repeated tapping sounds, often against the side of the glass, as one Hermit Crab tries to deprive another of its home. This will occur even if there are plenty of empty shells provided.

There are many aspects of the behaviour of the largest British species, *Pagurus bernhardus*, that the aquarist can find out for him/herself. The worm that sometimes occupies the shell with adult Hermit Crabs is *Nereis furcata*, and the commensal sea anemone that may be found on specimens collected from deep water in south-west Britain is *Calliactis parasitica*.

The success rate in keeping Hermit Crabs in captivity was at first highly erratic. This was due to several factors, an important one being its vulnerability to attack by almost every other creature. The smaller Hermits succumbed quickly, and the worst predators were larger crabs, especially the Shore Crab.

The ability of some Hermit Crabs to survive throughout a hot summer was confusing at first. I have now discovered that I was keeping two different and similar species. One small species, which I believe to be *Anapagurus laevis*, remained in a small Grey Topshell for over one year before ejecting its larvae in the late spring. The Common Hermit Crab seems to be intolerant of water temperature exceeding 19°C (66°F).

The deep water Hermit Crab, *Pagurus prideaux*, is coloured a deep red and possesses numerous fine hairs on its appendages and legs for trapping plankton. However, its most distinguished feature is its commensal arrangement with the spotted Cloak Anemone, *Adamsia maculata* (= *A. palliata*). Early in the life of this Hermit Crab, the sea anemone is attracted to it and attaches itself to the empty shell that the crab inhabits, wrapping itself around and completely covering the shell. From then on the anemone affords the crab protection instead of the collection of different shells.

This association will occur on all occasions, and neither the crab nor anemone will survive for long if they are separated. Unfortunately, this crustacean has proved to

Left, top, my personal favourite of favourites, the Blenny, *Lipophrys pholis*.

Left, above, Cushion Starfish, *Asterina gibbosa*. Full-grown specimens of this echinoderm are able to live happily in home aquaria as long as they obtain sufficient nourishment.

Left, an adult Hermit Crab, *Pagurus bernhardus*, in a whelk shell.

Far left, the Sea Anemone, *Sagartia troglodytes*, thrives best in strong currents. Although it frequently occurs in buff hues, this anemone can be found in almost any combination of colours, including the purple in this photograph.

be difficult to keep in aquaria for periods exceeding four months.

Other Hermit Crabs found in British waters are two very small species *Anapagurus hutchinsoni* and *Anapagurus chiroacanthus*, a medium-sized species, *Pagurus caementis*, and a larger species, *Pagurus pubescens*, all of which are normally present only in waters offshore. A further species *Diogenes pagulator*, is bluish in colour, and also differs in having the largest claw (chela) on the left side (appears on the right when viewed from the front, with the shell spiral on the left)¹. A warm water species, *Gibbanarius erythropus*, is now absent from the British fauna list².

Fish favourites

Rare or spectacularly colourful fish usually attract the most attention, so it may come as a surprise to the reader that my favourite fish is both not particularly colourful, and the most widespread, and one of the most prevalent fish found on British shores. It is the Blenny, *Lipophrys pholis*, which was featured in the October 1989 *A & P*. It is both hardy and amusing. If you are lucky, it will even breed in captivity.

The Bullhead, or Sea Scorpion, *Eophrus bubaia*, is a typical shore fish, relying on camouflage to enable it to remain hidden, before rushing out from its place of ambush to swallow small fish and prawns. It has large pectoral fins that enable it to manoeuvre in confined spaces. Its voracious appetite and its readiness to feed, obviously, have their appeal. Bullheads are intolerant of sustained high temperatures and must be kept away from any other animal that will fit in their over-large mouth.

One of the complaints or disadvantages voiced about the local piscine fauna is the absence of free-swimming fish. This role can be filled by the colourful Wrasse family of fishes. Corkwing Wrasse, *Crenilabrus melops*, are the most common, and juvenile fish provide amusing antics as they carouse around the aquarium. They are territorial, though, and intimidated fish will die if not removed. Also, in two years, they will out-grow most home aquaria and ferociously attack prawns and crabs, and the more delicate creatures. On the plus side, they are hardy and will thrive in temperatures as high as 28° (82°F).

The only small mid-water fish that can be recommended is the Two-spot Goby, *Gobiusculus flavescens*, which needs to be kept in a tank without predators. Although the smaller Gobies (family Gobiidae) are easy to keep, they are rather dull-coloured and hide on the bottom. One of the first fish that I kept was an adult Black Goby, *Gobius niger*, a sandy-patterned fish that sat on top of the largest rock in the tank and attacked anything else I tried to put in with it.

Anemones

Colour in British sea life aquaria is provided by the sea anemones. Beadlet Anemones, *Actinia equina*, are the most noticeable on rocky shores. In a properly established aquarium, they prove to be easier to keep than the Goldfish. Adult specimens,



The Bullhead (or Sea Scorpion) has an enormous mouth. It can swallow fish as large as itself.



The Sea Hare, *Alypsia punctata*, is a mollusc with a small internal shell. These creatures are often referred to as Sea Slugs, or nudibranchs. They feed on selected seaweeds, eg. *Ulva*, and are difficult to keep alive in aquaria.

GLOSSARY

Anomuran: a crab-like creature with the fifth pair of legs reduced and often hidden. (True crabs are Brachyurans.)

Gastropod: a soft-fleshed mollusc, usually with a coiled shell.

Mollusc: soft-fleshed animal, usually with an external shell, although this may be lost in the evolution of some species. Often colloquially referred to as shellfish.

Crustacean: an invertebrate with a carapace or external skeleton.

Plankton: the drifting, usually miniature, life of the surface waters of the sea.

Commensal: living together.

Pectoral fin: fin just behind the gills, on the side of a fish.

Zooxanthellae: a type of symbiotic algae associated with corals and sea anemones which will usually colour the species green.

with base diameters of 25mm to 45mm (1 to 1.8in) can be found in red, green and brown varieties. A larger "strawberry" variation can attain 64mm (3.6in).

In July, 1989, I was fortunate to discover an anemone with the scientific name of *Anthopleura balia*, which only occurs on rare occasions on Sussex shores. It was possibly only the second occasion it had been recorded. This brownish-red speckled anemone had green zooxanthellae (internal symbiotic algae) lines emanating from the mouth, across the disc to the base of the tentacles.

This brings me to the discussion of the nature of the "native" hobby, and why

enthusiasts persist in keeping the local species rather than the more colourful tropical imports. It lies in the discovery and exploration of the coast itself, and the understanding of the world of the seashore. The successful aquarist will return more specimens than (s)he catches realising that many of them are not compatible with one another.

Other inverts

Experienced native aquarists tend to concentrate on the small invertebrates because they are often easier to keep, and provide more interesting aspects of behaviour.

The humble Prawn, *Palaemon*, provides great fascination for people who have not observed the complicated cleaning procedures of this transparent creature.

The small crimson-red Hairy Crab, *Pilumnus hirtellus*, is desirable because it does not wreak the destruction of the larger species. It can be identified by having claws of unequal size (I used to think that most of the crabs had a larger right claw, but it may be that the smaller females had larger left claws).

Although all species of animal from British shores are now likely to have been identified, there are many puzzles of behaviour that have yet to be explained. Why does the small Short-legged Spider Crab, *Pisa armata*, maintain a close association with certain sea anemones? It probably obtains nutrition from organic matter exuded or collected on the tentacles of species like *Sagartia troglodytes*, a sea anemone that sports every colour excepting blue. Yet, larger Dahlia Anemones, *Urticina felina* (= *Tealia felina*) will swallow this and other crabs if given the opportunity.

On a final note, I would recommend that, for the best enjoyment and interest the aquarist chooses carefully which species (s)he wishes to keep. For example:

1 The most peaceful fish include some of the smaller Pipefish, *Syngnathidae*, which require exclusively live food.

2 Two species of Clingfish are only rarely found on the shore: the Cornish Sucker, *Lepadogaster lepadogaster*, and the Small-headed Clingfish, *Apletodon microcephalus*.

3 The Cushion Star, *Asterina gibbosa* is tolerant of high temperatures, while the Common Starfish, *Asteria rubens*, is not.

4 The Shore Urchin, *Psammochinus miliaris*, should be kept away from sharp-toothed fish like the Blennies and the Wrasse.

With a little bit of thought and care, the discerning native marine aquarist can put together a collection to match any tropical equivalent every step of the way.

References

¹*A Key to the Crabs and Crab-like Animals of British Inshore Waters*. By John and Marilyn Crothers AIDGAP Field Studies Council (1988).

²*Journal of the Marine Biological Association of the UK*, Vol 68, No 3 (August, 1988). A J Southward and E C Southward.

³*The Eggs and Planktonic Stages of British Marine Fishes*. By F S Russell, Academic Press (1974).

SEAWEED SELECTION

Gordon Walker selects some of the seaweeds, or macro-algae, which do well in tropical marine aquaria and presents some of the background and guidelines essential for their successful cultivation. (Photographs by the author)

A wide range of the plants are found in the oceans. The flowering plants, or Spermatophytes, range from mangrove forests which serve an essential environmental protection role (as their spear-shaped seeds fall and take root) to bind the tropical estuarine mudflats together, thus protecting valuable fisheries and coral reefs from silt damage during the rainy season, to Eel, Turtle, or Manatee Grasses which are important in areas of lagoon between shore and reef and other shallow water regions.

Then, of course, there are the algae or seaweeds. These are divided into micro (small) and macro (large), depending on size. They are further divided by colours into greens, browns and reds. Other groups include the diatoms and dinoflagellates, micro algae which, while important to reef and marine ecology, are not very important to hobbyists (although fossil structures of these plants are used in diatomic powder in water filtration where high purity is required).

Symbiotic relationships

I have always stressed that growing algae successfully is the key and starting point in marine aquaria. Micro algae, for example, are found growing symbiotically within the structures of many marine organism, such as corals, anemones, molluscs and crustaceans. They provide essential nutrients to their partners through photosynthesis, when light enters the animal through its tissues.

Therefore if one can't grow algae, these animals will eventually die. This accounts for the tales of shrinking corals and despondent anemones, which, despite good vitamin-rich food eventually succumb, providing another "mystery" of marine aquar-



Above, *Caulerpa sertularoides* — one of the most popular of all seaweeds.



Left: Sea Apple (a type of sea cucumber) among some red seaweeds.

ium culture. Yet, the answer is quite simple: the death of the symbiotic algae!

Minimal lighting requirements

Because of the requirements of photosynthesis, marine plants are limited to a depth where adequate light will penetrate. They are therefore absent below 100 metres.

Lighting is an important factor in the aquarium, with the best algal growth occurring where the light is strongest. Any normal fluorescent tubes suited to aquariums, and even tungsten bulbs, are suitable. If there is a basic rule, it is to use about 9in (c 22cm) of tube square per foot (900 sq cm) of surface area of aquarium as a minimum. You can't have too much light, basically, but there are exceptions to every rule.

One friend placed a 400 watt Halogen quartz horticultural plant growth light over a 4ft (120cm) marine aquarium containing a few *Caulerpa* plants. He expected rapid growth of this valuable species, plus some mail order profits as a result. In an attempt to promote successful growth, he then added a sea plant fertiliser. After only a day the water was pea soup green; after another, filamentous algae had smothered every surface of the rock work. Returning after only a week away, his *Caulerpa* was dead, and the tank an unsightly mess.

The lesson is that, with strong light near to reef intensity, and in a shallow home aquarium, algae will rapidly exploit any food source, causing a micro-algal bloom, which will need to be tackled (i.e.) filtered and removed with a diatomic filter, or "eaten", utilising natural plankton available for rotifer cultures.

Rotifers (microscopic "wheel" animals) can be introduced, in fact, into a new aquarium where algal blooms occur. Once the algae are devoured the rotifer population crashes, but corals and filter feeders will enjoy the situation in the meantime.

Solving algal problems

One answer to algal problems (i.e. sudden explosions of green, red or brown) is very simple: remove their food sources of (e.g.) nitrates, by minimising additions of protein, by minimal feeding of the fish and by using nitrate filtration methods (e.g.) Nitrex or Siporax, or other proven systems, according to manufacturers' instructions.

In addition, do not remove red algae from the aquarium; allow them to spread unhindered where they will form mats. Eventually proliferation will stop, and almost magically, they will be transformed into a mixture of green and green filamentous algae. The red mats seem to form a good base on which other organisms can grow, including spores from macro-algae introduced with imported fish and invertebrates, water and living rock; even fish droppings may contain living organisms ready to colonise rockwork.

If you want to see some of the "red algae" micro-community, remove a ten pence sized piece of algal mat. Examine it under a microscope or hand lens, and you will get an idea of its complement of animal life, all

helping in the battle to achieve balance in the aquarium by utilising the excess nutrients that cause some of the problems.

It is, of course, advisable to remove red algal mats from living corals or macro-algae that may be threatened by them. However, if coral sand is cleared by siphoning the surface off, the problem will return, within a day or so, so long as the appropriate nutrients are present... better let nature take care of things.

Above all it is worth remembering to use minimal feeding in new set-ups, and very low stocking levels of fish that require protein-rich foods. For filter feeders this may require the addition of controlled amounts of liquid feeds of proprietary invert mixtures. Any excess will, of course, increase the fertility of the system and add to algal problems.

As a general rule, I always soak and boil shells used in decoration, never accepting the story that they are completely clean.

Even a small amount of dead animal, once re-hydrated, could, if not ruin a new set-up, cause great problems and promote the nasty algal problems I've mentioned above.

Never be tempted to add crab or lobster exoskeletons as decoration, unless well painted with a safe marine varnish; it's asking for more trouble.

This may all seem to stress the negative, but if we heed this caution, red algae need never be a lasting problem.

Seaweed sources and cultivation

Many old publications say that seaweeds are impossible to cultivate. I'd guess that this was due to use of high levels of ozone introduced into filtration systems, plus excessive use of copper medications, which remain in holding tanks, rockwork, etc as copper carbonate, often in levels high enough to kill many inverts, and seriously weaken algal growth. Copper is present in

SEAWEED SUMMARY CHART

Green Seaweeds

Caulerpa Species: Green seaweeds that grow on running stems with many divisions, "leaf" form is variable, depending on growing conditions. Within limits, very tolerant; can become rampant; to control, cut back "leaves".

C. prolifera: Dark green strap-like leaves, up to 2ft (60cm) long, with divisions; thin hard rhizome (i.e.) "creeping stem"; slow-growing compared to other types.

C. mexicana: Bright green, fern-like "leaves" with awl-shaped leaf petaloides; may become rampant; easily affected by filamentous algae; water fertility low; light requirements low.

C. verticillata: Blue-green, delicate fine "leaves", feather-like cylindrical leaf petaloides; attractive; preferred by grazers; good water quality and high light levels.

C. serrata: Small, serrated or saw-toothed "leaves" on thick rhizome; slow grower, but hardy.

C. crassifolia: Most attractive oak-shaped, light green translucent soft "leaves", on soft hollow rhizome; needs good light; protect from grazing till well established.

C. racemosa: Large "leaf" structures, like bunches of grapes; most unusual, but needs strong light; avoid disturbance; tends to collapse if damaged.

Other Green Seaweeds

Halimeda (Sea Cactus): The calcified plate segments make this plant easy to recognise; common on high-quality living rock; forms thick mats; often colonised by invertebrate communities.

Penicillus capitatus: The "shaving brush" shape identifies this plant; must have a rock base for long-term survival.

Thalassia testudinum (Turtle Grass): Rarely imported, but easily grown in coral sand.

Brown Seaweeds

Sargassum: Easily grown plants found on living rock, floating and on sand; has gas-filled floats.

Brown seaweeds, if attached to rock, grow well. Watch out for damaged "leaves" extruding thick gelatinous substances. All species require good water quality.

Red Seaweeds

Many species are regularly imported. All require clean, well-filtered water free from particulate matter. Will tolerate low light levels; slow growers, so protect from grazing. Best grown individually, rather than as a group, to highlight red colour.

Extracts courtesy of *Beginners Guide to Marine Plants*, ISBN 1-871776-007 — Gordon Walker Associates, The Cottage, 20 Dundonald Road, Kilmarnock KA11 6E.



Caulerpa prolifera can grow extremely well, given a bit of care.



"Red Grape Seaweed" — as yet, we have no scientific name for this species.

small quantities in seawater, and is naturally concentrated in seaweed growth; nevertheless, excess copper kills sea plants.

Marine plants other than those which grow from a creeping stem (e.g.) the various *Caulerpa* species, require a holdfast of coral rubble or rock; any plant removed from its base will ultimately die, causing slow pollution of a small enclosed aquarium system. Marine seaweeds on proper bases therefore require careful transportation, and higher air freight costs, and demand a premium price because of this.

A wide selection of green, brown, and red sea plants are available, and, as always exceptions prove the rule, some are commercially grown from cuttings!

Living rock is a perfect source of sea plants, often being covered in *Caulerpa*s in variety, as well as in calcareous "green cactus" plants like *Halimeda*, or the green fan-like *Udotea*.

Interestingly, even the most unpromising living rock may, after months, sprout a fantastic and unexpected seaweed. Look out for red patches or brown green dots on rock surfaces; these may be small "plates" of algal cells which will eventually, given the right conditions, burgeon forth.

Some hobbyists sell excess supplies of *Caulerpa*s through classified adverts. This can be a very good source of plants, but it is worth bearing in mind both potential postal problems and the narrow temperature toler-

ances of delicate plants.

Seaweeds must be sent by Datapost, or Special Delivery — not ordinary letter post. I once spent £8 on a small sample, and received, by return, *Caulerpa* crushed into a poly bag in an ordinary envelope... so check things out before buying in this way.

Bearing all this in mind (and herbivorous marine life permitting) there is no reason why a home aquarium should not be more than just a sterile habitat. Plants and animals can flourish in any marine aquarium... given time and due consideration.



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TOP INVERTEBRATES

Thinking of taking up invertebrate keeping? Then go no further until you read **Dave Garratt's** expert views on what to choose and what to avoid.

(Photographs courtesy of the Coral World, Eilat)

It is not surprising that the beauty and serene nature of an established marine invertebrate aquarium attracts many admirers. This admiration is enhanced by the stunning coral reef documentaries that regularly appear on TV screens these days. Commercially, "Mini-reef" aquaria that are aimed primarily at invertebrates, are gaining a large slice of the market, thus giving invertebrates a high profile on the retail front. These factors are leading a great number of people into the area of marine invertebrate aquariums.

Unfortunately, unlike the fish side of the hobby, the information available via literature is at a minimum. Added to this is the fact that many of the new "invertebrate converts" are inexperienced in any form of aquarium keeping. Such factors can contribute to potential disaster, especially in the area of suitability, hardness and compatibility.

The aim of this article is to introduce the would-be invertebrate aquarist to a selection of invertebrates that are relatively easy to keep and will not tear each other apart. The scope of this article does not cover the technical aspects of setting up such an aquarium as this has already been covered by various sources (Refs 1 & 2).

It should be pointed out that quality and quantity of lighting are major factors that must be considered when setting up any invertebrate system (Ref 3). I hope that the information that I can give in such a short guide as this will encourage the reader to seek out the references stated and read more about the various invertebrates before purchasing them.

ANEMONES

The endearing sight of Clownfish wallowing in the tentacles of an anemone is probably the reason for most aquarists' interest in the invertebrate aquarium. The species available are many and varied, although mixing too many species is not advisable as they may poison one another with toxic substances or kill each other by aggressively stinging near neighbours.

Some anemones are not advisable in the close confines of a tank, eg *Cerianthus* and *Talis* species. Their long powerful stinging tentacles and aggressive nature make them a threat to other invertebrates or small fish. *Condylactis* anemones are an attractive and safe choice but they do not form a symbiotic relationship with Clownfish. *Radianthus* are hardy anemones that are readily adopted by Clownfish; *Stoichactis* and *Discosoma* species



Starfish are slow movers and should therefore be hand-fed.

Soft corals are generally a safer bet than their hard-bodied relatives.

also fall into this category.

Anemones often do better in well established invertebrate tanks and are intolerant to changes in temperatures or specific gravity; they are also very sensitive to the presence of nitrites. This sensitivity to water changes means that a great deal of care is needed in acclimatising them to their new environment upon arrival from the retailer.

When choosing an anemone ensure that its pedal disc (base) is undamaged and that it is capable of retaining its hold on the surface to which it has attached itself. The tentacles should be plump and show no signs of shrivelling at their tips.

Feeding varies from symbiotic algae, through partial filter feeders to opportunist



Tubeworms are very popular but are sensitive to poor water conditions.

predation on sick fish. Most of the "suitable" anemones mentioned here contain symbiotic algae in their tissues, enabling them to derive most of their nutrients. This should be supplemented twice weekly by feeding brine shrimp, plankton, chopped shrimp or mussel, etc, choice being dependent on the size of the anemone.

CRUSTACEANS

Most crabs are too destructive and/or predatory to be considered for an invertebrate community. Even the very active, interesting and amusing Hermit Crab can be very destructive and, generally, an inadvisable purchase. However, there are a few small crabs that are occasionally seen for sale and these make excellent choices. The anemone crab, *Neopetrolites eskawai*, is a small attractive filter-feeding crab that co-

exists with the *Stoichactis* or similar anemones. The Decorator Crab acquires its name from the fact that it decorates itself with bits of shell, coral, sponge and any other debris it can find. Providing a smaller species is considered, they should exist peacefully in our invertebrate community.

Shrimps are one of the commonest groups of invertebrates offered for sale. The most readily available being: — Boxing Shrimp (*Stenopus hispidus*), Cleaner Shrimp (*Lysmata* species, usually *L. grabhami*), Blood Shrimp (*Lysmata debilis*), Dancing Shrimp (*Rhynchocinetes*, usually *R. uritae*).

All these shrimps are perfect for the invertebrate aquarium, with exception of the following reservations concerning Boxing Shrimps. Boxing Shrimps form mated pairs and will only exist as such in the confines of an aquarium. Males will fight to the death, this also being so if a male and female are not a true pair. Thankfully, sexing is easy as the female has a blue/purple underside.

I have also heard experienced aquarists express concern at the aggressive nature of larger Boxing Shrimps towards other shrimps such as Dancing and Cleaners. Hence caution is advisable, with a wary eye being kept on them. Dancing Shrimps and Cleaner Shrimps will co-exist peacefully with their own kind and each other.

All these shrimps are fairly hardy creatures and will readily take most foods, including flake. The aquarist should steer clear of Mantis Shrimps because of their ferocious predatory nature which makes them a threat to fish and invert alike. The Harlequin Shrimps (*Hymenocera*) are a group of very beautiful shrimps. Unfortunately, they have very specific dietary requirements, thus excluding them as suitable for tank life — they appear to exist solely on a diet of starfish.

ECHINODERMS
This is a large group of marine animals

that includes Starfish, Sea Urchins, Feather Stars and Sea Apples or Cucumbers. All are related by their radial symmetry, although this is not always apparent by their external appearance. Many hardy and undemanding invertebrates are found in this group.

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SEA APPLES OR CUCUMBERS: (Ref 5) The most common aquarium species is *Paracucumaria*, a brightly coloured, hardy invertebrate with a good lifespan in captivity. Good water circulation is necessary for their success as they are filter feeders. They are easily catered for by commercially available liquid invertebrate food or by liquifying squid, mussel, clam, cockle, etc. However, as with any liquid or liquidised food, extreme caution must be taken to avoid over-feeding and consequent tank pollution.

Other cucumbers available are slug-like and generally drab in coloration, spending their time crawling along the tank floor to obtain their food. These species are not much to look at, but they do serve a purpose in helping to prevent the coral sand in the filter bed from compacting.

SEA URCHINS: Algae-browsing sea urchins will do well in an aquarium with a plentiful supply of algae. A commonly seen species is the Long-spined Black Urchin (*Diadema*). This species is not recommended as it shows a tendency to browse on coral polyps. The species also has long spines that can cause problems to the aquarist should (s)he brush against them.

Other species that may cause problems are the Slate Pencil Urchins (*Heterocentrotus*). They are not particularly hardy and some can excrete chemicals enabling them to burrow into rockwork. Short spined, brightly coloured urchins are being seen increasingly in dealers' tanks. These fairly hardy algae browsers are a better choice for the home aquarium.

STARFISH: Starfish vary in size from small harmless scavenging species to those which are large and predatory, making them unsuitable for a community tank. The larger starfish prey on molluscs and other inverts, so the aquarist should seek out information on the habits of any species before purchase.

Brittle stars are a commonly seen group of starfish. They are generally thought of as hardy scavengers, but in common with some other starfish, they don't always thrive in aquaria. This is probably due to an incorrect diet; they may well require supplements of algae and a once-a-week feeding of shrimp, clam or mussel.

Starfish are slow in eating, enabling other inhabitants to steal their food, so to prevent this, one should try to hand-feed them by pushing the food under one of the arms.

FEATHER STARS: These beautiful creatures are rarely seen for sale, which is a good thing as they are difficult to maintain in captivity.

FANWORMS (SABELLIDS AND SERPULIDS): Some of the most beautiful invertebrates available are found among these. All these worms build a tube around their bodies and have a beautiful feathery fan of tentacles. These tentacles are, in fact, gills and they perform respiratory and feeding functions. The tubes are of a calcareous

nature or of a mucus, mud and gravel formation, depending on the species. The tentacles are retracted into the tube at the first signs of danger.

Feather Duster-Worms (*Sabella* and *Spirographis*) are commonly available, with tentacles up to 4in (10 cm) across. Other smaller Fanworms are often seen as a colony living in a small rock. They are sold as "Christmas Tree" worms or "Wormrock"; these are the smaller Serpulid worms.

All these Fanworms are colourful and hardy additions to any invertebrate aquarium. They are, however, sensitive to water conditions; if they are not happy they will drop their tentacles and replace them with a much smaller set. This can re-occur and lead to the creatures eventual demise. Feeding of Fanworms follows the usual pattern for filter-feeding invertebrates.

CORALS

Most corals suffer an untimely death when kept in captivity, especially the hard corals. Hard corals have a calcareous shell protecting the soft coral polyps. This hard skeleton is often used as an aquarium decoration after it has been killed and bleached.

The question of corals and the aquarium is a controversial subject and not for debate in an article such as this. Personally, I think stringent regulations, outlawing the importation of many hard corals, are long overdue.

Some soft corals do succeed in a well-maintained, adequately lit, long established marine tank. Such corals include the Leather Corals (*Sarcophyton*) and "mush-

room polyps" that are often seen for sale.

Mushroom and "Polyp Rock" is seen in a variety of sizes and colours. Some are related more closely to anemones than corals and more successful for the aquarist.

MISCELLANEOUS

Nudibranchs are beautiful coloured sea slugs, but they are extremely difficult to keep in captivity due to their specialised diet. Definitely not to be recommended.

Clams require a high level of light and excellent water conditions and do not adapt well to captivity. This makes them unsuitable for inclusion in many of our home tanks.

Gastropod Molluscs form a large group of invertebrates, many of which are predatory. They also contain dangerous and poisonous species; with the exception of the familiar Cowrie they are best avoided. Cowries are algae browsers that make hardy tank inhabitants, but larger ones may not always discern between algae and coral polyps!

CLOSING REMARKS

I would truly urge anyone considering setting up a marine invertebrate aquarium to seek out the references listed. The more knowledge that one can accumulate, the greater one's chance of success. I would also recommend Reference 6 for general reading, while the new book on the market by Martyn Haywood and Sue Wells (Ref 8) should be well worth looking out for. For information on fish that will be suitable in an invertebrate community, 7 is indispensable.

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Brand new general book worth consulting.

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Seaview



by Gordon Kay

Christmas presents with a difference

Another year is coming to an end — I'm sure somebody pinches a couple of months — but more importantly, the end of the eighties is upon us.

It has been the decade when marine aquariology has come of age. Although we still have much to learn, the hobby has progressed in leaps and bounds. We are now able to keep our own little coral reef in the sitting room with relative ease. We now understand things like Redox Potential and denitrification and we can now keep species we regarded as impossible ten or so years ago. Coral-fishes are now breeding in captivity and one or two of us are even breeding second and third generations.

We have reached the age of 'High-Tech' — with some wonderful equipment — and the future for the hobby has never looked brighter. But at what cost? Whole reefs have been almost destroyed. On top of this, man continues to jeopardise the marine environment in so many ways that the future for our species worries me sick — and make no mistake, what happens to the sea affects us all.

This time last year, I listed a few Christmas presents that I would like to receive. Here, along similar lines, is my list of presents which I would like to see us give to the World during the 1990's.

1) It's high time that the use of chemicals and other destructive methods of catching fishes

were wiped out once and for all. Many people pay lip service to the cause but few appear to be doing anything concrete.

2) Marine pollution (in all its forms) should be stopped — NOW. The North Sea, in particular, is in a very sorry state and yet the British Government continues to allow the dumping of all sorts of stuff into it, despite the fact that all the other countries around it have stopped. It's nothing short of a crime. We vote them in, it's up to us to tell them to stop — NOW!

3) I would like to see the aquarium trade put some of the money it makes back into the hobby by helping to establish breeding programmes to supplement the progress made by the ordinary hobbyist. In this way, maybe by the end of the decade we would be relying on wild-caught stocks very little. Believe it or not, the oceans of the world are not bottomless pits.

4) I think that most people would agree that the trade in ivory stinks, but still so many people buy coral skeletons (or jewellery) and shells from the trinket shops while on holiday. Buying the same coral skeletons and shells for aquarium decorations is no better either.

Perhaps if the media could show pictures as distressing as those seen from Africa, then the trade in coral skeletons would eventually cease. This is long overdue.

5) The destruction of rain forests has to stop. Not only for the forests and all their flora and fauna — although that is reason enough — but because of the far-reaching effects that this destruction has on coral reefs.

6) Whales and Dolphins are such benign, intelligent and interesting creatures, and yet we continue to persecute them. For one reason or another, we slaughter them wholesale and have reached the point when some species are becoming extinct.

Even if we don't kill them, we imprison them and make them perform tricks. For heavens sake, WHY?

Anyone who has been lucky enough, like me, to see these creatures in the wild will agree

that they are the most magnificent of creatures and surely don't deserve the sort of treatment they receive. Why can't we stop?

7) Everyone loves going on holiday (none more so than me) but because of the tourist trade — among other things — the breeding grounds of turtles are being destroyed with resultant dwindling of turtle populations.

This is happening especially on the Greek islands, a particular favourite holiday destination among the British. Surely, turtles and tourists can exist together, without the destruction of the weaker species.

8) The demand for oil grows ever stronger. To meet this demand the oil companies transport the stuff on ships that get ever larger. I'm a simple man, I know, but it seems to me that if we had smaller oil tankers then we wouldn't see such huge wholesale slaughter of marine life when the things run aground.

9) Finally, why do we still have such dirty beaches? I appreciate that we have come a long way in this respect but we still have many a beach where to swim could seriously damage one's health. I can think of one beach in particular where the sea is so polluted with raw sewage that one doesn't swim so much as go through the motions! (I've been dying to crack that one all year!)

Most of all, I would love the day to dawn when man realises that we are just one of the species on this planet and that all the others have a place upon it with a right to their existence. What do we think that the world will hold for us when we have destroyed everything else in it?

Corsican paradise

Just to make you feel better (or worse!) in the middle of an English winter, I wrote this month's page on the island of Corsica in autumn. I have to say that there can be no more spectacularly beautiful place anywhere in the Mediterranean (including even Gibraltar,

John!). Mile after mile of sandy beaches where the mountains end.

The coastline tends toward rocky coves here and there which provide some really interesting habitats — all teeming with marine life — and so there are some terrific diving sites around the island. The sea is crystal clear (cleaner than I can remember the Med. anywhere!) and so one doesn't even need to dive — just a snorkel, a mask and away you go.

In fact, I've just spent an hour or so on one particular beach wading in water only 3 ft deep and watching schools of fishes swim around my legs. There were also gobies, blennies and hermit crabs scurrying around



Pollution-free rocky coastline in Madeira — for the moment, at least.

on the bottom only two or three yards out — wonderful!

The highlight of the holiday, though, was the tiny public aquarium on the harbour at Bonifacio which is on the southernmost tip of Corsica. They have just thirteen tanks there and yet everything is well presented and thoughtfully housed. They had all the usual species of the area there, all housed in beautifully clean conditions — they even had two Trigger Fishes which were just visiting. Triggers stray into the Mediterranean when the weather is hot, and the summer was a scorching all across Europe.

I'll be with you again next year, "Editor willing", (*The editor is very willing!* [Ed]) but in the meantime, have a happy and peaceful Christmas and let's hope that 1990 brings you everything you desire.

YEAR-ROUND TORTOISE CARE

Jim Wright, Fellow of the Zoological Society and member of the British Chelonia Group, sorts out the legality of tortoise ownership and provides detailed guidance on the care of these fantastic reptiles.

ON 31 December 1983 the trade in the three species of European tortoises came to an end in Great Britain. The three types affected by the ban are the Mediterranean Spur-thighed Tortoise (*Testudo graeca*), Hermann's Tortoise (*Testudo hermanni*) and the Marginated Tortoise (*Testudo marginata*).

The last consignments of these three species were imported and sold in the summer of that year. All are classed as endangered species, so it is no longer possible to obtain specimens from a pet shop (unless they are certified captive-bred specimens). In addition, there are restrictions regarding the selling of European tortoises by private owners. This means that certain groups of these three species cannot be sold, exchanged or bartered without written permission from the Wildlife Section of the Department of the Environment. The regulation also applies to the first-born of any such tortoise. In other words, the first babies hatched from eggs laid by these imported parents are also covered by the same regulations.

Anyone disregarding these regulations can actually be fined or imprisoned. But, as these regulations can change from time to time, it is always advisable to check with the Department of the Environment if you have a tortoise which you wish to sell, e.g., your own pet tortoise of one of these species (in fact, the chances are greatly in favour of any UK-owned tortoise belonging to one of these species). Anyone wishing to import a specimen of any species of tortoise, or turtle, must first obtain an import licence from the DOE and they must also show documentary proof that they have permission from the appropriate department of the country of origin to be allowed to take the tortoise from that country.

DISTINGUISHING CHARACTERS

The shell of a tortoise basically consists of the upper shell (carapace) and the "under-shell" (plastron) joined at the sides by the bridges. The whole is made of bone, and is covered by a layer of shields for protection. The Mediterranean Spur-thighed species is easily recognised by the spur, or nodule, on the inside of each thigh. It has a short tail. Hermann's Tortoise is identified by the long horny spur at the end of its tail, which in the male, can be over 1in (2.5cm) in length. The shell of the Marginated Tortoise is similar in shape to the other two, but a distinctive feature is the serrated edges of the shell at the rear, which form a spade-like flange.

HEALTHY SIGNS

If you are the lucky owner of a tortoise, you will no doubt be interested in knowing how to tell if it is healthy. A healthy tortoise will have bright clean eyes and will be lively. Unless the tortoise has had a drink recently, or has been eating something wet, the nose should be dry. The inside of the mouth should be clean and pinkish in colour.

On gently touching the fore-legs the tortoise should withdraw them, and on gently pushing against the bottoms of the hind feet, the tortoise should push strongly against your hand. A healthy tortoise also has a good appetite in warm conditions.

GENERAL CARE

When a tortoise feeds in the summer months it is in fact preparing for the winter months ahead, so from the time it comes out of hibernation in the spring, it is important that it is well fed.

Feeding

Tortoises are generally vegetarians, and a healthy tortoise will feed well, and especially on warm sunny days will feed for long

periods, requiring a variety of foods. It should feed well right through the summer and into the autumn.

In my opinion a tortoise cannot be over-fed, but it can be under-fed. When it has eaten sufficiently it will simply stop feeding until it is hungry again. So it is essential that one gives a tortoise all the food which it can eat, and if a tortoise has the freedom of the garden, one must make sure that it gets sufficient food on its own.

Naturally, some of the food is used up in energy each day, but the excess is converted into a special kind of fat on which tortoises will live during their hibernation. Being mainly vegetarians they will, of course, eat plenty of greens, but they will also eat tinned pet food. This should be limited, however, because although it is fattening, it provides the wrong kind of fat. Some people like to give their tortoise bread and milk to eat but this can cause digestive problems.

Given sufficient and appropriate food the tortoises should be well prepared for hibernation. The foods most liked are lettuce, dandelion flowers and leaves, clover, tender cabbage, plantain, sliced beans, grated carrot and Chinese cabbage, although most have preferences. Cucumber, tomatoes and soft fruit can also be given, but in moderation, because their food value is low, although they do contain some vitamins and moisture. Food must always be fresh and be kept out of the sun.

All green food must be washed thoroughly in clean water, for two reasons. First it removes dirt, and possible pollution, etc., from the food, and secondly, it gives the tortoise some fluids. But, despite this, fresh drinking water must always be available where the tortoise can find it, and, as a tortoise has to lower its head down into the water to drink, a suitably sized dish must be sunk into the ground with its rim level with the surface of the ground (if possible in the shade). A dish about 12in (30cm) in diameter and 1in (2.5cm) deep is ideal, but it must be topped up with clean water when necessary. Some tortoises do, in fact, like to soak themselves on a sunny day.

Living quarters

Tortoises must never be kept permanently indoors, as they do love to wander, so if they can be given the freedom of an enclosed and escape-proof garden, so much the better. Failing this, one must construct an open-top enclosure, at least four metres square, and with solid sides about 12in (30cm) deep, and situated so as to catch as much sun as possible. Solid sides help to keep out cold winds, etc. Further, if any type of netting is used, a tortoise may climb up it and escape, and, once out of its home garden, it will wander away.



Modest accommodation will suffice to provide tortoises with adequate shelter in outdoor enclosures

The greater part of the enclosure should be of grass, which will not only give the tortoise more natural surroundings, but will also give it some protection against cold winds, or too hot a sun. Even so, a weather-proof shelter must also be provided, in case greater protection is needed, such as from cold winds or heavy rain.

The remainder of the enclosure must have some rough surface, e.g., paving stones or concrete, over which the tortoise will walk; otherwise its claws could over-grow and penetrate the foot. If the claws become too long they must be trimmed by a vet.

Warnings

Some people may wish to tie a tortoise, to keep it from wandering. This is not only cruel, but also dangerous, and must not be done. The shell of a tortoise is sensitive, containing nerves and blood-vessels, and to bore a hole in it to tie a string through is painful and unnecessary.

To tie a tortoise by the leg could result in the leg becoming damaged, and even gangrenous, resulting in it dropping off. In either case, the string could loop around the tortoise's neck and strangle it. As the tortoise wanders about, the string will also become entangled around shrubs, etc., so limiting the tortoise's freedom.

On no account should paint, varnish etc., be put on a tortoise's shell either, as these can be harmful. They could damage the shields covering the shell, causing them to flake off, thus allowing harmful germs to attack the shell. The shell also traps and retains heat from the sun, which, in turn, helps the tortoise to digest its food, so the application of paint, etc., to the shell could seriously affect this.

WINTER CARE

With the coming of autumn, a tortoise will start preparing for its forthcoming hibernation, or winter sleep. Therefore as from late September it will eat less and less, and will eventually stop eating altogether. This allows any food in the stomach to be digested before the tortoise goes into hibernation, usually, in late October or early November, depending on how soon the outside temperature drops to about 50°F (10°C). If the tortoise went into hibernation with food in its stomach, this could perforate the lining and kill it.

When the tortoise has been lethargic for a few days one can assume that it is ready to hibernate, providing that it has fed well in the summer, and is not ill or injured. If you are in any doubt, your local vet will be pleased to give advice. To let a tortoise hibernate out of doors could be fatal, as our climate is too wet, so it should hibernate indoors.

Recommended conditions

The best place to choose is one that is cold, draught-proof, frost-proof and completely dry. Draught, frost and damp can cause respiratory troubles, and even death, even during hibernation.

Never use a garage unless you really have to. Preferably, use a shed or attic, or even a



Two European tortoises shortly after re-awakening from their winter sleep (the hay in the photograph was not used for hibernation purposes)

spare room . . . or a friend may agree to the use of their shed. If you have to use a garage, protect the tortoise from exhaust fumes, as these and other fumes can kill. Keep the tortoise well away from possible fumes, and leave doors and windows open when you start the engine. Then get the car out immediately. It will also be a great help if you can create a high barrier between the car and the tortoise, particularly if you are in the habit of reversing your car into the garage.

Ideally, the temperature for hibernation should be around 45°F (7°C). During hibernation, all the body systems should slow down to a minimum — just enough to keep the creature alive. Above 50°F (10°C) the systems may commence to work and the tortoise will wake before its time. Below 40°F (4°C) the tortoise could die from the cold, or the severe cold could cause the fluid around the eyes to freeze, causing blindness. It could even cause brain damage.

Hibernation box

To hibernate your tortoise you will need a strong cardboard or wooden box, big enough to allow the tortoise to turn around comfortably, which it will do. It should be at least 12in (30cm) deep to prevent the tortoise from climbing out if it does not settle right away.

Put several layers of paper in the bottom of the box, in case the tortoise urinates before it settles. Put the tortoise on these layers of paper, and cover it with a layer of shredded paper, or leaves which have been washed and well dried. This layer should be about 12in (30cm) deep.

I never use hay or straw as these contain harmful dust, bacteria, spores, etc., which the tortoise will inhale, possibly causing respiratory infections which could be fatal.

Put a lid on the top, with holes bored for ventilation, or a sack, to keep out the light. Do not make holes in the box itself as these will let in cold air or even frost. If you have rats or mice on the premises these could bite your tortoise, so, in this case, put fine mesh netting around the box.

Then put the box, with tortoise, in the place which you have chosen to hibernate it, and well off the floor. Take a peep at the tortoise daily until it has settled, in case it climbs and falls onto its back. Subsequently, just check it occasionally, but do not disturb it.

Re-awakening

A tortoise should sleep until March or early April, depending on how soon the outside temperature rises to about 50°F

(10°C), so one should commence checking it for signs of activity from early March. When it has been awake for a few days it should be offered a drink of tepid water, but it might not accept this at first.

On the first sunny day, if the temperature is at least 50°F (10°C), one can put the tortoise out of doors for a while, protecting it from cold winds, or rain. This can be repeated daily, and when the temperature rises to about 60°F (16°C) the tortoise will begin to feed; a little at first, then more as the temperatures rises. It usually takes two or three weeks for proper feeding to commence. Tortoises should be brought indoors at night while there is a risk of frosts, and even then, they must have protection.

NON-HIBERNATORS

A tortoise which has not fed properly during the summer, or is ill or injured, must not hibernate, but must be kept awake through the winter in a temperature of 75°F (24°C). Such a tortoise should be seen by a veterinary surgeon in any case, as it will probably need treatment.

It must be offered food daily, e.g. lettuce or any other suitable green food which is available. It is also essential that the tortoise is placed in tepid water up to its chin on alternative days, for about twenty minutes, to give it the opportunity to drink and to soak itself. It will absorb some water through its rectum, and this will prevent dehydration if it does not drink. A plastic bowl, or similar container, is ideal for this.

If the tortoise recovers, or feeds (if it was not previously feeding) on no account must it be put into hibernation. To do this would kill it.

Closing remarks

A healthy tortoise is a happy tortoise, so we must give it all the care it needs. If cared for properly it can live for many years.

It is important to remember too that these creatures are now virtually unobtainable in pet shops in Great Britain (only certified captive-bred specimens can be sold), so it is up to all of us who have them to make sure that they can continue to exist for many years to come.

REFERENCES

Tortoises as Pets, By Jim Wright, Obtainable only from publishers, Meadowbank Studio, 2 Meadowbank, Mylor Bridge, Falmouth, Cornwall TR11 5SW.

Taking Care of Your Pet Tortoise, By Henry Fenwick, New Barn Farmhouse, Toft Road, Kingston, Cambs. CB3 7NS.

Tortoises, RSPCA, Causeway, Horsham, West Sussex, RH12 1HG.

USEFUL ADDRESSES

British Chelonia Group, General Secretary, Mrs Diana Desmond, 29 Victoria St., Staple Hill, Bristol, Avon, BS16 5JP.

British Herpetological Society, c/o Zoological Society of London, Regent's Park, London, NW1 4RY.

Association For Study Of Reptilia & Amphibia, c/o Cotswold Wild Life Park, Burford, Oxfordshire.

OUT AND ABOUT

WATER DECOR'S "SOUTH WALES" GRAND OPENING SUCCESS

by John Dawes

Saturday 14 October saw the grand opening of Water Decor's latest retail outlet located at Hurrans Garden Centre, Langstone, near Newport in South Wales.

By 10.30 am, a sizeable and expectant crowd had already gathered, eagerly waiting to see what aquatic goodies lay tantalisingly hidden behind the large (and firmly closed) shop doors.

Half an hour and a traditional ribbon-cutting ceremony later, all was revealed... and pretty good it was, too. From Guppies to Goldfish, books to Botias, Koi to kits, ponds to plants, and statuary to service, it was all there in abundance, along with free-to-enter competitions and a prize draw worth £150.

A *C&P* was well represented at the event with one of our Koi experts, Roger Cleaver, on hand throughout the day to answer customers' coldwater queries, while I handled the tropical ones (after performing the pleasant duty of proclaiming the centre "well and truly open"). It was also very nice to see our other Koi specialist, John Cavelier, doing the rounds during the early part of the day. Plant queries were expertly handled by Brian Fowler, proprietor of Holberrow Aquatics from Redditch.

The day proved a resounding success, with a constant flow of people from opening time right through to late in the afternoon — an excellent response that kept all of us busy answering questions from keen aquarists and pondkeepers of all ages.

Peter Wheeler, Water Decor's Project Manager, and Tony Arthur, Manager of the Langstone centre, were obviously well pleased with the way things went.

Water Decor see "an exciting future ahead in Wales, offering a full range of products and services, as well as new job opportunities in the area as business expands". To this end,



The moment of truth — flanked by Water Decor's Peter Wheeler (on my right) and Tony Arthur.



The time... 11.01 am... and the rush is on!

they are always looking for enthusiastic individuals to join their retail team.

With the opening of the Wales site, Water Decor now has a total of four centres, the others being at Blagdon Water Gardens near Bristol, Water Decor at Hurrans Garden Centre in West Hagley near Kidderminster, and Water

Decor at Jardinerie Garden Centre at Hampton-in-Arden, near Solihull.

By the time we go to press, there will be a further centre, at Sainsbury's Homebase in the centre of Plymouth (scheduled to open on 11 November).

I'm sure that I also speak, both for Roger Cleaver and Brian Fowler, when I say that

we enjoyed our day enormously, that it really looks as if Water Decor are going about things the right way and that the potential for further development is both exciting and considerable.

My best wishes go to Peter Wheeler and his team, not just at Langstone, but at the other centres as well.

ZOOLOGICA '89

by Dick Mills

The South of England Showground at Ardingly, Sussex, plays host to many agricultural-based events throughout the year but, in recent years, at the beginning of September, it has seen a series of the most amazing one-day events featuring animal life that almost exceeds the imagination.

Imagine a vast indoor location filled with everything living from a Stick Insect to Highland Cattle, and you've nearly got the picture. What completes the scene is the enthusiasm that

every exhibitor has for their charges; although there were several stands selling pertinent goods, the main commodities freely available were information, entertainment and affection, no matter what particular animal life was involved.

The *Aquarist & Pondkeeper's* display stand was situated just across the corner from that of the Federation of British Aquatic Societies, which was putting on regular demonstrations of setting up an aquarium. To give you some idea of the mix of exhibits, these two aquatic interests were separated by

Komondor dogs and surrounded by rare Sheep and Llamas!

The driving force behind this Noah's Ark was Clinton Keeling, a self-confessed advocate and champion of those animals other people tend to forget. Together with a small band of like-minded and dedicated supporters, he masterminds the annual Zoologica 'days', which are of his own invention. The sheer enthusiasm and amount of effort expended by so few, yet enjoyed by so many, is something to be wondered at... and you can do it again next year at Ardingly.

Koi Talk



by John Cuvelier

KOHAKU ET AL ... IN COLOUR

With its customary speed, the Festive Season has once again crept up on us and our thoughts must reluctantly turn away from Koi for a short time and concentrate upon what to buy for one's loved ones' Christmas stockings. May I suggest a rather nice Koi-orientated present for the Koi-keeper who should have everything?

There is now available a very nice house name service from which you can obtain a cast metal plate which embodies the name or number of your house, together with a very nice representation of a Kohaku in full colour. At £60 plus, they're on the expensive side but very attractive (wish I could afford one).

You should be able to obtain details from one of the many outlets which specialise in this kind of thing. We actually saw one of these in a seafront emporium in Torquay this summer.

SEASONAL TASKS

By the time you're reading this, one hopes you have all been good little Koi-keepers and have carried out all those essential end-of-season tasks so beloved by us all!

Those of you who have ignored the tell-tale signs of winter's coming do still have time to get cracking in relative comfort with the removal of the remains of a fabulous season of water lilies and all the other dead and dying plant life.

Now is not the time to envy those owners of clinical, plant-

less Koi pools, since what could possibly be nicer than the sight of your Koi lolling around in the shade of all those leaves? Well worth the slight amount of extra work involved in their upkeep.

Those of you with concrete pools will have a significant growth of Blanket Weed adhering to walls and floors after our exceptional summer. Don't be tempted to remove this material from pool walls as it will be teeming with animal life and will provide a safe winter diet for your fish. Do, by all means, clean the pool floor (which you should have been doing throughout the season, but the walls, if left, will be systematically grazed upon by Koi through the winter).

I make a habit before turning in for the night of going round our pool with a torch and can guarantee that, however cold the weather (and water), there will always be a Koi or two happily harvesting the wildlife.

ACCIDENTAL DISCOVERY

Pool cleaning reminds me to pass on another discovery which surfaced by accident this year. For quite some time I have been feeding my Koi with a well-known brand of pelleted food (for cheapness I have to admit). As our fish have grown, so has the amount of food they've required, and so has the amount of unpleasant "gunge" left behind.

Now, solid fish waste I can expect and accept, but this revolting dust-like matter was something else, requiring constant attack with a vacuum and the consequent unacceptable loss of water.

Idly reading the recipe of

these pellets printed on the bag, I suddenly realised that one of them was ash. Don't ask me what type of ash; I can only assume it is fly ash, resulting from the burning of power station pulverised coal fuel, as it certainly has that appearance when disturbed by the fish. I get the impression that it passes straight through the gut of fish and is expelled in semi-liquid form, solely with the purpose of upsetting me!

Suffice to say that since this form of feeding was discontinued, the gunge has disappeared, along with the extra cash required to feed 'em on Koi sticks which, it must be admitted, have done wonders for them. It just goes to show even us, old hands in Koi-keeping, that there's always something new to be learned.

I can't help wondering how those much-vaunted centrifugal type primary filters would cope with this stuff?

RECURRING CHLORINE PROBLEM

Our little corner of the Welsh Water Authority's area is once again suffering from the effects of a chlorinator failure somewhere up the line, with a residual chlorine content at our taps of between 0.6 and 0.8 ppm (mg/l).

My phone call to the local office to report this abnormality met with the airy response that, yes, there had been a chlorinator breakdown, but not to worry since the water was quite safe to drink! It's a little tricky trying to argue on behalf of your pond fish when a hosepipe ban is operational, so one bites one's tongue and takes the necessary precautions.

Chloramine explained (?)

Mind you, I'm relieved that, at least, in our area, we do not yet have to suffer the effects of chloramine treatment of our water supply.

For those of you who are not yet aware of this form of water treatment, let me give you a quick run-down in layman's terms: If ammonia is added to chlorine, the end product is chloramine. The purpose behind such a lethal-sounding cocktail is to increase the active disinfection life of the chlorine.

We can best understand the thinking behind this by reading a quote from a learned some on water treatment: "A number of investigators have reported that the disinfecting properties of chloramine are only one twentieth to one thirtieth the power of free residual chlorine. On the other hand, once the chlorine is compounded with ammonia to form chloramine, it is more stable, or less reactive, than free chlorine and may show a chloramine residual at the end of the distribution system, whereas chlorine under a similar set of circumstances might be absent long before the end of the distribution system due to being absorbed by organic matter in the pipework."

At first sight this appears to be a clear contradiction in terms, but, of course, to offset the weakening effect upon the chlorine, more of the end product is added, which makes life much more difficult for Koi-keepers!

Chloramine cannot be removed by that old standby of de-gassing via spraying, so more sophisticated methods must be used. Passing any "topping" up water through activated carbon is probably the easiest method, although it can be expensive should a large amount of water be required continuously. Alternatively, one of the commercially available "in line" filters which use a combination of carbon and resins can be useful, but you're looking at an outlay of £300 plus (ouch)! Makes a wonderful Christmas present, though?

With that happy thought, I'll wish you and above all, your Koi, a very Happy Christmas and Prosperous New Year.

**See Page 81
for news of what's
in store in our
January issue**

Your questions answered

Having problems? Send your queries to our panel of experts who will be pleased to be of service. Every query receives a personal answer and, in addition, we will publish a selection of the most interesting questions and responses each month.

Please indicate clearly on the top left hand corner of your envelope the name of the experts to whom your query should be directed. All letters must be accompanied by a S.A.E. and addressed to:

Your Questions Answered, The Aquarist & Pondkeeper, 9 Tufton Street, Ashford, Kent TN23 1QN.

Herpetology, Julian Sims. Koi, Roger Cleaver. Tropical, Dr. David Ford. Coldwater, Pauline Hodgkinson. Plants, Barry James. Discus, Eberhard Schulze. Marine, Graham Cox.

COLDWATER



Large-mouthed Cat

I have a 6in (15cm) Bullhead Catfish. Is it too big to keep in a 53in (c 130cm) tank with a selection of other coldwater fish?

The Brown Bullhead, *Ictalurus nebulosus*, can reach about 12in (30cm) in an aquarium, although it will grow larger if kept in a pond.

These fish are territorial and are inclined to be more aggressive in the confines of an aquarium. They have large mouths and feed on small fish, shrimps, aquatic insects and enjoy earthworms.

The Brown Bullhead can soon dispose of a tankful of smaller fish.

FRANK ORME

Well-fed Bullheads can be said to be reasonably safe housed with other similarly-sized species, though any smaller fish must look very appetising and a great temptation!

I know many people who have introduced one of these fish into a tank of goldfish and have discovered to their cost that this is a foolish thing to do.

MARINE

Compatible Tangs

I would like to keep two Yellow Tangs in my 6ft x 2ft x 2ft aquarium — along with an assorted collection of other fish. Will the Tangs co-exist quite happily? How big are they likely to grow?

You could safely keep up to four Yellow Tangs in a 150-gallon tank without any serious bickering developing, either between them or between any of the other fishes and the Yellow Tangs.

Yellow Tangs would grow to a maximum size of 3½in (c 9cm) in your aquarium.



The Yellow Tang (*Zebrafish flavescens*) is generally peaceful towards members of its own species.

DAVID SANDS

Invert lights

How much light will living rock and invertebrates require in a 48in (120cm) aquarium? I already have a 42in Gro-lux tube and a 36in tropical daylight one. How do I feed the organisms on the living rock?

I would recommend as much lighting as possible in order to keep the living rock and invertebrates in a healthy condition.

Unfortunately, you neglect to mention how deep your aquarium is. If it is a 24in (60cm) vertically deep tank, then you need two more tubes (North-light) for a fish-only tank and

four more tubes for a mixed fish invertebrate community. Alternatively, you could use three 80-watt Floraset spotlights at 12in (30cm) centres above the tank sited as near the cover glasses as possible.

The organisms on the living rock should be fed with a proprietary invertebrate food in accordance with the instructions on the bottle.

In order to encourage the growth of phytoplankton in your seawater I would suggest the use of a supplement like SeaGreen as directed.

PLANTS

Shady choices

I would like to set up a South American community tank with subdued lighting. What plants should I choose?

In general, South American aquatic plants need high light levels as they tend to grow in open country rather than in the dense jungle.

For soft, acid water with subdued light, your best bet is to use *Cryptocoryne* and *Anubias* species which do well under such conditions. *Microsaurium* and *Vesicularia* will also thrive attached to bogwood or rocks. Approximately 3/16in gravel in a thick layer is ideal. I would also suggest internal or external power filters in preference to undergravel ones.

For subdued light use one



Cryptocorynes (this is *C. cordata*) generally do well at low light intensities.

RUDA ZUKAL

Truelight or Triton tube for 10 hours per day.

TROPICAL

Deceptive Oscars

A short time ago I bought some 1in (2.5cm) Oscars and put them in a tank with five Cardinals. Next day the Cardinals were gone. Having read that Oscars are not aggressive, I then bought two 4in (10cm) Sawdusts but had to remove them immediately because the Oscars — at less than a third their size — attacked them: Please help!

I do not know which book you read but Oscars are quite aggressive fish. They are territorial too, and once established in an aquarium, woe betide any new fish added. A pair brought up together will tolerate each other but even then a quarrel can break out at any time. *Corydoras* are among the few fish you

can add ... they live in a different world (the bottom) to the Oscar, and so are tolerated.

Oscars are perpetually hungry fish and will eat anything, including other fish. Beware of polluting the system, however, because they are also messy feeders and produce copious amounts of excreta. Do not use u/g filters (they cannot cope) and do lots of partial water changes. If ammonia builds up the Oscar is prone to Popeye — so keep a check on ammonia levels regularly.

Oscars have large mouths ... and appetites to match!

LAURENCE E. PERKINS



KOI

Which pump?

Can you advise me on the best type of pump to choose for a Koi pool? There is such a wide range of pumps available today that it is difficult to give precise advice regarding choice. There is, however, one important factor to consider:

External, submersed or even a central heating type of pump, whichever type you choose, they are all pretty good. The decision that needs to be made concerns turnover rate. Pumps

should circulate the total volume of a pool at least once every three hours and, preferably, once every two hours.

Check that the pump you choose will provide this sort of turnover at the head. The head of water refers to the distance that the pump has to raise the water above the surface level of the pool before it is discharged.

After this, it's a question of personal preference and size of pocket!

DISCUS

Egg-eating Discus

Although my pair of Blue Discus fish spawn regularly, they always eat their eggs. How can I prevent this from happening?

Many theories have been put forward as to why Discus fish eat their eggs or even hatched-out larvae, but the fact is, that nobody really knows. The most unlikely reason ever given in a magazine some time ago was that they simply were eating the eggs because of hunger!

There are pairs of Discus which will eat their eggs for the first few spawnings. Usually, they are very young pairs and there is very little one can do other than wait until they have fully developed their breeding instincts.

Then there are other pairs where the spawning sequence goes according to plan, and the eggs actually hatch out and are raised without any problems at all. If such a pair suddenly start to eat their eggs, it can often be related to water conditions, quality of food, stress or other outside factors.

Sometimes the egg eating from such a pair will stop merely as a result of re-positioning the aquarium. Also, if such a pair were given an enforced rest period (by basically making the water much harder for a few weeks) the egg eating might stop.

Another way to protect the



A pair of Discus with their fry. Not all adults are such good parents.

eggs while they are on a substrate, would be to cover them with a mesh. The parents would still see the eggs, and they still would be able to fan them to supply them with oxygen-rich water. Yet the mesh will prevent the parents from getting too close to eat them. When the eggs hatch out, the fry will often be raised without any further problems.

Sometimes, there will be some Discus which will persist in eating their eggs. In such cases there is very little one can do. These fish can then be regarded as being suitable only for the show aquarium and not as breeding stock.

HERPETOLOGY

Protected Natterjacks

Is it possible to obtain supplies of Natterjack Toads?

Natterjack Toads (*Bufo calamita*) are very rare in Britain, being restricted to a few specialised regions where they spawn in shallow pools in sandy soil.

Since they are extremely local in distribution, they are particularly at risk from the destruction of their habitat and, thus, are quite properly, totally protected by the Wildlife and Countryside Act, 1981.

Their spawn, tadpoles, metamorphosed toadlets and adults cannot be collected, purchased



Natterjacks are totally protected by law.

or exchanged without a licence from the Department of the Environment.

PRODUCT ROUND-UP

BY DICK MILLS

AQUASCAPING

NEW PRODUCTS

TAHITI AQUARIUMS

Take a good look at your tank on its stand: can you see your power filter, air-pump and tins of fish food easily on the bottom shelf? If you can, then **TAHITI** can put a stop to that right away.

A new base unit complete with Rosewood, Pine and Dark Oak panels and sliding doors can be yours for half price. A typical example is their 48" x 12" base unit: it used to retail at £129.90 but you can get it for £59.95. If you then blow just £1.29 out of your 'savings' on a can of their **AQUA SHINE AQUARIUM GLASS CLEANER**, you can add an extra sparkle to the whole set up!

You can find full details of this Tahiti Aquarium Furniture offer in the advertisement pages of this issue of *ACP*. Details of all Tahiti products from:

TAHITI AQUARIUMS, 60 Stockport Road, Ardwick, Manchester, M12 6AL. (Tel: 061 273 7555, Fax: 061 431 0786).

RUTO FOODS

Giving your fish the very best from varied diets is a major contributory factor to fishkeeping successes, and now there's even less excuse for not doing so.

RUTO FROZEN FOODS comprise a very large range of quality and highly-nutritious 100gm blister-packed foods. Almost every "livefood ingredient" is represented: separate packs contain Artemia, Black Mosquito Larvae, Cockles, Daphnia, Fish Eggs, Fish meat, Krill (Pacific), Krill Super (Antarctic), Mussel, Mysis, Plankton, Red Bloodworm and Squid. Specialist foods include Cichlid Mix, Discus Food, Micro-Plankton and Food for Invertebrates. Single blister packs of Lancefish, Whole Cockle and Whole Krill are also available.

The majority of the packs consist of ten "blisters", each of

Naturally enough, we fishkeepers are a selfish lot; we generally decorate our tanks to suit our preferences and, while the main argument for this is, quite logically, that we've got to look at the end results, we should not lose sight of the fact that aquarium decoration has more usefulness than just looking pretty.

Rest assured, this is not to be a directive as to how the aquarium should be aquascaped (who am I to give advice to those far more qualified than myself in such underwater artistry?) but, rather, how the subject can be approached to the best advantage of those most concerned — the fishes.

Aquarium plants, being living organisms, will help to purify the water as well as look good; they will also provide shade, shelter, food, spawning sites and sanctuary for fry. As they help to hide the 'hardware' too, plants might be seen as perfect accessories for the aquarium — so where's the need for anything else?

Not all fishes come from well-planted streams and rivers (even though these scenarios make the best illustrations for books and lectures!). Even among the fish which do, some may also take a delight in eating the plants! In either of these instances, you can still achieve that 'well-planted look' in tanks containing such fishes by using artificial plants which are quite realistic in their appearance.

Rocks and logs provide services in some respects that plants do not do so well. A steeply-banked gravel terrace will be held in place much longer if supported by rocks. Rocks also provide a good surface on which algae can grow for herbivorous, grazing fishes (alright, so can plants, but algae-coated plants don't always grow too satisfactorily). Logs or branches replicate the many natural hiding places beloved of those fishes you always need to catch last thing on show-day mornings.

Rocks and logs can be used in

two modes — natural or synthetic. With the 'real things' beware of introducing problems: soluble rocks or those bearing metallic ores will affect the water chemistry; living spores in not-quite-dead wood collected from nature will create pollution and tannins in the wood will colour the water. Always soak wood for many weeks in regularly-changed water to allow all the tannins to leach out before use in the aquarium and to ensure water-logging.

Alternatively, painting with polyurethane clear varnish will seal the wood so that it can be safe to use, although you may still be faced with dealing with a troublesome 'floater.' Petrified wood or decorative wood may also need some pre-soaking to be safe, but is otherwise a far safer proposition.

Mention should also be made of synthetic rocks: these are usually modelled in resin (or a similarly inert and safe materials) from real-life originals and are subsequently not too artificial-looking, particularly once they have acquired a thin coating of aquarium detritus or algae. Several 'rock' manufacturers have developed the designs further to accommodate aquarium filters or convenient planters. It is better to avoid aquarium ornaments that are plaster or cement.

Aquariums for 'non-plant compatible fishes', or those containing brackish water which might adversely affect plant growth, can be imaginatively furnished using rocks and wood: create rocky grottos by gluing together shapes with silicone-sealant; a 'back-wall' of rocks can be similarly constructed, but make sure no fish becomes trapped and dies unseen.

Finally, although the thought of using any of the many 'action ornaments' might well send shudders down the spine of the purists, many young aquarists will find them attractive, and who are we to deny anything which firstly encourages, or later maintains, interest in our chosen hobby?

which can be separately removed and halved for ease of use. Details and price list from:

NEILS AFRICAN CICHLIDS, 11 Manor Road, Swanage, Dorset BH19 2HS (Tel 0929 424007, Fax 0929 427557).

TRIDENT

Browsing through catalogues from the comfort of the fireside armchair is one of the joys of winter evenings. More often than not, though, you come across just what you want to set up that complete water garden, except that the ingredients are in separate catalogues!

Now, the chances of this occurring have been lessened, for **TRIDENT** have hit upon the idea of including in their catalogue the pick of the rest — high-quality, best sellers, every one. From pool-liners to filters, statuary to nets, lamps to pumps, the list is endless so, the next time your dealer starts rummaging among several mounds of paper, politely request (s)he looks in the Trident catalogue for more quality, for less effort and quicker satisfactory results! Regrettably, the Trident Catalogue is for **Trade-only** use, but with its backing, your dealer can now offer so much more. Details of the Trident way from:

BACH AQUATICS LTD, Stoke Road, Stoke Poges, Slough, Bucks, SL2 4NL (Tel: 0753 692595, Fax: 0753 31173).



Just one of the Ambassador range of ornaments from Trident.

HANNA INSTRUMENTS

A new addition to the HANNA range of extremely portable (pocket-sized even) test instruments is the SALT TEST METER.

The well-tried 'dip in and read' principle of earlier instruments is repeated here; on initial models, the digital read-out gives a reading between 0.00 and 1.00 and this apparently arbitrary scale, although accur-



New portable salt meter from Hanna UK Instruments Ltd.

ate to within 0.02 in either direction and with a resolution of 0.01, needs to be transferred to a graph for final calculation of the salt content of the water (in gm per litre).

Latest information from Hanna reveals that later models will feature final salt content readings in the read-out window itself. Retailing at £41.00, the unit has a life-use of 1,000 hours from its three, easily-replaced, Duracell batteries. Full details of all Hanna aquarium-practicable instruments from:

UK INSTRUMENTS LTD,
Happy Valley Industrial Park,
Primrose Hill, Kings Langley,
Herts, WD4 8HZ (Tel: 09277
60655, Fax: 09277 68669).

TOYA CERAMICS

A criticism often levelled at aquarium sculpture is that it looks a little "heavy", but this cannot be applied to the latest addition to aquatic furniture decorations, **TOYA CERAMICS**, which are nicely proportioned.

One thing they will not tolerate (apart from physical dropping), according to the makers, is any large fish which gets inside and flexes its muscles — as a Moray Eel proved recently!

Fired to 1100°C, the pale terracotta-coloured, hand-

made pieces are pleasingly light with a matt finish. The range covers most of the usually-met-with underwater subjects — an old Boot, Castle, Sunken Wreck, Treasure Chest (with or without gold!), "No Fishing" Sign, Arches, Walls, Bridges and a Tower.

In a more aquarium-pertinent and practicable nature are Log Heater Covers (two sizes), Planter Wall, Tree Stump, and obviously for cat-fishes, a Cat Tunnel.

All decorations have stood the test of time, being long-immersed in aquaria with no ill-effects to the fish, or altered water chemistry, occurring. Recent tests in marine tanks have also proved the products' safety in both these respects. For a few pence extra over the standard prices each piece can be personalised with a business, personal (or even Society?) name. Details from:
TOYA CERAMICS, Unit 3,
The Old Tannery, Newport
Industrial Estate, Launceston,
Cornwall PL15 8EX (Tel 0566
4730).

LOTUS

Are you a 'meat and two veg' or a 'fillet steak' type? If your fishes follow your dietary tastes then **LOTUS** have just the foods for them. Twenty years on from their first floating fish pellet, Lotus have introduced a new generation of fish foods.



Lotus have produced a colour information leaflet to accompany the launch of their two new foods.

LOTAMAX is a complete balanced basic diet (the M & 2V) with the in-built design of purposely limiting the protein content (essential for growth and tissue-building), as any surplus otherwise produces excess ammonia, especially in captive

environment conditions, leading to stress and overloaded filter systems. Similarly, sufficient carbohydrate and oil levels are present for immediate accessibility of energy. Over 10% of Lotamax is wheatgerm, an easily-digestible rich source of proteins and essential vitamins and minerals.

KOI-SEN (particularly suitable for Koi) goes even further than Lotamax: the protein content of this, the 'fillet steak', is made from fish meal sources while the carbohydrate element is made from a variety of vegetable sources, sweetcorn, brown rice, yeast, peas and, of course, wheatgerm — a highly digestible format which obviates the need for protein conversion. Spirulina is also included for natural colour enhancement.

Both foods are available in small and large pellet forms and in half-, 1 and 4 litre sizes. A full colour leaflet describing Lotamax and Koi-Sen, together with feeding details is available from:
LOTUS WATER GARDEN PRODUCTS LTD, 260-300
Berkhamsted Road, Chesham,
Buckinghamshire, HP5 3EZ
(Tel: 0494 774451, Fax: 0494
791279).

BATSFORD PRODUCTS

BATSFORD PRODUCTS have been manufacturing **SIM-LAWOOD** and **SIM-LAS-TONE** articles for twelve years now. The sales of these products have continued to increase over the years and they now form the company's main product line, employing a workforce of eighteen people in a factory of almost 5,600 sq ft.

New products have been introduced at regular intervals, and the range now exceeds fifty different models. A few of the original designs have been discontinued to prevent the range from becoming too extensive, and further changes are planned for the near future.

Even so, new products are constantly being introduced, the two latest being: (Ref GP3) — Grecian Urn and (Ref CH3) — Three-link chain.

For details of these and all other Batsford products (about 50% of which are exported to over 20 countries) contact:
BATSFORD PRODUCTS,
Holly Lane Industrial Estate,
Atherstone, Warwickshire,
CV9 2HA (Tel: 0827 713730;
Fax: 0827 718679).

NEXT MONTH

If you're interested in Koi or cichlids, adders or corals... or even piranha, you can't afford to miss the New Year Edition of *Aquarist & Pondkeeper*.

- On the Koi front, we have an excellent article from experienced Koi-keeper **David Twigg** who takes a close look at the mechanics and economics of **Koi Pool Heating**.
- Cichlidwise, there's the very latest on the Lake Victoria Cichlids from an international team of scientists who've recently returned from there. Their conclusions are both surprising and far-reaching.

● SPOTLIGHT ON REPTILES

Dr. Gareth Evans, one of our regular reptile experts, dispels many of the unfounded myths surrounding adders, while the rest of the team consisting of **Julian Sims**, **David Alderton** and **Robert and Valerie Davies** deal with Collared Lizards, terrapins and other equally interesting species of much-sought-after reptiles.

- The Piranha? Well, that's the subject of our next giant **FREE** full-colour poster... imposing to say the least. A picture with real "bite" to it!

Interested? Then, all you need to do to make sure you obtain your personal copy of January's *A & P* — which will include many other specially commissioned features, along with all our regulars — is place your order early. Or, why not fill in a Subscription Application Form and guarantee yourself a full year-round supply?

Books & TV



The Interpet Manual of Marine Invertebrates

By: Martyn Haywood and Sue Wells
Published by: Salamander Books Ltd
ISBN: 0 86101 474 X
Price: £12.95

Peer into any well-established marine aquarium and it won't be too long before you realise that there's more in the tank than just fish.

This 'supporting cast' is, of course, provided by the invertebrate life, and there is a rapidly-growing interest and awareness in this aspect of marine fishkeeping. The problem has always been to find reliable information, both on identification matters and on aquarium care of these brilliantly-coloured and often bizarre-shaped animals. Look no further than this latest manual from Interpet/Salamander.

Divided into three sections, the book first introduces you to what makes up an invertebrate, how it functions in the wild and its compatibility with others (including fishes).

Part Two sensibly starts off by asking the reader to decide on what type of marine aquarium is to be maintained before any further examination of possible invertebrate tenants is made.

Water conditioning and the setting up of the invert tank is succinctly described; technical terms are not shirked, but their inclusion will not deter the most novice of readers, such is the quality and clarity of the explanations, both in textual and diagrammatic form.

Feeding is another potential headache and here, it must be said, only a partial cure is administered: the problem of feeding filter-

feeders, although well covered, lacks the answer to surely the one question that everyone new to invertebrate-keeping asks — how do you prevent the aquarium filter taking out the food before the inverts get it? Do you 'overfeed' (horrors!) to some degree to allow for this, or do you turn off the filter for a time and, if so, how long for? On the plus side, an 'at-a-glance' feeding table provides instant information on the various needs of all types of invertebrates.

The third part of the book is the one everyone has been waiting for — a survey of nearly 100 species of invertebrates, from static corals to highly mobile shrimps. Each entry provides practical hints on care and warnings where necessary as to the animal's compatibility or difficulty in keeping.

With this book, yet another aspect of fishkeeping has been given the successful Salamander treatment, with all the quality of text and illustrations that that word has come to imply. With Christmas on the horizon why not treat yourself to this more-than-useful book or, better still, get someone else to do so! You won't regret it.

Dick Mills

TV PREVIEW

Fish People

(Produced by Maurice Melzak)

David Alderton previews *Fish People*, scheduled for screening on Channel 4 during peak Christmas viewing time. (Christmas Eve: — 1-2 pm.)

Over 5 million people keep fish in the UK at present, and this carefully-crafted programme will doubtless swell their ranks still further. By allowing people to speak naturally about their fishkeeping interests, without intrusive editorial comment, their enthusiasm becomes infectious.

This approach is in stark and refreshing contrast to the highly-edited "bitty" treatment which all pet-keeping topics have received on BBC 1's *Animal Roadshow*. Whether or not other members of your family share your interests in fishkeeping, they will enjoy this programme, because it shows how significant fishkeeping has become in the lives of the people concerned.

Every side of the hobby is represented, from Peter Waterman, a record producer who searches out quality Koi in Japan, to Nancy Shuttle, a retired typist. She suffers from agoraphobia and finds that her cichlids help her to come to terms with her illness, which could otherwise keep her trapped indoors, with nothing to occupy her time.

Then there's Alex Torbet, serving a life sentence in Edinburgh prison, who breeds "Tilapia" cichlids so successfully that he saves the Institute of Aquaculture at Stirling



Jack Harter and daughter Toni — two stars of Maurice Melzak's *Fish People*.

University £100,000 per year! The fry are used as food fish in the Third World.

Gary Lewis explains the appeal and complexities of breeding top-quality Ranchus, while Jeanette Charles, actress and royal impersonator, takes us on a tour of her garden pond and gives a graphic description of giving the kiss of life to a goldfish!

You probably won't agree with all the comments made by the participants. But the programme runs primarily on their conversations, without intrusive comments from an interviewer. Simple and direct in approach, this is highly effective television. Producer Maurice Melzak has gone much deeper than a superficial exploration of the hobby. He captures the personalities as well. One revealing sequence features David Sands, accountant (*A & P* contributor) and catfish expert, who describes his childhood dreams about South America, and how he became attracted to catfishes.

David Saxby complains about the lack of knowledge in some shops selling marine invertebrates, and how newcomers to the hobby are being misled into believing these are easier to keep than is actually the case.

The subject of fish sales from garden centres is raised in a critical light by Peter Waterman. What are your experiences when visiting such establishments? You may agree with Peter, or you may not. What about the price of Koi — are you getting a fair deal? Peter also has some harsh words for those dealers who charge top prices for what he maintains are only mediocre quality Koi.

The trade should take notice of such comments. These are not being made by ignorant activists, but by concerned and committed customers. The only statement added out of context was the assertion that 500 million fish were imported into the UK last year and most are probably dead now. This is really supposition, and takes no account of the normal mortality and high reproductive potential of the majority of fish.

In any event, the counterbalance should have been presented in the otherwise excellent commentary that about 90% of the tropical freshwater fish now available are captive-bred. Not just from a conservation angle, but because I'm certain that many viewers would be amazed to know just how successful this form of animal husbandry has become, this subject would be worthy of a programme on its own. But for now, enjoy *Fish People*.

David Alderton

PUTTING ON A SHOW . . . IN DIAMOND STYLE

The Bristol Aquarists' Society celebrated its Diamond Jubilee Open Show in September. Stephen Smith was among the hundreds of enthusiasts from all over the country who made the trek to this Mecca of goldfish keeping.

(Photographs by the author)

To the uninitiated, the prospect of driving around the country with several plastic buckets-worth of fish packed into the back of the car, might sound a little eccentric.

"Well, if we're going to be eccentric, then we might as well be harmless," remarked one fishkeeping colleague.

And it was in this manner that dozens of similar "eccentrics" descended upon the church hall of St Ambrose in Whitehall, Bristol, for Bristol Aquarists' Diamond Jubilee Open Show. The Bristol show is, without doubt, the largest of its kind in the country. Dedicated almost entirely to Goldfish, almost 400 of the finest quality fancies were lovingly benched by their enthusiastic owners on the first weekend of September. Strangely, as if it had been marking the days off the calendar, the scorching summer sun subsided to the first coolness and mists of autumn — perfect for low-stress transportation of coldwater fish.

Throughout the previous few days (and nights), members of Bristol AS had been busily preparing the church hall for the big day. There is more to keeping fish than keeping fish, and preparation for "the big show" is part and parcel of the hobby.

Once rooms had been swept, specially-constructed tiered benches were brought out of their mothballs from last year, and covered with the black polythene which makes so perfect a backdrop for the living jewels which were to follow.

Before their arrival, however, tanks have to be scrubbed, filled with water and positioned on the show benches, ready for their inhabitants the following day, by which time, hopefully, all traces of undesirable additives in the water will have dissipated.

The last entries will have been telephoned in just a couple of days earlier, so the headache of allocating tanks to show classifications begins, ensuring that all classifications are grouped together.

"So that's why the classes never seem to appear in number order . . .!"

Finally, the trophies are laid out at the top table and we're ready (aren't we?) for the first arrivals.

Benching has to be completed by 11.30 am so it's an early start for many exhibitors. Buckets will have been scrubbed out and watered the previous evening in readiness for "the big show."

Fish will have been selected for the show bench in the first of many close inspections

that weekend: "Where's my copy of the show schedule? I forgot to enter that Lionhead . . ."

Eventually, and it's only 7 am, the last bucket, half-full of water and every one accommodating a champion, is loaded into the car and it's onto the motorway and head for Bristol.

At the show hall, it's around 9.30 and the first exhibitors are clearly arriving for "the big show." One of the highlights of any major show is meeting one's fishy colleagues again — often not seen, nor spoken to, since the previous year's event. It's 11.45 am and the last exhibitor has finally finished benching. The show secretary has tugged just about the last follicle of hair from his head and the judges have arrived and been treated to their first cuppa.

The show hall sports the most magnificent array of colour and movement. Over 400 Goldfish — more attractive than the Crown Jewels and twice as valuable — are resplendent, each in its own show tank and eager for the judge's eye.

A whole wall is devoted to Bristol Shubunkins: not surprisingly, as this most popular and attractive variety has been developed to near-perfection by members of

Bristol AS over a period of more than a quarter of a century. It is fair to say that these fish on display are the best of their type in the world.

Just about every variety in the show schedule (and a few that are not) are on display: Fantails, Veiltails and Moors; Celestials, Bubble-eyes and Lionheads;



Vic Capaldi's prize-winning Fantail.



Above, best in show winner was Vic Capaldi, pictured on left receiving his trophy from Jim Bundell, president of GSGS, for a beautiful and perfect specimen of a Fantail



Potentially a rising star of the Goldfish-keeping world, 13 year-old Craig Chivers was the first recipient of the Bristol A.S. Diamond Jubilee trophy for the best goldfish kept by a junior under 16. Craig also won the trophy for Best in Section, for a Calico Veiltail, and is seen proudly sporting his awards.



Orandas ("just look at the head on that one...") and Pearlscales. Even a display of Jikin grace the show bench, thought to be the first time in a UK show. Every fish is of magnificent quality, many have been produced by their owners and each of them is worthy of the care and attention of their keepers.

The doors are closed behind the judges in a scene reminiscent of a State ceremony, while fishy talk hangs in the air, supported by a buzz of excitement and anticipation. The weather, the spawnings, the finnage, the water, the pond, the filter, the algae... and on. No subject on earth escapes the attention of a fishkeeper in conversation with another.

Now, after a snack lunch and a breath of fresh air it's one o'clock and time for the

Undertaken behind closed doors, judging is a sight rarely seen. Here, judge "Tommy" Thomas studiously examines the finer points of a group of exhibits before recording their marks.

uction of fish. The auction is, for many, a highlight of the day and an opportunity to pick up some reasonable fish at a reasonable price.

Bidding is slow to begin with but, well, it was an early start and it's been a busy morning. The show secretary, as auctioneer, has his work cut out ("Don't scratch your ear ma'am, it'll cost you 10 pounds!"), but after almost two hours the last of over 30 fish receives its final bid.

Close to three o'clock, and those doors are still tightly closed, despite the judges having left the hall for a well-earned cup of tea. The queues at the door indicate that the advertising must have worked — not all of them are exhibitors — and, finally, they are admitted into the hall.

Two hours of fishy talk later and it's presentation time. Still the last of the general public is arriving from a wedding in the neighbouring church to view the exhibits and to enquire about membership.

A hush fills the hall as the chairman begins his presentation speech, and a round of applause from everyone in the hall greets every winner of a placecard. Even the juniors receive their class trophies, ensuring that there will be succeeding generations of successful Goldfish keepers.

Finally, it's all over as the last of the exhibitors departs with a cheery farewell ("Be seeing you at the GSGB show..."), with a trophy or two. Well, it may be all over, but for the clearing up, and here, the dedication of the members is tested to the full as the hall is painstakingly and carefully divested of every drop of water, every show tank, every polythene sheet, every show bench, every last, tired fishkeeper.

Congratulations, Bristol Aquarists' Society, on your Diamond Jubilee Show. Congratulations to all winners, and magnanimous losers. And congratulations to all those hard-working enthusiasts who helped to make Bristol's day a diamond-studded one.

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