OCTOBER 1988

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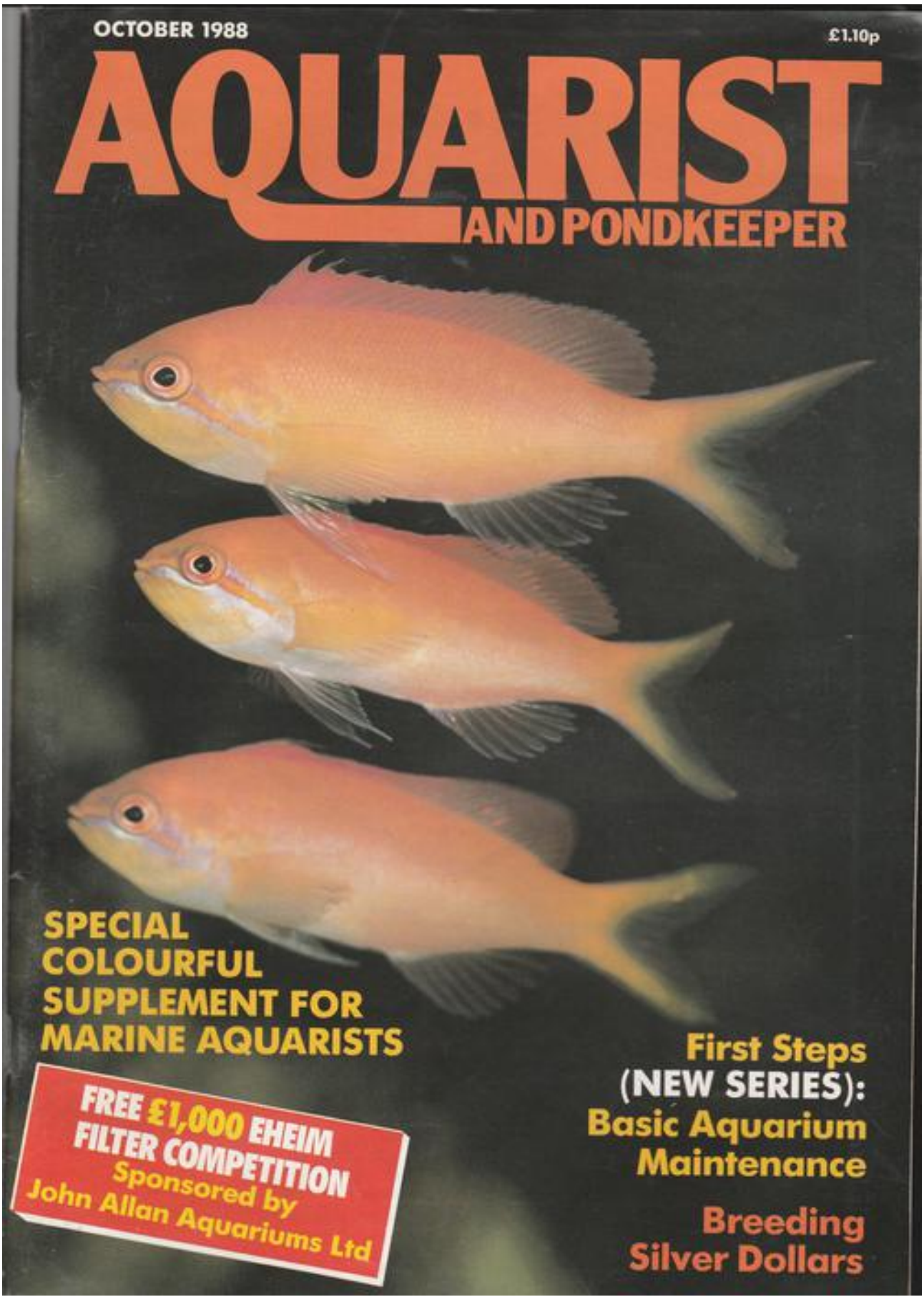
AQUARIST AND PONDKEEPER



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AQUARIST AND POND KEEPER
OCTOBER 1988
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COVER STORY

(Cover Photograph: Bill Tomey).

Anthias squamipinnis is not only a very attractive fish, but a rather remarkable one as well. It is a member of the Serranidae, the family which includes the Sea Perches, Sea Basses and Groupers. Many Serranids, among them *Anthias*, have the ability to change sex, in this particular case the change being from female to male. Such changes are examples of protogynous hermaphroditism — the opposite (as exhibited by Clownfish) is known as protandrous hermaphroditism. *A. squamipinnis* is a widely distributed species which is variously known as the Orange Sea Perch, the Lyre-tail Coralfish, the Wreckfish or, even, the Sea Goldfish.

PAST, PRESENT AND FUTURE

It's always very nice when people ring you up, drop you a line or approach you at a show (or after a lecture) to congratulate you on the quality of your publication. This is, in fact, what's been happening with increasing regularity since we started publishing *A&P* under the **Dog World Ltd.** banner in July. And long may it continue . . .

Our mailbag has swelled enormously over the past few months, and this has been accompanied by an equally healthy upsurge in high-quality unsolicited articles from home and abroad. All in all, we seem to have brought about some well-received changes and improvements . . . and there are more in the pipeline.

This month, for instance, we start our new series for beginners, **FIRST STEPS,** with an excellent article from Tetra's **Dr. David Pool** on basic aquarium maintenance. As I said in my July editorial, this is a beginners' series with a difference, in the sense that one month we could be dealing with aquarium maintenance, while the next we could (as we will in November) be dealing with buying Koi. The main linking theme between all these articles is that they are aimed at people who are starting up on one particular branch of the hobby or another . . . whatever that branch might be, and whatever their experience may be in other areas.

Therefore, even if you are an experienced marine aquarist, if you are thinking of taking up, say, keeping Killifish, a **FIRST STEPS** article on this topic may well be just what you need.

Look out for yet another exciting innovation in November . . . the first of our occasional **Guest Editorials** in which we invite a well-known figure to express his/her views on a particular topic. Our first guest is our own **Product Round-up** author, **Dick Mills,** who has some very interesting views on shows and showing.

Turning to this packed issue, we have put together a most comprehensive and colourful **Marine Supplement,** with no less than five thought-provoking articles. We've chosen this month for our **Supplement** to coincide with the **British Marine Aquarists Association** autumn seminar which will be held, under *A & P* sponsorship, at London Zoo on **23 October.** There's a cracking programme planned for the day, plus a special behind-the-scenes visit to the Aquarium, so book your tickets without any further delay (see **Out & About** for further details).

We've also had a very encouraging response to our SVC plea (August editorial), the first fruits of which you can see inside in **The SVC Review** co-written by **Coldwater Jottings** author **Stephen Smith** and yours truly.

And, talking of Koi . . . wasn't that a super fish on the front cover of our August **Koi Supplement?** The only thing wrong was that I slipped up and omitted crediting the source of the photograph. In fact, it, along with several (credited) others, came from **Kent Koi Ko's** outstanding library. My sincere apologies to **Kent Koi Ko** for the oversight . . . my thanks go to them as well for their courtesy in not taking offence at the omission, or even complaining about it.

See you all at the B.M.A.A. seminar.

John Dawes
(Editor)

TROPICAL MARINE SUPPLEMENT

(Cover Photograph: Arend van den Nieuwenhuizen).

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DR. CHRIS ANDREWS

As the number of vets interested (and trained) in fish diseases continues to grow, expert diagnosis and treatment for all manner of diseases (including Hole-in-the-Head) is becoming progressively more widely available.

IN SUPPORT OF VETS

Do you feel that aquarists get a raw deal from vets? **Amanda Grimes** thought so . . . until she took the matter up with **Peter Scott MRCVS.**

In giving the above title to this long-promised feature, I am admitting to a quite blatant turn-around on my part. For years, I have thought that aquarists got a pretty raw deal from vets — maybe you thought so too — and it was not until I talked it over with an eminent veterinarian that I realised how very wrong I was. Not that I am constantly in need of veterinary skills; obviously it would not be financially feasible to take a sick barb for treatment. But I have recently been thinking of expanding my interest to the larger cichlids, possibly marines and, eventually, Koi. What, I wondered, would I do if one of these expensive fish developed an illness I couldn't treat?

I talked about my concern to **John Dawes** and he put me in touch with **Peter Scott** of the Zoo and Aquatic Veterinary Group. Our conversation and subsequent correspondence was such an eye-opener to me that I re-create it here in the hope that it will answer some of the questions you, yourselves, might be asking.

"Why," I asked, "are most vets not conversant with fish problems?"

Peter Scott replies:

"Quite simply because, over a five year veterinary course, very little time is available for fish education. Fish are, in fact, omitted from the Veterinary Surgeons Act of 1966. This does not mean that vets know nothing about fish. The course at all six university colleges in the UK allows about two days for specific fish lectures, but much of the other lecture material relates to fish e.g. nutrition, basic physiology, pharmacology, microbiology etc.

"However, once in practice, there are courses available for vets to attend, from a one-year course held at Stirling University in Aquatic Veterinary Studies, to weekend courses and individual lectures. They can also learn from scientific papers dealing with fish diseases which are published in the veterinary press and books.

"There are, in fact, over 200 vets who have attended courses and expressed an interest in fish sufficient to join the British Veterinary Zoological Society. This is a division of the British Veterinary Association which tries to bring these vets together with meetings and newsletters.

"If you think 200 is a small number, you have to appreciate how vets work. Time is the major problem. All practices are tightly run, with most of the day spent in consultations, surgery, visits and day-to-day business concerns. In a three-man practice, the required 24-hour cover means vets usually work most evenings till 7pm, then one night on duty in three, and one weekend off in three. And that's a surgery with three vets!

"Then there's money, to cover the course costs — tuition, accommodation and possibly a locum to keep the practice going. This isn't such a major problem as vets can expect to recoup these outgoings from their clients.

"The final reason is one that aquarists can help with — motivation. If the vet is not in him/herself interested in fish, which is often motivation enough, local aquarists can lead a vet to see the need for taking such a course. And that is up to you — you have to let your vet know that you need his/her advice."

At this point, I asked Peter how I could go about finding a vet for my fish, and, having found one, how do I tackle the problem of taking my fish to the surgery.

"There are several options. You could check your own vet when you next take your cat for treatment; ask friends who might know of a vet who has an aquarium in the waiting room (that usually shows an interest in fish) or enquire at local aquarist shops. If you're a member of a society, ask your fellow members.

"Once you've found a vet, book the last appointment of the consulting session and tell the surgery what you are bringing. That will mean as little delay as possible. Then prepare a list of relevant details about your tank, feeding, cleaning, water changes, new introductions and, of course, what you have observed of the problem your fish has. Don't write a book on it — just the essentials. Most importantly, if you think your fish will need anaesthesia, take a spare container of the same water for the fish to recover in. If you are taking a fish in cold weather, you can get a thermally insulated box from your local aquarist shop."

In writing this feature, both Peter and I would like to emphasise one important point. Where the individual can only look after his/her own interests, societies can help us all. By inviting your local vet along to one of your meetings, and thereby showing your need for their services, you can encourage interest and help.

My need for a veterinary surgeon's advice is still in the future. But for those of you who keep Koi, Malawis and the larger cichlids — and particularly those readers who are involved in societies — the message is clear: "NO-ONE INVESTS IN EXTRA STUDY UNLESS THEY KNOW THEY'LL BE REPAID WITH INTEREST — IN THIS CASE, *YOUR* INTEREST."

Herpetology matters

By Julian Sims

Marine reptiles

If asked to name a reptile living in the sea, almost everyone would say "turtle". There are just six species of turtle living in the world's oceans and seas, including two types of Ridley: Kemp's and the Olive Ridley.

Probably the next most easily recognised group of sea-going reptiles are the Marine Iguanas *(Amblyrhynchus cristatus)* of the Galápagos Islands. Yet, although many of these Islands have their own coloured variants, *Amblyrhynchus* is the only genus of lizard which lives in the sea, and then, close to shore, feeding on the seaweed growing underwater on volcanic rocks.

Sea snakes are by far the most numerous type of marine reptile, with just fewer than 50 known species belonging to two sub-families of the Elapidae (the Cobra and Krait family). These sub-families are the Laticaudinae and the Hydrophinae.

The Laticaudinae are least well adapted to the marine environment, retaining the broad belly scales present in land-living snakes. Females of the genus *Laticauda* (the Sea Kraits) lay eggs above the high-water line in deep crevices of coastal rocks. When the offspring hatch, they move directly into the sea.

Most sea snakes belong to the Hydrophinae which contains 35 different species. These snakes, sometimes called "the True Sea Snakes", are totally adapted to marine life, having lost their large ventral scales, essential for movement on land. Females are ovo-viviparous (livebearing), so don't have to go to the shore to lay eggs. The young are born at sea.

Although sea snakes are very numerous, they are restricted to tropical waters and die if they are carried into cool, temperate waters by ocean currents. Sea snakes are distributed throughout the coastal waters of the Indian Ocean, from the east coast of Africa, around the Arabian Sea and the Bay of Bengal. The greatest number of species occur in the archipelago of South-East Asia where they spread as far as the northern Australian coast.

The Yellow Bellied Sea Snake *(Pelamis platurus)* is the most widespread species, being found throughout the Indian Ocean and across the Pacific Ocean to the west coast of tropical America. However, they are not present in the tropical waters of the Atlantic Ocean. Theoretically, the man-made Panama Canal would allow their distribution to be continuous throughout the tropical seas, but there is a prevailing current from the Atlantic into the Pacific through the canal locks; thus, colonisation of the Atlantic has not occurred to date.

The Yellow Bellied Sea Snake has a distinctive tail which is flattened and paddle-shaped. Even so, the snake is a weak swimmer and drifts passively near the surface, hence it is known as a pelagic feeder. Being dependent on ocean currents, aggregations of these snakes form drift lines many miles long. The contrasting warning coloration of yellow and black prevent the predation of such high concentrations of reptiles by sharks, dolphins and diving sea birds. Less vividly marked species of sea snake are eaten by sharks.

Human predation is a major threat to the long-term survival of sea snakes. They are used to make reptile skin shoes, wallets and handbags. The centre of this unfortunate industry is Manila in the Philippines. If such frivolous products weren't purchased, this industry would fall into decline through lack of demand.

Having evolved from the terrestrial Cobras, sea snakes have a very potent venom. There are many human deaths per year — mainly Indian and Malayan fishermen who are at greatest risk of being bitten by sea snakes. However, bites are not always fatal, as venom is only sometimes released.

The main diet of sea snakes is fish, but some eat marine invertebrates, and *Emydocephalus annulatus* searches out and eats fish eggs laid in sand. This snake has very small fangs as live prey does not have to be paralysed. Obviously, sea snakes form a fascinating group of reptiles which deserve greater recognition.

With proper care, the European Salamander (*Salamandra salamandra*) can live for 25 years in captivity.

JULIAN SIMS

Longevity

It is frequently suggested that animals live longer in captivity than they do in the wild. Certainly, this should be the case, with the threat of predation being removed, e.g. no storks to eat frogs, or snakes to prey on lizards if they are kept separately. Ectoparasites (those on the outside of the body) such as leeches and mites, can easily be removed and wounds or bites can be treated before they become infected with bacteria or fungi.

In the classic work, *Vivarium Life*, Alfred Leutscher cites some very interesting longevity records for captive reptiles and amphibians:

European Pond Tortoise *(Emys orbicularis)* 120 years
Japanese Newt *(Cynops pyrrhogaster)* 28 years.
European Salamander *(Salamandra salamandra)* 25 years
Alpine Newt *(Triturus alpestris)* 15 years.

The correct captive conditions are, obviously, very important in the achievement of longevity. The skittish African Clawed Toad *(Xenopus laevis)* can easily be stressed if kept in an all-glass aquarium which permits all-round viewing. Such stress will affect fertility and, ultimately, shorten the length of life of the toads. The back and sides of the aquarium should either be painted on the outside or, preferably, a film of photosynthetic algae should be permitted to grow on the inside face of the glass. Half flower pots resting on the floor of the tank also provide useful hiding places for aquatic amphibia.

In addition to captive conditions, correct diet is very important, and this theme will be developed in future editions of **Herpetology Matters.**

First STEPS

If you are starting up on a particular branch of the aquatic hobby . . . whatever that branch may be . . . and whatever level of expertise you may possess in other areas, then FIRST STEPS is for you. First Steps will provide expert advice on everything from buying Koi to setting up a Killifish aquarium . . . and everything else in between!

BASIC TROPICAL AQUARIUM MAINTENANCE

Once you've set up a tank and it has settled down, you need to look after it. **Dr. David Pool** of the Tetra Information Centre describes a simple, but successful routine.

PHIL TOMEY

A well-set-up tank will bring a special touch to any room. However, regular (though uncomplicated) maintenance is required to keep it in tip-top condition.

Once set up, an aquarium requires a minimum of care and attention to keep it looking attractive, and the fish and plants within it in the best of health. And yet, without this basic maintenance, the aquarium can quickly degenerate into an unhealthy place for the fish to live in, and the aquarist will be beset with problems. The routine tasks involved are simple and are not time-consuming, but they could be described as the secret to successful fishkeeping.

The routine maintenance of an aquarium involves tasks that need to be undertaken daily, monthly, or only occasionally. The Table summarises this information. Most of the tasks are self-explanatory. However, for others, a few comments may be helpful.

Feeding

Feeding the fish is, perhaps, the most enjoyable, and the most important task that needs to be performed on a daily basis. The fish should be fed 2-3 times each day, but only with as much food as they will consume within 2-3 minutes. With tablet-type foods the fish should show an interest in the food until it has all been consumed.

If there are tablets lying on the gravel with no fish feeding on them, you have added too many. Any excess food will accumulate at the bottom of the tank, where it will decompose and pollute the water.

While feeding your fish you should soon get to know the normal behaviour patterns of each individual, and so will be able to recognise immediately fish that are behaving unusually. Such behaviour is often the first indication of an unhealthy fish, or of a problem with the aquarium set-up.

Lighting

Turning the aquarium lights on or off can lead to the fish becoming stressed, particularly the more sensitive species such as Neon Tetras and Angel Fish. Occasionally, the sudden change in light intensity can startle the fish, causing them to dash about and collide with objects in the aquarium.

This is particularly a problem in the winter months, when the room is often in darkness if the aquarium lights are not switched on. It can be overcome by turning the room lights on for 10 minutes or so, before turning the aquarium lights on. In this way the light intensity increases in smaller steps, so preventing the fish from becoming startled.

Plant maintenance

The aquarium lights should be left on for 10-12 hours each day to encourage healthy plant growth. The plants in the aquarium grow at different rates and you may find it necessary to prune the faster-growing species.

Removing the top 2-3 inches of plants with stems is an excellent way of propagating these species, as well as encouraging the original plant to produce lateral shoots, giving it a more bushy appearance. This can be done at any time, but is considerably easier when the water level is reduced during a partial water change. This is also an ideal opportunity to remove any dead leaves from the plants. They not only look unsightly, but also decompose and can adversely affect the water quality.

Sufficient light is essential for good plant growth. **As a rough guide you should allow 15-20 watts of light for each foot of aquarium length, and leave the lights on for 10-12 hours per day.** To ensure that this light reaches the plants it is important to keep the condensation tray as clean as possible. Any dirt or algae on the tray may absorb certain wavelengths of light and adversely affect plant growth.

On a more occasional basis it is necessary to change the fluorescent tubes (say every six months) because their light output decreases rapidly with age.

Partial water changes

Once established, it is rarely necessary to empty and clean out an aquarium completely. However, regular partial water changes and cleaning are important to ensure that fish and plants remain healthy. The fish, in particular, can often be seen to be more active and show better coloration following the introduction of clean water.

Adding fresh water to the aquarium dilutes any pollutants (such as nitrates) which may be present. While the nitrate concentration within an aquarium will rarely

Gravel washers/cleaners provide an easy but effective way of removing solid wastes and debris.

Healthy fish, such as this Red Platy *(Xiphophorus maculatus)* indicate that conditions in the tank are well balanced.

Daily checks should be carried out to catch problems such as White Spot — seen here on a Black Neon *(Hyphessobrycon herbertaxelrodi)* as early as possible.

ROUTINE MAINTENANCE TASKS

Daily	Monthly	Occasionally
Check water temperature	Measure water quality	Thin plants
Check filter/air pump	Partial water change (every 10-14 days is best)	Replace fluorescent tubes
Check fish numbers/ behaviour	Clean filter	Check electrical apparatus
Turn lights on/off	Clean tank	Clean air pump valves
Feed fish	Remove algae from glass	
	Clean condensation tray	
	Prune plants	
	Remove dead leaves	

reach lethal levels, it can retard the growth and fin development of the fish and make them more lethargic, even at relatively low levels (40mg nitrate per litre of water).

Removing water from the aquarium should be combined with a general clean-up, and, particularly, with the removal of any debris or uneaten food. Using a gravel cleaner will allow you to remove any debris from the gravel without clouding the water. Regular use of a gravel cleaner also prevents the gravel from becoming clogged with debris and allows the undergravel filter, if used, to function more efficiently. If you use an undergravel filter it is advisable to place the siphon tube down the filter uplift tube occasionally and remove water from under the filter plates. It is remarkable how much debris accumulates there.

Removing about 20-30 per cent of the tank volume every 10-14 days is usually sufficient. With the water level reduced, this is an ideal opportunity to undertake any other routine maintenance tasks that might be necessary.

Remove any algae from the front glass of the aquarium. This can be done using commercially available algae scrapers, although I have found a piece of filter wool or, better still, a piece of net curtain to be more effective, with less chance of damaging the aquarium sealant. Only clean the front glass of the aquarium. The algal growth on the back and sides not only looks natural, but it also provides valuable food for herbivorous fishes and removes large quantities of nitrates from the water.

Your filter will also need cleaning to remove any debris that it may have trapped. The filter media in box or foam filters should be removed and rinsed in luke-warm water. **Do not use hot or very cold water as this will kill many of the beneficial bacteria that are present, thus reducing the effectiveness of the filter.**

When replacing the water it is important for it to be at the same temperature and quality as the water in the aquarium. Any large changes could stress the fish, making them more susceptible to infection.

The addition of a good quality water conditioner before replacing the water is also a good idea. Tapwater is specially treated to make it suitable for human consumption. This includes adding substances such as chlorine to remove any potentially harmful organisms. Chlorine is also toxic to the fish; therefore, to prevent any harm occurring, it needs to be removed.

Tapwater contains some of the nutrients and trace elements necessary for healthy plant growth. However, to ensure this, it is necessary to add a fertiliser to provide all the nutrients required in suitable quantities.

When replacing the aquarium water again use a siphon. Direct the water flow along the length of the aquarium, rather than at the plants or gravel. In this way you avoid disturbing any debris in the gravel or uprooting any plants.

And that is it! As you can see, there are not too many tasks to undertake. But regularly completing them will make the difference between a tank you are proud of and one that you wish to hide away.

Koi Talk

by John Cuvelier

Home-produced replacements

In spite of my previously described reluctance to take on the bother of raising Koi fry, this year I have decided to have a go, the principal reason, of course, being that of not being able to afford to replace my losses of 1987 in any other way! Spawning was rather late this year, due, no doubt, to the peculiar weather. However, in spite of everything, the Koi finally did their stuff, the session spanning three days of frantic activity.

For a spawning medium, I used several branches of Japanese Larch cut from trees in the garden, the foliage of this variety being both dense and soft. No attempt was made to separate the spawning fish into varieties, etc. I merely left them to it in my time-honoured fashion. Eventually, once the fun was over, I managed to beat the cannibals to the punch and removed the spawn-laden foliage from the pool.

Having earlier prepared a 36 x 18 x 12in (90 x 45 x 30cm) aquarium fitted with airlift filter and foam insert, and pre-filled with pool water, it was simply a matter of snipping off the various branches and placing them inside the tank. No means of heating was used, as the tank lives in a large shed which receives plenty of sun (Ha ha)! There is a heater for when the weather begins to get cooler, as the fry have a whole winter in the tank to look forward to.

Five days later, to the minute, the first tiny slivers of life could be seen clinging to the glass. 'Aint nature wonderful? Food consisted of Liquifry, lettuce leaf to rot down into infusoria and, later, a clump of watercress from the filter to provide tiny live food.

Some six weeks on, sizes range from almost one inch, down to half an inch in length, and the numbers have reduced by approximately 50%, thanks to the usual high mortality rate. At the time of writing, there are about forty fry swimming around the tank looking busy, so, with a bit of luck, I might rear a few. I'll keep you posted.

JOHN CUVELIER

Given good growing conditions, plus a little creativity, it is amazing how quickly any patch of ground can be converted into a thriving plant community which will enhance, and become an integrated part of, the area immediately surrounding a Koi pool.

Butyl splits

I had an anguished call for help from a reader last week who awoke one morning to find a third of his pool water gone and an enormous billow in the liner. The culprit was a horizontal split in the liner, starting at the point where the middle filter feed pipe connection had been made.

Sad to say, I had precious few words of comfort for him as, in my opinion, the only solution in such a case is to start again from scratch, as repairs with tape, etc. can only be a temporary measure. Although possessing considerable tensile strength, butyl tears quite easily once a break has started. Once going, it is almost impossible to stop. If a liner is installed with ANY tension at all present where connections are made, the weight of water will inevitably find a weak spot and 'Bob's your Uncle'! As I've said before, give me concrete every time.

Island progress report

As can be seen from the accompanying photograph, the 'man-made' island in our No. 2 pool is really beginning to look established. Considering it was only planted out just over a year ago, it isn't doing badly. Summer and winter flowering heathers, dwarf conifers and, of course, the Acer, ensure year-round colour. All in all, it was well worth the considerable work entailed in its construction. The tiny 'rock pool' and tumbling stream fed by back pressure from the venturi just finishes it all off nicely.

"Derek is fine, Aunt Emma! He's sitting up with the bat fish looking at their favourite 'Dracula' film."

Resuscitating 'Walkabout' Koi

I think most people with any knowledge of Koi are aware of just how hardy they are. This hardiness is, of course, inherited from their ancestors, the Common Carp.

Cases are on record of large carp having survived transporting over considerable distances just packed in wet grass, which brings us to the point of this paragraph. Should you be unfortunate enough to find one of your Koi lying on the ground, apparently dead, having jumped from its pool, don't give up on it! Your first priority must be to get it back into water, preferably holding it into a stream of well-oxygenated water, such as the outlet of a venturi. This might entail quite a long period of time, which can be very tiring. The task can be made easier by suspending the fish in a towel held with both hands, thus facilitating transfer to a relief 'nurse'. A backwards and forwards motion in the water will also help to stimulate the gills into working.

Having restarted respiration, the fish should be transferred to a hospital tank containing a strong salt solution (2oz cooking salt/gal), which will serve as an antiseptic for the inevitable grazes and bruising the fish will have suffered during its 'walkabout'. Any more serious abrasions or cuts can be treated once the fish has recovered some of its strength. Having, myself, experienced fish 'expeditions' on more than one occasion, I can vouch for the effectiveness of the above operations, and the kick one gets as the result of bringing a fish 'back from the dead'.

CRYPTOCORYNE

Dutch biologist, lawyer and teacher **Arie de Graaf** retraces the steps of his 1982 collecting trip to Sri Lanka.

Cryptocorynes have been very popular aquarium plants for a long time owing to the fact that they are very long time owing to the fact that decorative and present good possibilities for creating contrasting groups in an aquarium.

In the fifties and sixties the so-called "Leiden School" of Dutch fishkeeping became popular — aquariums with neatly-kept rows and groups of plants. These rows and groups consisted mainly of *Cryptocoryne* species and the "Leiden plant", *Saururus cernuus*. This method of planting, which contrasted with "terraced cultivation", produced an aquarium which was not only aesthetically, but also biologically, acceptable.

Cryptocoryne species are not only good indicators of environmental conditions (Hornwort and Pondweed do the same thing) but are also stabilisers of the environment. One species imported from Sri Lanka, which was to be seen often in the community aquarium in the fifties, was *Cryptocoryne thwaitesii* Schott. Presumably, because of the deterioration of the quality of the drinking water with which aquaria are normally filled, this species disappeared from the scene. It has also disappeared from the biotopes in Sri Lanka.

Other *Cryptocoryne* species of the so-called *Cryptocoryne beckettii* group from Sri Lanka are still, however, favoured by aquarium enthusiasts. On the one hand, the great variability of these species provides the advantage that beautiful community aquariums can be set up. On the other hand, however it has also caused grave problems concerning the names of these plants. At the same time there has been much uncertainty with respect to the locali-ties where the species of *Cryptocoryne* occur on Sri Lanka.

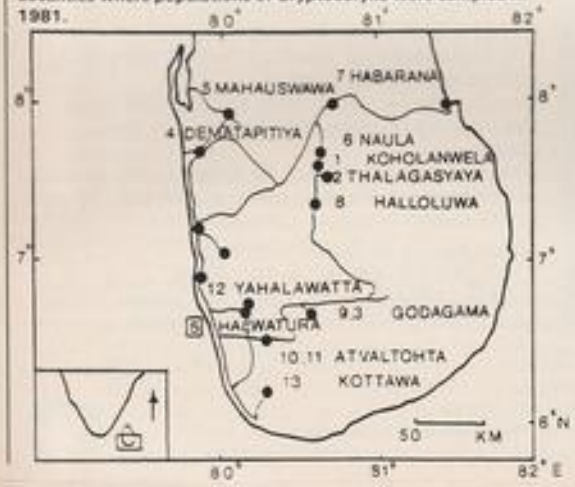
In order to remedy this undesirable situation, I made a journey of almost 2000 km across the south-western part of the island during April 1981 with Vladimir Sadilek (Brno, Cesr) who passed away in 1982, and also was my inspiring travelling companion.

Collecting and investigating flowering plants is of decisive significance in the study of *Cryptocoryne* species.

OVERVIEW

On the whole, the number of plants in the various *Cryptocoryne* populations was found to be very limited owing to the collecting activities of commercial plant collectors. Furthermore, many species of *Cryptocoryne* are also collected by local physicians who prepare a medicine from the plants (used in treating stomach ailments and helminthiasis). Only one apparently unaffected locality was found near Habarana (locality 7 on the map) where *Cryptocoryne wendtii* de Wit occurs.

Localities where populations of *Cryptocoryne* were sampled in 1981.



C. wendtii in a community aquarium

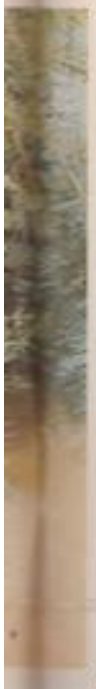
Our guide, John Martin Fernando collecting *Cryptocoryne wendtii* at Dematapitiya

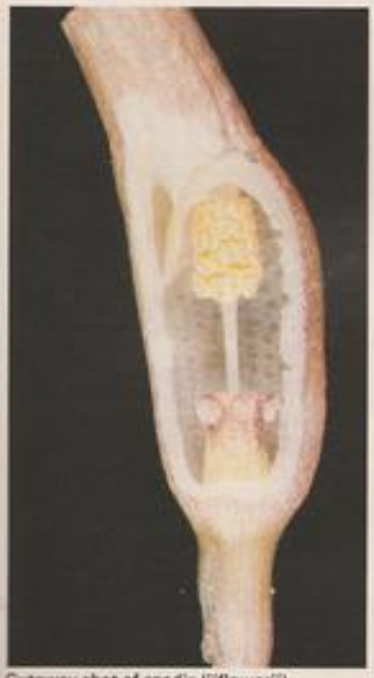
ES IN SRI LANKA

Laka. (Illustrations by the author)

C. beckettii

C. walkeri





Cutaway shot of spadix ("flower") of *C. wendtii*

C. willisii

C. alba

BIOTOPES OF CRYPTOCORYNE

It is possible to distinguish four different biotopes in which *Cryptocoryne* occurs, viz. the spring biotope, the river biotope, the dark forest biotope and savanna biotope. The first three biotopes occur in an area approximately between 6°C to 8°30'N and 79°45' to 80°45'E.

According to the vegetation map of Gaussen et al. (1964) the temperature in this area never drops below 20° (68°F). The annual precipitation is about 2000 mm. South of 7°40'N there is no dry season, but north of this latitude there is a dry period of one to two months.

Isolated river biotopes appear to occur in an area between 6°20' to 7°10' N and 81°20' to 81°45'E. In general, the climate in this area is dryer than described above, but the water in the rivers stem from the higher central part of Sri Lanka which is situated west of the area.

The fourth (savanna) biotope occurs in the plain east of the Central Mountain Range. The climate in this region contrasts with the former ones by the occurrence of a dry season of three to six months. The annual precipitation varies from 1400 to 2000 mm and the mean temperature of the coldest month does not go below 20°C (68°F).

In the following text, the four biotopes are described, and the various populations which the been sampled are discussed according to biotope. The numbers which preceed the localities refer to their geographic position indicated on the map.

SPRING BIOTOPE

This biotope consists of clear water coming from natural sources. As the water is used for drinking and washing, many of these springs have been changed into brick-walled basins in which the various species still occur.

Localities

1. Spring next to water pump installation near Koholanwela *(C. beckettii* Trimen (including C. *petchii* Alston)).
2. Spring among rice fields near Thalagasyaya *(C. x willisii* Reitz (including *C. lucens* de Wit)).
3. Spring among rice fields about 1 mile from the canalised river near Godagama (mentioned in 9) *(C. walkeri* Schott).

RIVER BIOTOPE

The populations are found in occasionally fast streaming rivers, where the plants grow permanently or temporarily submersed in a "bandjir zone". Such plants are classified as rheophytes.

Localities

4. Dematapitiya at the crossing of the road Banyadenia-Pallama with the Dedura Oya (oya=river). The hamlet is at a distance of 10 miles from Chilaw and 23 miles from Pallama. The Dedura Oya is a broad river (c. 10-20m — 33 to 66ft — at low level) with changing water heights each 24 hours. On the southern bank, with a clay-like soil, a particular form of *C. wendtii* was found. This form resembles *C. x willisii*, because of its red spathe, but also. *C. walkeri* because of its leaf shape.
5. Mi Oya at bridge across the river near the hamlet Mahauswawa. This population of *C. wendtii* differs from the other forms found during the expedition by its limb, which is brown and rough on the inside, whereas the outside is darker brown and smooth. The margins of the limb are warty and its collar and throat dark brown. Some plants in this population are characterised by a limb which is shorter and less spiralised; its colour is reddish brown with a distinct dark brown throat.
6. Naula, close to bridge over unnamed narrow river in a steep-walled valley near milestone 56.6. A form of *C. wendtii* was found, which is characterised by a limb which is smooth both on the inside and outside. The inside of the limb, the collar and the throat are dark brown; the outside is greenish-brown.
7. Bridge on the road Habarana/Maradaz-halawela near Habarana. Here a form of *C. wendtii* was found, which is characterised by a limb which is elongated and smooth in all parts. Its inside is yellow with red dots. The collar zone is broad and red, whereas the throat is white.
8. Mahaweli Ganga (ganga= big river) near Halloluwa. Banks of fast-running, broad river (5-10m-16 to 33ft) with big rocks *(C. parva* de Wit and *C. walkeri* Schott).
9. Canalised unnamed narrow creek (1.5m-5ft) near Godagama which runs parallel with the road A18 *(C. becketti* Trimen).
10. Atvaltohta-bridge (milestone 32) across the Pelang Ganga. On the grounds of the Timber State Plantation at a distance of about seven miles from the bridge *(C. walkeri* Schott).

DARK FOREST BIOTOPE

This biotope is characterised by narrow and shallow, but occasionally deeper, creeks (to c. 1m-39in), which are heavily shaded by trees and shrubs. The beds of the creeks are devoid of aquatic vegetation: the few and tiny populations of *C. alba* de Wit, *C. bogneri* Rataj, and *C. thwaitesii* Schott occur in very shallow water near the banks, where the plants grow in a layer of decaying organic material.

Kortmulder et al. (1978) give a detailed description of this apparently delicately balanced habitat for which they recorded some endemic species of *Barbus*. Bearing in mind the limited number of collections, our observations indicate that the three *Cryptocoryne* species are local endemics also. Each species occupies a restricted area. Moreover, *Barbus cumingi* Günther was found simultaneously with *C. alba* and *Barbus nigrofasciatus* Günther with *C. thwaitesii*. Hence the spatial separation of the plant as well as the fish species may be determined by similar environmental factors.

Localities

11. Atvaltohta-bridge (milestone 32) across Pelang Ganga, on the bank of a creek which merges into the river near the entrance of the Timber State Plantation. At a distance of about nine miles from milestone 32 *(C. bogneri* Rataj).
12. Yahalawatta forest near the Kalu Ganga — creek which merges into the river. The location is close to milestone 18.9 on the road between Panadura and Ratnapura *(C. alba* de Wit).
13. Kottawa forest — near a small bridge in the road from Galle to Udugama across a creek *(C. thwaitesii* Schott).

SAVANNA BIOTOPE

This biotope is known from the Batticaloa district. There is only one species of *Cryptocoryne* involved, *C. nevillii* Hook.f., which was recently recollected by D. H. Nicolson close to road A15 near milestone 25 in a seasonally inundated area. Two other localities are known. As the locality mentioned above was visited in April everything was dried out. Hence, no plants of *C. nevillii* were found. The plants produce leaves and inflorescences after the rainy season in the autumn. During the spring and summer, when precipitation ceases, the plants lose their leaves, whereas their rhizomes are covered by the substrate, which consists of a cracked brown clay layer. Consequently, plants can only be found during the transition time between the two seasons (November to January).

CONCLUSION

As already mentioned, the populations of *Cryptocoryne* are generally affected by human activities. It is obvious, also, that the number of populations has become smaller in recent years due to the general deterioration of the environment (Evans 1981). It is clear that the further exploitation of the habitats should be regulated by issuing licences by the responsible authorities (Anonymous 1979).

In fact, exploitation has ceased at the moment as it appears to be less lucrative for plant collectors to exploit the populations for commercial purposes, since the size of the populations has been severely reduced. As there is still a continuous European demand for Sri Lankian *Cryptocoryne* plants, the complete extinction of the species can be avoided by stimulating the present trend of propagating the species in commercial nurseries in Sri Lanka.

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THE SVC STORY

Following encouraging response to our pleas for information on SVC outbreaks, Coldwater Jottings author **Stephen Smith** and *A & P* editor **John Dawes,** summarise the current situation regarding this deadly disease.

JUST WHAT IS SVC?

Much has been written, and a great deal said, about the outbreak in Britain this year of Spring Viraemia of Carp-SVC. It has been stated in some quarters that SVC is potentially the most devastating condition to afflict the coldwater scene; while others maintain that the situation is one which European fish-keepers have lived with for years.

So, what is this "disease" which has caused so much alarm and controversy throughout the coldwater scene? How can we tell if we have SVC in our fish stocks, and what on earth can we do if we think this might be the case?

Firstly, one basic point to note is that SVC is, in fact, caused by a virus (*Rhabdovirus carpio*) — for which there can be no specific cure. In general, once any animal is infected with a virus, it is *always* infected.

For example, in humans, influenza and the common cold are both the result of different viruses. When we "get the 'flu" we suffer symptoms which disappear once our own system has developed immunity to that particular virus, or strain of virus. However, we, nevertheless, remain susceptible to new altered strains.

Herpes simplex, which is the virus responsible for cold sores in humans, is a similar condition, in that we develop immunity to the virus, and its symptoms generally only re-occur when we are "run-down."

A similar situation exists with SVC: a fish which is infected with Spring Viraemia will *remain* infected — even if it develops immunity. Such a fish will continue to live quite happily, but will be a carrier of the virus, thus placing other fish at risk.

Young fish are particularly susceptible to SVC — indeed, youngsters of any animal species are predominant victims of any viral infection. However, it is thought that offspring of infected fish — or at least a small percentage of these — may be immune to the virus. (One of us — J.D. — experienced a similar situation to this some years ago with the new-born fry of TB-affected Goodeid females, ie, the fry were clean.)

VARIETIES AND SYMPTOMS

It is understood that only the Common Carp (*Cyprinus carpio*) and other cyprinids are affected by the virus — these include Mirror and Leather Carp, as well as Koi, Hi-goi, and Goldfish.

The virus is temperature-dependent, reaching its peaks during the spring and, again, at around mid-autumn, when the temperature range, 13 to 15° Celsius (55.5-59°F) is best suited to the virus. At around 20°C (68°F) mortalities are reduced, while, at 23-24°C (73.5-75°F), symptoms disappear altogether.

SVC is transmitted by water and does not require a host fish in order to survive. The main symptoms could well be confused with dropsy — which is worth noting. However, although a fish may show signs of dropsy, this does not *necessarily* indicate that it is an SVC-infected fish.

Other symptoms are haemorrhages, exophthalmia (pop-eye), fin-rot, and ulcers — in any combination; or even no symptoms at all, except sudden death of the fish.

A fairly sure method of discovering whether any losses are the result of SVC is to dissect the fish and check its swim bladder. In an otherwise "healthy" fish, the swim bladder is virtually transparent in appearance. However, the swim bladder of a fish infected with SVC may appear mottled blue in colour.

DR DAVID POOL

Exophthalmia (Pop-eye) and dropsy are both common symptoms of SVC-affected fish.

WHAT SHOULD I DO IF I SUSPECT SVC?

Firstly, and most importantly, **DO NOT** keep it a secret. SVC is a notifiable disease under Government legislation*. You should immediately contact the Fish Diseases

ROBFIL® LTD.

Dear John,
Re. SVC:
In this instance, I feel that the general Fish Health situation now highlighted by the SVC problem in the ornamental sphere has reached a stage whereby ***all*** *responsible individuals and bodies with an appropriate platform must make their voices heard in an effort to create mutual understanding and co-operation.*

In my view (and I speak with a foot in both camps), the commercial fishfarming and the ornamental fish dealer lobbies, not to mention the conservationists, are so powerful, that left to their own devices, they will only succeed in destroying one another, and I fear it will be the hobby which would suffer the most from something like an import ban.

You will note that I say "highlighted by the SVC problem", because this is only the latest episode of a saga which most of us in the know have acknowledged for at least ten years. Having said that, the completely emotive over-reaction that I have witnessed from (with all due respect) the amateur/ hobby fraternity . . . can only worsen the situation and probably result in the sort of draconian Government legislation that they envisage.

I agree entirely with your reasoning on not publishing anything on the subject without 100% confirmed facts, but also feel that only yourself and your contemporaries are in a position to inject a degree of "tranquilisation" into the situation and get people thinking, rather than reacting.

As an instance, I have tried to calm various of my friends and associates . . . with an agricultural comparison — do we stop all Agricultural Shows and Sheep Dog Trials because of an outbreak of Foot and Mouth disease?

The answer is, of course, 'Yes' — but only until the situation is contained; then life goes on — M.A.F.F. will remove the restrictions in due course. The hobby as a whole must adapt to the fact that we now have a notifiable disease and organise accordingly (I'll not comment on Japanese-style shows!!)

What we need is constructive comment, not destructive reaction, and only the aquatic press is in a position to educate the layman in respect of a subject with very few specialists.

I trust this doesn't come across as my teaching granny to suck eggs, and would ask you to read it as my thoughts on the subject, rather than as a suggestion on any specific course of action. In any case, I look forward to reading your own contribution on the subject in due course.
Yours sincerely,

Alan Benson,
Director — Robfil Ltd.

One personal view from the trade received during our research.

Laboratory, part of the Ministry of Agriculture, Fisheries and Food, at: The Nothe, Weymouth, Dorset DT4 8UB (Telephone: (0305) 772137).

The Ministry will provide you with instructions on how to send samples of fish suspected of infection, or will arrange to visit your premises for inspection. Do not, however, simply dispatch samples of MAFF without first notifying them.

L. E. PERKINS

In an SVC-affected fish, the swim bladder (arrowed in the photograph) can become mottled-blue in coloration. Sadly, this can only be verified once the fish has died.

Movement of fish, both into and out of your establishment, will be prohibited for a minimum period of thirty days, during which time the virus can be cultured under laboratory conditions and the necessary tests carried out.

DISINFECTION

If the results of laboratory tests confirm that SVC is present in your establishment, you will then be advised to destroy *all* your stock and thoroughly disinfect all ponds, tanks, equipment, filters, etc, to ensure that the infection is eradicated.

However, the responsibility for this is very much on the owners, although the majority of hobbyists would, we are sure, prefer to "start again" than take any risks (as would responsible traders, of course).

Obviously, re-stocking should not be undertaken until thorough disinfection is completed.

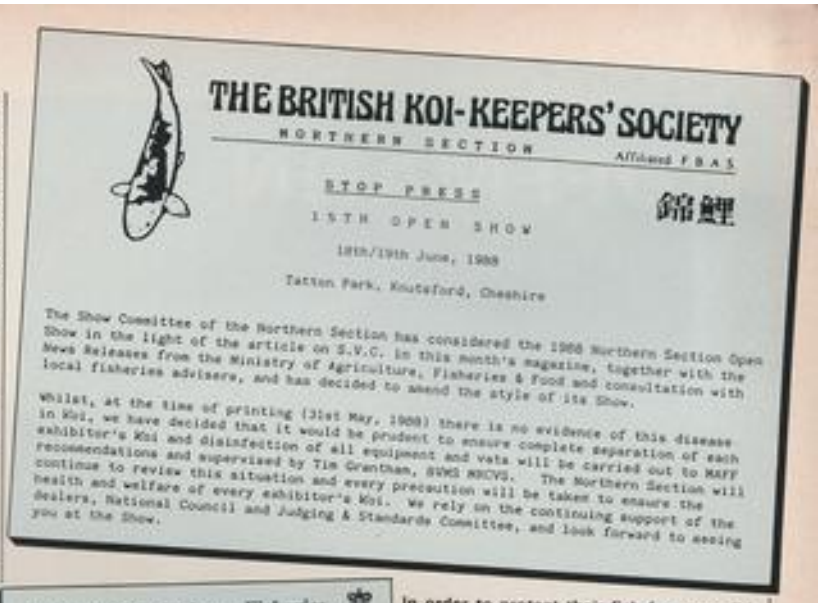
Chemicals used for disinfection are, obviously, lethal to fish, and it would not appear that a fish itself can be treated against SVC. It is understood that vaccines have been used on the Continent with some success, but such a vaccine may only help a fish to develop immunity itself, subsequently to remain capable of passing the disease on as a carrier.

Use of iodophoes, such as Fam 30, Wescodyne, bleaches, lime, sodium, hydroxide and phenolic compounds have all proved suitable for disinfection and, of course, such disinfectants should be neutralised before re-stocking.

PREVENTION

The basic rules of husbandry have been repeated time and again in the columns of this publication. Such basic disciplines

* Diseases of Fish Act 1937, as read with the Diseases of Fish (Definition of "Infected") order 1984.



THE BRITISH KOI-KEEPERS' SOCIETY

NORTHERN SECTION

Affiliated F B A S

STOP PRESS

錦鯉

15TH OPEN SHOW

18th/19th June, 1988

Tatton Park, Knutsford, Cheshire

The Show Committee of the Northern Section has considered the 1988 Northern Section Open Show in the light of the article on S.V.C. in this month's magazine, together with the News Releases from the Ministry of Agriculture, Fisheries & Food and consultation with local fisheries advisers, and has decided to amend the style of its Show.

Whilst, at the time of printing (31st May, 1988) there is no evidence of this disease in Koi, we have decided that it would be prudent to ensure complete separation of each exhibitor's Koi and disinfection of all equipment and vats will be carried out to MAFF recommendations and supervised by Tim Grantham, BVMS MRCVS. The Northern Section will continue to review this situation and every precaution will be taken to ensure the health and welfare of every exhibitor's Koi. We rely on the continuing support of the dealers, National Council and Judging & Standards Committee, and look forward to seeing you at the Show.

In order to protect their fish from possible infection, some leading organisations, such as the B.K.K.S., took sensible, precautionary steps, particularly when planning their shows — as this notice (published at the peak of this year's SVC outbreak) clearly demonstrates.

Ministry of Agriculture, Fisheries and Food

Great Westminster House, Horseferry Road, London SW1P 2AE

As of today SVC has been identified at some 34 sites in Great Britain, involving losses in both ornamental and coarse fish stocks. The source of this current outbreak has not yet been established but it is likely that the disease was introduced as a result of the import of ornamental fish carrying the virus.

In these circumstances and pending the outcome of our review of import controls, *we consider that it would be in the interests of all importers to take steps to determine whether overseas suppliers can give assurances that their fish stocks are free from infection with SVC virus and other serious diseases.* You may find it useful to ask a few specific questions of your supplier, such as those suggested on the attached sheet. Such questions will help you to assess how much reliance you can place on any supplier's claim to have "disease-free" fish and whether you will wish to proceed with your order.

Excerpt from a letter sent out by the Ministry of Agriculture, Fisheries and Food on 8 June to all holders of import licences for coldwater ornamental fish.

MAFF News Release

1. Outbreak of Spring Viraemia of Carp

The Ministry of Agriculture, Fisheries and Food has made an Order designating the inland waters and adjacent land at *(Name of Farm/Angling Club, or other affected site)* because the presence of Spring Viraemia of Carp (SVC) was suspected.

The Order, which came into force on 11 June, restricts the movements of any live fish or live eggs of fish, either into, or from, the designated area without previous written consent of the Ministry.

2. Spring Viraemia of Carp

A Variation Order has been made by the Ministry of Agriculture, Fisheries and Food which removes *(Name of Farm/Angling Club, or other site)* from a list of sites designated as areas infected for the purposes of the Diseases of Fish Act 1937.

(. . .) is now no longer described as an area where Spring Viraemia of Carp is present. Movement restrictions on that site have been lifted.

Examples of Press Releases issued by M.A.F.F. keeping interested/affected parties informed of progress.
1. Official notice announcing an actual outbreak and its consequent restrictions.
2. Notice released when a site is declared clear.

should, by now, be second nature to seasoned hobbyists, but we make no apology for repeating them here:

a) *Always* choose with care your source of supply: only buy from a reputable retailer or breeder whose stock is assured of 100% cleanliness;

b) *Quarantine* all new purchases for at least a month, in a separate tank or pond before introducing them to your existing stock. Failure to do so may result in losses — which are *not* the fault of the retailer (despite what some hobbyists may think);

c) *Disinfect* all nets and other equipment immediately after use, and ensure that equipment used for quarantined stock is kept separate from other equipment;

d) *Pay attention* to water quality — check all your fish continuously for signs of stress, disease, infection, etc, and immediately treat/quarantine anything which looks suspicious.

We cannot help but make mention of one well-known ornamental fish breeder who has always insisted that no buckets or items

of equipment are taken into his establishment. Any livestock which leaves his premises is not allowed back in. The result: thoroughly clean, healthy and reliable fish of exceptional quality.

If only this breeder's example were followed throughout the country, no virus would have any chance of taking hold.

AND FINALLY . . .

The outbreak of Spring Viraemia of Carp in the UK should not be underestimated. While it would appear that the virus is well under control at present, we will not be sure until next spring whether it has been beaten — if at all.

SVC *is* a devastating killer but it is possible that, in the distant future, all carp-related species will develop some immunity. Until then, hobbyists, importers, wholesalers and retailers alike, should bear their individual and collective responsibilities in ensuring that every effort is made to provide the virus with as little chance as possible of wreaking havoc among Britain's ornamental and native livestock.

ACKNOWLEDGEMENT

Our sincere thanks to all those who so kindly responded to our requests for information and assistance during the preparation of this article.

Excerpts from an information sheet issued by Peter Scott of Vetark Animal Health during this year's outbreak. Peter, who is also the Veterinary Adviser to Ornamental Fish International, has recently been involved in drafting guidelines in conjunction with the National Farmers' Union and British Veterinary Association for distribution to their members.

INFORMATION SHEET

VETARK Animal Health

Spring Viraemia of Carp (SVC)

The current outbreak, possibly related to importation of fish from France in the early part of the year, is the first time it has entered the "wild". This outbreak was first seen in Common Carp at a fishery in the West Country. The owner consulted the local Veterinary Investigation Centre which, because of the scale or mortalities, referred the fish to the MAFF Fish Disease Laboratory at Weymouth. The staff there responded quickly and, on confirmation of the presence of the virus, traced all contacts and tested them. This has led to over 30 positive sites. Several ornamental fish outlets have been forced to kill stock to remain in business, since a positive test result leads to imposition of movement restrictions preventing the sale of fish. The only option is slaughter without compensation, and disinfection prior to restocking.

The disease is spread via the faeces, or mucus, etc. and probably enters via the gills. It can be transmitted by parasites such as *Argulus* (the Fish Louse) or *Pisciola* (leeches).

THERE IS NO CURE.

Prevention is based on knowing the source of your fish and hence the likelihood of freedom from disease. Disinfect nets etc with iodophors, bleach, or phenolics — AND RINSE THEM AFTERWARDS as these chemicals are toxic to fish if they get into the water.

The disease is notifiable; even suspicion must be reported to MAFF, although obviously, there are many diseases which may occur in the Spring (or other times of the year) which can kill fish and these are often readily treatable, eg bacterial septicaemias, Costiasis, Chilodonelliasis, etc.

If in doubt consult your vet who can then either advise directly or get expert advice.

Peter W Scott

MSc.BVSc.MRCVS.MIBiol.MIFM

Diary dates

Preston & District Aquarist Society
P.D.A.S. are holding an Auction on **9 October** at Lancashire Polytechnic Students Union, Fylde Road, Preston. Booking in: 12.00 noon-1.15 p.m. Sale commences: 1.30 p.m. Further details from Temporary Secretary, Nicholas Gant. Tel: (0772) 634 616.

Boston Aquarist Society
The Open Show of the Boston Aquarist Society is scheduled for **Sunday 9 October.** Venue: The Drill Hall, Main Ridge West, Boston, Lincs. Benching: 10.00 a.m.-1.00 p.m. Judging: 1.30 p.m. Contact: K. Smith (0205) 67379.

Ilford & District Aquarist's & Pondkeepers' Society
Their Annual Exhibition of Fish will be held on **15 October** at Ilford Town Hall, Ilford, Essex. Doors open: 11.00 a.m. I.D.A.P.S. meetings are held every second Monday of the month at Wanstead Library Hall, Spruth Hall Road, Wanstead, starting at 8.00 p.m. Further details from R. Downer, 93 Brian Road, Chadwell Heath, Romford, Essex, RM6 5BT.

West Cornwall Fishkeepers
The W.C.F. fourth Open Show will be held at Holman's Sports Club, 'Blaythorne' Pendarves Road, Camborne, in conjunction with an Inter Club Show, with all clubs from Cornwall and Devon participating. Date: **Sunday 23 October.** For full details, contact Brian Sell (Show Manager), 'Westwoods', Illogan, Redruth, Cornwall. Tel: (0209) 842902.

The Scottish Aquarium Society
The 61st Open Show of the Scottish Aquarium Society will be held in the McLellan Galleries, Sauchiehall Street, Glasgow, G2, on **Friday 28 October (2.00-8.00 p.m., Saturday 29 October (10.00 a.m.-6.30 p.m.)** and **Sunday 30 October (10.00 a.m.-5.00 p.m.)** Entry forms should reach the Show Manager by Monday 17 October and all exhibits must be staged on Thursday 27 October between 5.00-10.00 p.m. Tanks, airlines, etc., will be provided by S.A.S. Further details and entry forms from V. Hamilton (Show Manager), 20 McKerrel Street, Paisley PA1 1AX. Tel: (041-889) 9400.

Blyth Aquarium Society
B.A.S's fourth Open Show will take place on **23 October,** supported by both the F.B.A.S. and T.T.A.A. Full details available from K. Stenton (Secretary), 2 Kielder Close, Newsham Farm Estate, Blyth, Northumberland NE24 4QQ.

Catfish Association of Great Britain
The autumn Convention of the G.A.G.B. will be held on **Saturday, 19 November,** at Amersham Community Centre, Amersham-on-the-Hill, Bucks. Guest speakers: Heiko Bleher, Mike and Gina Sandford. Contact Gina Sandford, 5 Sparrow's Mead, Redhill, Surrey RH1 2EJ, for further details. Tel: (0737) 769339.

OUT AND ABOUT

with John Dawes

A&P — sponsored BMAA seminar at London Zoo Aquarium

1988 has seen a new look for BMAA Seminars. It was decided that to revive the flagging interest in these events, a fresh approach was needed regarding their presentation. The major areas of concern were:

1. The venue (which we saw as important from two aspects);

2. The content.

After much discussion, we decided:

a. To take the seminars out of the 'Pub and Club' environment into a more professional setting (ie Zoos and Universities — with their abundant lecture theatre facilities),

b. To move the venue around so as to allow more people a chance to attend,

c. To present shorter, sharper lectures in order to provide a greater cross-section of topics.

So, with all this in mind, the first of these 'New-look' Seminars was held at Bristol Zoo on Spring Bank Holiday Sunday.

The day proved to be a roaring success — arguably the best ever. The speakers included *A&P* Editor John Dawes, Marine Ecologist Dr Elizabeth Wood, Dr Peter Miller of Bristol University, and Staff of Technical Aquarium Products — the Seminar's sponsors. There was also a lot of activity around the sales tables and lunchtime afforded the opportunity to visit the Zoo's excellent Aquarium. Everyone left the Zoo on a high and the Committee were left to pack everything away with a warm glow of satisfaction. Our ideas for what a Seminar should be had been well received, and so, work started on the organisation of the AGM/Seminar, scheduled for **Sunday, 23 October.** This time (sponsored) by *Aquarist & Pondkeeper*), at London Zoo.

This is the main event on the BMAA's Calendar. It is the day when the new Committee is elected and when everyone gets the chance to air their views on the running of the Association, as well as to gain an insight into how the whole thing 'ticks'. Apart from the business, however, their will be plenty of things happening to interest everyone. Speakers for the day are:

1. DR DAVID POOL of the Tetra Information Centre. Those who have heard David before will know him to be a knowledgeable and interesting speaker on all aquatic topics, who has filled the gap left at Tetra by his predecessor — Dr Chris Andrews — admirably. David will be talking to us in October about **Fish Behaviour.**

2. DR CHRIS ANDREWS, who left Tetra to become Assistant Curator of the Aquarium at London Zoo. Chris needs no introduction, for he is well known to all hobbyists — especially BMAA members, as he is a patron of the BMAA. Chris will be talking about the work he and his colleagues do at the Aquarium: **Marine Life in the Aquarium at London Zoo.**

3. DR JENNIFER GEORGE. Jenny is a lecturer at London Polytechnic and a prominent figure in the Marine Conservation Society, along with her husband David. Jenny's subject is **Marine Invertebrates,** which was the theme for the classic book she and David wrote and which has found it's way into the collection of all discerning marine aquarists.

4. DR PETER MILLER of Bristol University, who will be talking about the **Goby Family.** When Peter was given half an hour to cover this subject at Bristol, we had more than a few moans that this was nowhere near long enough (a sentiment with which I wholeheartedly agreed) so we've asked him back to talk in more detail about this fascinating family of fishes.

Apart from the AGM and lectures, there will be the chance to look around the Aquarium, a raffle and sales tables carrying books and other items of aquatic interest. The cost for all of this — including entry into the Zoo and coffee — is £2.00 for BMAA members and £3.00 for non-members. Tickets are obtainable from: **Roy Martin (Secretary), 20 Richens Drive, Carterton, Oxfordshire OX8 3XT.** See you there!

Gordon Kay
BMAA Chairman

NEXT MONTH

- As we begin to approach the long, dark evenings of winter, our colourful November issue brings back a touch of Mediterranean air as **Dr Chris Andrews** reports on his hectic week in Monte Carlo.
- South America in a margarine tub! Impossible? Not so, as **John Skillcorn** attempts to incubate and hatch Killifish eggs in his latest South American Pearls article.
- Arriving late can be good for you! At least, that's what happened to a cracking transparency of a Sea Apple (submitted by **Max Gibbs** of **The Goldfish Bowl** in Oxford) that the vagaries of our postal system failed to deliver in time for our July Sea Cucumber feature. The result: full-page colour reproduction, accompanied by a super article from **Dave Garratt** in November's Spotlight feature.
- Next month's specially commissioned **Focus** articles concentrate on Nutrition with in-depth contributions from **Adrian Exell** (Interpet), **Dr David Ford** ('Aquarian), **Dr David Pool** (Tetra) and *A & P* Editor **John Dawes.**
- There's even more! No less than 50 of Tetra's spectacular Stamp Calendars, valued at around £30 each, will be given away in a great colourful, easy to enter competition. Clearly, you can't afford to miss Novembers' *Aquarist & Pondkeeper.* Book early!

BMAA Seminar Programme

10.00 am — Reception with coffee on arrival.
10.30 am — Association AGM.
11.00 am — *'Marine Life in the Aquarium at London Zoo'* talk by **Dr Chris Andrews** Ass Aquarium Curator.
11.45 am — *'Marine Invertebrates'* talk by **Dr Jennifer George** of MCS.
12.45 pm — Lunch.
2.00 pm — *'Behaviour of Fishes'* talk by **Dr David Pool** of Tetra.
3.00 pm — Coffee & Raffle.
3.30 pm — *'The Goby Family'* talk by **Dr Peter Miller** of Bristol University.
4.30 pm — *'Closedown'* with **Roy Martin** and **Gordon Kay.**

Seaview

by Gordon Kay

Sick . . . as a Parrot (fish?) about Damsels

I'm as sick as the proverbial! When I moved house recently, I packed my fish off to a friend's house, after his kind offer to look after them until I had my tank set up and running again. Among the collection was a shoal of Damsels, which I said he could keep as a token of my gratitude.

Last week I had a call to say that they had spawned. He had risen that morning to find the eggs on the aquarium glass, in the corner, where the side glass meets the front. Obviously, had they been laid on a rock, he could have taken them out and put them into a separate container until hatching, but damaging them was too much of a probability to risk it, so they had to stay there.

I had a "Resting Rotifer" kit stowed away for such an eventuality, so my friend drove up here (3hr round trip) to collect it. Unfortunately, the culture had passed its shelf life, and so, a search was launched to find an algae culture. By Friday (day 5) the culture had not been forthcoming and my mate was resigned to losing the first batch, although he resolved to try anything to keep them.

Well, the eggs hatched in the early hours and the fry scooped out as quickly as possible. This proved a problem as there were hundreds, and my prized Longnose is in the same tank! Ah, well, he had a good meal . . . Anyway, an algae culture was tracked down on the Sunday in Southport, but, alas, too late for this brood, who were dead by then. However, now that the Damsels HAVE spawned, they will do it again (and again!). I'm just peeved that they didn't do it when I had them!

One thing which I feel is important in all this; I'd decided to run my aquarium at a lower salinity than usual (1.018), for various reasons, and a week before the spawning, I had called my pal and asked him to start reducing the salinity in the tanks housing my fish, in readiness for when they came home. A week later the Damsels had produced. Coincidence?

CORAL WORLD — TEAM

Would you rather face a bee or a shark? See Snippets.

Ammonia toxicity

We all know (or should!) about the phenomenon known as the nitrogen cycle in our aquariums. We know all about nitrites and nitrates and use test kits to monitor them from the start. However, we usually ignore what is probably the most important (and deadly!) part of the cycle — Ammonia.

Most books on marine aquatics stress the importance of nitrite and tell us to measure an aquarium's level of maturity by using nitrite test kits. This is probably a throw-back to the early days when the process of nitrification was not properly understood and ammonia test kits were very unreliable and difficult to use. When fish died, because there was a nitrite reading, nitrite was blamed.

In fact, nitrite is tolerated more easily by fish than ammonia (ie, some hardy fish will tolerate 4 ppm for days without coming to much harm. Ammonia is lethal over 0.4 ppm and will cause problems over 0.2 ppm).

It should be said, however, that almost no fish can survive ammonia and nitrite together so, as this combination is always present during the maturation process, the filter has to be properly matured before adding delicate fish. When one considers that the presence of ammonia (a) inhibits the ability of bacteria to transform nitrite to nitrate and (b) inhibits the fishes' ability to excrete ammonia through their gills (which is why it kills them!), and, also, that it is possible to have ammonia without nitrite and vice-versa, then the importance of an ammonia test kit becomes apparent.

SNIPPETS

1. The Japanese consume, on average, 50 grams of seaweed a day, each.

2. Seaweed contains 25% more protein than milk.

3. According to the Marine Conservation Society, at least 30% of Britain's beaches fail to come up to EEC safety standards. They say that the sea at some of our favourite resorts is so polluted that bathers run the risk of catching Gastro-enteritis, ear, nose and throat infections and — if not vaccinated against them — even Polio and Typhoid.

4. According to legend, sharks are dangerous beasts which eat swimmers in America. The truth is more people are killed by bees than sharks. That probably wouldn't fill so many cinemas though, would it?

5. *Hetropsammia cochlea* is a little coral whose life style is unique. It has just one or two polyps and lives unattached on the sandy floor of the inner-reef. Inhabiting its skeleton is a Peanut Worm — *Aspidosiphon corallicola* — which prevents it from becoming buried in sediment and keeps it in an upright position with its foraging activities. The Peanut Worm settles out of the plankton to live in a tiny shell, discarding smaller shells for larger ones as it grows. The larval coral then attaches itself to the shell inhabited by the worm, which then stops looking for new shells and starts to modify the developing coral skeleton. It maintains an entrance hole and a series of small holes around the edge of the coral, which it uses to draw in water and expel it — for breathing.

6. Many different mobile animals feed on and around corals without damaging the polyps. Nudibranchs scavenge bacteria and detritus caught in the mucus which is exuded by the coral.

7. And, finally, did you know that each cubic mile of ocean contains an estimated $200 million worth of gold and $12 million dollars worth of silver?

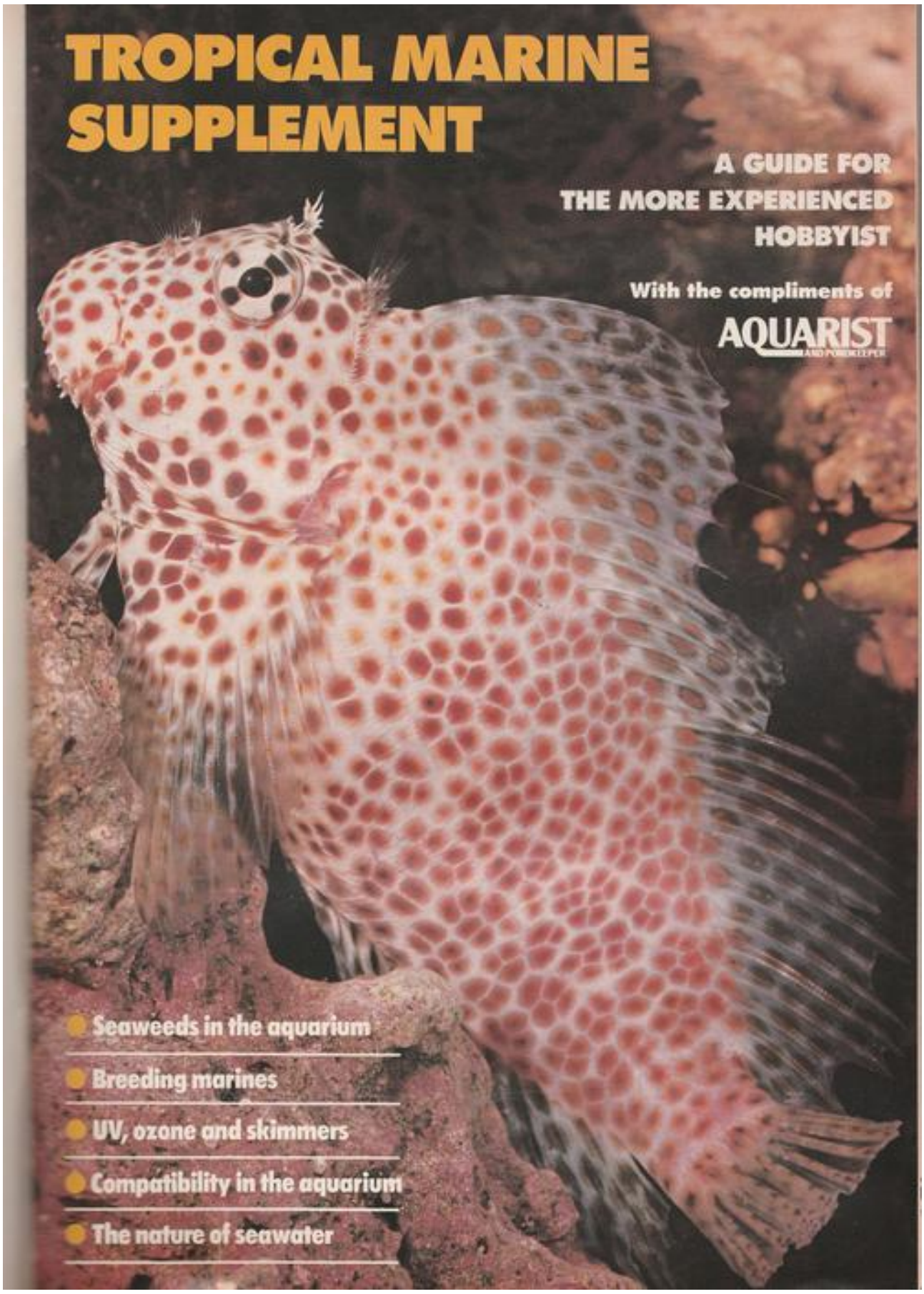
Until the next time . . .

TROPICAL MARINE SUPPLEMENT

A GUIDE FOR THE MORE EXPERIENCED HOBBYIST

With the compliments of

AQUARIST AND POND KEEPER



- Seaweeds in the aquarium
- Breeding marines
- UV, ozone and skimmers
- Compatibility in the aquarium
- The nature of seawater

MARINE SUPPLEMENT

SKIMMERS, OZONE AND UV — THE SAFE APPROACH

Handled properly, both ozone and UV radiation, especially when operated in conjunction with a protein skimmer, will help improve water quality and disease control. **Dave Garratt** reviews the principles involved and offers sensible advice on how to obtain optimal results.

Until quite recently many UK aquarists viewed any technical innovations with great scepticism. However, with the advent of sophisticated systems such as Hockney, Tunze and Minireef, allied to enlightening textbooks by Spotte, Lundegaard, Moe, Baensch and De Graaf, technical equipment has come of age in the UK. Three such items: protein skimmers, ozonisers and UV sterilisers, are considered in this article.

PROTEIN SKIMMING

Protein skimming will reduce the load on any biological filter bed and will also remove substances that cannot be biodegraded by the filter bed.

This is a known scientific fact and, as such, no marine aquarium should be set up without a protein skimmer.

Certain organic compounds exist in the marine aquarium that are known as non-bio-degradable. This means they cannot be biologically broken down by the filter bed and, as such, even with water changes, they will gradually accumulate. Such an accumulation can lead to toxicity problems, excess detritus formation and yellowing of the aquarium water.

Many of these compounds exist in an electrically charged form (known as polarised) and, in this form, opposite ends of the molecule have differing affinities for air and water. The water-loving part of the molecule is termed *hydrophilic*, while the non-water-loving part is *hydrophobic*. These molecules are thus attracted to an air/water interface. The basis of a protein skimmer is to produce such an interface. This is achieved by producing a stream of tiny air bubbles inside a column, or reaction chamber, to attract these polarised organic molecules.

For aquariums up to 40 gallons (180 litres) a counter-current skimmer is usually used. This device uses an air-pump to introduce a stream of tiny bubbles into a plastic column. The polarised organic molecules adhere, by reversible adsorption, to the bubble/water interface and are carried up the skimmer column. Water is also drawn down through the column to increase the contact time between the bubbles and the water. When the bubbles reach the top of the column they burst, leaving behind the organic molecules which are collected as a scum in the collection cup that sits on top of the column. Powerful power-skimmers are available, and these are run by a water pump that produces a high-pressure water jet which is mixed with air using a venturi device. These models can cope with tanks up to hundreds of gallons.

Factors affecting skimming

Most of these are not under the control of the aquarist. However, certain factors can be controlled or improved: bubble size and consistency of supply; contact time of bubbles with aquarium water; height of column; and bubbling rate. The skimmer should be the correct size for the tank so as to ensure maximum column height.

A good-quality wooden air diffuser (usually limewood) should be used to ensure good, even bubbling with a small size bubble. Bubbling rate should be adjusted so that it barely exceeds the rate of foam collapse.

Other advantages of protein skimming

Even if most of the organics are biodegradable, skimming would remove them, and so will greatly lessen the load on the filter bed. This would lead to a more stable pH and a lower build-up of nitrate. Skimming also prevents a build-up of protein slime on tank walls and in the filter bed, thus helping to prevent colonisation by unwanted bacteria that may thrive in this slime. Finally, skimming would seem to lessen greatly the risk of "wipe-out."

Disadvantages

Skimming will remove trace elements and, although in a fish-only tank normal water changes should overcome this, it may be necessary to use trace element supplements in an invertebrate tank.

OZONE

Ozone is a powerful oxidising agent and therefore has the ability to destroy micro-organisms such as viruses and bacteria by oxidising their cellular DNA. Ozone may also "burn off" the cilia and flagella of protozoans, and will thus make them immobile.

However, before we assume that we have found an infallible disease cure, there are three important restrictions on its success:

i) success is dose-related;

ii) organisms can recover from sub-lethal doses;

iii) fish and humans are adversely affected by overdosing.

Ozone is an oxygen molecule possessing an extra oxygen atom, thus giving it the chemical configuration 0_3. This third atom is highly unstable and is readily given up to produce the strong oxidation effect of ozone. Ozone is produced in the aquarium by pumping air through a silent-discharge ozoniser. A transformer produces a 1500 voltage that passes to a pair of electrodes that are separated by a dielectric (insulator). This produces an electrical corona through which air is pumped to produce ozone.

Factors affecting efficiency

Efficiency is greatly improved by drying the air before it enters the ozoniser. The ozoniser should be used in conjunction with a skimmer so as to contain the ozone and prevent direct contact with fish (this also

improves the efficiency of skimming). A great concentration of organics in the aquarium will decrease the effectiveness of ozone against disease as the organic molecules are preferentially oxidised.

Disadvantages of ozone

1. Excess dosage damages fish gills; its toxicity to inverts is a matter of general disagreement.
2. Care must be taken not to get a build-up inside the hood in those systems where the bacteria of the filter bed are exposed eg. Tunze.
3. Excess ozone is toxic to humans.
4. Ozone attacks plastic and shortens its life.
5. Sub-lethal doses may enable bacteria to recover and they may then survive in a mutated, resistant form.
6. Medications can be affected; copper should not be used concurrently.
7. Toxic intermediaries have been postulated following the oxidation of organics.
8. Ozone cannot usually be supplied at safe levels to destroy parasites on fish — only free-swimming parasites.

After reading such a problem list you may wonder why ozone is ever used in a marine aquarium. A few simple precautions will usually overcome the major problems: Pay attention to dosage and do not under- or overdose. Any excess should be piped away to fresh air; most skimmer chambers have this facility by means of a vent. Ozone must be used contained in a skimmer so as not to come into direct contact with the livestock. Carbon may be useful in absorbing any toxic by-products that may be produced.

Advantages of ozone

1. Oxidises organic waste and so reduces load on the filter bed.
2. Produces crystal clear water.
3. Will keep down the number of free-swimming bacteria and protozoans in the aquarium, thus helping to contain disease.
4. Promotes wound healing.
5. Increases oxygen levels in the tank water.
6. Increases the efficiency of protein skimming.

Suggested dosage: Continuous use — 1-2 mg/hr per 10 gallon tank capacity.
For 2-3 hours after feeding — 2-4 mg/hr per 10 gallon tank capacity.
Disease — 10 mg/hr per 10 gallon tank capacity (duct away excess).

UV STERILISERS

Ultra-violet light (like ozone) is usually thought of as a disease preventative, or even a cure. Again, this role must not be over-estimated as UV is rarely capable of totally eradicating a disease. At best it should be thought of as a general control measure.

Ultra-violet sterilisers are used in conjunction with a power filter or some other means of passing the aquarium water through the steriliser. The ultra-violet is capable of destroying the DNA of any free-swimming organisms that pass in close proximity to it.

Factors affecting efficiency

The wavelength of UV produced must be as close as possible to 253.7nm as its effectiveness rapidly diminishes as one moves away from this wavelength. Efficiency is 100% greater at 104°F (40°C) than at the usual tank temperature of around 75°F (24°C). Because of this the quartz-jacketed steriliser is the one of choice.

The UV tube is enclosed in a quartz jacket (unlike ordinary glass, quartz allows the passage of UV). This quartz tube is, itself, surrounded by a plastic tube with a small air space left between the two. Water is then pumped through this gap and is heated to 104°F (40°C) by the tube to ensure maximum killing efficiency.

A balance needs to be reached between flow-rate, contact time and percentage killing effect. Most UV sterilisers quote a flow-rate that will enable the steriliser to produce 35,000 microwatt seconds/cm^3. This should be capable of killing most viruses and bacteria and, even, *Oodinium*. *Cryptocaryon* or flukes would require many times this dose and, as such, practical treatment of these organisms is impossible.

Water clarity is an important factor to consider. Particulate waste, or an excess of organics, such as dyes in the water, will seriously impede efficiency.

Disadvantages

1. A UV tube will *appear*, to the human eye, to be giving out ultra-violet rays long after it has lost its efficiency, but the tubes only have an effective life of 6 months when used continuously.
2. UV catalyses chemical reactions — an unknown quantity.
3. UV is a powerful mutagenic agent at sub-lethal doses. Any organism exposed to UV and not killed may, possibly, mutate to a different form that may have enhanced resistance and disease capabilities.
4. In very heavily polluted tanks ultra-violet can produce nitrite from nitrates.
5. Concurrent use of copper may seriously decrease oxygen saturation of the tank water.

Advantages

1. UV keeps down the number of free-swimming bacteria and parasites.
2. UV can flocculate proteins to a size where they can be removed by a power filter.
3. UV is thought to help prevent the dreaded "wipe-out".

CONCLUSION

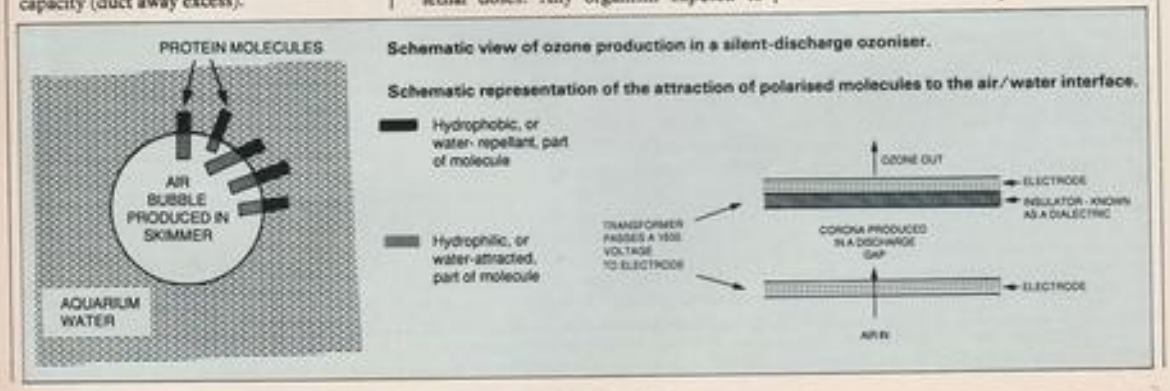
A protein skimmer has a marked effect on water quality by reducing the load on the filter bed and, in doing so, removes undue stress caused by poor water quality, and indirectly effects the general health of the livestock.

Ultra-violet and ozone have a lesser effect on water quality and can primarily be looked on as water disinfectants, but not disease cures.

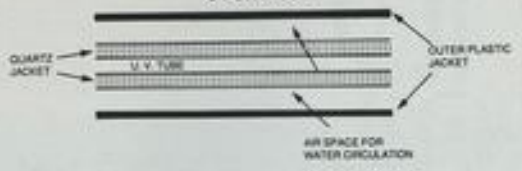
From the basic premise that water quality is the paramount key to success with marines, the more important role of the skimmer becomes obvious. When price is considered (an air-operated skimmer suitable for tanks up to 40 gallons (130 litres) can be purchased for £20 or so), the logic is even clearer.

Should the aquarist wish to consider UV or an ozoniser as an aid to disease control he/she is faced with a dilemma of which one to choose. UV is easier to handle and control and causes less side-effects on the tank's biochemistry. However, a UV steriliser requires a power filter. Ozone is less easy to control and causes the problems stated earlier, but it does not need a power filter, and it can be easily connected to a skimmer with a resultant increase in skimmer efficiency.

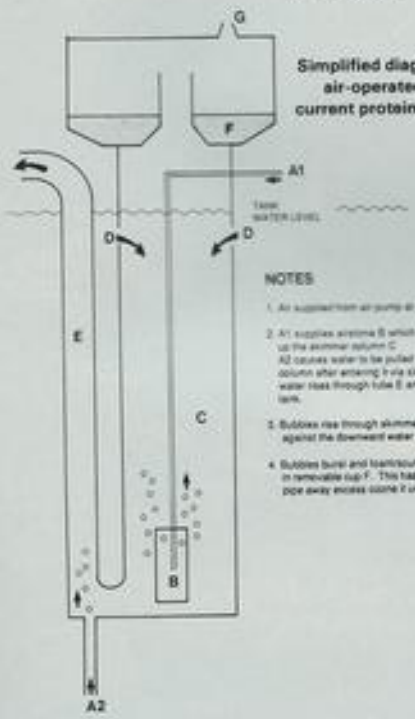
The choice is really in the hands of the aquarist. Undoubtedly, if all three are used together, a significant improvement in water quality and fish health could be expected. If such a system is used, the component units should be connected up in the order shown in one of the accompanying figures to ensure maximum efficiency.



Cross-sectional diagram through a quartz-jacketed UV steriliser.



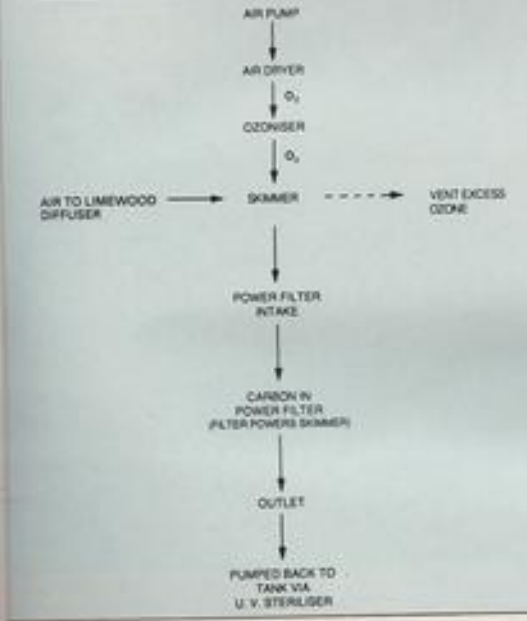
Simplified diagram of an air-operated counter-current protein skimmer.



NOTES

1. Air supplied from air pump at points A1 & A2
2. A1 supplies airstone B which bubbles fine air up the skimmer column C
   A2 causes water to be pulled down skimmer column after entering it via slots D. This water rises through tube E and re-enters tank.
3. Bubbles rise through skimmer column against the downward water flow.
4. Bubbles burst and foam/scum is deposited in removable cup F. This has a vent, G, to pipe away excess ozone if used.

Flow chart showing the sequential installation of UV steriliser, ozoniser and protein skimmer when used together.



BREEDING TROPICAL M

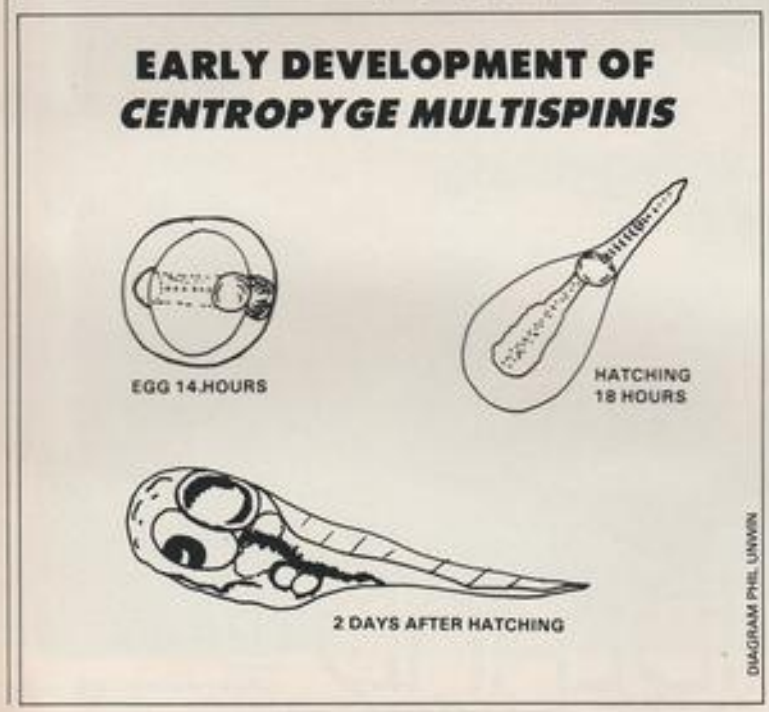
Phil Unwin has bred more tropical marine fish and invertebrates than most aquarists could even dream of. Share the secrets of his success, and you, too, could become a member of this select "club".

The breeding of marine fishes and invertebrates is becoming more common, particularly now that more advanced filtration techniques are replacing the undergravel filter. Finding suitable first foods for newly-hatched larvae, though, can still be a problem, as many fry are too small to eat the rotifer *Brachionus plicatilis*. However, green water cultures have a limited success rate, particularly with Damsels and crustacea, offering an interesting area for experimentation. Hopefully, we will see more and more species added to the current list of reared marine creatures and, perhaps, take a little pressure off the world's coral reefs.

Selecting Breeding Stock

Selecting healthy fish which will be suitable for breeding is not easy. Choose a reputable dealer, preferably one who obtains his/her stock from one of the larger importers; they may be a little more expensive but, in my experience, are more healthy owing to better handling on arrival in this country. Also, your dealer will have access to large numbers of the same species of fish and may be able to select a pair or group of fish for you. There is, unfortunately, little or no noticeable difference between the sexes of many marine species, so behaviour becomes the most useful method of selecting a pair. For example, many fish will not tolerate another of the same species and sex, so by watching who chases who, a pair can sometimes be found.

Failing all else, and if you have plenty of tank space, buy four or five fish, the two largest, plus the two or three smallest. If you're lucky, you may get two pairs, particularly as many species are either protogynous (turn from female to male) or protandrous, such as anemone fishes (male to female).



Conditioning

The importance of low stocking levels cannot be over-emphasised. One or two pairs of compatible fish in a well-filtered tank is ideal. Tank size, of course, depends upon the species being kept. I have had Neon Gobies and Dancing Shrimp spawn in a five-gallon undergravel filtered tank, Damsels and small Clowns in twenty to thirty gallons, and larger Clowns and *Centropyge* Angels in thirty to fifty gallons.

Water conditions must be kept very stable: temperature 80-82°F (27-28°C), S.G. 1.022. Keep tank disturbances to a minimum, with plenty of cover provided, such as large bivalve shells and plant pots which also make good egglaying sites for the demersal spawners.

Food should be provided two to three times daily, alternating a good quality flake and a good frozen food.

Spawning

Many spawnings probably go unobserved as they occur at first light (Damsels) late afternoon (Clowns) or dusk (*Centropyge*), so a torch is useful to check the interior of plant pots and under shells, etc., for eggs of demersal spawners. The torch becomes essential with pelagic spawners, as the only way to detect the tiny transparent floating eggs is to shine the torch at an angle across the surface of the tank to catch the reflection of the tiny (less than 1mm) spheres as they drift about.

Pelagic (drifting/floating) eggs must be collected at once before they are drawn into the filter and lost; this is best done with a small scoop or jar. They will hatch in about 18 hours (*Centropyge*), but will not feed for another two or three days, as they are not fully developed. Demersal (attached) eggs must be watched for hatching, and are best left with the parents. They usually hatch within an hour of darkness and can then be siphoned off carefully, ensuring that the siphon outlet is not too far below the water level of the parent's tank to minimise damage to the larvae.

Rearing Tanks

The larvae must be transferred to a static larval rearing tank. Small floating tanks may be used in the parent tank to rear a few fish, but a separate tank with give better results.

A volume of about ten gallons (45 litres) is ideal. Provide a heater and one or two fluorescent lights (left permanently on); then, after about three days of the larvae feeding, change 10 to 20% of the water daily.

MARINES

Feeding

Many larval fish are too small to take rotifers, so green water must be cultured. This is available from a few sources, and can be placed in two categories; monocultures, which are very pure cultures of a single algal species; and wild cultures, which are a mixture of, possibly, several algal strains, along with other organisms, such as ciliates and copepods.

While the mono culture is good for feeding Brine Shrimp and rotifers, it seems that tiny larval fish will not feed on it; therefore, a wild culture must be developed. I say "developed" because the best way to obtain one is to grow a good strong culture for several months. It may eventually die off, or you may be lucky and the right organisms will develop to feed the larvae until they are large enough to take rotifers. For larger larvae, rotifers are excellent. They are easy to culture in buckets, bowls or old tanks and eat a variety of foods, such as dried yeast, New Technology invertebrate food and green water.

It is important to remember, however, that each rotifer acts as a "parcel", so what goes into it, foodwise, is what the fish get. Therefore, while it is possible to rear Common Clowns on yeast-fed rotifers, Shunk Clowns fare very badly without algae-fed rotifers.

As the fish grow, Brine Shrimp may be used to boost growth until they are large enough to take powdered flake food, at about the time that they take on their colours. At this time, they can be transferred to filtered tanks to grow on.

Several species of shrimp, Boxing, Dancing and Cleaner, can be reared in a similar way. Although the female carries the eggs around with her until hatching, they hatch soon after dark, when they can be transferred to the rearing tank. Growth, however, is slow and, after a few weeks, they may need to be kept individually, particularly Boxing Shrimp, to prevent cannibalism.

PHIL UNWIN

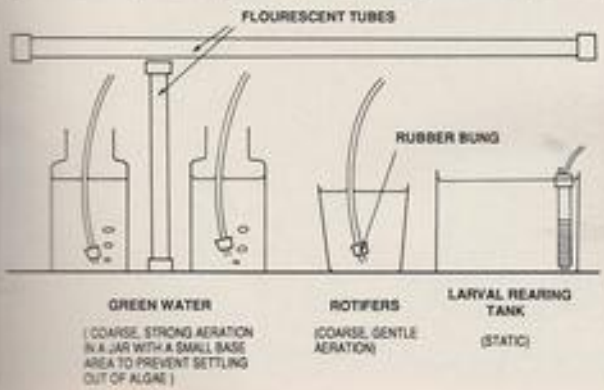
A pair of Tomato Clowns within their territory. The female is cleaning the nest site.

Closing request

I am in the process of collecting data from any aquarists who have managed to breed tropical marine fish and/or invertebrates. If you have managed to do this, I would be very grateful if you would supply the following information via *A&P*. I have filled in one line to to give you an idea of what we require. Details of problems would also be welcome.

If there is a good enough response, I will put together a review list (hopefully) later on this year, or early in 1989, for publication in *A&P*.

Species	Tank	Eggs	Temp°	S.G.	Incubation Time	Reared In	Foods used/ other Information
Centropyge aconthops	35 gal U/gF	Pelagic	80°F (27°C)	1.022	18 hrs	20 gal All-glass tank	Green water. Fry died after 10 days



Once the green water culture is established i.e. once it is a good strong green colour, it can be used to feed to the rotifers and/or added to the rearing tank. The rotifers must, however, be strained before adding to the fry tank as their water may be polluted.

PHIL UNWIN

By the time they are four weeks old, Yellow-tailed Blue Damsel young are fully coloured.

PHIL UNWIN

Yellow-tailed Blue Damsels at 18 days — just beginning to colour up.

PHIL UNWIN

Common Clowns at 10 days, (highly enlarged).

SEAWEEDS IN THE AQUARIUM

Derek Bunn has enjoyed success and suffered failure in his attempts at cultivating seaweeds. He now has a successful formula which works. Read on . . .

For many years, to grow seaweeds in the marine aquarium was considered an impossibility and the advice was not even to try it, as their inevitable death and decay would only lead to disaster. Eventually, when their requirements were understood, it was found that certain tropical seaweeds (not the familiar brown ones on our shores) *could* be grown, and today, many serious marine aquarists would be no more content with a weedless aquarium than would their freshwater counterparts.

Yet, the attempts of some marine aquarists to cultivate seaweeds still meet with little success. The truth is that to achieve consistent good results requires some knowledge and skill, and I hope that by re-counting my own experiences — some not happy ones — in this article, I will make things easier for those still struggling.

Micro-algae

It is worth pointing out, though it is not of great practical significance, that seaweeds are not plants in the popular sense of the word (scientifically they are), but a type of 'higher' algae known as macro-algae. Unfortunately, what suits macro-algae also suits the lower micro-algae — the 'nasties' — and this causes even the experienced marine aquarist some problems.

The least troublesome of these lower algae are the green filamentous (or 'string') types. They are unattractive to the eye and, in abundance, tend to float about in the water, blocking filters, choking the tank and fatally smothering sedentary invertebrates. On the credit side, they do do all the beneficial things that green seaweeds do, removing nitrates, oxygenating the water and generally purifying it. For this reason some aquarists have devised sophisticated external filters containing these types of algae, through which the aquarium water is pumped and returned to the tank. Another good thing about filamentous algae is that they harbour large numbers of tiny crustaceans which provide a continual supply of live food for the fish, free of charge!

Filamentous green algae grow well in good water conditions and are an indication of the tank's wellbeing. Overfeeding can cause the appearance of much less pleasant types — the blue-greens. This is an unfortunate description because blue-greens can be of a variety of colours: red, brown, maroon, yellow and various shades of green. They appear as a slimy coating or skin, often covered in bubbles, over rocks, gravel, glass and seaweeds, smothering the latter. Their rate of growth is phenomenal: after being siphoned out, they can cover everything again within hours. Blue-greens are definitely a bad omen; they point to an excess of nutrients and a polluted tank.

Macro-algae and lighting

The first requisite for the successful cultivation of macro-algae is adequate lighting. The simplest and most economic way of providing this is with fluorescent tubes, but there are more sophisticated ways, mainly through the use of mercury lamps and spotlights; ordinary light bulbs cannot be recommended.

Fluorescent tubes, especially the slim types, are easy to install, taking up little room in the hood, and, being fairly cool, do not overheat the water in normal weather conditions. They are cheap and (I find) adequate for the growth of many, if not all, available seaweeds.

Assuming the reader is content to rely on this sort of lighting, the question remains: How much? The usually quoted formula to answer this is **a minimum of 30 watts per square foot (900 cm^2)** of water surface. This is simple enough to calculate and usually means 3-4 tubes along the length of the hood.

If the aquarist is not able to afford this minimum lighting (s)he should not hope to grow seaweeds and will have to be content with the filamentous types which require much less light and will colonise the tank without needing to be introduced. Painting the inside of the hood white will maximise the output of the tubes and it would be wasteful not to do so, whatever degree of lighting is used.

The next question — and a confusing one to those without the benefit of advice — is what type of tube to use. There are so many, each with a differing spectrum, that the problem can seem quite baffling. However, a little knowledge of the requirements of green plants can solve the matter. Very bright fluorescents (to us) tend to have a lot of yellow light, but this is of little use to plants; red and blue light is what they need. For green plants, red light is the most useful, but this is unable to penetrate very far through seawater, so only those growing in shallow water can benefit from it in nature. Therefore, blue light is the most important for the majority of seaweeds, as it can reach them at much greater depth.

It is clear from this that one must choose a tube which emits a lot of red and/or blue light. The ideal fluorescent for plant growth is the 'Grolux' which emits both very strongly. However, the pink colour-rendering of this tube is not too pleasant in my view and, if it is used, I believe it should be in combination with two or more tubes giving a whiter light. For my part, I have grown tropical seaweeds successfully with various combinations: 2 Grolux and 1 Northlight; 2 Northlights and 1 Grolux; 1 Grolux, 1 Northlight and 1 'power-twist' Trulite; 2 Northlights and 1 'power-twist' Trulite; and, currently, 3 Northlights.

The last type can be purchased remarkably cheaply, is available in the slim form, and gives out a very bright light which makes the tank all the more attractive. Moreover, seaweeds (eg, *Caulerpa* species) grow prolifically under it. Actually, my tank is rather shallow, only about 12in (30cm) from the top of the gravel to the surface, so if it were deeper, I might replace one of the Northlights with a more growth-promoting Grolux. A further word of advice: there is

nothing to beat natural sunlight, and I am sure it is an advantage to site the tank, if at all possible, in a position where it will receive, at least, a little sun.

Other types of lighting, such as halogen and high-pressure mercury bulbs, will, of course, also make seaweed cultivation possible. Manufacturers provide their own guidelines which must, obviously, be followed for optimum results.

Fertilisers

After much experimentation, I have come to the conclusion that the successful cultivation of *Caulerpa* species and other seaweeds depend very little on the type of light, provided it is of the requisite intensity (see above), but is very dependent on the amount of algal nutrients in the water. *Caulerpa* species, in particular, grow very rapidly — unbelievably rapidly — and deplete the water of its nutrients and essential trace elements. Fortunately, algal fertilisers and trace elements are available to replenish these; less fortunately, judging the right doses to add is largely guesswork, since the amounts being assimilated by the seaweed cannot be measured. This is where even experienced aquarists are likely to go wrong, and one's only recourse is to take careful note of the different types of algae growing in the aquarium and adjust the doses accordingly.

What *is* certain is that to add nothing can lead to disaster, for on more than one occasion, all desirable algae in my tank gave way to a noxious brown type which clearly had toxic effects on the inhabitants.

At the correct level, macro-algae seem to be able to prevent the growth of unwelcome amounts of filamentous algae, presumably by starving them out, just as higher aquatic plants will prevent the growth of algae in the freshwater tank; but if too much is added, the filamentous will appear, and by growing on the fronds of seaweed, will kill them. A good indication of over-dosing is the appearance of one of the slime (blue-green) algae, but, unfortunately, when this stage is reached, discontinuing the additions will only bring about a slow recovery, and, in my experience of this, the problem has got worse before it has improved. With me, the tank has gone through a long phase of rampant filamentous algal growth (for some months) before returning to normal.

Sapphire Damsels *(Chrysiptera taupou* — formerly *Abudefduf sapphirus)* will not harm seaweeds and are therefore ideal fish for a "mixed" tank.

DEREK BUNN

DAVID ALLISON

With careful planning and attention to detail, it is quite possible to keep invertebrates, seaweeds and fish successfully in the same tank.

DAVID ALLISON

DAVID ALLISON

Left, *Caulerpa serretaluroides* — an elegant fern-like seaweed for the tropical aquarium. Right, some types of red seaweed, such as *Rhodymena*, and calcareous algae like *Corallina officinalis* are difficult species best suited to cool water conditions.

I should mention here that, in the opinion of some aquarists, the growth of macro-algae is seasonal and, therefore, its periodic failure is natural and cannot be avoided. It seems to me, however, that their growth and death in the aquarium is more 'cyclical' than 'seasonal' and is controlled by the amount of nutrient in the water. After a certain length of time, during which there is little or no growth, the water recovers as a consequence of the waste products of the animals and routine water changes, and the algae then undergo a further burst of growth. Inadequate lighting can also lead to the impression that their growth is seasonal, the seaweeds thriving when the aquarium is lit by natural sunlight, and dying at times of the year when it receives too little. At any rate, those aquarists who have 'got it right' seem to grow *Caulerpa* continually throughout the year.

Obvious measures to avoid the swings from one extreme to the other, ie. from depleted to over-enriched water, are:

(1) to thin the seaweed regularly (your local shop may even pay you for it); and

(2) to slow its growth by limiting the lighting (photoperiod) to twelve hours maximum.

Within the twelve hours, some keen aquarists contrive to give their tanks full lighting only during a part of the day, consistent with nature, but I, myself, have not gone this far.

Other desirable algae

Besides the relatively easy green seaweeds, other desirable algae will probably develop in the well-kept aquarium: red seaweeds may slowly appear, and there are sure to be various kinds of lower algae, hopefully in acceptable quantities.

It is true that certain species are more rampant than others, and it may well be that one or two take over to the exclusion of others. This is a natural phenomenon, as any gardener knows. However, in all probability, certain areas of the tank will be darker than others and some will differ in the amount of water movement. This will enable a variety of species to flourish, each in its preferred habitat.

Closing warnings

Finally, a few words of warning. Seaweeds should be treated with as much care as animal life when being introduced into the aquarium: they should be floated in a plastic bag until the temperatures equalise, and the specific gravities should match as closely as possible. This is most important.

Also, seaweeds are more likely to survive if securely anchored, either with a rock placed over part of the rhizome, or by pressing part of it into the gravel.

Further, don't expect seaweeds to survive if the tank is stocked with vegetarian fish. A careful choice of animal life must be made at the outset, and only the most innocuous of species should be included until the seaweeds have become established in some profusion.

MARINE SUPPLEMENT

CORAL FISH COMPATIBILITY

Compatible species on the open reef may not necessarily be so within the aquarium. **Gordon Kay** examines the problems involved, and puts forward some "compatibility" thoughts concerning a few of the best-known tropical marine fishes.

Wouldn't it be nice if we could house all the types of fish we liked in our aquariums and have them live happily together just as they appear to in the films of coral reefs we see on the television? Notice I said "appear" to — the truth is that they don't. Life on the reef is a constant battle for survival. Every animal needs to find space and food, as well as make sure it doesn't become something else's dinner. It also needs to procreate so as to ensure the continuation of the species.

Nature has a solution to every problem and, fortunately, this one is no exception. Reef fish communities are made up of numerous species, with high numbers of individuals inhabiting every conceivable place on the reef. Each species of fish has evolved different ecological requirements, which have made it suitable for life in a particular part of the reef's ecosystem. There are species which shoal in open water above the reef, living on plankton, and there are species which lead a solitary, almost totally sedentary, existence at the foot of the reef, feeding on other fishes. Between these extremes are countless different species whose lifestyles differ from each other in some small detail. In this way, nature has come up with a superb arrangement for the co-existence of many different animals to ensure their being and continuation.

If we had aquariums holding hundreds and hundreds of gallons, we could replicate this to some extent. Unfortunately, we do not, and, in the confines of the usual aquarium, this principle goes out of the window. In fact, the problems of housing fishes which will live happily together are such that this article would appear to have the wrong title — **Coralfish Incompatibility** would appear to be more correct!

Main sources of incompatibility

Incompatibility is due to any one of several interactions — or even a combination of two or more. The main ones are:

(1) The relationship of predator and prey. This is an easy one to solve — just don't mix small Damsels, or similar, with things like Lionfishes, Groupers or Morays.

A simple rule of thumb is that anything small enough to fit into a predator's mouth will be considered fair game. Having said that, Lionfishes don't seem to read articles like this and I've heard more than once of them eating fishes bigger than themselves! A "Rogues' Gallery" community would seem the best here.

(2) Competition for similar territory (ie. hiding places) within the tank. This occurs most frequently between species of the same genus, although similar shapes, colours or patterns can cause problems, even in unrelated fish.

(3) Competition for similar foods. This is a very similar problem to the above, and the two can be considered as one.

(4) Feeding aggression. An example of this is when Triggers and Puffers, who go wild at feeding time, are "living" with

Porcupines are messy, indiscriminate feeders — hardly fitting the ideal image of compatibility.

CORAL WORLD — FILAT

Butterflies. The poor Butterflies have no chance of feeding properly, and get treated unmercifully until they eventually starve to death.

This particular topic has become one of my hobby-horses and I have written about it on many occasions. The type of situation I've described should *never* arise, but I see tanks with that sort of stock-mix all the time. Stocking aquariums in this manner is asking for trouble, both with regard to the poor shy species and, more importantly, to the life of the whole aquarium system. Anyway, speech over — I'd just like someone to listen to me!

(5) Spawn and mate protection. Any species which prepares spawning sites (Damsels, Clowns, etc) will defend them aggressively. The level of aggression will, of course, depend on the species and the stage of spawning activity. This shouldn't be a problem for most people, but is worth bearing in mind if you have a shoal of Damsels.

If, in some small way, we understand the effects of the intricate evolution, complex interactions and means of survival which are deeply instilled instincts in Coralfishes, we are far better prepared for achieving our goal of a harmonious aquarium. How does all of this relate to the families of fishes we usually keep?

Damselfishes

This is such a large family — approximately two hundred and seventy five species, including the Clownfishes — that to lay down hard and fast rules for them all would take a whole article. However, there are certain species which we see more than others so I'll look at those.

All Damselfishes are aggressive, but lots of them do very well in shoals, when their aggression becomes "introspective" and they indulge in petty squabbles among themselves, posing no threat to anything else. A lot of Damsels actually do better in a group than singly, when they have a tendency to

waste away. The Chromids are a prime example of this. They have the reputation of being somewhat delicate, and yet, do very well in a group, being hardy and long-lived.

Other species which are much better in a shoal are: Electric Blue Damsels *(Abudefduf cyaneus)*, Yellow-tailed Blue Damsel *(Glyphidodontops hemicyaneus)*, Sergeant-Major *(Abudefduf saxatilis)* and Fiji Damsel *(Glyphidodontops cyaneus)*. Species which are just downright villains under any circumstances are the Neon Damsel *(Abudefduf oxyodon)*, Humbug Damsel *(Dascyllus aruanus)*, Cloudy Damsel *(D.carneus)*, Marginate Damsel *(D.marginatus)*, and Domino Damsel *(D.trimaculatus)*. Notice anything? All *Dascyllus* species, except the Neon.

The Clownfishes are a different kettle of fish(!) Species like Skunk Clowns *(Amphiprion akallopisos)*, Common Clowns *(A.ocellaris)* and Salmon Clowns *(A.perideraion)* can be mixed with no trouble although two or three Anemones would help no end. Some Clowns, however, will fight to the death with members of their own family, not to mention bully other species. These include the Clark's Clown *(A.clarkii)* the Tomato Clown *(A frenatus* or *A. ephippium)* and the Maroon Clown *(Premnas biaculeatus)*.

Angelfishes

The compatibility problem is much simpler here; we can lay down hard and fast rules based on the many years experience gained by aquarists everywhere.

There are two groups of Angels: the Dwarfs *(Centropyge* species), and the others, the big Angels.

The large Angels tend to live on their own, or in "life" pairs, on the reef, with quite large territories which they will defend against interlopers of the same family. The aquarium rule is not to mix fishes of the same genus — i.e. mix *Pomacanthus* with *Holacanthus*, but NOT *Pomacanthus* with *Pomacanthus*. Even when observing this rule, be careful not to house fishes of the same size. Large Angels will even become aggressive when faced with a fish from a different family if that fish is of a similar size, colour or marking. One observation here is that the large Angels seem to like a well-defined hierarchy — with a definite boss. Even when there is only one Angel in the tank it will be much better if it is the biggest, bossiest fish in the community.

The Dwarf Angels tend to be more gregarious, living in complex groups on the reef. This behaviour makes them far more amenable to aquarium communities, making even groups of one species possible. This trait has even led to spawnings among *Centropyge* species. One thing to remember, however, is that to succeed with groups of Dwarf Angels, the group needs to be bought together as juveniles. Just bunging in two adults of the same species will lead to trouble. Generally speaking though, *Centropyge* species can be mixed without worries, providing that there are plenty of hiding places in the tank.

BILL TOMEY

BILL TOMEY

BILL TOMEY

Top, a perfect candidate for the "Rogues' Gallery" aquarium — a Moray *(Muraena helena)*.
Above, if it's swallowable — it will be swallowed — all predators "think" like this Scorpion, *Rhinopias frondosa*.
Right, Tangs (this is the Sailfin — *Zebrasoma veliferum*) can present a bit of a compatibility puzzle — see text for details.

Butterflies

My favourite subject! Generally, Butterflies are shy, peaceful species which can be mixed fairly well with each other and other types of fishes, providing these other types are peaceful too.

Again, though, some care has to be taken with similar sized, coloured and marked fish. For instance a Yellow Longnosed Butterfly *(Forcipiger* spp) will probably attack a Copperband *(Chelmon rostratus)*.

There are even some species which can be kept in groups. The main candidate for this is the Wimplefish *(Heniochus acuminatus)*, although the leader of the pack may become a bully. Butterflies do much better in a "theme" tank, which is my own personal choice. My tank at home has a group of Green Chromis, a pair of *Centropyge bicolor* and various Butterflies — no sign of real aggression anywhere.

Surgeons and Tangs

This family provides us with one of the great aquatic puzzles. They swarm over the reefs in great shoals and yet, in an aquarium, can knock seven bells out of each other. I can't pretend to understand this phenomenon, and I wish someone would tell me why they should be like this.

There is one species — the Regal Tang *(Paracanthus hepatus)* — which could, possibly, be kept in a small shoal, but, on the whole, mixing two Tangs of the same species doesn't work. In fact, many of the rules concerning Angels apply here too. Fighting will result between fishes of similar size, colour or patterns — whether between Surgeons or a Surgeon and a different species. Many established fish, which regard the whole tank as their own, will resent the introduction of a new fish so, again, care must be taken — especially when one considers the "scalpels" these animals possess. The best one can do when aiming to maintain a mixed community tank is to introduce Tangs and other known trouble makers last.

Wrasses

This very large family (400-ish species) is made up of generally peaceful fishes which go about their business without harming anything else. However, there are species which possess "undesirable" characteristics (who was it who called these "idiosyncwrasses?" — see *A&P*, May 1986) of which the aquarist should beware.

BILL TOMEY

Large Angels such as *Euxiphipops navarchus* will become aggressive even towards fish of an unrelated family . . . if they happen to be of a similar size, colour or body pattern.

(1) Some will eat smaller fishes. An example is the Cuban Hogfish *(Bodianus pulchellus)*

(2) Some can be — shall we say — enthusiastic, especially at feeding time, giving shy species little chance to eat. The Lunar Wrasse *(Thalassoma lunare)* springs immediately to mind here.

(3) One or two Wrasses can be the complete opposite to the above, being very nervous if housed with boisterous species. The Dragon Wrasse *(Novacalichthys taeniurus)* is one example.

Rogues' Gallery

These are all the fish which, for one reason or another, cause problems when mixed with other species. This does not necessarily mean that they all deserve to be called rogues; rather, that they are best clumped together.

The rogues include the Lionfish, Triggers, Moray Eels and Puffers of this world which either like to eat other, costly, fish, or enjoy fighting (or both). I feel that a tank for rogues like these is the answer, housing a Moray, a Trigger, a big Puffer and, maybe, a large Angel if there is room.

Lionfishes are predators, so smaller fish are to be avoided. They also have poisonous spines and so should be treated with care. Having said that, they are peaceful and hardy.

Triggers are also hardy, but most are far from peaceful! They are also over-enthusiastic feeders, and some even enjoy re-arranging the furniture or eating heaters. The worst is the Undulate Trigger *(Balistapus undulatus)*, the "nicest" is the Black-finned Trigger *(Melichthys ringens)*. In between, are the Queen Trigger *(Balistes vetula)*, Clown Trigger *(Balistoides niger)*, The Picasso Trigger *(Rhinecanthus aculeatus)* and several others — all of which can be aggressive to each other, deadly to small fishes, but relatively peaceful with other species, providing the others are bold.

Morays are, again, predators (see Lionfish) which can also bite, so watch your fingers! Apart from this, they are quite peaceful!

Puffers and Porcupinefishes do not really deserve to be called rogues, although they do eat smaller fishes if given the chance, and Porcupines will fight among themselves. They are also messy, indiscriminate feeders, and this, in itself, makes them unsuitable for community aquariums in my book.

Closing remarks

This subject of compatibility is so complex, with the number of families and their members so great, that I could go on and on. However, I have discussed the major families here. There are many others, like the Blennies and Gobies, the Boxfishes, the Grunts, the Sweetlips — Oh! the list is endless — all of them playing their part in the rich tapestry of life on the reef and the confusion of life in our aquariums.

If we understood it all, maybe we wouldn't be so fascinated with it. One thing is for sure, we've all got a lot to learn, and I haven't even mentioned invertebrates. Now, there's a thought

WATER—THE UNIV

A&P editor **John Dawes** takes a close look at seawater, the single most important component of the marine aquarium environment.

Water is a remarkable substance. Chemically, in its pure state, it consists of just two *elements*, hydrogen (denoted in chemical shorthand by the symbol — H) and oxygen (symbol — O). Both these elements are gases yet, when they combine chemically, they form that precious life-giving liquid, water.

When *elements* combine chemically, they form a *compound*. Compounds have unique qualities which are *not* a sum total of the qualities of the component parts. Therefore, the properties of the compound, water, are quite different to those of either oxygen or hydrogen.

Further, when substances combine chemically, the resulting compound always has the same composition. For example, a molecule of water will *always* be made up of two hydrogen atoms and one of oxygen. It is represented chemically by the formula H_2O (the 2 after the H refers to the two hydrogen atoms — a 1 after the O is unnecessary and is, consequently, omitted).

If these ratios were changed in any way whatsoever, the resulting chemical would not be water. For instance, H_2O_2 is hydrogen peroxide, that well-known bleaching agent which, in recent years, has found application within the aquatic hobby, e.g., in Oxydators.

Water — the "universal solvent"

Pure water is always colourless and always tasteless. Yet, as we all know, water from different parts of the world, or even from different parts of the same country, tastes differently.

The answer to this depends, again, on the remarkable properties of water. Despite its extremely simple chemical nature, water is a "universal solvent". This means that virtually all substances that we know will dissolve to a greater or lesser extent in it. In some cases, the rate at which this happens is so slow that we tend to disregard it. But it *does* happen. For example, if you fill a glass bottle with *pure* water and leave it for one year, you will find at the end that minute traces of silicon, phosphates and other chemicals will have actually dissolved out of the glass and into the water!

It is hardly surprising, therefore, to discover that waters from different environments carry their own characteristic selection of dissolved chemicals. Add to this the chemical cocktail put in by water authorities to safeguard our health and you begin to appreciate more fully how different "pure" tap water is to pure natural water.

It is also hardly surprising, in view of the above, that pure water is next to impossible to find in nature. No sooner has it been produced than chemicals begin to dissolve in it. Therefore, even a raindrop will contain its fair share of dissolved substances before it reaches the earth. Once it gets there, the rate at which it picks up other substances in solution accelerates even further.

As it joins forces with other raindrops to form trickles of water and, later, streams and rivers, it continues its relentless, inevitable dissolving action. By the time this water reaches the sea, it is markedly different in content to the original raindrop that started life somewhere in the clouds.

The result of all this is that we have ended up, today, with very salty seas whose properties are such that very few of the organisms that have evolved to live there can survive in any other environment.

Salinity measures

In marine conditions, the large amounts of dissolved substances give sea-water its salinity. This can vary from place to place, but the usual range extends from between 32 and 37‰ salinity. Note the sign after the 37 — it looks like a percentage sign (%), but it has two zeros along the bottom line instead of one, i.e. ‰. This means that the figures represent "parts per thousand". Therefore, most of the world's seas contain between 32 and 37 parts of salt per thousand parts of water.

Once you go above, or below, this, you begin to move away from genuine, "normal" marine conditions. At the lower end, you begin to move into brackish water, while at the upper end, you move into hypersaline conditions which are hostile to most living organisms. For instance, the famous Dead Sea has a salinity of around 40‰. Similar conditions can be found in other inland, landlocked seas, such as the Great Salt Lake in Utah.

CORAL WORLD - ELAT

Purification through the action of bacteria, fungi and other micro-organisms keeps reefs healthy and conditions constant in nature. This is considerably more difficult to achieve in aquaria.

Within the marine hobby, salinty is not usually referred to in parts per thousand. The scale used instead refers to the *Specific Gravity* of a particular sample.

Pure water has a Specific Gravity of 1.000. The more salts we add to pure water, the "heavier" it will become and the S.G. figure will rise. Therefore, if we find that a particular sample has an S.G. of 1.022, this means that it is 1.022 times "heavier" than pure water.

Using this scale, most water from open seas varies between S.G. 1.020 and 1.022. If the seas are "restricted" in any way, and if this is linked with low rainfalls and elevated temperatures in the surrounding region, high levels of evaporation will lead to more concentrated water. This is, in fact, what happens in the Red Sea, where S.G. values as high as 1.035 have been recoeded.

The Caribbean suffers to a much lesser extent but it, too, has a relatively high S.G. value of around 1.025.

Fish and other maritie oeganisms evolve in tune with the conditions that exist in their natural environment. Consequently, Indo-Pacific fish suffer under Red Sea conditions. But, since moving "down" the S.G. scale is biologically a much simpler operation than "going up", it is quite easy to acclimatise Red Sea and Caribbean organisms to Indo-Pacific conditions, thus making mixed collections possible.

Artificial mixes

While it may be true to say that no artificial mix can be expected to replicate seawater in every minute detail, it is nevertheless equally true that the best of the synthetic salt mixes come pretty close.

Examine a bag of synthetic salts, and you will find a long list of substances. The ones found in highest concentrations are sodium (Na) and chlorine (Cl) which bind together to form sodium chloride (NaCl), otherwise known as common salt. As you move down the list, you can find some rather unusual elements, including arsenic, iodine, tin, aluminium, gold, silver, nickel and weird-looking chemicals like praseodymium, thullium, tantalum, samarium and many, many others.

Some are found in minute quantities and are referred to as *Trace Elements* yet, despite their low concentrations, they all play a part in the well-being of marine

ERSAL SOLVENT

Left, all marine organisms are in finely-tuned equilibrium with their environment, whose single most important component is the water itself. This is a perfect example of a tank-maintained Pin Cushion Starfish (family Oreasteridae).

Right, going up the salinity scale is quite difficult. Therefore, this Indo-Pacific Red Lionfish *(Pterois radiata)* would have difficulty adjusting to Red Sea conditions . . . even though the species itself also occurs in Red Sea waters.

organisms. A good synthetic marine salt must provide as many of these substances as possible *in the correct ratios*. This helps to explain why a high-quality salt mix costs much more than a pound of table salt. It also helps to show why table salt is absolutely useless from the marine hobbyists' point of view.

Water quality maintenance

Once water of a particular chemical make-up and specific gravity (measured by means of a hydrometer) has been obtained, regular top-ups with *freshwater*, to replace that lost through evaporation, should ensure that this aspect of water quality is easily maintained.

Establishing and maintaining sea-like conditions in respect of the above parameters may not be difficult. However, no matter how good a salt mix is, it will soon become less than useless if we fail to take account of several vital factors concerning the biology of the organisms which we expect to survive in our aquariums.

One of these vital biological factors is that all living things produce waste products. In the wild, these never cause problems because they are disposed of quickly and efficiently. Breakdown of toxic wastes is largely carried out by bacteria, often within the reef itself. Much of the rest becomes diluted by, and dissipated in, the surrounding sea and broken down by floating bacteria and other micro-organisms.

The fact is that a natural reef is continually being purified. In the confines of an aquarium, however, this cannot occur, *unless* one takes steps to ensure that it does.

There are various ways of doing this. Good efficient filters represent one obvious solution. However, things can be taken considerably further through the use of ozonisers, ultra-violet sterilisers, protein skimmers and the like (more about this in Dave Garratt's article in this **Supplement**).

Patience is important

Yet, no matter how sophisticated our equipment may be none of it can be regarded as an infallible, 100% replacement for time and patience.

Whichever way we look at it, a brand-new marine aquarium is far too raw to support any form of life, other than the very toughest, or the very primitive. Put a fish into such a system and you are almost certainly sentencing it to death.

All new set-ups need to go through what we call the Nitrite Crisis before they can be considered at all safe. Even once the "crisis" is over, we cannot go overboard and introduce a full complement of fish and/or invertebrates. The system is far too young for this.

Basically, the reason is that most marine communities rely on the action of bacteria, to a greater or lesser extent, to maintain the levels of toxic substances, such as ammonia and nitrites, within tolerable limits.

But, before we can do this effectively, we need to have a sufficiently large population of bacteria in the first place. It is this that takes a bit of time, and it is the actual process of establishing the bacterial population that takes a tank through the Nitrite Crisis.

There are three well-known stages to the Nitrite Crisis. The first one involves the formation of ammonia, a natural waste product generated by aquatic organisms. Even in what may appear to be a bare tank, some ammonia will be produced through the action of bacteria which are always present.

Ammonia is highly toxic. Despite this, some bacteria *(Nitrosomonas)* actually "feed on it", converting it to nitrites which, incidentally, are also toxic to marine organisms.

The most frightening thing about these chemicals is that they can be poisonous even at doses as low as one part per million (1 ppm) in the case of ammonia and 0.2-0.5 ppm in the case of nitrites.

A second group of bacteria *(Nitrobacter)* take the process a stage further by converting nitrites to nitrates which start becoming dangerous at the relatively high concentration of around 50 ppm, even for delicate organisms such as corals. Some fish (which are tougher anyway) can actually tolerate a dose of 500 ppm for a short time. Seaweeds, however, begin to suffer once the level goes above 30 ppm.

As can be seen, nitrates are relatively harmless when compared to ammonia and nitrites. What should also be apparent is that nitrate production represents the third stage in the overall process.

It is only once this has been achieved that a tank begins to become safe and attain a certain degree of maturity. It can take anything up to six weeks for a "good working population" of *Nitrobacter* bacteria to become established (and, perhaps, up to six months for complete maturity to develop).

Things can be speeded up in a number of ways, though. The most natural simply involves the addition of several handfuls of coral sand from an already established, *disease-free* aquarium. Alternatively, or in addition, a small quantity of safe mature water can be used. Nowadays, there are also quite a few commercial preparations designed to speed up the maturation process. Full directions on how to obtain optimal results are provided by the various manufacturers and these should, of course, be followed to the letter.

Fish and other aquatic aquariums depend on us to provide them with an environment where qualities match their needs, water is the single most important component of that environment . . . a little knowledge of its nature and behaviour should, therefore, help us achieve the balance we all want, and which our fish, invertebrates and plants deserve.

Note The text for this article is based on a feature published in the American Trade Journal Pets Supplies Marketing (August '88).

Coldwater jottings

Stephen J. Smith

What's in a name?

Considerable response has been received to my thoughts on a more appropriate name for the ubiquitous "Common" Goldfish *(Coldwater Jottings — June 1988)*.

Notable among the suggestions received is the following extract from a letter from **Ron Wixon,** of Bristol: "Book after book, article after article, always give a quick 'repetition of word' when referring to the single-tail Goldfish, *'Common Goldfish have long been the most popular fish because they are hardy, colourful and relatively inexpensive'* — and that's the lot the ANCESTRAL GOLDFISH can expect for the lifetime of pleasure it has given.

"So, in reply to your ROYAL GOLDFISH, may I suggest ANCESTRAL GOLDFISH, although, whatever name seems right, it will be a massive, difficult aim for people to drop the word 'common' after so many writings." Any further suggestions . . . ?

Check your purchase

A further point raised by **Ron Wixon** in his correspondence is with regard to display methods of coldwater fish in garden centres. Ron writes: "The holding tanks showing coldwater fish only allow viewing from above and the constant flow of the exchange water systems makes things rather awkward for the prospective purchaser when checking the fish."

I receive a fair amount of correspondence relating to the conditions in which coldwater fish are kept in garden centres. It is a fact of life that more complaints than praise will be received, but retailers should always be aware that they are dealing with *animals*, which deserve the best possible treatment.

In reply to Ron Wixon's comment, I would suggest to all prospective purchasers that, if the fish are difficult to view, ask the retailer to help you by providing a viewing tank, polythene bag, or similar, so that your intended purchase can be checked for any signs of injury, or disease.

If, on the other hand, the retailer cannot help you in your purchase . . . find a different retailer!

Show success

My personal thanks are extended to the *thousands* of visitors who swarmed the Goldfish stand at the **'Aquarian' Fishkeeping Exhibition** (Sandown Park, 18/19 June) and for the kind comments made by all the visitors who chatted to me and my wife during the two days.

The display of Fancy Goldfish was presented by this enthusiastic hobbyist to represent some of the popular Goldfish varieties available — and it was evident that many had never previously encountered an Oranda, Bubble-eye, or Lionhead, for example.

Surprisingly, visitors were as much intrigued by the size of some of the fish as their shape, though, again, the Bubble-eye and Celestial varieties proved to have limited appeal.

The display provided the opportunity for fellow enthusiasts — and newcomers to the hobby — to discuss individual approaches to keeping Goldfish, as well as to discuss some of the problems encountered.

As with last year's event, the most common problem was that of overcrowding. Somehow, there exists a dangerous myth that two-dozen Goldfish can survive quite happily in a twenty-four inch aquarium, fed three times a day with only occasional maintenance!

Brighton next

I shall be staging a similar Goldfish display at the **Brighton Festival of Fishkeeping** (Sunday 30 October, Corn Exchange and Pavilion Theatre) when, again, a selection of my own Goldfish will be presented. I shall be delighted to meet readers to discuss any aspect of Goldfish keeping and general matters coldwater.

The festival has been organised by a consortium of aquatic product manufacturers, led by **Interpet,** and will incorporate a comprehensive selection of informative displays to present fishkeeping as a hobby for everyone to enjoy.

It promises to be a huge success. See you there!

Societies

A question which I am often asked during my travels is: "Is there a society where I can learn more about Koi/Goldfish/Coldwater?"

The answer, without doubt, is a resounding "Yes." Whether or not you can attend regular meetings, membership of a specialist society provides you with the opportunity to exchange views and ideas about the hobby, and most societies produce an informative news-sheet.

Obviously, from the number of questions I receive on the subject, not all societies are keen to let their existence be known. But the following would be pleased to hear from you, and don't forget to enclose a stamped, self-addressed envelope with your enquiry:

British Koi-keepers Society (Middlesex and Surrey Border Section). Secretary, Mrs C. Pritchard, 22 Hazeltree Lane, Northolt, Middlesex UB5 6XA.

Bristol Aquarists Society Information from: Mr S. B. Peacock, 13 Coffington Avenue, Brislington, Bristol BS4 3QY.

Goldfish Society of Great Britain Information from: Mr R. Dodkins, PR Officer, 64 Ox Lane, Harpenden, Herts.

Association of Midland Goldfish Keepers Secretary: Miss E. J. Edmunds, 17 Woodside Avenue, Boothville, Northampton NN3 1JL.

South Park Aquatic (Study) Society Secretary: Mrs N. Brown, 4 Combe Lane, Whiteley Village, Walton-on-Thames, Surrey KT12 4EL.

The Goldfish display proved to be an extremely popular attraction at the Aquarian Fishkeeping Exhibition in June.

Look out for a similar display at the Brighton Festival of Fishkeeping, organised by Interpet, at the end of October (see Brighton Next).

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 expert 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, Buckley Press Ltd, 58 Fleet Street, London, EC4Y 1JU

TROPICAL
Dr David Ford

COLDWATER
Pauline Hodgkinson

PLANTS
Barry James

KOI
Roger Cleaver

MARINE
Graham Cox

DISCUS
Eberhard Schulze

Koi

Hand feeding

Can you tell me how to get my fish to feed from my hands?

Hand feeding your Koi is one of the great pleasures of Koi-keeping. Usually, it is only a matter of time and patience before you get your Koi to feed from your hand.

Having said that, I find that most Koi become hand tame very quickly after they have developed a taste for cockles. These shellfish, obtained from most good wet fish shops, make an excellent additional food for your fish, as well as peoviding a means of taming your fish to your hand.

Once your Koi have developed the taste for cockles (and this is not always an immediate reaction) to get them to feed from your hand is quite simple. Take a handful of cockles and place your hand in the pool. Keep it quite steady. Your fish will soon sense that food is about and will start to become inquisitive. As they approach your hand release a cockle or two without moving your hand. The fish should steadily get nearer and nearer to your hand and, usually, in very little time, one or more will begin to nudge your hand to get to the cockles. When this happens you have won.

From then on, the more often you feed this way, the greater the number of Koi that will come right up to your hand. Some fish, however, never seem to want to come right to the hand, so make sure that these also receive some of the food. Do not ignore them and feed only those that take from the hand.

Time and patience will usually result in Koi feeding happily from their owner's hand.

Coldwater

Scratch and yawn

I have a variety of Goldfish in three tanks. All the fish are suffering from the same condition. They constantly flick through the gravel, scratching themselves. They also gape widely as if yawning. I have written to, and received advice from, two well-known manufacturers of fish food and medicines. I regret to say neither of their products has eradicated my problems.

It would appear that the problem which your fish have is a parasite one. As you have tried to eliminate the pests by proprietary products, it seems that more drastic measures should now be taken.

Formalin should see off the pest; it can be obtained from a chemist at a 38–40% strength. However, great care must be taken when using Formalin; never overdose, or the consequences will be fatal.

Using an eye-dropper, prepare a solution of 15 drops of Formalin to one gallon of water (which should be the same temperature as the water the fish have left). Mix well and leave the fish to swim in this for 20 minutes only. One treatment should, in most cases, be sufficient, but, if necessary, a second bath can be given in three or four days.

Hood mucus

I think there may be something wrong with two of our Orandas. White growths appear to affect their raspberry-like heads which, despite treatment for white spot and fungus, still persist. We would be grateful for your advice.

Please do not worry about the white spots or tufts of white mucus which appear from time to time on your Oranda's hoods as it is, in fact, just that, mucus, and part and parcel of the hood's development.

All varieties of goldfish which have the characteristic of the hood, will, if they are to grow a large hood, develop spoes of excessive mucus. Therefore, there is no need to administer any treatment for this condition; it will come and go as the hood develops.

JOHN DAWES

Plants

Difficult Riccia

I've never been able to grow Riccia, *yet everybody seems to regard it as an easy plant. Please help.*

Riccia is not easy to grow for most people. Normal aquarium husbandry, such as regular water changes, removal of bottom detritus, plus high light levels, are normally not appreciated by this species.

Old-time aquarists with grubby mulm-filled tanks, water which looked like well-matured brandy, and tungsten

lamps so furred up with lime from water splashes that they gave out light levels like Alpha Centuri on a bad night, had no trouble growing this plant. There must be a clue there somewhere!

Marine

Quarantine — a must

I have been told that a quarantine tank is absolutely essential. Is this correct?

Ideally every tropical marine aquarist should have a hospital/quarantine tank. The size should be in direct proportion to the size of the aquarist's main tank. In other words, if you've brought a 6ft x 2ft x 2ft show tank so that you can house a collection of larger Angelfish, Butterflies, Surgeons, Tangs, Lionfish, Wrasse, etc, then there's not much point in buying a 36in x 12in x 15in hospital/quarantine tank, UNLESS you intend buying all your large-growing showfish as babies and then growing them on.

However, what you've got to realise fast is the following: (i) The u/g filter bed of this H/Q tank must be kept in a permanent state of bacterial maturity by a weekly addition of something like 'SEAMATURE' and:

(ii) That partial water changes need to be done from time to time in order to keep the *NITRATE* content of the seawater down to reasonable limits, and:

(iii) That you *MUST* medicate the newly-purchased fishes with a bactericide/protozoacide/fungicide for four consecutive days after purchase. This can be done either in your show tank or in your H/Q tank, but it must be done. If after DAY 5, the fishes are flicking still (=fluke infestation), then you must carry out a full course of medication to rid the fish of all ectoparasites and endoparasites. Please note that, although ecto/endoparasite infestations are most common in spring and autumn, they can occur at any time in a badly-maintained aquarium — whether it be a hobbyist's tank or so-called professional's tank.

(iv) *PLEASE* keep your charcoal in a separate *NON-VITAL* filter which can be turned off at anytime that medication becomes necessary. At its simplest and most sensible, this charcoal filter can be a 90 pence plastic air-operated box filter. At its most spectacularly-unnecessary, it could be a huge electrically-operated power filter.

Seahorse gas bubbles

My seahorses (despite articles I have read) have not proved to be difficult to feed. I have fed mine from the very start, on a diet of frozen Mysis and the occasional live Brine Shrimp. I have three Common Black Seahorses and a yellow variety, and all fed and settled down very quickly.

However, I have noticed what look like small ulcers on the tail of one of the seahorses. These ulcers are becoming more numerous and seem to me to be air bubbles. The seahorse's swimming is affected as it seems unable to keep its tail down.

I tried to burst some of the ulcers with a sterilised needle with some success, but all I got out was air and, within a matter of a couple of days, they returned.

The seahorse shows no sign of discomfort, and, indeed, still eats very well, although it is increasingly difficult. Can you possibly suggest a reason for this ailment, and point me in the direction of a cure?

Although you don't mention the sex of the affected seahorse, I would imagine that it is a male and that the brood pouch at the root of the tail contains either a clutch of dead eggs or dead baby seahorses which are slowly decomposing. The recent move and the consequent shock and stress to the creatures probably resulted in the deaths of the eggs or developing fry.

All you can do for the adult fish in these sad cases is to continue to expel the foul gases after piercing the bubble with a flame-sterilised needle or a small-mammal hypodermic which can be purchased from a local veterinarian, and then swab the affected area with a broad-spectrum medication. The "ear-buds" sold by chemists' shops are ideal for this purpose.

DR R. GOLDSTEIN

Young seahorse hiding among Sargasso weed. In aquaria, many don't make it to this stage — or even beyond hatching.

Tropical

Over-successful breeding

Through trial and error . . . and much luck, I can't keep up with the rate at which my fish are spawning. What's the best way of distributing the young?

The best way of distributing surplus tropical fish is to join your local aquarium society. If they are too distant to go regularly, you should still contact them with information on species and numbers available so they can come to you. Most club people dispose of their fish via their society's Open Show when an auction is usually held.

The local aquarium shop is always pleased to accept good quality fish of a reasonable size (i.e., not fry), because they are usually disease- and parasite-free. Most shops are willing to exchange other fish or equipment for stock, rather than pay cash, but this means the hobby can cost little or nothing to run.

Finally, one can advertise the available fish in the local paper, just like selling a puppy or kitten . . . 'free to a good home,' of course.

Large scale water treatment

We are building a fish house for about fifty tanks. How can we go about de-chlorinating such a vast amount of water?

Our next-door neighbour has had a water softener installed and said that we could use it for our tanks. Is this safe?

Water can be collected in bulk (rainwater is best, of course), but if you have to use tapwater, add an airstone and use a pump to bubble air through the water for at least a day, or, preferably, several days. The chlorine will be driven off by this.

The water from your neighbour's softener is not suitable if it is of the domestic type that is regenerated with salt. This system is 'ion exchange' where the hard calcium ions are exchanged with soft sodium ions. This is fine for making a lather with soap, but quite unsuitable for fish, the high sodium content stressing, even killing the fish.

The only suitable chemical system for soft water is that provided by a cation/anion absorbing resin that actually *removes* the ions from the solution. These resins are non-reusable, or can only be regenerated with strong acids and alkalis.

If you want soft water, collect rainwater and/or boiled water from the tap. Remember to re-acrate boiled water, because boiling removes oxygen, as well as precipitating the temporary hardness.

Discus

An apology

I have recently received a number of letters from hobbyists complaining that I have not answered their Discus queries.

As many of you will know, I have been abroad a great deal during the last 15 months writing a book on Discus. Although it was always my intention to answer every letter received, many of these have gone astray in the post between the UK and Bangkok (where I was based). Some others were sadly, and inadvertently, destroyed while my files were being updated in my absence.

I can only but apologise!

Eberhard Schulze

Editor's Note

Eberhard is now back in full swing, so please start sending in your queries once more. As far as I know, he's got no plans, as yet, to start work on the follow-up of his book . . . at least, not for the moment!

John Dawes

News

Interpet's extrusive plans for 1989

Mention **Interpet** and everyone knows that you are referring to a company which manufactures and distributes a wide range of high-quality aquatic hardware, freeze-dried foods and water treatments — not to mention the best-selling **Interpet Guides** regularly reviewed in *A & P*.

One association which does not immediately spring to mind, though, is that between Interpet and dry fish foods. But, all that is set to change . . . and very dramatically so . . . come 1989.

Like every other thriving, successful and energetic company, Interpet have been researching possibilities for improving fish foods and nutrition for some time. They feel that they have now made a major breakthrough by identifying a whole new exciting area in fish feeding.

Flake foods are pretty well catered for, but, although there are some successful "extruded" foods around, that field still holds considerable possibilities in terms of ornamental fish. Therefore, if you can come up with a really good idea, plus the expertise to research and develop it, plus the sophisticated machinery required to produce a top-quality, highly nutritious, easily assimilated product, you have something rather special to offer the fishkeeper to feed his/her fish.

In Interpet's case, all these criteria have been fulfilled.

JOHN DAWES

JOHN DAWES

Left, the "extruding" end of the twin-screw machine, being made ready for a trial run. Right, Charles Botting adjusts the pulsebed drier as the extruded food begins to come through after cutting.

The Idea:

(i) A uniquely shaped floating fish food which wets quickly, making it highly digestible.

(ii) Different dietary formulae to suit the precise and changing needs of Koi as they go through the different seasons of the year, as well as a good general pond fish food to meet their needs all year round.

Research and Development

With the appointment of Adrian Exell as Product Development Manager, Interpet secured the services of an extremely well qualified nutritional biologist — the ideal person to carry out all the necessary, and lengthy, research and development behind the basic idea.

The Machinery

Two years were spent examining the various machines and options available, until it was decided that a twin-screw extruder would be the only one capable of producing the carefully formulated extrusions required by Interpet.

The association of the company with the Botting family and its four generations of food milling tradition (plus the enthusiastic services of Charles Botting, himself personally involved in food preparation for twelve years), Richard Leach, John Hargreaves and Berkshire, Buckinghamshire and Oxfordshire Farmers, made the purchase of an expensive Swiss-manufactured Bühler twin-screw extruder feasible.

Now that the machine is installed and fully functional, the finishing touches are being put to the Interpet project in readiness for next year's coldwater season.

Bearing in mind that the trade has to be made aware of any new product months before the hobbyist can get to buy it — that trade orders for the 1989 coldwater season will be placed early in the year — plus the last-minute "fine-tuning" which such an ambitious project requires Interpet's timing seems to be just about perfect.

JOHN DAWES

Trial "wet" run of a twin-extruded product (the machine has been opened to show extrusion in action). In practice, the "sausages" are cut into predetermined sizes by automatically activated blades as they appear from the extruder.

As the accompanying photos show, things were pretty well advanced when we visited the plant a short time ago, and the latest news we have confirm that plans are proceeding according to schedule. So . . . watch this space for further news — and for Interpet's brand-new range of pond foods next season.

Sole distributorship for Tropicure

Tropicure Products Ltd., the Hosforth-based firm of pet trade importers and exporters, have just secured the sole distribution rights for "pet-related" books published by **British Museum Publications.**

Among these are:

Clupeoid Fishes of the Guianas
Cichlid Fishes of Lake Victoria
Haplochromine Fishes of the East African Lakes
Tilapiine Fishes
Snakes — A Natural History
The Natural History of Primates.

For further details on all Tropicure-distributed titles and pet products, contact **Ray Hampson or Bernie Ketton, Tropicure Products Ltd., The Headlands, Scotland Lane, Hosforth, Leeds, LS18 5HX. Tel: (0532) 582 193.**

Books

The Complete Guide to Pet Care

By: John Nichol
Published by: **Christopher Helm**
ISBN: 0-7470-2406-5
Price: £6.95

I sincerely hope that there are enough people around who are interested in pet care *in general* (as opposed to the care of a *particular* type of pet), to make this book the good seller which it deserves to be.

John Nichol is not a man who minces his words, so some people may find some of what he has to say a bit uncomfortable. If so, then John will have, at least, struck some form of chord with such individuals — and achieved one of his aims in the process. The message is clear: if you lack commitment, you shouldn't keep pets. Few level-headed people would disagree with that, I think.

By its very nature, this **Guide to Pet Care** attempts to say something about so many pets, that only bare basics regarding individual species are covered in the Glossary of Pets which embraces, in alphabetical order, most animals from Axolotls to Tropical Fish.

Elsewhere, the book, with a few exceptions, is a real gem, covering several subjects which have hitherto not really made a significant appearance in other pet books. Working with Animals, Free Pets, The Pet Keeper and the Law, First Aid, and other topics spring to mind as good examples of this.

While supporting much of what the author says on *many* subjects, we, nevertheless, part company when he makes totally categorical, didactive statements such as: "Let's get something out of the way for a start: if you have a goldfish bowl, throw it away now. Goldfish bowls are great as ornaments when filled with glass marbles, but for keeping fish they are terrible things and should not be used. What is necessary is an aquarium."

Are *all* goldfish bowls, irrespective of their size; irrespective of the size of the fish housed in them; irrespective of whether they are planted, aerated, filtered, filled to exactly the right level or not; *and* irrespective of the expertise of the aquarist concerned, "terrible things"? I think perhaps not. Even though I am not an ardent goldfish bowl fan myself, I cannot, somehow, accept such once-and-for-all statements when I can't really see the advantage that a small square/rectangular aquarium can possibly have over a large, well-looked-after, properly filled goldfish bowl housing (preferably temporarily) one or two *small* fish.

Still, both John Nichol and I have the same priority at the top of our list: the welfare of the animals we keep.

I therefore heartily support his sentiments and generally applaud his approach. Further, I think the author needs to be complimented on having produced a readable, entertaining, informative and "important" book.

Well worth the cover price . . . and a little more besides.

John Dawes

A Guide to the Fishes of Lake Malawi National Park

By: Digby Lewis, Peter Reinthal and Jasper Trendall
Pub. by: **World Wildlife Fund**
ISBN: 2 88085 000 2
Price: £8.95

Lake Malawi National Park lies near the southern edge of this massive body of water which yields some 40,000 metric tons of food fish per year.

The Park was established in 1980 "with the primary aim of protecting examples of Lake Malawi's aquatic communities". From the aquarists' point of view, the best-known members of these communities are, of course, the Mbuna, those brilliantly coloured, mouthbrooding, rock-dwelling cichlids we've all come to know and love over the past 15 years or so.

It is estimated that there are between 500 and 1000 species of fish within Lake Malawi, including all the Mbuna, and other mouthbrooding cichlids, plus one non-mouthbrooding species, *Tilapia rendalli*.

Clearly, not all of these, by any means, are illustrated in the **Guide**. Yet, this does not diminish its immense value one bit. In my opinion, the wealth of information regarding the Lake, its fishes (in addition to the cichlids), the Mbuna themselves, the various underwater habitats, the regions of the National Park, the other fauna found in the Park, traditional fishing methods, safety guidelines for visitors, glossary, richly-illustrated identification section, and waterproof underwater nature trail sheets, all contribute towards making this book a virtual give-away at the price.

I am informed by the British Cichlid Association that the **Guide** is in rather short supply. The B.C.A. is the only major importer of this volume and, in view of the above, the Association has asked me to pass on the following request to prospective buyers: "Please enquire as to availability first — *do not* just send off your money."

Write to (or ring): **British Cichlid Association Sales, Brandy Hall, Bradshaw Lane, Bradshaw, Halifax, Yorkshire HX2 9XE. Tel: (0422) 240775.**

Buying this book may not be quite as straightforward as is normally the case, but if you like Mbuna (like so many of us do), I think that the effort is well worth it. As a result, you will end up with a book you'll treasure for a very long time.

John Dawes

COMPETITION WINNERS

We guessed right! Response to previous **T.F.H.**-sponsored competitions augured well for our latest one (Page 5 — August, *A & P*) . . . and we were not to be disappointed.

We also know that twelve entrants aren't going to be disappointed either. They are the first twelve lucky winners (out of the massive pile of entries) to come out of the hat on **1 September**.

First Prize: Marine Atlas, Koi Varieties, Gouramis, Water Gardens £85.85
Phillip Law, 13 Gandalf's Ride, South Woodham Ferrers, Essex CM3 5WX.

Second Prize: Marine Atlas, Koi Varieties £63.95
G. Darlington, 4 Wheatley Road, Ely, Cardiff CF5 4LT.

Third Prize: Reef Fishes, Koi Varieties, Gouramis £52.65
Mrs B. Abbott, 4 Woodhall Gate, Pinner, Middx HA5 4TL.

Fourth Prize: Reef Fishes, Koi Varieties £38.70
D. C. Waller, 46 Harpenden Road, West Norwood, London SE27 0AF.

Fifth to Twelfth Prizes: Koi Varieties, Water Gardens £21.90
G. T. Kent, 4 Turnpike Place, Langley Green, Crawley, West Sussex RH11 7UA. **Miss T. Thompson**, Whitegables, Pitsdown, Uckfield, East Sussex TN22 3XR. **T. Beddoes**, 7 Forest Hill, Aberdulais, Neath, West Glamorgan SA10 8HD. **D. H. Wilson**, Chad House, Holmside, Sacriston, Durham DH7 6EP. **Richard Inskeep**, 26 Luxor View, Leeds LS8 5JT. **Colin Shea**, 143 Cavendish Street, Barrow-in-Furness, Cumbria LA14 1DJ. **Mrs L. Simmonds**, 105 Yorkland Avenue, Welling, Kent DA16 2LG. **Graham Kershaw**, 15 Paddock Drive, Marton, Blackpool, Lancs. FY3 9TZ.

Thank you all once more for your tremendous support, and thank you **T.F.H. Publications** for yet another great competition.

EVOLUTIONARY ARMS RACE

Attack and defence are as finely balanced in the aquatic world as elsewhere. Biologist **Dr Gareth Evans** reviews some fascinating examples of the prey/predator relationship.

JOHN DAVIES

GARETH EVANS

CORAL WORLD — FRAY

Above, Two examples of crypsis, or camouflage — a young dogfish and a ray.
Top, *Pterois volitans*, the Lionfish, uses "be nasty and advertise" tactics in the evolutionary arms race.
Left, Sea urchins (this is *Diadema* use spines as their main line of defence. Even so, their main predators, the Triggerfishes, have evolved their own solution to this prickly problem.

In the wild, many animals have some need of defence. There are three basic types of threat against which a form of defence may be required: physical factors, like pounding by waves, dessication, extremes of temperature, etc., infection, and, lastly predation, which forms the main subject of this article.

Defence can be divided into two categories: primary and secondary. Primary defences are largely morphological, and always operative (the animal does not have to do anything special). On the other hand, secondary defences come into play only when a predator is detected or actually attacks, and are generally behavioural strategies. Some of the best examples of both mechanisms are to be found among the many and varied animals of salt and fresh water.

PRIMARY

Anachoresis (Hiding away)

One of the best ways to avoid being eaten is to hide where no potential predator can see you, as many of the sedentary marine polychaete worms and burrowing molluscs do. To be entirely successful, however, the activities of the animal in question remain, inevitably, limited.

Crypsis (Camouflaged hiding)

This method of defence effectively overcomes the limitations imposed by the previous one. The cryptic animal is free to move about, but remains hidden from its enemies by virtue of its habitat-matching colour or shape.

Fringed with weed-like projections from its body, the Sargasso fish, *Histrio histrio*, is a perfect example of such concealment, living in the floating *Sargassum* weed of tropical oceans, which it so closely resembles. Pipefish and Sea-horses (Sygnathidae) also pass unnoticed in the same way. Many species of flatfish possess an almost chameleon-like ability for self camouflage on differing surfaces, while the octopus, able to change not only colour, but texture also, in response to environment, must rank as the master of crypsis.

Aposematism (Be nasty and advertise)

Being toxic or distasteful is one sure way of discouraging would-be predators. Taking this idea one stage further, by advertising the fact with conspicuous warning colours, the animal avoids molestation by its enemies altogether. Once they have had a bad experience they recognise and avoid the bodly patterned aposematics in the future. As animals employing this high profile

defence are often slow-moving, the advantages of their strategy are obvious. The beautiful and commonly kept Lionfish, *Pterois volitans*, and its allies make use of this method.

Be protected

Many creatures opt for simple mechanical protection, relying on shells or spines for their defence. The many shelled molluscs, the turtles, terrapins and the boxfishes (Ostraciontidae) are examples of the first, while the porcupine fishes (Diodontidae) and sea urchins provide examples of the second.

SECONDARY

Flee

One of the simplest methods of avoiding trouble is to swim away. This is a reasonably effective measure, but a faster predator may still catch the animal. Erratic, twisting or zig-zagging movement may help to confuse the attacker, and make it seek an easier meal elsewhere. For most fish this strategy features in their repertoire of defence methods, but certain of them have become, quite literally, flight specialists. I refer, of course, to the 50 or so species of flying fish, of which *Cypselurus heterurus* and *Exocoetus volitans* are the best known. By bursting clear of the surface and gliding for considerable distances before re-entering the water, flying fish boch flee and confuse their would-be predators.

Deimatism (Startle tactics)

Slow moving, fossorial (burrowing), or young animals may use such tactics to avoid being an easy meal. By startling the foe, these animals gain precious moments to make good their escape, while the predator composes itself. Thus, certain species of burrowing molluscs or annelids may squirt a plume of water when uncovered, hiding away again in the moments of confusion.

The sepia cloud of the cephalopod molluscs (squid, cuttlefish, octopus), often described in terms of a smoke screen effect behind which the animal slips away, may also be considered in a deimatic context, as may the visceral (gut) ejection of sea cucumbers (Holothuroidea).

Prominent 'eye-spots' elswhere in the animal kingdom (most notably in the butterflies) act to startle predators, and this may go some way to explain the similar 'eyes' on the tails and fins of certain fish, like the aptly named butterfly fishes, Chaetodontidae, for example.

Group defence

Many individuals of a species help to defend each other, either actively, or as in the case of shoaling fish, passively. The large numbers of fish, and the constant movement of the shoal makes it difficult for a predator to single out a target. Moreover, the statistical likelihood of any one animal (particularly one in the midst of the group) being eaten is far lower than if it were solitary.

Offer a substitute

A number of lizards drop their tails, the predator stopping to eat this and allowing the reptile to escape. Some aquatic animals adopt a similar, if less dramatic, version. The 'smoke-screening' and deimatic functions of the octopus' release of ink has already been mentioned. It has been further suggested that the predator, initially startled, then proceeds to attack the ink cloud, perceiving it, as it shifts in the water, to be prey. The same has also been suggested of the gut ejection of holothurians.

Some 'eye-spots' may also play this role. By having an 'eye' on a tail or fin, the predator may be fooled into attacking from the wrong end. Although the smaller fish may lose all or part of its tail, the less expendable portions of its anatomy may survive.

L. E. PERKINS

Octopus use, at least, two methods of defence: they offer a substitute target in the form of the cloud they emit when they flee and may also use their discharge as a "smoke screen".

If Triggerfish had their eyes in the "normal" place, they wouldn't be able to tackle their main prey, sea urchins. As it is, they have eyes located way up the head, well away from the dangerous urchin spines.

Be armed

Many animals have the ability to fight back when attacked. Under these circumstances, most can bite at the predator hoping to dissuade it from pressing home the assault.

The nudibranch sea-slugs, however, have taken this one step further, specifically acquiring weapons for their defence. These creatures feed on sea anemones and jelly fish, incorporating the stinging cells obtained in this way into their body tissues to ward off their own enemies — making the anemones natures' only real arms manufacturer/supplier!

CLOSING REMARKS

As with all things natural, naming and pigeon-holing for ease of study only works up to a point; many methods, as in the case of 'eye-spots' or of the octopus and sea cucumber, may work at double or multiple levels. Additionally, most animals use a number of discrete, or combined, defence strategies determined by several variable factors. However, despite the essentially artificial nature of the categories mentioned, they do provide a starting point for further consideration of this fascinating subject.

Defences are never totally successful, as a predator may have many different methods of attack. In this way, a constant 'arms-race' exists between predator and prey to evolve better defences and better ways to overcome each new defence.

The animals in our aquaria do not just happen to look or behave as they do — they represent the best end result of millions of years of evolution. While nature 'red in tooth and claw' may have no place in our fish tanks, it is interesting to consider the 'why' behind colours, shapes and forms. To this end, I hope this article has given some insight into aquatic strategic arms.

Naturalist's notebook

By Eric Hardy

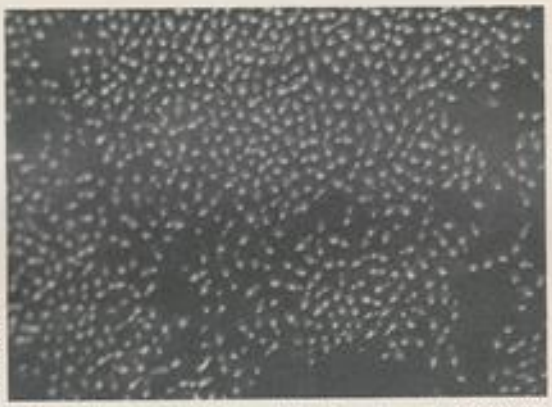
Ours is an ever-varying hobby; upset when an early morning heron helped itself to a friend's expensive Koi, but fascinating taking dental casts of turtles as a record of their growth and age, and when mosquito larvae infested with fluke worms fall prey to guppies sooner than healthy ones.

There are only three ways to meet the perennial problem of herons raiding garden fish-pools. Transparent nylon mesh just beneath the surface is seen by herons, but less so by humans; a model heron or stork placed on the bank with its position changed weekly may keep it off; a margin of tall plants closely packing the bank as well as the water edge affords it no landing room.

Duckweed explosion

A phone call from our city museum told me of the extraordinary abundance of duckweed in three species, Shiny Greater, Lesser and Reticulated Fat or Gibbous. These tiny green plants are well known to all pond-hunters, but they very rarely flower with us. Look at any pond covered with them like a green billiard cloth, and you'll soon see how difficult it is to find one in flower. This local "explosion" was part of this year's abundant flowering of many perennials after frost-free spring and June's hot spell. Densely-crowded male and female flowers are separate; male above, female below; but it rarely produces its berry-like fruit here, and most plants spread by attachment to waterfowl or boats. They become a nuisance in garden pools and water-gardens in hot summers and are controlled by raking off the surface. Being wind-pollinated, their flowers aren't coloured.

Rootless duckweed, *Wolffia arrhiza*, is our smallest native flowering plant, in still waters like coastal ponds in S.E. England, at North Stoke, Sussex, at Sedgemoor, a Burgh Heath pond near London, West Bedfont and Hampton Court Home Park. The *Lemna* duckweeds, the commoner ones, have a single, dangling white root, except Great Duckweed, which has up to four, and these terminate in a cap or spongiole. The roots come from the thallus or leaf-scale which floats flat on the water.



RUDA ZUKAL

Looking like small gleaming green droplets on the water surface, *Wolffia arrhiza* is our smallest native flowering plant — although the flowers, themselves, are rarely seen.

This leaf-scale is part stem in origin. Under the microscope the root shows a thread-like bundle of air-conducting tubes, supplied with oxygen by the leaf-scale. Its fine root-hairs convey salts from the water. On a sunny July day, as you lie beside the pond scanning the Duckweed with binoculars, you may detect male flowers by their vivid yellow stamens. They grow from a slit in the edge of the leaf-scale. The single-celled ovary can be dissected out, but the floral organs are very thin and fragile.

Coypu and other exotics

When you visit the Norfolk broads and dykes, keep an eye for traces of the large and ugly Coypu, once called Nutria, a large rodent with coarse, dirty buff hair and big, orange front teeth. After the Ministry announced that, in April 1987, they thought they'd finally exterminated them by trapping the last of these aliens at St Neots, in Cambridgeshire (animals which escaped from fur-farms, pre-war), one was killed this July at Barton Bendish in North Norfolk.

In its long campaign the Ministry trapped 34,000. The Coypu ate great gaps in the Reedmaces and young reeds. I remember in the early 1930s the Ministry finally exterminated the alien Muskrat population, mainly in the Shropshire meres and adjacent Welsh border waters, by trapping from the outside of their range inwards instead of scattering them by indiscriminate trapping. Meanwhile, American Mink, more predatory on moorhens and fish, looking like a black stoat with a white throat, are spreading along many rivers in Lancashire, Lakeland, the Isle of Arran and Wales. At Cheshire's Rostherne Mere reserve this year, they ruined the nesting of Great Crested Grebes. They are now only trapped privately. Fish-scales in their droppings, or a sudden shortage of moorhens, disclose their presence.

Fish memory

My experience of tench, pike and goldfish is that, however long one keeps them in an aquarium, they cannot recognise one. This does not mean they cannot be "tamed" to come for food, by smell; but, normally, they ignore one. On the other hand, two plaice, kept only four months, recognise one by flopping along the tank when approached in quest of food.

Some goldfish are exceptions, however, and many Koi fans may deny this. Fish can be taught to proceed to a given spot and wait to be fed in response to a tuning fork sounding lower C, but this isn't personal recognition, as can be obtained with dolphins. Fish may have some memory of environment as well as physical responses to return to favoured haunts; but have they the memory of humans? They also have some capacity to learn.

Tidal pool changes

The threat to rock-pool populations by casual day-trippers to the seaside is not so serious as their retention of tidal pollution; but there are very interesting changes over the years.

Low tide in Church Bay, Anglesey, only a short walk from Menai Bridge, is a favourite collecting and study ground for students from as far as London; but on the Mersey we are confined to a few pools on Wallasey's New Brighton shore.

Among noticeable changes in recent years has been the return, this year, of limpets, even to the bathing pool, probably due to less pollution of the river, for they browse upon its increasing seaweeds, "homing" before low water back to the same roosting niche. Unfortunately, Mersey seaweeds were recently found to have abormally high contents of lead and are the subject of a special University research project.

A further change started a few years ago when the alien 4-sided New Zealand barnacle, *Elminius*, which arrived on the bottoms of slow-moving ship-convoys during the war, and eventually ousted Common Acorn Barnacles to dominate the rocks and piers, has now declined, with a remarkable return of the native. This is the normal "climax fauna" where an alien intruder, finding a niche with little competition, soon dominates, but later levels off at a more constant population.

In order to save the Natterjacks from adverse competition in the sand pools of the nearby Dee at Hoylake Red Rocks, Common Toads have been removed, as they spawn earlier and are bigger. Several Common Toads taken to Hilbre Island, which has a single freshwater pool, became very active on summer nights.

CORAL WORLD — COKI BEACH

A short wooden jetty links the top level of the Underwater Tower with the shore. In the shadow, Squirrelfishes were waiting for night to fall.

CARIBBEAN CORAL WORLD

Dick Mills recalls the highlights of his recent, colourful visit to the Coral world at Coki Beach on the Caribbean island of St Thomas.

Undoubtedly, the best place to see marine fishes is in their natural surroundings on the coral reef. There are three options open to you for doing this — snorkelling, scuba-diving, and any other form of underwater observation. A recent holiday in the Caribbean presented all these opportunities, and I did indeed manage to pursue two of them.

Armed with a new, and, to me, quite necessary toy (an underwater camera complete with two focussing ranges, close-up facility and automatic flash), I donned mask and flippers and, with as best bravado as I could muster, marched resolutely *backwards* into the clear blue waters surrounding the French/Dutch island of St Maarten. Walking forwards with flippers is an art I have yet to master — a good imitation of Charlie Chaplin's famous walk soon results in a fall face-down in the shallows as the flippers become embedded in the soft sand!

A short swim soon brings you over the rocky coral outcrop and, in around six foot depth of water, you simply float face down watching the world of the coral fishes unfold beneath you. The antics required to co-ordinate the various movements necessary to maintain position, take pictures, and to continue breathing whenever the snorkel tube reappeared above the water, was probably more entertaining to the fish than it was to me! However, it provided enthralling views of real live marine action and added to the anticipation of the highlight of my holiday — a visit to Coral World Underwater Tower and Marine Park, on the American Virgin Island of St Thomas, celebrating its 10th Anniversary this year.

Modelled along the same lines as the observatory at Eilat in the Red Sea, Coral World is situated alongside Coki Beach, itself a good snorkelling site, on the northern coast of St Thomas (a 15-20 minute taxi ride from the main heavily tourist-frequented 'Duty Free' port of Charlotte Amalie). My guide around the Marine Park was Curator Thomas W. Nunn who, in response to a letter sent in advance of my arrival, had kindly set aside some time to see me.

Three-tiered tower

The actual observatory is an Underwater Tower sunk onto the reef in a water depth of some 15 feet. It is constructed in three tiers: the top level is the Coral Grotto/Tower Lounge, a resting place with a souvenir shop; the lowest level is the Observatory looking out in a 360 degree scan of the sea bed and reef. Hidden from outside view is a middle-level Reef Tank which affords viewing facilities to a "surround tank", in effect, a huge water-filled concrete collar around the tower between the upper and lowest levels.

The fishes seen from this middle level have two distinct qualities: first they are large predators in the main (Sharks, Groupers, Moray Eels, etc) and they are also quite captive, having no access to the open sea. At regular intervals, there is another most important inmate — a human diver who feeds the fish and cleans their side of the glass.

The fishes seen from the lowest gallery are truly free to do their own thing — and some Six-banded Sergeant Majors were doing just that right on a rock right alongside a viewing window. Nearby, a huge shoal of young fishes hung like a glittering silvery curtain, swinging to and fro in the water currents around the tower. The short pier carrying the public walkway to the tower made a very dark underwater connection and, within its shelter, were hundreds of Squirrelfish waiting for darkness to fall before they made their way out on to the reef for nocturnal activity.

With so many windows to look out of, and

DICK MILLS

DICK MILLS

Left, the Starfish pool— if you look closely, you can just make out the Pufferfish which shared the pool with the Starfish. Right, the adult Spotted Jacknife Fish or Drum *(Equetus punctatus)* has numerous spots on the dorsal fin but actually gets its name from the spot on its snout.

the ever-changing pattern of life passing by outside, it was easy to make many circuits of the gallery before you realised you'd completed a whole revolution. However, above water there were even more aquatic attractions.

Outdoor ponds with a difference

Walking through the grounds of any aquatic establishment the occurrence of ponds is not wholly unexpected, but finding separate pools with Starfish, Angelfish and Nurse Sharks in them is fairly unnerving, to say the least! Much more expected was an indoor, more formal display of marine aquariums. With such a wealth of marine life available in the local waters, each tank was able to feature various families quite strongly; only one tank that I could see was a true "community tank" that included some non-Caribbean species. The final section of this indoor display was set aside for luminescent invertebrate life, and these formed the penultimate display — the last tank holding a very extrovert-looking octopus.

With the sea so near it came as no surprise to learn that the tanks are supplied with a continuous flow of natural water which, in its turn, brings vital and nutritious plankton to the tank inmates; some tanks appeared to be equipped with "undergravel filtration" but Tom explained that these were a legacy from the previous management and not in keeping with current policy. It appears that wherever you go in the fishkeeping world, any mention of undergravel filtration soon starts off an animated discussion!

Apart from maintaining the excellence of the displays, Coral World has other constructive conservation work to do too: Turtle "tag and release" programmes are carried out all year round, and the much-admired Seahorse display is in reality a continuous rearing process with near-adults being released back into the sea. Similarly, the largest of the Sharks, Stingrays and Giant Eels are regularly released into the wild as they outgrow their accommodation.

DICK MILLS

I don't know who was more interested in whom but I, and not this juvenile French Angel *(Pomacanthus paru)* had the camera!

Pearl bar . . . and the rest

After emerging from the dimness of the aquarium, a nearby shady footpath not only helped to accustom the eyes gently to the bright sunshine again, but also led along a Nature Path to a Waterfall and Flamingo Pond; needless to say, being well into the tropics, there were many brightly coloured birds and colourful blossoms to see as well. Dotted around the main complex (to which the path eventually returned) were a Mongoose enclosure, an Iguana Tree and a real-life Pearl Bar. Here, a bed of oysters (already seeded with a naturally-growing pearl) were waiting in their running water home for you to pick one and discover the internal treasure to keep and have mounted if required.

For the slightly less fish-interested visitor there were ample alternative attractions: apart from craft, liquor and souvenir shops, there was even a one-hour photo-processing service so that you could not only see the results of your recently observatory-taken photographs, but you could go back and take them again if you didn't get it quite right the first time.

A popular feature of the Marine Park are the weekend (Saturdays and Sundays) "Touch the Caribbean" Tour. Escorted by a diver, whom you first see feeding the "open sea" fishes at the bottom of the tower, you then move on to the above-sea ponds to help to feed and *feel* the Nurse Sharks, Starfishes, Sea Anemones, Short-spined Sea Urchin and Sea Cucumbers. On Monday and Thursday afternoons the accent is on learning how the huge amount of life in the sea is sustained. The Curator gives guided tours around the Underwater Tower and shows the chains of life (and their inter-dependencies) from the smallest plankton to the largest shark. If this fully slakes your thirst for aquatic information, then a refreshing Frozen Mint Julep at the Restaurant will round off a super day for the "inner person" too!

Although I had set aside plenty of time for my visit, the time simply flew past, and without Tom's expert guidance I would have missed both seeing, and learning, quite a lot of things. Without detracting anything from Coral World at Coki Beach, my advice is that if you ever get within striking distance of any of the three Observatories (at Israel's Eilat and Nassau, Bahamas too) don't hesitate to visit them — you can always get your "Duty Free" at the next port of call or on the plane home!

EVOLUTION OF A

Next time you are going through the traumas of getting things just right for your Koi, it might help you to know that you are not alone. **Nigel Caddock,** like so many other leading Koi-keepers, has experienced it all in the course of his "evolution".

(Photographs: by the author)

My purpose in writing this short biography is not self-indulgence, but to reassure the many Koi-keepers throughout the UK who, from time to time, have to recover a dead Koi from their pond through the pea-soup greenness of their hard-worked-at Koi pond, that — you are not alone! Every Koi-keeper has problems, some large, some small, but *all* can be very frustrating and demoralising.

I received some excellent advice from a very good friend several years ago when we were trying to answer the question you will have all asked yourself at some stage, while gazing longingly into the murky green depths, "Why do we do it?" That advice was . . . *Never, never, never* take any part of the hobby for granted because, as soon as you begin to think you have cracked it . . . it will bite your leg!

Green water, diseases, holes that won't go away, scrapes, abrasions, split fins, and dead Koi, are facts of Koi-keeping life. The best we can ever expect to do is stay on the top side of the percentages. That was the bad news . . . The good news is far too voluminous for this brief insight, but rest assured that, by following some basic commonsense guidelines and responding quickly to the ever-changing needs of your Koi, the hobby of Koi-keeping can bestow untold pleasure and satisfaction that can only be understood by fellow hobbyists. Everyone else thinks we are complete loonies!

Multi-coloured "goldfish"

My Koi-keeping began one sunny July while I was strolling round a well-known Cheshire water garden centre minding my own business and glanced towards a small crowd of people hovering over the side of a large ornamental pool. I can still vividly remember my first glance of the multi-coloured "goldfish" which turned out to be Koi. I can truly say, without the slightest exaggeration, that that first glance changed my life. I will wager that this story rings many a bell with those of you who had a similar introduction to the wonder of Koi.

My then long-suffering fiancée, now even-longer-suffering wife, eventually dragged me away some hours later complaining that all we had seen were those silly goldfish . . . and what about the conifers we had come to buy for our lovely rockery for our new house? Little did she know that all plans for the rockery had been totally abandoned and that I was madly trying to find a way of persuading her that we never really wanted a rockery in the first place . . . and that a pond would be much better . . . all this before we even got off the garden centre car park . . . Sounds familiar, eh?

We moved into our house in late 1977 and, after at least 10 seconds' planning, I began to dig Mark 1 pond. This was a moulded fibreglass job acquired at great expense. The whole pond must have held at least 50 gallons (225 litres) and by the time I had finished cramming it with lilies, goldfish and Koi, there was hardly any room for the water. The pond did, however, come with two complimentary gnomes, so I guess that was good enough.

Green shroud

Needless to say, all went well for the first week; then it went green and one of the Koi died, so I indignantly took it back to where I bought it to complain bitterly that "These things are supposed to live hundreds of years and this one you sold me hasn't even lasted the week out!"

I am sure you know the type of approach, the long-suffering dealer actually insinuated that it may have been *my fault*, but I soon put him right and got a replacement which died within *three* days.

This went on until it finally dawned on me that the dealer may have a point, so I made an enormous improvement and bought a fountain kit which worked really well; the only problem was that, each time I switched it on, the fountain emptied the contents of the pond all over the garden.

At this stage I had been responsible for the indiscriminate slaughter of about 10 baby Koi, and was an undisclosed sum and a dealer ex-friend down on the whole exercise.

It was obvious to me that what was needed was a bigger pond! So, after at least 20 seconds' planning, out came the pre-moulded fibreglass job and in went the butyl liner. The final result held about 200 gals (900 litres); this time, at least, the fountain sprayed water back into the pond. The whole thing went even greener than the last pond and white mice were beginning to have a mounting attraction in preference to the stupid Koi whose life expectancy in my "expert care" could be likened to that of a snowball in a microwave!

In 1981 we moved house into a larger place with a bigger garden, and you guessed, a concrete pond with lots of nice healthy Koi . . . but I soon put that right. It was as if bad luck followed me round, and the collection of Orfe, Goldfish and Koi I had inherited soon began going the same way of my previous Koi.

It was at this stage I met my friend Peter Waddington and became involved with the British Koi Keepers Society. It was as if a blanket of ignorance had been lifted, and I soon began to appreciate that there was nothing wrong with the Koi, or the dealers, but the sole culprit and cause of *all* my problems was *me*.

Within a week, I had a dustbin with Canterbury Spa in, pumped by a small Grundfos pump and, within a month, the murky depths had been transformed into crystal clear, sparkling water and the Koi breathed a sigh of relief . . . the penny had dropped; the key was *filtration*.

My inherited Mark 3 pond was converted for virtually nothing into a perfectly adequate environment for my Koi in a very short period of time, and the surviving Koi remained in this pond of about 750 gals (3375 litres) quite happily for another two years.

During this period I realised that there was a lot more to this Koi game than I had first thought, and I found myself being fascinated and challenged by what appeared to me at that time to be mysterious and beyond my achievement. Under the expert guidance of Peter Waddington and Bill McGurk, I began the long appreenticeship of Koi-keeping which, I now understand, never truly ends.

There is nothing mysterious or magical about Koi-keeping; it really is basic, applied commonsense, and the application of well-known principles. This is really the first and most impoertant lesson to be learned.

Best advice

In late 1982 I constructed Mark 4 pond, after much consultation, thought, planning and design, and after asking a million "stupid" questions which are only perceived "stupid" in the minds of the ignorant. I found the BKKS, and especially the Local Section members, to be open, friendly, informative, expert and immensely resourceful. The best advice I could give to anyone is join a society, and then (if applicable) join your Local Section and ask, ask and ask again, until you understand.

Mark 4 was 2,200 gals (10 tons — or 9,900 litres) and had a bottom drain feeding bottom water to a small settling chamber, then a single chamber filter of Canterbury Spa. The return was through a venturi, via a Gundfos pump moving about 1000 gals per hour (4,500 litres).

Having learned my lessons, I began to stock up my pond with as many and big Koi as I could afford. The result was about 45 Koi, the largest being 22in (56cm), in 2200 gals (9,900 litres). This worked fine for a

A KOI-KEEPER

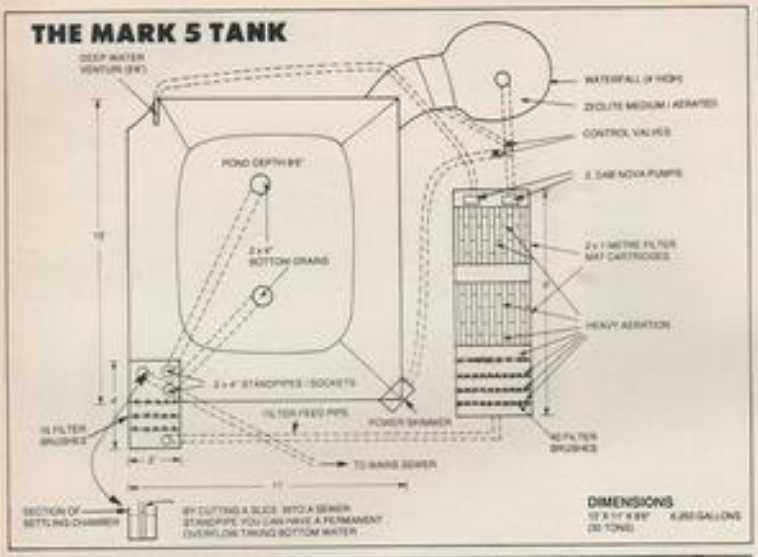
Top left, my first Koi pond (1978) had room for plants, plus a fountain . . . but little room for Koi.

Top right, Mark 2 (1980) was an improvement, but still gave me problems, particularly with green water.

Centre left, Mark 3 (February 1982) . . . with resident gnomes.

Above, Mark 4 (April 1982) was as Mark 3, plus improvements.

Centre right, and right, the "final" Mark 5 pool. On a summer's night, the pool is the ideal place to sit by . . . sipping the drink of your choice.



Stages in the construction of Mark 5.

while and, following the guidance of my friends, I treated the pool regularly with formalin and malachite to prevent illness; a practice I still believe very strongly in to this day.

Mark 4 was given a pergola to keep the sun off (silly boy . . . what sun?); it was also to enable me to cover the pond in winter, another of my hobby-horse subjects, as I believe Koi neither need nor will tolerate the long periods of cold water temperatures they are subjected to in the UK (my pond *never* goes below 50°F (10°C) at any time and the health of Koi in heated ponds, in my view, speaks for itself).

In 1984 my friend Greg Peck mooted a BKKS trip to Japan (— Mecca!) and, at that stage, I decided that if I was to go on that trip, then I needed a definitive Koi pond to put my new Koi into.

Mark 5, and *final*, Koi pond was over one year in the planning; every detail was meticulously planned and subject to scrutiny and, eventually, a design and specification was arrived at. I began working on the pond in February 1987 and completed it in late September 1987.

Mark 5 statistics

Mark 5 is of fibreglass construction on concrete, has two four-inch bottom drains feeding a settling chamber crammed with filter brushes, and fed into a single chamber filter with 40 more filter brushes, prior to two one-metre filter mat cartridges.

The pond water returns through a deep-water venturi (5ft 6in — 1.7m) and a waterfall, the header tank of which contains Zeolite and Water Cress. The filter and waterfall are heavily aerated using two Hi-blows and there are four pond airstones in the pond to provide supplementary aeration.

The bottom drains feed into the settling chamber which is discharged about three times a week; the filter brushes in the settling chamber are designed to be purely mechanical and are also cleaned. The filter, including the extra 40 bacterial brushes, are totally covered and are never disturbed, although they are heavily aerated.

The system filters bottom water and is gravity-fed; the pond dimensions are 14ft x 11ft x 8ft 6in (4.25m x 3.4m x 2.6m) and it holds 6,250 gals (approx 30 tons — or 28,100 litres).

I can honestly say the whole exercise was immensely rewarding, especially now the water has stabilised and is remaining consistently clear (there were times when I was suicidal, especially when there were seemingly endless leaks). Fibreglass is a fantastic medium, but I would strongly suggest it is installed by professionals. Mine was not and the price was six weeks of interminable leaks and total frustration.

I have reduced the stocking rate to 15 Koi (largest 24in-60cm) and have tried to improve the quality, rather than the quantity. Like everyone, I am limited by the availability of cash, but I now feel that I have a pond which will endure and provide my Koi with a stable and healthy environment.

Just rewards

My (now-even-longer-long-suffering) wife and I spend many an hour sipping gin and tonics gazing at the results of our hard work, and the pleasure and satisfaction gained from this is totally immeasurable, and makes all the true hard work completely worthwhile.

This is the tale of one self-confessed Koi-crazy person, and the moral of the tale is, you can go as far down the Koi road as you like, but what is really important to everyone reading this is, you are *not* alone, you are *not* mad, you *will* succeed (eventually), and help is always available — all you have to do is ask for it.

I hope this has inspired some, reassured others, and reminded you all that Koi-keeping, in particular, and fishkeeping, in general, is "Just A Hobby". The most important thing is, whatever branch you indulge in, and at whatever level, — *enjoy yourselves!*

PETER WALKER

Three of my adult Silver Dollars. Sexes are extremely difficult to distinguish, but the middle fish may be a female.

SILVER DOLLAR SUCCESS

Kevyn Wilson reports on a very rare event — the successful spawning of Silver Dollars (plus the subsequent rearing of fry).

Silver Dollars — *Metynnis hypsauchen (schreitmuelleri)* — are native to South American rivers, including the Amazon and its tributaries. They are related to the Piranha but, unlike the Piranha, are vegetarian, are not fussy, and will take anything offered.

Tank conditions

My eight Silver Dollars are housed in a 36 x 12 x 15in (90 x 30 x 37cm) tank with three catfish which help keep the bottom clean of unwanted foods. An undergravel filter system is powered by an Aquaclear 200, assisted by a mini internal power filter to remove large solid waste. The temperature is a constant 78°F (25.5°C), pH 6.5, DH 6 and nitrate levels of less than 0.1 mg/l. Lighting is of medium strength and functional for ten hours per day. The fish are happy in a sparse tank with plenty of swimming space. Their diet includes Aquarian Tropical flake and live foods, supplemented by occasional meats which are not too fatty; mostly liver, chicken, fish and, every few weeks, a lettuce leaf. They are only fed six days per week.

PETER WALKER

Ten-day-old fry, looking nothing like a Silver Dollar at this stage.

PETER WALKER

At 30 days, and between 11-13 mm in length, this fry can be seen to be filling out and taking on quite a bit of colour.

Courtship and spawning

The eight are 1½-2 years old and consist of five females and three males, approximately four inches long (the females are a little larger than the males). Males are recognised by a sickle shaped anal fin, whereas the female's is straight and red in colour. This is the only recognisable difference between the two sexes that I can distinguish.

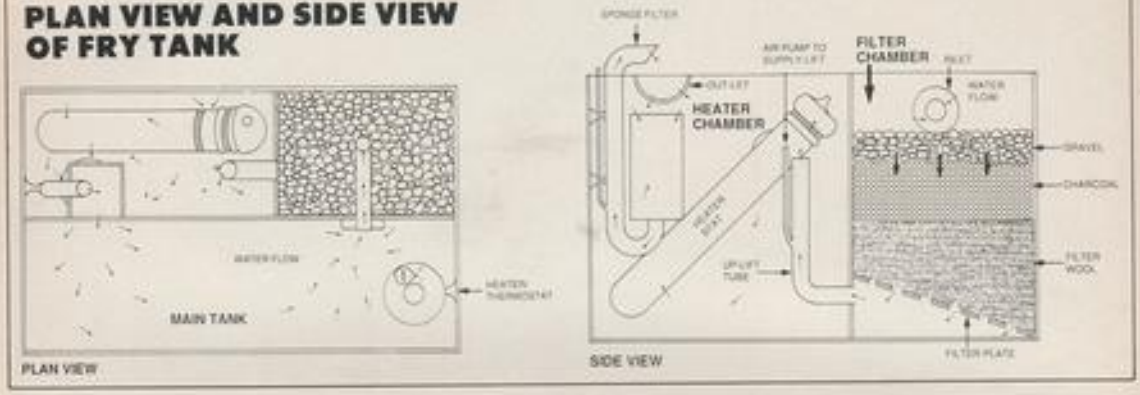
On reaching approximately one year of age the shoal started to show signs of breeding but were reluctant to do so when selected pairs were removed to a breeding tank. However, they did spawn successfully when left in the shoal. Pre-spawning activity included the males' fin tips turning black; black blotches were also visible on the body.

The males drove the females around the tank for 24 hours or more, the black markings disappearing and reappearing at intervals during this period, the females only being driven when the black markings appeared. When a male successfully attracted a mate they came together side by side, the male then wrapped his anal fin around the female, vibrating took place and, while swimming, eggs were released and fertilised.

To encourage spawning water changes were carried out at regular intervals: 25% taken out every 14-18 days. The new water to be added was treated with Waterlife Acid Buffer, Haloex (2 drops per gallon) and Algizin (2 drops per gallon). Before introduction the water was vigorously aerated and pH and temperature slightly lowered: pH to 6.3 and temperature 2-3°F (1-1½°C) below the tank temperature.

With this water change method the fish have spawned regularly every 20 days on average. This has lasted for a few months at a time, followed by a few months of no spawning activity. The Silver Dollars can stand up to the pH and temperature changes as long as they are not too severe (ie) the addition of the 25% water at a lower pH and temperature does not alter the chemistry

PLAN VIEW AND SIDE VIEW OF FRY TANK



too drastically when mixed with the 75% tank water.

Hatching and rearing

The eggs were removed quickly because the adults will eat as many as they can. They were about 1-2mm in diameter and transparent in colour. A conditioned tank 24 x 12 x 12in (60 x 30 x 30cm) was ready to take the eggs recovered. The temperature was a constant 80°F (26.5°C), pH 6.5, DH 6-7 and nitrate levels of less than 0.1 mg/l. Mild aeration and lighting were also provided.

After 24 hours all but five had turned to a white/cream colour. I presumed these had been fertilised and the white was the development of an embryo. However, 48 hours passed and the white eggs had fungussed. On removal, the transparent eggs moved and on, closer inspection, were found to be fry about 5-6mm long. I thought I had five for the first couple of days but, when they became more visible, I counted six.

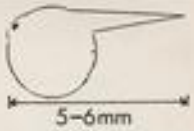
For the first eight days after spawning they lived on the yolk sac and developed small eyes, swim bladder, pectoral fins, mouth and gill slits. The yolk sac reduced over this period until it became hardly visible; a sign to start feeding.

After ten days, the fry were started on Liquifry No. 1, on which they continually fed by picking at particles on the bottom and sides of the tank.

The fry were tried on live food after fifteen days but they would not take any interest. Not wanting to return to Liquifry on its own, I tried a mixture of finely crushed flake and Liquifry and the fry took an interest in the flake particles. I discovered that the simplest way to check if they were eating was to look at the anal passage; if full of waste I knew they were eating. When the fry were continually eating, I fed them two or three times a day.

Development was rapid between twenty and twenty-five days, although this may vary between each individual. Development of a tail fin, dorsal fin, anal fin and larger eyes all occurred in this short period. The fry also changed colour and body shape; the body went a silver/grey and started to grow downwards to become more rounded, and lengthways, absorbing the tail.

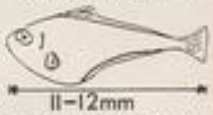
CHARTING THE DEVELOPMENT OF THE ADULT SILVER DOLLAR



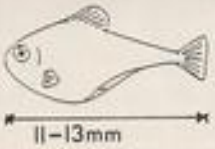
Day 1 (48-70 hours after spawning): Fry live on the yolk sac for up to ten days.

Day 10: The yolk sac has now gone and the fry are ready to take live foods such as Brine Shrimp (newly-hatched).

Day 20 of development (eating crushed flake): Fry very mobile — roam the tank freely for food.



Day 25: Body now changing colour to the *Metynnis* natural silver/grey. Fins are developing and the fry now have more control over their movements.



Day 30: Development is now more rapid; fins are becoming larger and body is growing outwards to end up, finally, like the adults. Development will vary between each individual.

Day 38: The body becomes broader but does not grow in length very much. The anal fin has started to develop into the adult shape; the dorsal fin is also changing shape. The gill slit gets larger at this stage.

Day 48: All the fins are now visible; the pelvic and adipose fins are only small at the moment but you can see the young Silver Dollar using the ventral fins to move about and slow itself down. The fry are now fully formed miniatures of parents, except, maybe, for a little growth around the caudal peduncle.

Unfortunately, only two have reached this period of development. The critical time was the transformation of fry from the yolk sac stage to taking food. It was during this period that I lost four fry. The fry are also sensitive to temperature changes and these must be avoided.

The remaining fry that survived the first twenty to twenty-five days are the ones most likely to reach adulthood if feeding, water quality and temperature are closely monitored.

The fry tank

This tank was set up after a small box filter and a sponge filter could not keep the water quality stable.

The separate compartments protect the fry from being drawn into the filter system and being burned by the heater. The dividing walls are perspex fixed with aquarium sealant. The filter chamber is fed by an overflow method into the inlet pipe and through the filter medium. Water is drawn through into the heater chamber by the uplift tube. Finally, it is drawn through the sponge filter and into the main tank via an overflow pipe.

The tank worked out very cheap to make costing about £10-12 for everything. It works well and provides gentle circulation which is needed for the fry and young fish. At the time of writing the tank is still under experiment.