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AQUARIST

AND PONDKEEPER

COMPREHENSIVE
POND AND WATERGARDEN
SUPPLEMENT



Mysterious Mormyrids

THE FLORIDA
EXPERIENCE (Part 1)

Luminous Fishes

AQUARIST AND PONDKEEPER

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COVER STORY

Photograph — Harry Grier
(Reproduced Courtesy of
F.T.F.F.A.)
Notropis lutrensis is known as
the Red Shiner, Red Horse
Minnow, Sandpaper Shiner or
Rainbow Dace. It occurs natu-
rally from central North Amer-
ica to Mexico and westwards
as far as California and Color-
ado. This attractive and active
Cyprinid has become de-
servedly popular with cold-

water hobbyists over the years
and is now regularly found in
shops and water garden
centres in the UK during the
summer season. The superb
specimen in our photograph
was produced by Ekkwill Tropi-
cal Fish Farm and won the
Danios and Minnows Class at
this year's F.T.F.F.A. Show
held in Tampa, Florida. See
major article inside for fur-
ther details of the Florida Show.



TAKE A TADPOLE . . . OR TWO

Amanda Grimes goes back in time to her childhood (did she ever leave it?) and finds that aquarium-reared tadpoles present a bigger problem than she had bargained for . . .

It just happened to mention to a very good friend of mine that one of the things I'd never done as a child was catch and raise tadpoles. And that until I had a pond in the garden, I probably never would. Unless, of course, I raised them in a tank . . .

This conversation had taken place nearly two years ago and I had forgotten it completely until I called in to see her early last year.

"By the way," she said, as she made tea, "I've got some frogspawn for you. It's in a bucket in the back garden; enough for you, me and another neighbour." I was delighted. It had only been a vague idea and now I had every chance of returning completely to my childhood; something my closer friends assured me I've been doing for years.

We went to look in the bucket. There was masses of the stuff! She explained that one of the local ponds was choked with spawn and it was very difficult to separate. You're telling me! I came away with enough to fill a pudding basin . . .

The spawn hatched very fast — within a few days — but that was probably accelerated by the central heating kept on during a very long, cold spring. I left the egg "cases" in the tank, as the miniature tadpoles seemed to return to it for nutrition. The light on the tank was building up a growth of algae and they picked over the plant as well. But what else to feed them?

No-one else I knew was raising them in a tank — they had all been introduced to garden ponds, where, of course, there was a wealth of natural food. I searched through my wildlife books, but although plenty of information was given on the diet of full-grown frogs, tadpoles were skimmed over without mention of sustenance.

If in doubt, experiment. I tried Liquifyr. Two small feedings twice a day and they were thriving! It was only a matter of weeks before the tank was black with rapidly-expanding tadpoles who, much to my surprise, did not spend much time in mid-water but an inordinate amount of hours shoving and pushing round the gravel at the side of the two-foot tank. This caused an unexpected problem. I had not anticipated their excursions down into the gravel, where many of them soon became trapped. Whether they would have found their own way out, I didn't wait to see, but hastily reduced the gravel level to a bare minimum.

By now they had progressed from Liquifyr to fry powder and on to growth food, which they were consuming in vast quantities. I

compared notes with my friend: in cold water outside, her batch were only just hatching; mine, cosseted in warmth and light, were nearly a month early! If I hadn't found their gradual transformation so fascinating, I would have been worrying about my blatant interference in their natural course.

During these weeks, I had been forced to set up a second tank, as the original was becoming very crowded. Their changing bodies astounded me. I had already raised Gouramis and had been very interested to see these tiny dots of life gradually transformed from ordinary-looking fry to that distinctive Gourami shape. And here before me the tadpoles seemed to be going through an even more complex reshaping. The first change was a gradual enlarging of the head, which flattened out and grew so wide it dominated the body. The hind legs, in exquisite miniature, appeared next.

As in fish fry, the rate of growth was unevenly spread and some were almost fully-formed young frogs before others had even pushed out their hind legs. Even the appearance of the front legs, exciting as it was, puzzled me. They still didn't look anything like frogs; until I noticed the very gradual 'thinning' of the head, which almost imperceptibly shrank inwards. This was made more disturbing by my suddenly realising that they now had a 'body'. It was only with much close study that I realised that the large flat 'head' reached a point where it separated itself into two distinct parts — a shrinking head and more clearly

defined body. The tail was still very much in evidence.

The young frogs appeared at such a rate that I hastily reduced the water level and added rocks and bogwood to provide the young amphibians with islands. All my tanks are covered with sheets of glass but they caused no end of problems! The cry of "Frogs on the loose!" was soon a daily event and it wasn't long before I was on the phone to London Wildlife, asking if they wanted any frogs.

I must now own up to two acts of ignorance! So what's new? The day London Wildlife were coming to take about 300 frogs off my hands — about half the amount I had raised — disaster struck. I found the frogs weak and dying. I had overlooked that, in their transformation, their diet also changed. I am sick to admit that I lost about 40, but the rapid collection of sycamore leaves smothered in an early plague of blackfly saved the rest.

My second possible mistake was to release the remaining few hundred young frogs into my garden. And I'm now panicking! I just can't help wondering if frogs are like Salmon . . . Will they come home to spawn?

Frogs go through remarkable changes in their lives, from tiny tadpoles with external gills (Fig 1) through the more "normal-looking" tadpole stages (Fig 2) and on to fully mature reproductive adults (Fig 3) which return year after year to their home pond to spawn.



FIG 1 ▾



FIG 2 ▲

FIG 3 ▶



E. PUGH

Seaview

by Gordon Kay

Correct stocking — the key to success

Many aquarists come to grief as beginners by not paying enough attention to the animals they put into their aquariums. They invariably spend a lot of time, effort and money to set up a superb aquarium — possibly with some super-duper filter system — and then ignore everything the experts tell them, making the most stupid basic mistakes with regard to stocking, both in terms of quantity and type of stock.

Everyone should be familiar with the old stocking rule first laid down by Graham Cox. The rule says 'one inch of fish to every four gallons of water for the first six months and then one inch of fish to every two gallons thereafter.'

One point to remember also is that these stocking levels should be built up gradually, buying fish every few weeks until the stocking level is reached. Fix this rule firmly in your mind and remember it every time you go to buy a fish. We have all tried to kid ourselves that the odd extra inch won't make any difference, or that the four-inch fish we want is only three inches long, but we have all come unstuck sooner or later.

Go on — admit it, you have too. The point is that if we understock by an inch or two, there is always room for the odd mistake — like a slip of the hand when feeding — but if we overstock by an inch or two, we put our fish in danger constantly, with that slip of the hand being enough to trigger a chain of events which ends with everything dead.

A different aspect of stocking which I feel is equally important, but so often ignored, is what I call the 'stock mix'. What I'm saying is that compatibility is often underestimated when choosing tankmates.

None of you would house a Grouper or Lionfish with a three-inch Damsel, would you? At least, I hope you wouldn't — but, all too often people put the weirdest mixture of animals in their tanks. I have seen things like Butterflies with great fat Puffers and vicious Powder Blue Surgeons with timid little

Hovercrafts — the list of daft things that people mix together is endless. The result of such a lack of forethought is, at best, hassle for the fishkeeper or, much worse and more usual, the timid little fish feels so threatened it won't eat — and you know what happens when you don't eat.

There is one other, more insidious, danger. Imagine a tank containing, say, a big Puffer, a Queen Angel, perhaps a greedy Tang or two, and then a Copperband and, maybe, a Royal Gramma. Every day, the aquarist will have to grossly overfeed the tank to make sure that the Copperband and the Gramma get something to eat. That aquarium will be constantly under threat and there will be persistent problems with ammonia and nitrite until, inevitably, something gives and the whole lot collapses. So, from now on, give a little more thought to what you put into your aquarium — take it from me, you'll find it a lot more enjoyable.

Water Changes

With all the sophisticated filter systems around these days, more and more people ask me which is the best. Frankly, in my opinion, there is no 'best' — the quality of aquatic equipment has become so high in

recent years that it really is a case of "you pays your money — you takes your choice".

However, that is not the important point here. Excellent though these systems are, they all do basically the same job — albeit in different ways. These systems make life easier but they will never replace aquatic skills or knowledge. They will not make you an aquarist overnight, they will not allow you to overstock, nor overfeed, and they will certainly not eliminate fishkeeping chores altogether.

So, my reply is always the same. As good as these systems are, (and they are good) they can never totally replace the only failsafe aid there has ever been — the good old water change.

Conch Conservation

Recently, the World Wildlife Fund reported that the famous Caribbean invertebrate, the Conch, was to receive more protection. The Conch has become such a popular delicacy in the States that an estimated 6 million are imported there every year, and around another 6 million are eaten in the Caribbean itself. On top of this, of course, the shells are popular ornaments all around the world.

To help control this mount-

ing pressure on the hapless Conch, several of the Caribbean countries — including Belize, The Turks and Caicos islands and the French West Indies — have banned the collection of these shells by divers using scuba gear. This should be effective in stemming the decline in numbers, since scuba divers account for most of the conches collected in the region.

O.F.I. & Butterfly Protection

You will remember seeing in last month's News column that O.F.I. have asked their members not to handle The Rainbow Butterflyfish (*Chaetodon trifasciatus*). To one who is a Butterfly freak this is wonderful news. It might seem like an insignificant little move, but to me, it is the first step up a ladder that will lead to more impossible *Chaetodon* species being protected, which is in the interests of us all — if only from an economic standpoint.

A chat with Graham Cox (one of the men involved in the move) confirmed that there would be further steps if this 'tester' is successful. As Graham said, however, one big problem is that, no matter how many times they are requested not to do it, exporters still sneak the odd impossible species into shipments from time to time.

It could be argued that, had we not attempted the more difficult species over the years, then we would all still be keeping Damsels, and this is true to a certain extent, but, surely, we know enough by now to differentiate between difficult and impossible. There are many Butterflies which can only be kept alive by providing living coral heads for them to eat — and who in the World could justify that?

My sources tell me that work is already underway on the compilation of a list of fishes which cannot survive under normal aquarium conditions, and the sooner this comes out the better, in my opinion.

All I can say is 'Well Done,' O.F.I. — it's high time someone set the ball rolling. Let us, the hobbyists, help the cause by refusing to buy species like *Chaetodon trifasciatus*.



LIONFISH

Spotlight

JULIDOCROMIS MARLIERI

Jeff Challands, of "Cichlid Data" and the British Cichlid Association, focusses his attention on this attractive and interesting Julie from Lake Tanganyika. (Photograph: Bill Tomey).

During the last thirty years there have been a great many weird and wonderful species of cichlids imported into Europe from the African lakes, including many dwarf varieties from Lake Tanganyika, and these include species of the genus *Julidochromis* Boulenger, 1898.

There are five described species in the *Julidochromis* genus (*J. ornatus*, *J. regani*, *J. marlieri*, *J. transcriptus* and *J. dickfeldi*) and all are endemic to Lake Tanganyika. Although, geographically, they cover a wide area of the lake, ie; each species may only inhabit small areas but there can be many miles between the various species, *Julidochromis* are never to be found in deep waters or over open areas where there is no rocky substrate for them to use as cover. Mainly, they range over rocky substrate along the shorelines of the lake at varying water depths. This can range from as little as three feet (c 1m) to about one hundred feet (c 30m) but, more often, the species are to be found in the shallower waters of the lake.

Body shape is the same in all of the five species, long in comparison to the depth of the body, which is cylindrical in shape, whereas the larger majority of cichlid species tend to be thinner in body shape. Another factor common to the *Julidochromis* species is the presence of longitudinal stripes, in varying numbers according to the species, that stretch from the head to the caudal peduncle. All five species have a peculiar habit in that they very rarely swim in a horizontal position but, over open substrate, when possibly looking for food, swim at an angle with the head in a downwards position. When near their caves or overhanging rocks, they tend to swim along the contours of the rocks, or even upside-down along the roof of their caves, or overhanging rocks. Rarely are they to be found in the upper regions of water, tending to be more middle to bottom dwellers.

The genus name, *Julidochromis*, is derived from the Latin "Julis", a rock-dwelling wrasse which *Julidochromis* are very similar to in shape and "Chromis" which means brightly coloured. The genus name *Chromis*

is now restricted to species of marine fish, but the word forms part of the name of many cichlid genera.

J. marlieri Poll, 1956, was named in honour of G. Marlier and, along with *J. ornatus*, is probably one of the better-known and widely kept species of *Julidochromis* within the hobby. This is one of the two species which tend, along with *J. transcriptus*, to have vertical, as well as horizontal, stripes on the body, which in effect, when displayed, give a sort of checkerboard pattern. The brown, narrow, longitudinal bands (of which there are four) are similar to the pattern of *J. regani* in that they start (the first stripe, that is), in the belly region and finish at the base of the dorsal fin, and run along the side of the body to finish at the caudal peduncle. The wider, up to about eight, vertical brown stripes conceal the larger part of the base or background body coloration, which is a sort of dirty yellow. The single fins have a sort of flecked pattern on a brownish background and are edged with a bluish and brown thin stripe. *J. marlieri* is also one of the two bigger species of the genus and can reach a size of 6 inches (15cm).

Aquarium requirements

Generally speaking, all five species' requirements are very much similar with regards to aquarium conditions and diet. In my experience, water conditions are not critical with regards to pH or hardness, but with wild-caught specimens, more care and attention will have to be paid to the water chemistry to match that of their natural habitat until they become acclimatised to domestic water supplies. Of course, it goes without saying that fish should never be subjected to the extremes of water chemistry. I have found that domesticated bred species of *J. ornatus* and *J. marlieri* will, happily, live in water with a pH of 7-7.5 with a fairly soft hardness and, I daresay, that other species will also tolerate these conditions. Water should never be allowed to go onto the acid range, under 7, as fish will not survive long in such conditions. Noe are *Julidochromis* species tolerant of dirty or polluted water conditions; losses soon occur if such condi-

tions either occur or are allowed to prevail. Temperature should be 72-76°F (22-24.5°C) — around 80°F (c27°C) for breeding.

Food is not too critical as I have found that commercial flake food is eaten with relish, and so are any of the many types of live foods generally available to the hobbyist. While *Julidochromis* species do not require a planted tank as part of their set-up, the addition of plants can be considered and these fish will not dig up or generally damage plants, as is the case with a large number of other cichlids.

Sexing and Breeding

Sexing these fish is virtually impossible with certainty, except maybe with the very experienced cichlid keepers who have devoted much of their time to the study of the species. Personally, I have had very little success with sexing them with positive results. Older, large, males can sometimes be seen with a bump-like feature on the top of the head, but this is by no means an infallible way of identification. Also, quite often, the male of a pair is smaller than the female but, again, this may only give an indication to the sexes as both fish are also often the same size.

Should breeding be the ultimate aim of the aquarist, then a tank of not less than two feet in length by twelve or fifteen inches wide (60 x 30 or 37cm) should be considered — tank depth is unimportant. The smaller species, *J. dickfeldi*, *ornatus* and *transcriptus* should breed successfully in a two-foot tank (60cm) (personally I use a three foot, or bigger, aquarium for breeding). The two larger species should not be put into a tank of less than three feet (90cm) in length for successful, continued, breeding. I use a four-foot (120cm) tank but, again, tank size is dependent upon the preference of the aquarist and I have known Julies breed quite happily in an 18-inch (45cm) tank.

Small gravel should be used as a substrate on the bottom of the spawning tank, as while, generally, *Julidochromis* species do not dig, they will excavate a cave under any flat stone if a suitable place is not available.

Continued on page 22



MYSTERIOUS MO

Elephant Nose Fish have a somewhat unusual exterior which hides an even more unusual interior, here revealed by researcher Samantha Jones.

It is only in recent years that the Mormyrid family of fishes has become the subject of interest both to scientists and fish hobbyists, the former because it was only in the 1950's that Hans Lissman discovered the electro-sensory system used by the Mormyrid *Gymnarchus niloticus*, and the latter as a result of improvements in the importation of these fish to the West.

Yet, if these fish are relatively new to us they are not so to the inhabitants of many parts of Central and West Africa where they have formed part of the staple diet for many thousands of years. The ancient Egyptians portrayed Mormyrids on tomb murals, depicting the life of the Nile fishermen more than three thousand years ago.

Despite their rarity in this country Mormyrids are quite common in their natural habitat and the family consists of over 200 species, ranging in size from the small shoal-living fish such as *Petrocephalus bovei* at just under 4in (under 10cm) to the large and solitary species such as *Mormyrus rume* which can grow up to three feet (1m) in the wild.

Most commonly found in aquaria is the Elephant Nose Fish (*Gnathonemus petersii*), while less frequently, one may see *Pollimyrus isidori* (or the very similar *Petrocephalus bovei*) and *Brienomyrus brachyistius*. Once or twice, I have come across the unusual species *Gnathonemus elephas*.

Aquarium requirements

Mormyrids are not difficult to keep, as long as some attention is paid to their

special needs. They are basically bottom feeders and seem either unable, or unwilling, to eat anything other than live food. Even species without the "chin" of *Gnathonemus petersii* will not, in my experience, consume dried foods, and so they can be quite costly fish to keep.

Other factors, while perhaps not so critical for their survival, are very important if one wishes to create an environment which reflects the natural habitat and conditions. In the wild these fish are most active at dawn and dusk, the twilight hours, when their weak eyes are possibly of some functional use. During these periods they emerge from hiding places at the water's edge (such as plantlife, wood or underwater roots) and swim into more open areas in order to hunt and forage.

With this in mind, it is possible to arrange a tank which Mormyrids do not find too alien, and so encourages them to exhibit their natural behaviour. My attempt to do this has resulted in a tank with a few shady places created with bogwood and Java Moss. I use mostly floating plants, the reason for this being two-fold: firstly, Mormyrids such as *G. petersii* can leave a planted tank looking as though a hurricane has passed through it (they are exceptionally good at digging up plants as they hunt for food); and secondly, they dislike bright light, and having surface plants dims the tank and provides conditions whereby the fish will emerge during the day.

Mormyrids are tolerant of the usual variety of water conditions, but, naturally, they live in soft, slightly acidic water between 79-82°F (26-28°C). Due to their electro-sensory system they are affected by the conductivity of the water in which they live (the normal range being 15-110µS/cm). In the wild this fluctuates during the two rainy seasons, Feb-April and Sept-Nov, when the water levels may rise by several metres and the conductivity drops.

Breeding behaviour

In most species of fish, light period and temperature are the cues which trigger breeding behaviour at certain times of the year. However, it was found that Mormyrids breed during the rainy season, and Frank Kirschbaum, in Germany, discovered that the key to breeding these fish in captivity involved imitating the rainy season using four main factors. These were: water conductivity (which was lowered), the imitation of rainfall, an increase in water level, and a lowering of pH (though this latter condition was found to be less important).

The first successful breeding of the Mormyrid *Pollimyrus isidori* in captivity was reported in 1969 by Birkholtz in Germany. It seems sad that news of this has taken so long to filter through to fish hobbyists. *P. isidori* has now repeatedly been bred, both in Germany and America, but not, as yet in Britain, though Dr Max Westby at Sheffield



Right, *Gnathonemus petersii* is the most common Mormyrid in the aquarium hobby (Photograph: L. Hetherington). Left, one of the more rarely-seen Mormyrids, *Pollimyrus isidori* (Photograph: L. Hetherington).

University has attempted to do so, and was able to induce gonad development. Unfortunately, no spawning occurred. The same is true of attempts to breed *G. petersii* in captivity; females become gravid with eggs but spawning does not take place. For a full account of the methods used in the breeding of *P. isidori* see the article by Frank Kirschbaum in the journal *Environmental Biology of Fishes* Vol. 10 No. 3, 1984. (available through a library).

"Electric" behaviour

The main body of scientific research however, is concerned with the fascinating electro-sensory capacity shown by the African Mormyrids (of which the Mormyrids are the largest family), and the South American Gymnarchiformes (the Knife Fish and relatives). Mormyrids are known as weakly electric fish because, unlike the Nile Catfish (*Malapterurus electricus*) they are only capable of emitting a very weak discharge; a few volts at most.

The term *electrolocation* applied to Mormyrids is analogous to the term *echolocation* applied to bats. A field of electricity, rather than sound, is set up and receptors in the fish's skin respond to the changes caused in that field when an object or another organism passes through it. Mormyrids have several types of receptors, each with differing functions. There are the passive Ampullary receptors, which are so sensitive they can detect the currents produced as the fish swims through the earth's magnetic field, while other receptors, the Mormyromasts, are responsible for the active echolocation required for hunting and navigation.

Possibly more amazing is their ability to communicate using the same medium. They generate pulses of electricity from modified muscle tissue in their tails (the electric organ), and these can be detected by other Mormyrids. (The pulses reveal quite detailed information about the sender). A third type of receptor, the Knollenorgan, responds to pulses of electricity emitted by other weakly electric fish.

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MORMYRIDS



Elephant Nose
(Mormyrus elephas)
Mormyrus isidori. (Photo-



Far Right, part of a water colour copy by Nina de Garis-Davis of a wall painting in the tomb chapel of Menna. Original 1400 BC. The Mormyrid Mormyrus rume is second fish from the left at the bottom of the picture. (Reproduced by kind permission of Phaidon Press).



Each species has a characteristic electrical pattern by which individuals can identify one another. This has obvious functional uses for the shoaling species, enabling cohesion at night when visual recognition would be impossible. More specific still is the fact that the electric pulse of each fish is as unique as a human fingerprint. As well as individuality, in some species it can convey sexual identity (male/female), and may indicate age (juvenile *P. isidori* have an

entirely different pulse pattern to that of adults).

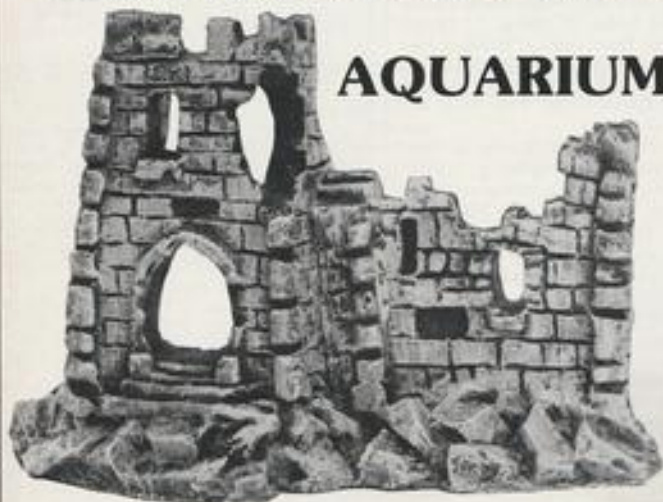
Motivational information is contained, not so much in the pulses as in the way they are emitted. The nature of the electrical discharge is such that extremely short pulses (100-200µs) are interspersed with much longer intervals which vary depending on the motivational state of the fish. Very rapid pulses with intervals of about 10ms usually indicate aggression in *P. isidori*,

while if the fish feels threatened in any way, it may stop discharging for several minutes.

This fascinating extra sense possessed by Mormyrids requires a great deal of co-ordination and organisation and thus explains the relative enormity of their brain which accounts for 1.3-2.0% of their total body weight, comparable to that of humans. Unfortunately, despite being inquisitive and trainable, they are not the intellectuals of the fish world. However, they possess a unique ability, and the mystery of their sixth sense has not entirely been unravelled. Who knows, maybe one day we, too, will be able to see with electricity.

SIMLAWOOD AND SIMLASTONE

AQUARIUM DECORATION



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THE FLORIDA EXPER

“What colour did you say it was?”
 “Well, it was sort of light-brown, almost tan, with a small, regular, darker pattern running diagonally across it.”
 “And how big was it?”
 “About twenty inches — give or take an inch.”

No, this is not the description of some large, hitherto unknown, species of spiny eel, cichlid . . . or whatever. It is the description of our smallest suitcase — the one that contained my diving gear — the one that had decided to hop onto the wrong aeroplane at Miami and go walkabout (or is it flyabout?) instead of coming with us to Tampa.

“Don’t worry, Sir — we’ll have the case back at your hotel this side of midnight.”

Are Lost Property Office staff at airports trained to look and sound that confident . . . or are they really that confident? I’ll never know the true answer to this overwhelmingly mind-stretching question (!) because the case arrived, complete with all its contents, a few minutes after midnight. OK — so he got his timing out by about 15 minutes — but who’s counting?

I needed my gear because I was planning to go manatee-diving with my friend Rick Gibson (yes — the same Rick Gibson with whom I had had the “mammoth moth” experience during my trip to the Amazon in October, 1986 — see *A & P*, January 1987 — and who later wrote about his experiences in Costa Rica — *A & P*, November 1987). As it turned out, we couldn’t go manatee-diving in the end, but more about this in Part II.

Exciting though the prospect of swimming with these genuinely wild, but genuinely gentle, giants was, it wasn’t, nevertheless, the main reason for the Florida trip. We were there because I had been invited to judge at the Florida Tropical Fish Farms Association 10th Professional Show which is staged every year at the Curtis Hixon Exhibition Hall in Tampa.

Quality fish

I had first visited some Florida fish farms in 1986 and had been hugely impressed by the quality of the fish I saw. In particular, the “Plecos”, *Corydoras*, African Rift Lake Cichlids, High Finned Black Widows and Albino Tiger Barbs, had struck me as being the best farm-produced fish of their kind I had ever seen anywhere. Well, if I was impressed in 1986, I was knocked out this time round.

Just try these names for starters: Marigold Painted Lyretail, Red Painted Lyretail, White Bloodfin Lyretail, Marigold Wagtail Lyretail, Gold Dust Lyretail, Blue Star,



1

2. In the Grow-Out Class (10”+), this Golden Gar from Ekkwill Tropical Fish Farm took the top prize. 1. Is it a Platy, or is it a Swordtail? Well — a bit of both. This Sword Tail Rainbow Variatus, produced by Ruskin Tropicals, won first place in the Fancy Platies and Variatus Class. 3. Some of this year’s Gold Dust Mollies, such as this one from Summerland Tropical Fish Farm, had a great deal of bright yellow in the body. Could this lead to a new variety (how about the Canary Molly) next year? 4. Sanchez Tropical Fish (who won the Best in Show — Freshwater Livebearer, with a Green Swordtail) also took the trophy for South and Central American Cichlasoma and Oscars with this magnificent *Cichlasoma (Heros) festae*. 5. Claws . . . Florida Blue Crawfish from Tropical Gardens Fish Farm, won the top Crustacean award.

Blue Wag, Amber, Red Tail Black and Sword Tail Rainbow.

Now, if you know exactly what all these fish are . . . you’ve been reading my “secret” notes! In fact, they are all livebearers which were entered in competition at this year’s show. The first four are Swordtails, the Gold Dust Lyretail is a Molly, the Blue Star is a Guppy, and the others are Platies — the last one being a hybrid between a Variatus Platy and a Swordtail.

And these are just the livebearers. In total, there were 433 entries in 45 classes, put in by some 44 professional Florida fish breeders, so you can well imagine what a mind-boggling feast of colour awaited our judgement. To say that judging was extremely difficult would fail totally to convey the actual enormity of the task which, despite this, proved to be both extremely enjoyable and illuminating. Having to look at every perfect scale on the perfect body of a perfect 8in *Haplochromis compressiceps* female (the best fish of its kind any of us had ever seen) teaches you a great deal . . . and leaves an indelible, and very welcome, impression on your mind, I can assure you!



2



4

CATEGORY SPECIES/TYPER/VARIETY

Swordtails	Green Sword
Fancy Swordtails	Marigold Painted Lyretail
Mollies	Black
Fancy Mollies	Gold Sniffin
Variatus Platies	Rainbow
Platies	Blue Wagtail
Fancy Platies & Variatus	Sword Tail Rainbow Variatus
Guppies	Blue Star
Any other type of Livebearer	Asian Hill Bunt
Kribia	Apocheilus lineatus
Dwarf Cichlids	Eretmodus cyanostictus
Aequidens & Geophagus	Aequidens rivulatus
South & Central American Cichlasoma & Oscars	Cichlasoma (Heros) festae
Any other Cichlids	Solid Turquoise Dwarf
Mbuna Cichlids	Labotropheus aurilabris
Haplochromis Cichlids	Haplochromis compressiceps
Tanganikan Cichlids	Lamprologus leleupi
Common Angel Fish	Black
Velvet Angel Fish	Marble Veil
Tetra	Emperor
Fancy Tetras	High Fin White
Barbs	Albino Blushing
Fancy Barbs	White Ruby
Danios & Minnows	Rainbow Gace (Red Shiner)
Fancy Danios & Minnows	Leopard Veil Danio
Glassfish	Charlie wallfi
Rainbows	Yellow Rainbow

RIENCE

Part 1

Among the many delights which Florida has to offer is the annual show staged by the Florida Tropical Fish Farms Association. John Dawes was one of the judges at this year's outstanding event . . . and was hugely impressed by what he saw.



3



5

An impressive industry

Ornamental fish farming in Florida is big business — and I mean BIG. It represents the single largest freight "item" out of Florida — it accounts for 95% of all the ornamental fish produced in the U.S.A. — it grosses around \$75 million dollars retail — it involves 300 farms (200 of which are full-time) — it produces 20-25,000 boxes of fish per week . . . and so on.

These statistics are quite staggering. Yet, how many aquarists are there in the UK who have Florida-produced fish swimming in their tanks? The answer is: nowhere near as many as there *should* be. True, some discerning importers are shipping fish from Florida on a regular basis. As a result, some lucky aquarists have Florida fish in their tanks . . . but what about the rest?

The photos that accompany this article show just a few of the gems being produced over there. If you are suitably impressed (and you probably are) then why not take a copy of the magazine to your retailer? Let him/her see the photos and scan through the list of winners. A 'phone call to his/her supplier could well start things rolling and, with a bit of luck, you could soon end up with some of these fish in your tank.

Quality precedes volume

As you have probably begun to gather (!), I am a bit keen on Florida fish. It is little wonder, therefore, that I found my judging job such an enriching one.

Despite the fantastic display of new fish and well-established fancy varieties, I was delighted, as an out-and-out livebearer fan, that the best fish in the Swordtail Class was a "basic" Green Sword (Sanchez Tropical Fish), and, on top of this, that this same fish (with its elegant, subtle and "undeveloped" lines) was the winner of the coveted Best in Show (Freshwater Livebearer) trophy.

As Elwyn Segrest, the F.T.F.F.A. President, said, when referring to the Florida approach to fish farming in his speech at the show banquet, "Quality comes first — volume follows". The winning Green Sword was, of course, a perfect example — it had to be to beat its competitors, all of which were a credit to their dedicated producers.

Elwyn Segrest finished his address by complimenting the Florida industry on "A job well done". I certainly echo that and, having visited a few farms during the weekend, know for sure that some of the "new" fish already undergoing development will guarantee the flow of high quality entries next year . . . and the year after that . . . and long may it continue.

NOTE: Tune in next time for a taste of the Florida Fish Farms, as well as one or two examples of the Sunshine State's midlife which you can expect to see . . . in relative safety. See you in Part II.

MAJOR TROPHY WINNERS

WINNER	CATEGORY	SPECIES/TYPE/VARIETY	WINNER
Sanchez Tropical Fish	Redstart	Screened	Elwell Tropical Fish Farm
Starlight Fishery	Phoxinotus	Blond "Phoxinotus"	S-D Tropical, Inc.
Gutter Tropicals	Corydoras and other Catfish	Corydoras pinnatus	Rawlins Tropical Fish Farm
Under Tropical Fish Farms	Betta splendens	Steel Blue Double tail	S-D Tropical, Inc.
Golden Tropicals, Inc.	Anabantids	Golden Gourami	Southern Tropical Fish Hatchery
Segrest Farm	Goldfish & Koi	Bubble-eye Goldfish	Gordon Aquatics
Golden Tropicals, Inc.	Sharks, Loaches & Bolas	Redtail Shark	Elwell Tropical Fish Farm
Residence Tropicals	Any other type of Freshwater Eggplant	Redd Balls	S-D Tropical, Inc.
Tropical Gardens Fish Farm	Amphibians	Asian Fire Belly Frog	S-D Tropical, Inc.
S-D Tropical, Inc.	Mollusks	Gold Apple Snails	Gardenville Aquatics
El World Exotic Fish, Inc.	Crustaceans	Florida Blue Crayfish	Tropical Gardens Fish Farm
Sanchez Tropical Fish	Bunch Plants	Rotale macrandra	Florida Aquatic Nursery
Sanchez Tropical Fish	Freshwater Fancy Plants	Echinodorus sp.	Florida Aquatic Nursery
Miss Fisheries	Grow-out (0-4in)	Redstart heteromorph	Tropical Gardens Fish Farm
Florida Exotic Fish Sales, Inc.	Grow-out (4-9in)	Synodontis decora	Segrest Farm
El World Exotic Fish, Inc.	Grow-out (10-1in)	Golden Gar	Elwell Tropical Fish Farm
El World Exotic Fish, Inc.	Best New Freshwater Livebearer variety	White Blood Fin Lateral Sword	Rainbow Fishery
Gordon Aquatics	Best New Freshwater Eggplant Variety	Lug Fin Odessa Barb	Elwell Tropical Fish Farm
Lumiere Aquatic Farm, Inc.	Best in Show (Freshwater Livebearer)	Green Sword	Sanchez Tropical Fish
S.B. Tropicals, Inc.	Best in Show (Freshwater Eggplant)	Labeotropheus turkellorum	Florida Exotic Fish Sales, Inc.
Elwell Tropical Fish Farm	Best in Show (Aquarium Livebear Other Than Fish)	Asian Fire Belly Frog	S-D Tropical, Inc.
Starlight Fishery	Breeder's Award (Edward Lewis Award)	Red Tail Tetra Barb	Elwell Tropical Fish Farm

A CHALLENGING LIVEBEARER

Derek Lambert of the Livebearer Information Service, introduces *Gambusia melapleura*, an attractive and challenging livebearer from Jamaica.

My love affair with *Gambusia melapleura* started on 29 May 1982 when I obtained a gravid female from Colin Howe. Unfortunately, it lived up to its reputation of

being almost impossible to breed. Three months later I managed to obtain a further pair, followed, a week later, by another female. This now brought my colony up to three females and one male. On 1 October I finally managed to get some fry, three to be

precise, of which only one survived for more than 24hrs. Six weeks later the same female dropped another brood of eight. From these I was able to build up a small colony, but by late 1983, I was again in trouble. Having released too many to various fishkeepers I was now down to one female which would not drop fry. New blood was desperately needed so I decided to collect some for myself.

Gambusia melapleura is found in a few rivers on the Island of Jamaica. It was first discovered in the Shrewsbury River and was later collected by Dr Radda in the Bluefields area in 1980. My collection was made on 4 November 1983 in the Great River.

Fishing this river with my little hand net proved to be something of a problem. The water depth was about five feet (c.1.5m) and the bank dropped steeply away with no foothold. In desperation, I tried getting in the water and chasing the fish upstream. This was a dismal failure and I could have drowned when I lost my footing and was swept away by the strong current. I abandoned this method and walked along the edge until I discovered a mud bank just by a bridge where I could reach the water. As I fished here, I found that I was slowly sinking into the mud. So, to prevent myself becoming a permanent fixture, I had to keep lifting up my feet.

I saw no adult fish close to the banks of the river; all the adults seemed to be in the middle. Even in the few rafts of water plants I could see there was not a gravid female in view. All I could catch from my mud bank was small fry. After several hours of patient fishing I had caught only eight.

Keeping and Breeding *G. melapleura*

When I arrived home I found that only



Below, while being less spectacular than her mate, a female *Gambusia melapleura* is, nevertheless, still a most attractive fish. Above, *G. melapleura* males are colourful, active fish.



DEREK LAMBERT

BEARER *Gambusia Melapleura* (1851)

two had survived the journey back. I carefully transferred these into an 18inch tank and grew them up. At about three months old they sexed out as a pair. They and their children have been breeding on a regular basis since then.

This species is one of the most attractive of the *Gambusia*s, with a basic body colouring of sky-blue overlaid with green highlights and black speckles across the back. The anal fin is edged in lemon yellow and the dorsal and caudal fins are light grey, edged in black. There is a black 'ear' mark just behind and above the operculum (gill cover). The body is deep and very chunky. The lovely coloration of this species, in common with many other wild livebearers, can only be truly appreciated in sunlight or reflected light. The males grow to 35mm and the females to 50mm (1.4in and 2in respectively).

I have found this species to have a boisterous temperament and, if kept with smaller species, will chivy them. Therefore, I would only recommend keeping it with larger species, such as some barbs or some of the larger Goodeids. It should never be kept with other *Gambusia* species as there is a risk of hybridisation. I have found this species does best in a large, well-planted

species tank with aeration and filtration.

The breeding of *Gambusia melapleura* has caused some problems in the past. I have found that it must be bred when young, as older females seem to become spawn-bound. Another problem seems to be that the fry are rather weak at birth and do not straight-away swim up and away. Instead, they can often be seen wriggling on the bottom of the tank. This, of course, looks very much like an appetising meal to the mother who will gobble them up with relish.

For this reason the spawning tank should be packed with plants, preferably a bed of Java Moss on the bottom which rises up to the surface at either end. The mother should be removed as soon as possible after birth. Since this usually takes place between 2 and 3 o'clock in the morning it is best to check the tank first thing every day. If you leave it until you get home in the evening the bulge will have moved from the rear of the mother to the front!

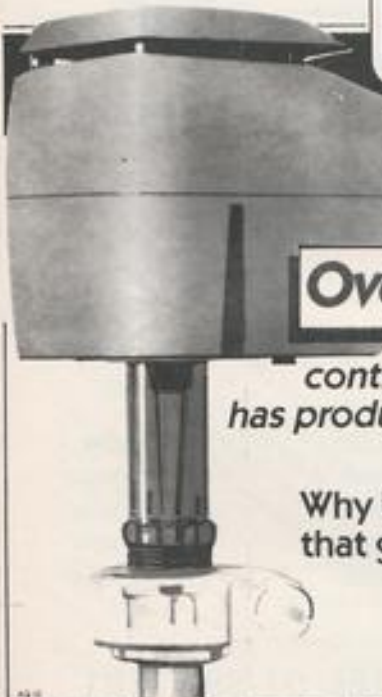
The female's girth often gives the false impression of pregnancy but, just prior to term, a dark patch shows high up on the body above the vent. This can be seen when the fish is swimming away from the observer. Otherwise there is little or no gravid mark on the female. The gestation period is four

to six weeks.

Diet is of the utmost importance in breeding this fish. It is a natural carnivore with little or no interest in vegetable matter. Dried flake food, while keeping it alive, will not provide all the nutritional requirements that it needs to breed. I find it thrives best on one feed of livefood per day. This is usually Whiteworm or freshwater shrimps, dependant on what is available. The other three feeds are of a high protein granulated food or flake food.

Gambusia melapleura is a livebearing species which provides a constant challenge to the livebearer enthusiast, and as such, would always find a home in my collection. The fact that I can look in my tanks on a cold winter's evening at the beautiful progeny of my two tiny hand-caught fry and be reminded of my holiday on the paradise Island of Jamaica is, I think, an added bonus.

Note: Derek Lambert is founder-member of the Livebearer Information Service. For further information on *Gambusia melapleura* and other livebearers, write to Livebearer Information Service, c/o 20 Queen Mary Avenue, Morden, Surrey, SM4 4JR.



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Every year, I receive lots of letters from people who want to join the ornamental fish industry and would like to attend some "job-related", full-time (shortish) course. If they are interested in pets other than fish, then the Pet Trade and Industry Association can offer them some help. There are also academic university/polytechnic (long) courses on aquatically-related subjects, e.g. at Stirling University and Plymouth Polytechnic. But, until Sparsholt College (Hampshire) came along with their one-year full-time Aquatics and Ornamental Fish Management course, at least one type of "hopeful" remained uncatered for.

All that will now be put right, starting this September. Following our News item on the course in April, I've held further discussions with the course developers and, subsequently, invited Pat Haughton, the Aquatics Centre Co-ordinator at Sparsholt, to send me a fuller write-up of their new venture which, I am certain, will be of interest to our readers. Here is his report:

As the National Training College for Fish Farm-

ing and Fisheries Management, we deal with many skills that are common to the ornamental fish retail industry; for example, fish disease work, genetics, water recirculation management etc. Owing to these links, we have always taken a close interest in the ornamental fish and aquatics trade, and it has become increasingly clear that there could be a need for specialist full-time training for the aquatics industry's employees. The lack of training appeared to be because the industry required an odd mix of skills: a combination of fish and plant husbandry, retailing skills and holding systems management. No training establishment had taken the initiative to provide this package despite the size and growth of the industry. However, in 1986, Sparsholt College, Hampshire, responded to this market opportunity and began to research the need for the course, and the resources demanded to run it.

Research

To establish if the industry was interested in a specialist course for its future employees, a questionnaire regarding employment and training was sent to 200 aquatics businesses

OUT AND with Job LEARNING ABOUT F

throughout the UK. The results from the excellent response highlighted two important aspects. Firstly, there is a big demand for employees, and trained employees, if available. Secondly, fish husbandry, aquaria systems management and retailing were identified as the most important skill areas, if training were available.

Course Content

Clearly, from the results of this survey, there was an urgent need to set up a new course, and the next stage involved the writing of a syllabus and training programme that reflected the results of the questionnaire. Keith Davenport, a fish specialist lecturer at Sparsholt, took up this challenge and a working party, made up of representatives from the many different



interests within the aquatics business, went through the detail of the syllabus to ensure that the final package covered the subject areas and standards demanded for skilled employment in the future.

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ABOUT

in Dawes

FISH AT SPARSHOLT



Students on the Higher National Diploma in Fish Farming and Fisheries Management course, injecting a Common Carp with pituitary extract to induce ovulation and spawning.

The course itself will be for one year, full-time, and is aimed at training persons who have already gained at least one year of industrial experience, to a level of 'skilled employment'. There are four aspects:

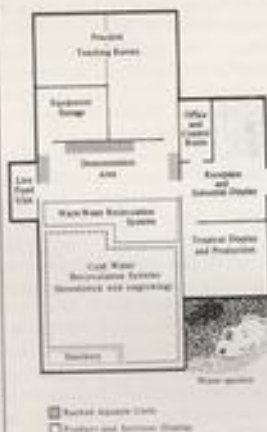
- Fish and plant husbandry
- Sales, selling and retailing
- Product technology/maintenance
- Design, display and landscaping.

It should be stressed that the course does not involve the farming of ornamental fish, but rather the management of them and their environment. (The College already provides full-time and part-time courses on fish farming).

Resources

The final stage before the new course starts in the autumn is to provide the resources to cover the programme. The College is made up of many departments, including departments in Fish Farming/Fishery Management, Business Management, Horticulture and Engineering. The training programme will draw expertise from all these areas to cover various aspects of the course,

National Aquatics Training Centre
Floor Plan of Facility



and outside speakers and instructors will be employed to provide specialist expertise as necessary.

Our existing fish and horticulture facilities are being expanded to resource the new course, and this includes a purpose-fitted aquatics training centre which is currently under construction. Industrial support was sought to provide equipment for training and fittings for the new centre and the response by the industry has, again, been exceptional. Already, over forty companies have enquired for further details or pledged support in the form of materials, fittings or finance.

Short Courses

Once the aquatics centre is up and running, the Fish Department is looking forward to running a series of short courses and workshops for employees currently in the industry. We anticipate running short courses on subject areas such as ornamental fish disease, water quality control and monitoring etc, but we particularly want the employers and employees in the industry itself to contact us to let us know their specific requirements.

The National Certificate in Aquatics and Ornamental Fish Management that starts in September 1988, is virtually unique because, from the moment of its conception, it has been market-led. It is not surprising, therefore, that already, the number of enquiries from persons wishing to come on the new course is greater than even our popular courses.

The modern trend in education has shifted over the last decade from an environment where training and industry were often distant, and industry was poorly served, to an environment of co-operation and integration between the two parties. Nowhere has this been more clearly demonstrated than in the setting up of the new Aquatics course. I have been delighted and greatly impressed by the aquatics industry's support of the College's initiative. Its response has not only been very positive verbally, but it has been prepared to offer its time, and invest its own resources, on training facilities. I believe we can look forward to an exciting and progressive partnership for the future. "

For further details on the Aquatics and Ornamental Fish Management course, please telephone 096272 441 and ask for Patrick Haughton or Keith Davenport.

Y.A.F. PREVIEW

The 1988 Yorkshire Aquarist Festival will be held at The Spa Royal Hall, South Marine Drive, Bridlington on Saturday and Sunday, 9 and 10 July. Marie Harrop, Secretary of Y.A.F. reports:

"The Festival has been moved to a new venue and date for various reasons, the main one being the cost of hiring a suitable Hall. Leeds and Doncaster have now out-priced themselves as far as the Yorkshire Festival is concerned. We just cannot afford them, but are very appreciative of all the help we have been given by the Management and Staff at Doncaster and Leeds in past years.

This year we hope to have a 'Family' atmosphere, and think that Bridlington can give us this. Most of the people we

have spoken to are making the Festival weekend part of their holiday, and others seem to be thinking of it as a mini-weekend break.

Understandably we have lost one or two of our Trader friends (the journey to Bridlington just appears to be a little too much) but we are welcoming back one or two Traders who have been missing for a while, and we are receiving quite a lot of enquiries from Traders in the North East.

Interest among Societies wishing to exhibit tableaux is absolutely phenomenal. In fact, we do not remember a Festival where so much interest has been shown. We are, therefore expecting an excellent show of tableaux and I am sure the competition will be very keen. Undoubtedly there will be far more show fish than ever before, and I am sure that the Judges are going to have a very hard time.

Something a little different — there will also be a model railway exhibition on the top floor in the space we are not able to use.

David Ford and John Dawes will be on hand to give expert advice, and these two stalwarts will also be giving lectures.

The emphasis of the Festival is 'A great day out for all the Family' and for wives, husbands or children who do not wish to spend much time at the Festival, there is always Bridlington itself: sands, shops amusement arcades, the newly opened Leisure World complex, and all the usual seaside attractions. Accommodation and parking facilities are no problem. We would add that Bridlington was chosen as Resort 2000 from a field of nearly 40 competing holiday towns.

This year's entry fee is £2.00 adults and 75p for children and Senior Citizens, pass-outs will be available as usual if required."

For further details contact: Mrs Marie Harrop, Secretary (Y.A.F.) 'Croft View', Oldfield, Honley, Huddersfield HD7 2RL. Tel: Day (0422) 72852, Evening (0484) 666591.



Spotlight

Continued from Page 8

The more rockwork in the formation of a number of caves that there is, the better, as this then gives the pair a selection of possible breeding sites from which they can choose.

When spawning is imminent, the breeding tubes of both male and female are visible — long and thin in the male, and short and wider in the female. The eggs are laid upon the roof of the selected cave by the female swimming upside-down along the stone, where she lays eggs in very distinctive rows. The male then quickly follows up fertilising the eggs. Quite often, and dependent upon the species, the eggs are not always laid all at once but over several hours. Again, dependent upon the species (and of course the size and the age of the pair), brood size is not very large, with about an average of 50 eggs being laid for the smaller species and 70 for the larger. Batches of up to 150 and 250 eggs for the two bigger species are quite common, but smaller clutches are more the norm.

Eggs hatch out between 48 and 72 hours, dependent upon temperature, and the resulting fry are suspended from the roof of the cave by mucus glands on their heads, until

the very large yolk sac is absorbed, which takes about five days. During this time, the female alone tends the eggs and resulting fry and rarely, if ever, leaves the nest. The male protects the territory, and if the pair have bred in a mixed tank, then the male will keep other species of fish at bay, even those three times his own size. If the female should wander too far from the nest then he will chase her back into it. Once the fry become free-swimming, they should be fed upon a diet of microworms or grindal worms and also very small brine shrimp nauplii.

The fry are cared for by both of the parents and are not allowed to wander from within the boundary of the chosen territory. In a small aquarium this could be the whole tank, but in a larger aquarium it will be the space designated by the parents, particularly the male, as their territory. In a large aquarium, several broods can be the norm, with the parents breeding every month or so and fry even a few months old will be allowed back into the nesting area as species of *Julidochromis* are very tolerant to the young of any fish, not only their own. Several broods can therefore live peacefully together without any harm befalling the smaller ones. If this method of reproduction

is used, then, after a few successive spawnings, it is prudent to remove the larger fish. Besides them reaching maturity and possible aggression should a pair form, a high density of young at varying stages of growth can result in the adult fish ceasing to breed.

Personally I never mix species of *Julidochromis*, especially when they reach maturity, as I have known *J. ornatus* and *J. marlieri* to cross-breed, even when their own kind were present. The resulting fry turned out to be infertile, but should any of the hybrids get onto the market, this can cause a lot of confusion and some very undesirable problems.

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Brichard, P. 1978. Fishes of Lake Tanganyika. T.F.H. Publ. Neptune City, 448pp. Scientific names and their meanings. F.B.A.S. No. 10, 1977. Digest of Scientific to Common Names *Act. of Aquarists* 1987.

NOTE ●

For further details on *Julidochromis*, plus membership application form contact: Andy Cluer (Membership Secretary), British Cichlid Association, 32 Mayhew Crescent, Totteridge, High Wycombe, Bucks.

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Koi Talk

by John Cuvelier

Microscopic views

The use of a microscope by Koi-keepers to identify(?) the various 'bugs and beasts' which appear to live on every Koi ever spawned seems to be gaining popularity, a trend which I, personally, view with some trepidation.

Let's face it, a great deal of skill is required both to obtain a specimen correctly for examination and to carry out the examination itself. The amateur dabbling in this area is quite capable of doing serious harm to his/her fish through an incorrect diagnosis, followed by some course of treatment which was probably not required in the first place.

Conversations held with Koi-keepers around the country have brought to light cases where a routine examination of a scraping of mucus from a healthy fish has resulted in

blanket treatment of the whole pool, simply because a couple of Skin Flukes were found to be present in the scraping. Now, I defy anyone to produce a fish anywhere which DOES NOT have a few Skin Flukes about its person! In fact, it would be quite unnatural if none were present.

Where a problem can arise is when a fish is under par, or has damaged itself in some way, resulting in the removal of an area of mucus. In such a case, flukes and other 'nasties' can multiply at an alarming rate, but a microscope will certainly not be required in this instance as the symptoms will be only too obvious. As for identifying all the other inhabitants of a fish's gills, scales and mucus, a glance through any good book on the diseases of fish should put you off for life as there are literally hundreds to choose from, the vast majority being completely harmless.

Should you be unable to resist the thrill of exploring the unknown, at least buy a good quality instrument and not one of the 'Xmas Cracker' toys which appear to abound. But, bear in mind the experience of an acquaintance who lives North of the great divide. He, when relating an unhappy episode with his pool and fish said, "For all the use my expensive microscope was, I might just as well have chucked it into the Mersey!" 'Nough said!

Brushing up

Time for a bit more on that favourite subject of mine (and most other Koi-keepers), filters. My new multi-bay filter should be commissioned by the time you read this and will be the subject of a later article. In the meantime, I have just taken delivery of a set of brushes which will form the first stage of the filter chain.

Although I have mentioned

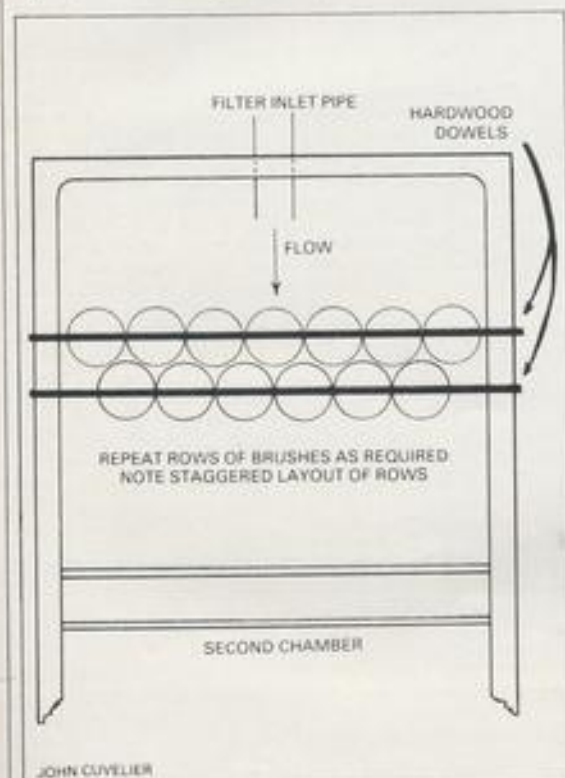
these brushes before, this will be my first experience of actually using them, but, judging from the reports of other users, they are first class and CHEAP!

Correct installation is important to ensure them doing their job which, of course, is to prevent the heavier solid wastes from reaching the biological sections of the filter. Take a look at the sketch and photograph to see what I mean.

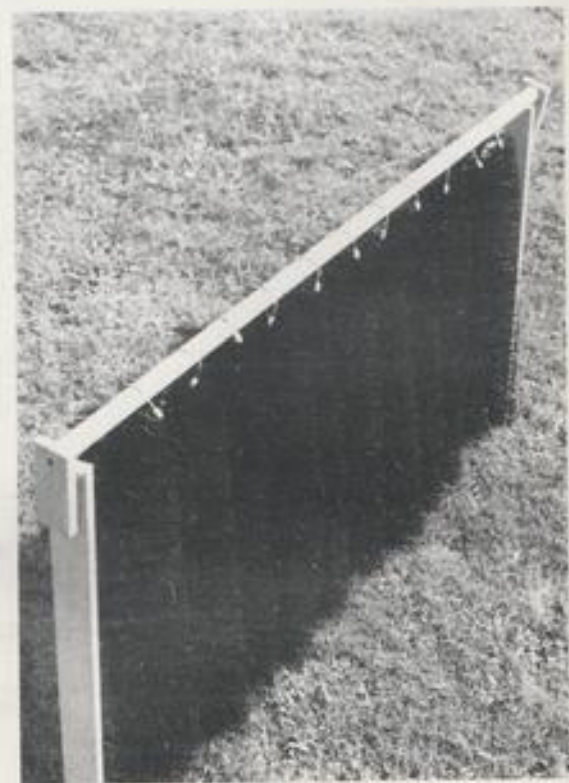
Regular cleaning is essential, depending upon the stocking rate of your pool, and the method is simply to lift the brushes out a row at a time, hose down and replace. That's all there is to it.

The imported brushes from Japan can be horrifically expensive, but a telephone call to the Speedy Brush Company should prove quite profitable for you. The telephone number is: (0322) 62480. One case, at least, where it could pay to buy British!

Top view of brush arrangement in my filter.



Suggested method for mounting brushes using hardwood dowels.



PRODUCT ROUND-UP

BY DICK MILLS

GARDEN POOLS

The addition of water to the garden can be seen in two lights — as a genuine attraction in its own right, or simply to reduce the amount of lawn to be maintained! Whatever the reason (and once the hole in the ground has been excavated) there are a number of ways to achieve your goal, ranging from hard work, to an almost instant result. The site of the pool should be chosen to be far enough away from trees, yet in a reasonably sheltered spot, and also where a fair amount of sunlight can reach it. On the other hand, you might want it to be visible from the house too; another factor to consider. Excavating the hole, whether it is to be of formal or informal shape, can be facilitated these days with a hireable digger (there's even one which can be 'folded' so that it can easily bypass the narrow side of the house if necessary.) Do bear in mind which kind of fish you intend keeping — for instance, Koi require much deeper water than other fishes. So, now you've got the hole in the right place and it's level; the next move is to decide how to make it watertight.

Generally, the larger, and more formal shape lends itself to a concrete construction, whereas the irregularly-shaped pool can be made from a pool-liner or a pre-fabricated, rigid moulded shape. If the pond is to be made above the ground then the supporting structure must be strong enough to prevent distortion of the water-filled 'container' occurring under its not inconsiderable weight. Another constructional consideration for 'over-ground pools' will be to incorporate some lagging, to protect the pond against frost damage.

LINERS

The quality (and therefore lifespan) of lining materials are distinctly proportionate to their cost: always buy the best quality you can afford for the most permanent results. The cheapest plastic liner will have a



Lotus tough line garden pool.



Free standing, holding or isolation tanks from Medway Moulding Ltd.

short lifespan, especially if no provision is made to shade the area above the water level from direct sunlight, whose ultra-violet rays soon degrade the plastic, making it brittle. Prices of lining materials range from around 17p to 50p per sq. ft., and many can be bought 'off the roll' in various widths. Polythene, PVC and butyl rubber are the most used materials in ascending order of usefulness and price.

Although the 'dig-a-hole, line-and-fill-with-water' theory is quite practicable, liners cannot be treated carelessly; they must be protected against incursion of tree roots; never use a spade or trowel to plant (or move) aquatic plants; bare feet are ideal tools when initially spreading, stretching and smoothing down the liner ... etc.

Polythene is not recommended for any long-term project since it has a relatively short life, a factor which far outweighs its apparent cheapness.

PVC is regularly available in standard widths — usually in multiples of 4ft — with the starting point of 12ft being the average dimension. Two 'thick-

nesses' are quite common too, with the cheapest being 14 thousandths of an inch. Heavier duty PVC at 20 'thous' is obviously a better (and more serviceable) proposition. Do 'shop around' for best buys — while your local garden centre may be nearest, it may not be the least expensive (and you have to collect the liner yourself). Check the advertisements in the Aquatic Press; many prices include free delivery. Most aquatic dealers that include coldwater stock will have supplies of lining materials, particularly as the season is now in full swing.

WIGHT BUTYL LINERS have 14 thou. PVC lining material (black one side, stone colour on the other) at 17-19p per sq. ft. Also 20 thou. PVC lining (black on both sides) at 20-24p per sq. ft. 30 thou. and 40 thou. Butyl liners at 36-42p per sq. ft. All prices include delivery. For further details write to: WIGHT BUTYL LINERS, Dept AQD, Freeport, Cowes, I.O.W. PO31 7BR. (Tel: 0983 200011).

Another fast service is offered by GORDON LOW PLASTICS, especially as a result of their new depot recently open-

ing in Wyboston, Bedfordshire. Over 500 flexible liners in their popular Dragonfly Pond Liner range (from all good garden centres) are available: popular sizes are available from stock, as well as in rolls of 50, 75 and 100ft. Materials include Butyl or PVC grades. Normal delivery takes three days but, for a few pounds extra, impatient fish-keepers can get their liners the very next day. Details and information from either of two service area headquarters: GORDON LOW PLASTICS LTD, Dragonfly House, Rookery Road, Wyboston, Bedfordshire MK44 3UG (Tel: 0480 505433). GORDON LOW PLASTICS LTD, Keppard House, Three Gates Road, Cowes, Isle of Wight PO31 7UT (Tel: 0983 292151).

PRE-FORMED POOLS

Two main points about pre-formed pools; they always look bigger 'out of the ground' (a point to remember when buying); if you can see the pool of your choice 'set up' with fish and surrounding plants, so much the better. Secondly, many are not deep enough to allow comfortable overwintering for fishes. Other aesthetic drawbacks are that you're stuck with the manufacturers' designs, and of course the 'lip' needs just as much camouflaging as a liner's turn-over edge. On the plus side is that shallow and deeper water areas are ready-built into the design and, generally, any associated external watercourses such as cascades or waterfalls are made to colour-match the pool's materials. Again, price dictates quality and longevity. A recent innovation is the availability of a free-standing pre-formed small pool for overwintering fishes in, say, the garage or shed.

BETTER WATER GARDEN PRODUCTS have a range of Indestructa pools ranging in size and shape — not all pre-formed pools are the ubiquitous kidney shape — and rectangular tastes are well-

The background of the cover is a photograph of a pond. In the foreground, there is a dense cluster of purple flowers with dark green leaves, growing on a rock. The pond water is visible in the background, with some lily pads and other aquatic plants. The title 'POND AND WATERGARDEN SUPPLEMENT' is printed in large, bold, yellow capital letters at the top. Below it, the subtitle 'A GUIDE FOR THE MORE EXPERIENCED HOBBYIST' is in white capital letters. Further down, it says 'With the compliments of' in a smaller font, followed by 'AQUARIST' in large white capital letters, and 'LAND PONDKEEPER' in a smaller font below it. At the bottom, there is a list of five bullet points in yellow and white text.

POND AND WATERGARDEN SUPPLEMENT

**A GUIDE
FOR THE MORE EXPERIENCED HOBBYIST**

With the compliments of

AQUARIST
LAND PONDKEEPER

- **A Goldfish-eyed view of the pond**
- **Guide to pond edging**
- **Success with pond plants**
- **Pond fish — other than Goldfish**
- **Invertebrate invaders**

APPLIED SCIENCE — THE KEY TO SUCCESS WITH POND PLANTS

Barry James takes a refreshingly different look at the background to success with pond plants.

When we contemplate the building of an ornamental pond in the garden, it is wise to consider the needs of the individual species and groups of plants if they are to thrive. For this we need some understanding of how these plants colonise certain areas of a body of water, and why only certain species favour particular micro-habitats in the overall geography of the area.

Freshwater is found in rivers, streams, lakes and pools. Each of these features enjoys quite different conditions from the others. However, I shall concern myself only with ponds.

Limnologists are constantly debating the exact definition of a pond, but we need not concern ourselves with these fine definitions, as we can all certainly recognise one when we see one! Most are the result of Man's activities in draining fields or providing drinking water for cattle.

Natural conditions

Ponds are generally quite shallow — no more than six feet deep in the deepest area. A cross-section will show a gently sloping bank, leading into a boggy area with little free water in the drier months. This, in turn, enters shallow water which shelves gently to the deeper portions. The pool is generally standing on clay, which is impervious to water when wet. This is overlaid with fine silt or mud, and, in the case of ponds surrounded by deciduous trees, there may be a thick layer of decaying leaves. Plants tend to root in this overlying mud (only very vigorous plants such as the taller rushes tend to send down rootstocks into the clay itself). This mud is anaerobic (lacking in free oxygen). What little there is, is used by bacteria to break down the detrital matter.

The stillness of the pond is proverbial, and water movements are slight. Temperature tends to fluctuate wildly, and, in winter, ice forms quicker on ponds than on



larger bodies of water such as lakes. Sunlight, on the other hand, can penetrate to the deepest portions, so rooted plants are able to grow even in the deepest parts, and, because of their photosynthetic actions, are important in maintaining a large number of animal species — a feature lacking in lakes. In some ponds the oxygen in the water may be almost exhausted at night owing to the respiratory functions of the abundant plant and animal life combined. Only the return of sunlight in the morning rescues the animal life from suffocation.

Virtually all water plants are perennials which die back in the winter, and re-establish themselves each year vegetatively from stems and rhizomes. Some produce winter buds known as turions, that drop to the bottom in the autumn and re-grow in the spring in much the same way as seeds. Few plants, however, rely wholly on turions. The floating species, Duckweed and Frogbit, may be two of those that do.

It seems that only emergent plants produce viable seed in any quantity. Some of these such as the Reedmace (*Typha latifolia*) may produce as many as 222,000 seeds from a single spike.

Because so many water plants do not produce much viable seed, it is difficult for scientists to understand how they spread so rapidly over the countryside. However, it is almost certainly due to fragments of stems being carried on the feet of birds, wrapped around the propellers of speed boats, etc.

The filamentous algae behave in much the same way as higher plants, dying back in the winter and re-growing when the water temperature and intensity of sunlight increases in the spring. Growth rates of algae can be very rapid at this time.

Once the plants are established in a particular body of water, their size and rate of growth will depend on the local environmental conditions, and especially the factors which affect the supply of raw materials needed for the manufacture of tissue by

Left, above, 'Crispa' (*Legorosiphon major*), like other submerged aquatics, needs light to perform its photosynthetic role in a pond.

Left, Reedmace (*Typha latifolia*) — sometimes sold as Bull Rush — can produce over 200,000 seeds per head.

photosynthesis. These are basically the same as for other plants.

Carbon Dioxide

This gas is always present, being a product of respiration, the supplies being continuously replenished by all living organisms.

Mineral Nutrients

Terrestrial plants obtain most of their mineral requirements through their roots. Under aquatic conditions, these essential elements are found, not only in the mud, but in solution in the water itself. In a garden pond these elements might well have to be added artificially. Many plants absorb nutrients directly through their leaves. The level of nutrients is governed by the nature of the bedrock, the amount of silt and other organic matter which accumulates. This can also affect the pH and other characteristics of water chemistry.

Light

Light is essential for photosynthesis. Immediately sunlight impinges on the water, both its intensity is reduced and the spectral quality altered by reflection at the surface and absorption in the top layers of the water. For this reason, many submerged aquatic plants have developed very finely divided, or very much enlarged, underwater leaves, compared with those they produce in the emergent state.

Temperature

Most aquatic plants are herbaceous and very susceptible to frost, but some such as Starwort (*Gallitriche* spp.) can remain green and growing in winter. A rise in water temperature is believed to be the biggest factor in inducing plants to break dormancy in the spring.

Applying knowledge to the garden pond

How does the above knowledge of how natural ponds behave enable us to be more successful with the plants in our garden pool? First of all we should make our ponds a little deeper in order to mitigate the severe icing up which occurs in small bodies of water. This will induce quicker spring growth in our water lilies and also help our fish to have a better chance of survival.

By planting our aquatics in mesh containers we also help to provide the rootstocks with more oxygen than they would normally receive growing in a mud bottom. Due to the fact that the minerals are not constantly circulating from a natural mud bottom, we must ensure that our plants are given regular doses of solid and liquid fertilisers, both basic and trace-element, to ensure sturdy growth. Containerised plants often show signs of stunted growth after a couple of years in a container with no extra feeding.

As was shown, the natural pond normally shelves gently and each group of plants occupies its own particular niche. For instance, *Lobelia cardinalis* grows best in well-drained, but moist, soil on the banks. It will suffer being grown in shallow water



Above, in nature, many ponds occur in densely vegetated areas, are fed by a small stream, and have gently sloping sides with leaf-laden mud bottoms.



Right, Water Chestnuts (*Trapa natans*) need to be brought indoors during the winter months in the UK.

in the warmer months, but will perish if left there over winter. Similarly, water lilies which are grown in water too shallow for their needs, will produce much leaf growth at the expense of the flowers.

Very vigorous species should not be grown in close proximity to weaker-growing types. For instance, our native Water Iris *Iris pseudacorus* would soon overwhelm the tiny *Cotula coronifolia* if planted too close.

In this respect pay particular attention to the growth instructions displayed on the bed labels when buying from aquatic centres. These should lead to less losses among plants. How often I have seen *Iris sibirica* being sold as an aquatic species, when, in truth, it is a plant only really happy in moist soil.

Beware, too, of plants only on the borderline of hardiness in this country. Some *Cyperus* species, Arums, Water Hyacinth (*Eichhornia*) and Water Chestnut (*Trapa* species) must be brought into heated green-

houses if they are to survive the winter months. Beware, too, of plants showing luxuriant growth in garden centres in very early spring. They have almost certainly been forced under glass and will perish if hit by a hard late frost.

Do be patient if certain species do not seem to be available in the early part of the season. Frogbit (*Hydrocharis*) and certain Pygmy Lilies are notoriously slow in coming into growth and will often not be available until late May.

Problems with algae, both filamentous and 'green water' types, often lie in basic underplanting. The guide quantities laid down in 'collections' offered by the trade are only minimal 'starter' quantities, the idea being that, in two or three seasons, the pool will be correctly stocked by natural increase. By trebling the initial planting, the quicker establishment of the 'higher' plants will often lead to algal bloom being stifled in one season instead of taking three.

THE HEALTHY POND

Follow the basic rules of successful "broodstock management" and, as Jerzy Gawor demonstrates, you should be able to steer clear of most pond problems.

'Broodstock Management' is the fish-farming term which holds the key to successful ornamental pondkeeping. To the fish-farmer, broodstock — adult breeding fish — are the crown-jewels of his/her farming operation.

Their careful management is paramount to the success of the business.

By installing a garden pond, be it a small, well planted pool for a selection of *Carassius auratus* (Common Goldfish, Shubunkins, Fancy Goldfish), or a large pool housing a community of cyprinids (Koi, Mirror, Ghost

Carp etc . . .), we are essentially taking on certain roles of a fish-farmer, in that we are keeping, managing, and possibly breeding, livestock.

The fish-farmer will want to pamper his/her broodstock which in turn will produce the reward of healthy spawnings. We, as pondkeepers, will pamper our fish, hoping for health, growth, better colour, tame behaviour, etc . . . Our aim, and indeed, our responsibility, is therefore to ensure the continued good health and growth of the fish in our care.

This is the essence of a Broodstock Management programme, the main points of which I will illustrate as follows:

PROBLEMS CHECKLIST

Follow this checklist at first sight of unnatural behaviour/symptoms.

Symptom	Probable Cause	Action
Fish gasping at surface of water.	Poor water quality. Low oxygen, high ammonia, pH, nitrite.	Partial water change (up to 40%); increase aeration; cut back on food/stock levels; improve filtration.
Fish gasping at surface. White mucus on fish's body and in gill cavities. Evidence of external parasites. White spots, skin haemorrhaging fish scratching and scraping; distressed.	External parasites. Gill congestion.	As for above. Use salt bath followed by proprietary anti-parasite treatment in pond.
Large external parasites on fish's body causing raised scales, bumps and small localised ulcers.	Anchor Worm, <i>Argulus</i> damage to fish.	Check as above. Salt bath fish. Treat pond with Masoten or Dipterex (or equivalent).
Small to large whitish lumps on fins and body. No haemorrhaging. Hard to the touch.	Pox virus (carp-pox) infection. Symptoms similar to lymphocystis in tropical and marine fish.	No action necessary. Condition not usually fatal.
Small to large ulcers on fish's body. Some ulcers may be deep and reddened. Fins ragged and haemorrhaged.	Bacterial infection. Usually by the <i>Aeromonad</i> / <i>Pseudomonad</i> Gram -ve groups.	If small ulcer, treat with surface application of Mercurochrome followed by Polybase cream. If little response use 'King British' medicated food, which contains *Oxolinic Acid — available through your local dealer. In severe cases use antibiotic injection of *Genetacin (narrow spectrum).

*These products are available only with a veterinarian's prescription. Remember, your local vet is there to help you with your fish, as well as other animals.

Species selection

It is better to decide at the outset which fish you wish to keep. In my fish laboratory experience, problems would arise mostly in ponds where too many types of fish were being kept together.

An actual case history example had the following: Goldfish, Shubunkins, Veiltail, Orandas, Tench, Koi, Catfish, Roach and Mirror Carp. These fish were just not suited to live with one another. They fought, caused damage, became diseased and gave the owner a very tough time.

I would suggest that if you wish to keep Koi then do just that — keep Koi — and nothing else.

If you wish to keep a nice ornamental garden pool, then I would say keep a selection such as Common Goldfish, Shubunkins, Orfe, Tench, and Rudd together with an array of pond plants. I, personally, do not recommend keeping the 'fancy' goldfish in outdoor ponds. They are not, in my opinion, generally suited to our climate or our pools (except perhaps in warm summer months).

If you wish to keep 'coarse' fish, such as various Carp, large Tench, Roach, Chubb, etc . . . then do so, but, perhaps, in a separate pond. These fish are generally more aggressive feeders and may cause problems for more passive 'ornamental' fish. If wild-caught they may also harbour disease organisms.

Keep Catfish at your peril. My experience of these fish is that they are too aggressive to be kept in a pond community. The fish-farmer will select broodstock species very carefully; I suggest you do the same.

Pond suitability

Having decided to keep a selection of six 18in Koi, it would be unwise to house them in a 150-gallon glassfibre pond, with a fountain pump! Conversely, there is little point in building a 10,000-gallon, eight-foot-deep, concrete pool with multi-chamber filter and four bottom drains in which to admire your collection of Goldfish, Orfe, Tench and Swan Mussels!

There are many good books available,

AVOIDING PROBLEMS

and many good Aquatic Centres, which will offer you advice and help you design a pond suitable for the fish you want to keep. The main rule is to understand that the final pond will have a limit on the size and number of fish it can accommodate. **DO NOT OVERSTOCK.** No fish-farmer will risk the collapse of his/her business by cramming too many brood-fish into one pond.

Give your fish plenty of room to call their own. If you must have more fish, then either enlarge your existing pond, or build another.

N.B. Keeping Swan Mussels may cause problems to your fish. Their larvae (glochidia) will parasitise fishes' gills.

Water management

Fish are in intimate contact with their environment, water, throughout their entire life. Allow that environment to deteriorate and your fish could suffer severe shock at best, or irreparable damage at worst. The fish-farmer will ensure the high quality of water circulating through the broodstock facility, and indeed the whole farm, at all times.

On many fish-farms, high technology is used in the way of water quality sensors linked to alarms, pumps, aerators, etc... to compensate for even slight variations in water quality, thus ensuring the safety of the fish.

As the fish in our care cannot do anything about their own water quality, other than contribute to its gradual deterioration (waste product excretion), it is up to us to monitor water quality using test kits, ensuring adequate waste removal by filtration, adequate oxygenation by pumps or venturi equipment, and generally maintaining the pond throughout the year to keep water conditions optimal.

Disease — Prevention and Cure

With the consumer demand for coldwater fish running into several millions in 1987, it is regrettable, but, nevertheless, a fact, that some fish harbouring some sort of disease organism will be offered for sale.

A fish-farmer will not only carefully examine any new broodstock before selecting them, but (s)he will also ensure adequate quarantine procedures for the new fish before they ever join the existing stocks.

When purchasing new fish you should be very critical as to what you buy. Do not purchase fish that show obvious damage, spots, ulcers, lost scales, etc... or, indeed, any fish that are housed in overcrowded, dirty, de-oxygenated conditions.

The list of what to look for is outside the scope of this article, but the old saying 'buyer beware' really holds true.

A two- to three-week period of quarantine



Plant and design your pond carefully. The correct size, depth, etc., must correspond to the types of fish you wish to keep. This pond, which will hold approximately 1500 gallons, is being constructed to hold a selection of Goldfish, Shubunkins, Golden Orfe and Tench.



Right, hypertrophy of skin cells (giant-cell formation) causing the typical nodular 'lumps' associated with Carp Pox.

Left, a Common Goldfish carrying a severe Anchor Worm (*Lernaea*) infection. Some of the mature parasites are visible along the back, below the pectoral fin and on the lower lobe of the caudal fin.

is recommended for all new fish before they are placed in a main pond. A preventative treatment (prophylaxis) of salt bath, followed by a course of anti-parasite medication, is recommended during this quarantine period, e.g., 4oz pure salt per gallon of water as a bath for 5-10 minutes, followed a day later by a course of treatment with a product such as ERADIC or STERAZIN.

Good pond and water maintenance goes a long way to maintaining fish in good health. Preventing the introduction of disease via infected new fish by careful stock selection and quarantine will improve the situation even further.

However, the best managed pond will, at some time, give cause for concern, as a particular fish, or even a group of fish, exhibit unnatural behaviour or symptoms.

At this point, it is vital to determine the cause and act immediately.

Pond problems will not go away! Parasites like Costia, *Trichodina* and White Spot, for example, if left unchecked, will cause immense damage to fish and leave a pond in a state of semi-devastation.

By being aware of fishes' normal behaviour patterns (especially at feeding times) one can learn to spot problems and take action before any serious damage occurs. The successful fish-farmer operates 'broodstock management' systems, routinely all year round. Do the same and your pond fish will reward you with long lives, health and vitality with, maybe, a few spawnings thrown in for good measure.



Nowadays, there are many good Test Kits available with which to analyse pond water.

EDGING YOUR BETS

Pond edging may not have any direct influence on the state of health of the pond inhabitants, but, as John Dawes explains, it does determine whether a pond will look like just a water-filled hole in the ground or an object of great beauty.

Two factors about the nature of pond edging which are well worth bearing in mind before you go out and buy any materials are:

- i) that your chosen approach is compatible with the type of pond you have;
- ii) that the edging you choose is safe.

Compatible edging

If your pond is of formal design, surrounding it with an informal edging of irregularly shaped blocks of natural stone with plants growing between the cracks or trailing down to the water's edge, is not the best option. Not only will the pond's regular shape (which is what gives it much of its appeal) be obscured, but the two contrasting styles will look totally mismatched.

Formal ponds are shown off to best advantage by an edging of regular shaped slabs laid in an orderly fashion.

Informal ponds, for their part, look quite wrong if surrounded by formal edging. However, the type of arrangement outlined in the first paragraph is ideal.

Intermediate arrangements are, of course, quite possible, particularly since many ponds are neither formal nor informal.

As far as wildlife ponds are concerned, nothing could look more incongruous than a paved edge. In fact, wildlife ponds look more natural when grass is allowed to grow down the edge of the water and this is combined with a considered planting of waterside/bog plants, such as Water Forget-me-not (*Myosotis palustris*), Bugle (*Ajuga reptans*), Rushes of various species, Creeping Jenny (*Lysimachia nummularia*) and other similar moisture-loving species. At a few spots around the edge, large, flattish, natural rocks can be worked into place to provide firm, safe, dry, viewing points.

Safe edging

People seem to have an irresistible urge to come as close to the edge of a pond as possible. Some even have an incredible knack for falling in, despite your best precautions. In view of this, pond edges must be made as safe as possible, while remaining compatible.

Comfortable wide slabs (overlapping the wall on both sides and cemented firmly into position) are ideal for raised ponds, whether of concrete, block or prefabricated type. This kind of edging does not have to extend all the way round the pond. If a few slabs are missed out, the cavity can be filled with

soil and attractively planted to complement the overall design.

As for sunken ponds (again, irrespective of type), the slabs or stones used should overlap the edge by about 2in (5cm). This should be sufficient to hide the concrete/prefab/lined edge of the pond from view.

There are three main safety factors to consider when installing edging around sunken ponds:

1. The slabs or stones used should be wide enough to support a person safely, i.e., without toppling into the pond, even if the person concerned stands with his/her body weight directly over the 2in (5cm) overlap.
2. The 'anchored' part of the slab or stones should rest on a firm, solid base.
3. The slabs/stones must not have a slippery surface. Polished stones, like some of those used for crazy paving, should not be used for pond edging. Even non-slippery stones can become covered in algae (or other types of slime), particularly in winter. If this happens, just give the affected areas a vigorous scrub with a stiff brush (do not use detergents!). The application of a solution of pond algicide afterwards should help discourage further growth.

BEDDING IN THE EDGING SLABS

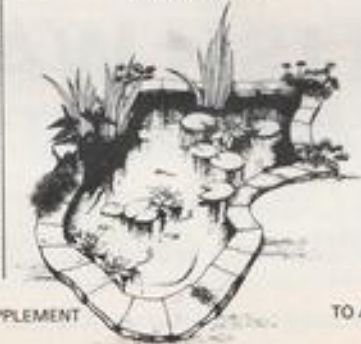
Several bedding techniques can be used, each designed to meet a different need. Three such methods are outlined below.

Basic method employing cement

This is, perhaps, the simplest technique of all.

Step 1 Prepare a mixture consisting of

An informal pond can accommodate both slabs and plants in any number of attractive configurations.



three parts sand: one part cement.

Step 2 Add just enough water to achieve a working consistency.

Step 3 Apply a thin layer of cement directly on top of the lined/prefab/cement edge of the whole area that the slabs will take up.

Step 4 Bed the slabs in, checking that they are level and preventing any of the cement from dropping into the pond. If an excessive amount of cement does drop in, you will need to drain the pond if you have already started the maturation process.

Step 5 Allow the cement to dry for at least one day, preferably longer.

Alternative method employing cement

Though the first method described is quite adequate for most ponds, it is possible to go a stage further with a little bit of extra effort (and at a little extra expense). This second method is designed to ensure that the section of liner, plastic/glassfibre/polyester or cement between the water surface and the edging slabs is always hidden from view, even if evaporation causes the level of the water in the pond to drop significantly.

For this technique, a shallow, level shelf must be provided all the way round the pond. Although the normal 9in (22cm) pond shelf can be used, shallower shelves are better because they require fewer stacking blocks/slabs.

Because prefabricated and concrete ponds have rigid, sloping slides, this technique is most easily used on lined ponds.

Prefabricated ponds

Stability can be given to the stacked slabs by overlapping them backwards and cementing them together.

Concrete ponds

As the overlapping described below is being carried out, the gaps left under the slabs can be filled with cement to provide extra support.

Lined ponds

The inherent flexibility of liners does away with the need to employ either of the techniques just described. Instead, the slabs are stacked directly on a shelf, the liner is then wrapped virtually round the back and tucked in under the top slab to give a watertight finish. The stacked slabs and the top one could be cemented in for greater stability.

POND AND WATERGARDEN SUPPLEMENT

Stacking techniques hide lined/cement/prefab edges from view and give a pond a truly finished appearance. The fact that a liner is hidden from view also protects it from potentially harmful ultra-violet sun rays. (Some liners become brittle after prolonged exposure to this type of radiation).

On the debit side (besides the expense), stacking virtually eliminates any possibility of obtaining a gradual transition zone between pond and dry land.

Bedding method avoiding the use of cement

The 'non-cement' technique is best reserved for informal and wildlife ponds. This method uses garden soil, preferably fine-grained, instead of cement, to bed in the edging slabs or stones.

One great advantage that soil has over any other material is that it provides a good rooting material for edging plants. With a little ingenuity, it is possible to create quite spectacular displays of waterside plants. The technique is simplicity itself.

Step 1 Spread a layer of soil directly on to the liner/cement/prefab edge of the pond.

Step 2 Select your plant and lay it on the soil with the roots directed away from the pond edge and towards the centre of where the slab or stone is going to rest.

Step 3 Trail the stems and leaves over the pond edge. (Use sufficient numbers of plants to cover up the liner/cement/prefab edging).

Step 4 Cover up the roots with a liberal layer of soil.

Step 5 Bed in the slab on top of this second soil layer, taking care not to exert so much pressure that you damage the plants' roots.

Step 6 Repeat the process with a second slab or stone, leaving a gap (if desired) between it and the first slab or stone.

Step 7 Fill and plant the gap as outlined in Steps 1 and 2 above.

Points to note:

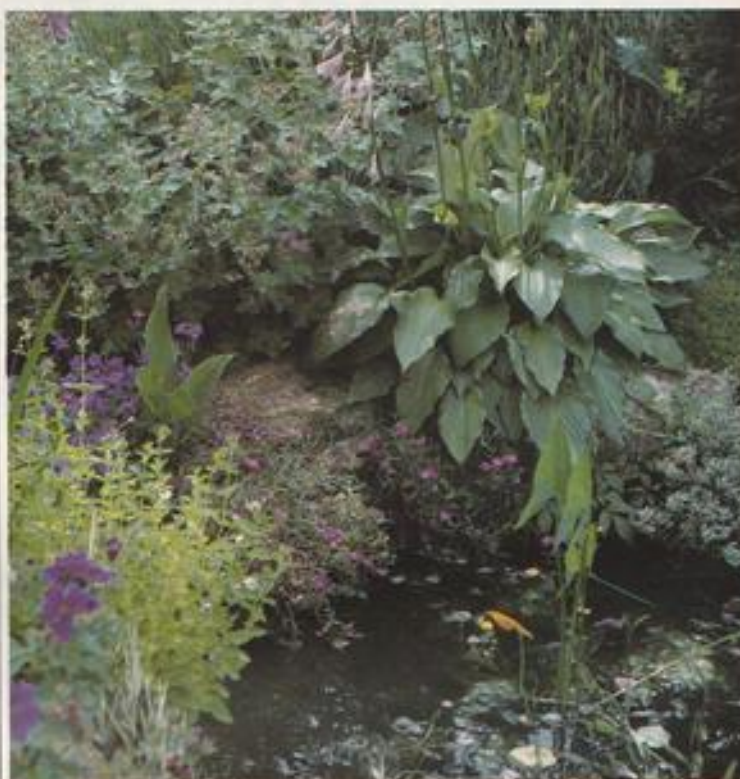
- The informality of this approach means that slabs or stones of varying shapes and thicknesses can be used to great effect.

- Fine-grained soil is preferable because of its greater clay content. This will improve adhesion between the slabs or stones and the substratum as root growth expands and natural bedding in occurs.

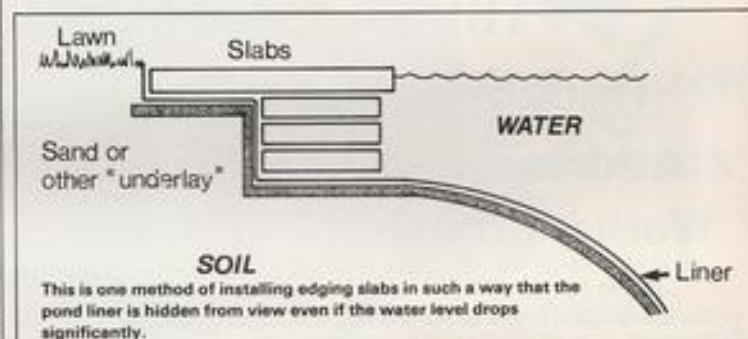
- Bedding in and maximum adhesion takes time to develop fully and can be helped along by keeping the soil moist. Autumn is, therefore, a good time for carrying out this type of pond edging.

- Even if the work is carried out in autumn and the slabs or stones bed in properly, this technique cannot provide the sort of stability achieved with concrete bedding methods.

- Some loss of stability will also result if the soil is allowed to dry out during hot weather. Fortunately, the fact that the edging plants require water to survive



Natural rock, creatively-planted in the cracks (and underneath) can produce a very attractive display which has the added bonus of hiding a liner completely.



should ensure that total drying out will not occur (at least, not too often).

- Although the plants used have their roots close to water, they do not necessarily experience marshy or boggy conditions. In fact, most will be subjected to normal garden conditions or even, since relatively thin layers of soil are used, fluctuating wet/dry conditions. Both of these provide suitable environments for a wide range of plants, including species such as Houseleeks (*Sempervivum* spp) at the dry end of the spectrum and Astilbes and Hostas at the other. Plants as diverse as *Asubricia*, *Arabis*, *Marjoram* (*Origanum vulgare*), *Bugle* (*Ajuga*

repens), *Stonecrop* (*Sedum* spp), *Saxifrage* (*Saxifraga* spp), *Creeping Jenny* (*Lysimachia nummularia*), *Primroses* (*Primula* spp), *Creeping or Dwarf Thyme* (*Thymus serpyllum*), *Cranesbill* (*Geranium* sp), and even prostrate conifers such as *Juniperus squamata* or *J. communis* 'Prostrata', can all be incorporated quite successfully into this type of pond edging scheme.

NOTE:—

The text for this article is largely based on a forthcoming book on patio and garden ponds, and other water features, by John Daves, due to be published by T.F.H. Publications Ltd.

COLOUR VISION IN GOLDFISH

Man's ability to see colour is due to the presence in the retina of the eye of cells known as cones, of which three types exist: one especially sensitive to short wavelength (blue) light, one to medium wavelength (green) light, and one to long wavelength (red) light. Light arriving at the eye stimulates one or more of these types of cones in varying amounts, depending on its wavelength or wavelengths, and the brain translates this information on wavelengths into the subjective mental code we call colour ('Redness' is only a conventional mental code, an arbitrary sign ascribed by the brain to light of a particular wavelength. The real world is totally devoid of colour, just as it is utterly silent).

This system of colour vision is termed *trichromatic* (three colours). Using this trichromatic system human colour vision is restricted to a relatively narrow spectrum of wavelengths between 400 nanometers in the violet and 740nm in the red (for us, the visual spectrum runs from violet through blue, green, yellow, and orange to red). But at least 80% of the light reaching the earth's surface lies between 290nm in the ultraviolet and 1100nm in the infra-red outside our range of sensitivity.

Research using advanced new techniques of microspectrophotometry has shown that the mechanism of colour vision in goldfish and related carp (Common Carp, Crucian Carp, Koi, etc) is very different. The Goldfish is *tetrachromatic*. That is, the goldfish's ability to see colour is due to the presence in the retina of *four* types of cone: one sensitive to very short wavelength light at 340nm, one to short wavelength light at 455nm, one to medium wavelength light at 540nm, and one to long wavelength light at 640nm.

What do these results mean? The results show that goldfish have much better colour vision than we do. In two ways:

1. First, within the spectrum of colours visible to Man, ie, violet through red, goldfish distinguish more shades than we do. A person with good eyesight can distinguish some 250 pure shades of colour and some 17000 mixed colours (pure colours form part of the spectrum violet to red; mixed colours are a mixture of different colours, eg, purple is a mixture of violet and red). Experiments have shown that, within the same band of wavelengths, goldfish can distinguish 350 pure and 25000 mixed shades: which is roughly what one would expect, given the wavelength sensitivities of the four types of cone, the density of cones in the goldfish retina, and the organisation of the visual computer in the brain.

What would you see if you were to look out at the underwater world of a pond through the eyes of a goldfish? The answers to this question are surprising, as Dr Andrew Allen reveals.

Human colour vision is good at the red end of the spectrum, less good towards the blue/green (we can see c130 shades in the yellow-orange-red half of the spectrum, c120 shades in the green-blue-violet). The goldfish sees more or less the same shades of yellow, orange and red (ie, c130), but it can see more than 200 shades of green, blue and violet.

2. Second, the results mean that goldfish see colours invisible to us. With *trichromatic* vision Man sees a spectrum of wavelengths from 400nm in the violet, to 740nm in the red. With its *tetrachromatic* vision the goldfish sees a spectrum of wavelengths from 290nm in the ultraviolet through far violets at c550nm to reds at about 750nm.

This means, of course, that a rainbow looks very different seen through the eyes of a person and through the eyes of a goldfish. Our rainbow has six colours (violet, blue, green, yellow, orange and red). The goldfish's rainbow has eight (ultraviolet, far violet, violet, blue, green, yellow, orange and red).

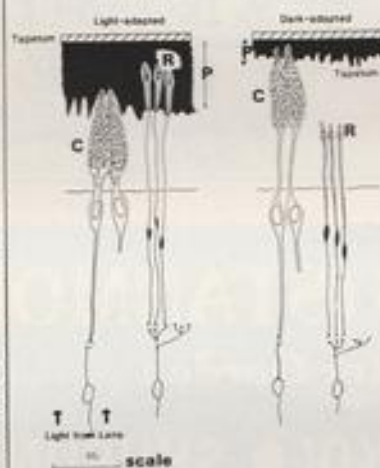
More to the point, perhaps, than how goldfish see rainbows, the Goldfish looks out on an underwater world where there are objects coloured ultraviolet, far violet, ultra-purple (a mixture of ultraviolet and red), etc, etc.

The facts and figures of goldfish vision I have outlined make good biological sense. Light rays are absorbed and scattered as they pass through water, but low energy long wavelength rays in the red are absorbed, scattered, dissipated and lost more rapidly than high energy short wavelength rays towards the blue/green end of the spectrum.

In shallow water on bright sunny days when much of the sun's energy lies in the red, reds, oranges and yellows are almost as clearly visible underwater as on land, so goldfish need a passably good ability to discriminate colours towards the red end of the spectrum. But towards dawn and dusk, and on overcast days, when the sun's rays have less energy in the red and what little red light there is is rapidly absorbed and lost as it enters the water, strange underwater transformations take place. Objects which were yellow, orange and red change colour and become various shades of green, blue, violet and far violet. In deep water, where natural red light never penetrates, everything is coloured green, blue, violet, far violet or black (novice divers who cut themselves underwater are sometimes perturbed to see green blood welling from their wounds).

Because the underwater world is predominantly a green-blue-violet-far violet world, goldfish need better vision towards the blue-green than towards the red end of the spectrum.

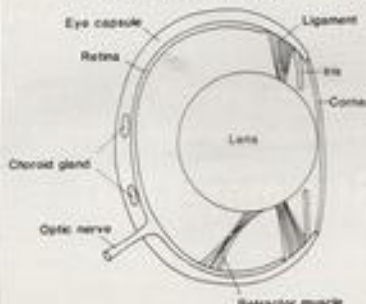
SECTION THROUGH THE RETINA OF A GOLDFISH



- 1. cones (outer vision)
- 2. rods (black and white vision in poor light)
- 3. pigment layer

NOTES:
1. Light arrives from direction shown.
2. In bright light the cones are in contracted form as in poor light the cones are in expanded form.

CROSS SECTIONAL VIEW THROUGH THE EYE OF A GOLDFISH



POND AND WATERGARDEN SUPPLEMENT

INVERTEBRATE INV

A natural body of water (or a garden pond) can hold a vast array of aquatic life. Some of it can be harmful to fish, but many of the "invaders" can add interest and variety, as naturalist and photographer Jason Smalley reveals.



The Backswimmer, recognised by its long rear legs, can prey on smaller fish but should not cause damage to larger specimens.



Great Diving Beetle larvae pose a serious threat to small fish.



A smaller relative of the Backswimmer, the Water Boatman, is harmless.

Unless an infestation is severe, Fish Leeches (*Piscicola geometra*) do not do irreparable damage in a pond.



A village duckpond may seem quite lifeless apart from the domesticated mallards, but just under the surface of the water it is teeming with life. This same environment can be created in a garden pond with a little care and planning, but there are problems.

The world of the pond is a vicious one. The motto 'live and let live' is not known. The water plants are used as an endless food supply by many creatures which, themselves, are viewed as nothing more than a tasty morsel by others, and so it goes on right up the chain. But even the 'super-predators', the fish, are not safe. Many small bugs and other invertebrates will happily feed on them.

This is why it is necessary to vet all natural introductions to a prized pond, otherwise you may find your prized Koi, or at least, their young, suffering at the jaws of some miniature monster.

Of course, we all know about the various minute mites that get under the scales and can cause death, but these are not among the predators that we can easily prevent. Many fish parasites do not cause death, but just a weakening of the stock which can interfere with breeding, or allow the prey to fall at the hands of some disease.

Leeches

The first to come to mind are the leeches. Not the ones which cling to people in the jungles of South America, but the small ribbon-like worms that swim through the water or swing from water plants waiting for a fish to brush past. They have piercing mouthparts that penetrate or drill a hole in the fish and suck out a gutful of blood before detaching themselves and dropping to the bottom to digest the meal. The fish suffers no real harm unless the environment is severely infested.

It may seem improbable that leeches can travel to a new habitat, but they are quite remarkable creatures. They are capable of surviving out of water for quite a while and can envelope themselves in a cyst to survive a dry spell. They are unlikely to travel far from a pond in this way, though. When looking for a breeding site, they wait for a bird to drink from the water. By crawling into its nostril, the leech gets transported to the bird's next watering hole, which may well be your pond!

To rid yourself of these creatures you will first have to determine if they are present. Using a fine net on a long pole gently sweep in and out of the plants and empty the contents into a light plastic container.

After a few sweeps examine the contents for what at first appear to be brown worms. Leeches can contract their body to less than a quarter of their extended size, so watch

ADERS

for small jelly-like blobs about 5mm (0.2in) long adhering to the sides of the container. If they grow when prodded or swim off with a waving motion you've got leeches. Usually brownish or dark in colour, they can be hard to spot in the pond.

If you feel infestation is severe, with your fish always having them hanging from their sides, the only real remedy is to empty the pond, clean it out and restock with clean plants (although trichlorophen will kill off leeches, if used properly, and in the absence of delicate species such as Orfe).

Be careful not to mistake flatworms for leeches. These small relatives glide along smoothly, not looping as leeches do. Being harmless to everything but algae, etc. they are no cause for alarm.

Insect invaders

Possibly the most dangerous invaders are the larvae of certain large insects and some beetle adults. Those glistening dragonflies that catch our eyes as they flit over the pond on hot summer evenings are not themselves damaging to the fish population, feeding only on small flies, but their larvae can be classed among the most deadly.

Growing to a good two inches, the brown nymphs live for a year or so and have a special extendable appendage that folds under the face and can be darted forwards at great speed to trap prey in the powerful jaws that they carry. Large fish need not worry, but anything Stickleback-sized will be devoured with ferocity.

Dragonfly larvae do not normally cause any problems in a garden pond; at worst only a few small, weak, or young fish could be taken. They are more likely to help clear the pond of other predatory invertebrates and to reduce the number of tadpoles.

It would be unwise to disturb or attempt to remove them from the pond, as many species are protected, being so rare as to be on the brink of extinction in this country. So count yourself lucky if you have any in



A natural pond such as this one in the village of White Coppice, near Chorley, Lancashire, holds a large number of creatures, both prey and predators. If you want to achieve a natural environment, you must be willing to accept all in order to achieve an ecological balance.

your back garden.

Water beetles and bugs have no trouble getting from pond to pond, being such expert fliers. While most will ignore fish to concentrate on vegetation and water fleas, there are exceptions.

The Backswimmer is one of the commonest bugs to be found in still water and it is the most ferocious. Feeding largely on insects as well as others of its own kind, it will occasionally attack fish. Beware of handling them; they pack a powerful nip. Simply fishing among the plants will reveal these silvery-green creatures. They can be recognised by their long back legs which they use like oars, and the beak-like mouthparts, perfect for spearing their prey.

One of the biggest insects that could be found in your pond is the Great Diving Water Beetle, measuring in at 1½ inches (c. 0.4 cm). Both the parent beetle and the fearsome-looking larvae attack anything that moves, and they are quite common. The larva is a brown creature with a pair of jaws that look like two curved needles. These jaws are, in fact, hollow to allow the victim's body fluids to flow through after being partially digested by enzymes secreted by the larva.

Being largely nocturnal, these beetles fly at night and can cover great distances. The only effective way to stop them setting up a family in your pond is by covering the surface with a fine wire mesh frame, the

gaps being no more than a centimetre or so. This need only be laid over during warm summer nights when the beetles are likely to be flying.

Of course, not all insect visitors which decide to grace your pond are harmful; most are to be made welcome as adding to the beauty and providing a supplementary live food source for fish. Ones that spring to mind are the Whirligig Beetles that spin endlessly on the surface of the water, accompanied by Water Measurers and Pond Skaters. All these creatures help clear the surface of dead insects. The dangerous Backswimmer has a cousin known as the Water Boatman that looks very similar, except for its golden hue and its preference for swimming the right way up. This small creature is totally harmless, feeding on *Daphnia* and similar creatures.

If your fish numbers do seem to be steadily declining, it could be worthwhile spending an hour or so dredging your pond with a fine net to evaluate what creatures are inhabitants, and then simply transferring those which are deemed harmful to a far-off natural pond. It is always best to conserve in this way rather than destroy. If you are just setting up a pond, why not consider introducing some wild creatures? Transfer some specimens to an indoor tank temporarily and watch visitors marvel at this alternative aquarium.

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SOME "OTHER" FISH FOR THE POND

Once you've mastered the basics of pondkeeping, what fish could you introduce other than the ubiquitous Goldfish? Dr Chris Andrews of the London Zoo Aquarium has some interesting suggestions.

Imagine a 'typical' garden pond: six by four feet, up to 18 or 24 inches deep, with a shallow area for emergent vegetation and fish spawning. It probably also has one or two lilies and some deep water aquatic plants and oxygenating plants. It has been set up for a few years, and was originally stocked with a few goldfish, some carp or Koi, and one or two tench. Since then, the fish stock may have dwindled as a result of minor outbreaks of disease, or predation, or else the stock may have remained more or less constant as a result of occasional small additions of fish. What can you do if you feel like keeping some slightly 'different' fish in your pond?

Obviously, you have to keep to the stocking limit for your pond, and the time-honoured figure of, roughly, three to six 'inches of fish' per square foot of pond surface is a good one to work to. This figure does allow for growth of the fish, and includes a margin of safety for hot, 'muggy' days, etc. This is not to say that it cannot be exceeded, so long as suitable care is exercised.

Tench and Koi problems

With regard to fish for the pond, goldfish are, of course, ideal. They are colourful, hardy and generally inexpensive. Naturally, some of the more unusual, delicate varieties are best suited to the indoor aquarium. And goldfish will breed in the garden pond, which adds a fascinating dimension to water gardening. As already mentioned, the pond will almost certainly also contain tench and carp and/or Koi. In many ways they are also typical pond fish, although they do bring with them one or two problems.

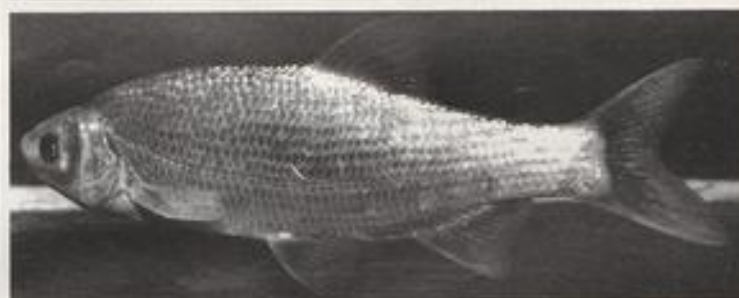
Tench are often referred to as the 'doctor fish', which they are not, and they are also referred to as 'scavengers' which they are



L. E. PERKINS



L. E. PERKINS



L. E. PERKINS

Top, the Crucian Carp (*Carassius carassius*), while being sturdy and attractive in its own way, is hardly the ideal candidate for an ornamental pond, owing to its "wild-type" coloration.

Middle, nowadays, the wild-type Rudd (*Scardinius erythrophthalmus*) shown in the photograph, has been largely superseded by a golden variety.

Above, deservedly popular, the Golden Orfe (*Leuciscus idus*) can provide a highly active, colourful display.

POND AND WATERGARDEN SUPPLEMENT

not really either! Both tench and carp (including Koi) are bottom feeders, and enjoy grubbing through the silty bottom of a garden pond, feeding on a range of aquatic invertebrates and even plant material. As a result of this type of feeding behaviour, and especially in a silt-laden garden pond, this can lead to problems with cloudy or murky water conditions. In fact, tench probably have limited real value in a garden pond, and you certainly do not see them very often once introduced. Similarly, Koi are best kept in a specially filtered pool, where they can be fully appreciated.

Other choices (and problems)

So, apart from more goldfish, where does that leave you in relation to adding more fish to your pond?

Various British and European 'coarse' fish species are available from water garden centres and aquarium shops, but only some of these make ideal pond fish. For example, Golden Orfe and Golden Rudd are colour-forms of rather ordinary-looking native species. They are active, surface-swimming and surface-feeding fish, although Orfe can grow quite large (24 inches - c.60cm) and are rather sensitive to poor water quality, especially low oxygen levels. Other coarse fish, such as Roach, Bream, Crucian Carp and the like, will certainly live and even thrive in a garden pond, although their natural coloration and camouflage will make them rather difficult to observe.

In fact, in some ways, many of our native species are best maintained in suitably large, filtered tanks — rather than ponds — for proper observation, study and appreciation. The same can also be said for fish like Bitterling, Minnows and Sticklebacks. However, while our native Minnow is a useful, if somewhat sensitive, 'activity' or 'dither' fish for a garden pond, Sticklebacks can prove to be aggressive sources of a range of disease which makes them more suitable for a single species aquarium.

The Asian Grass Carp and Silver Carp are also available from time to time. These active, rather nervous, fish can grow quite large and, consequently, may get too big for

FISH FOR THE ORNAMENTAL GARDEN POND

*Goldfish	<i>Carassius auratus</i>
Crucian Carp	<i>Carassius carassius</i>
Carp	<i>Cyprinus carpio</i>
Koi	<i>Cyprinus carpio</i>
Tench	<i>Tinca tinca</i>
*Golden Orfe	<i>Leuciscus idus</i>
*Golden Rudd	<i>Scardinius erythrophthalmus</i>
Roach	<i>Rutilus rutilus</i>
Bream	<i>Abramis brama</i>
Bitterling	<i>Rhodeus</i> spp.
**Minnows	<i>Phoxinus phoxinus</i>
Sticklebacks	<i>Gasterosteus aculeatus</i>
*Fathead Minnow	<i>Pimephales promelas</i>
**Pumpkinseed	<i>Lepomis gibbosus</i>
Trout	<i>Salmo</i> spp.
**Sterlet	<i>Acipenser ruthenus</i>
Wels Catfish	<i>Silurus glanis</i>
Channel Catfish	<i>Ictalurus punctatus</i>
Bullhead Catfish	<i>Ictalurus nebulosus</i>
Grass Carp	<i>Ctenopharyngodon idella</i>
Silver Carp	<i>Hypophthalmichthys molitrix</i>

NOTES

- * Ideal fish for the ornamental garden pond.
- ** Can be interesting inmates for the garden pond.

a small garden pond. Like many of the above-mentioned British & European 'coarse' fish, Grass Carp and Silver Carp cannot really be fully appreciated in a pond, and are seldom seen to their best advantage. In addition, despite some comments to the contrary, neither species is a very effective control agent for green water conditions or blanket weed in British garden ponds.

An increasing number of North American 'coarse' fish are becoming available these days. Once again, most of these are fascinating inmates for an indoor coldwater aquarium, but are somewhat wasted in a garden pond. One or two exceptions to this rather

sweeping generalisation spring to mind.

The golden form of the Fathead Minnow (*Pimephales promelas*) is produced in fish farms in North America, and is primarily used as a bait fish by anglers. It is also a lively, active, hardy shoaling species which, because of its bright yellow colour, can be stocked with some advantage into a garden pond. The wild form of the Fathead Minnow is less colourful, and has less to recommend it as a pond fish. Various species of North American bass and sunfish are also available, and some of these are, perhaps, suited to the ornamental garden pond. While some species get quite large and are predatory, some species, such as the Pumpkinseed (*Lepomis gibbosus*), rarely exceed six or eight inches (15-20cm) and are usually not too aggressive.

'Cool-water' tropicals and others

I am not an advocate of stocking so-called 'cool-water tropicals' into a garden pond. They seldom thrive, and, like so many other fish, are best kept in a specially set up indoor aquarium. At the other end of the temperature preference scale, trout should not be kept in a garden pond.

Most trout species prefer temperatures around 46-54°F (c.8-12°C), and prolonged exposure to temperatures above 59°F (15°C) will precipitate disease problems and exacerbate low or fluctuating oxygen conditions. Fish, such as Sterlet, Wels Catfish and North American Channel and Bullhead Catfish, are also available with relative ease these days.

The catfish, which are naturally secretive and seldom seen, in any case, will grow and actively predate on other fish in the pond and should not be stocked-out by the hobbyist. The Sterlet, which can be difficult to feed when very small, will probably adapt to life in a larger-than-average garden pond, and is hence of some interest to the water gardener with an eye for the unusual.

So where does that leave us? Assuming you want a lively, attractive, interesting garden pond, relatively few species are really suitable, and many species can be excluded as a result of their cryptic coloration, their rather anti-social habits, their water quality requirements, or a combination of these factors. A range of species ideally suited for life in the ornamental garden pond is shown in the Table and includes Goldfish, Golden Orfe, Golden Rudd, and Fathead Minnows. Of course, should the aim of the individual hobbyist be to create a 'natural' or 'wildlife' pond, the requirements, and indeed the fish kept, would be much different.

Recommended reading

1. A Fishkeeper's Guide to Coldwater Fishes By: Dick Mills (Salamander, 1984).
2. Dr Axelrod's Atlas of Freshwater Aquarium Fishes By: H. R. Axelrod, et al. (T.F.H., 1985).

An out-and-out predator which will wreak havoc in any pond is the Channel Catfish (*Ictalurus punctatus*), available both in wild-type and albino forms.



catered for. Details from BETTER WATER GARDEN PRODUCTS, Blagdon Water Garden Centre Ltd, Unit 6-7, Walrow Industrial Estate, Highbridge, Somerset (Tel: 0278 781556).

Note: This address is for information only, see the products themselves at the company's Langford site.

Because of their deeper than normal depths, the pools made by DEEPOOLS are excellent on two fronts: first, they are generally better for Koi and secondly, as 'above ground' pools, have easy access and plenty of alongside/under-pool-space for the siting of filtration and pumping equipment. When seen from above, the range is instantly recognisable by its design theme (Balearic, Canary and Japan Islands shapes). Capacities range from around 350-2000 gallons. Details from: DEEPOOLS, Unit 1a, Rosevear Road, Bugle, St Austell, Cornwall PL26 8PH (Tel: 0726 63939).

The name LOTUS is synonymous with quality water garden products, and it has recently added new models to its ToughLine pools, bringing the range up to six styles. These moulded plastic pools are lighter in weight and less expensive than glass-fibre mouldings. Details from: LOTUS WATER GARDEN PRODUCTS LTD, 260-300 Berkhamsted Road, Chesham, Bucks (Tel: 0494 774451).

If you're bothered about overwintering fish in a shallow pond, then MEDWAY MOULDINGS have the answer to your problems. Three free-standing tanks are available: all are 3ft deep (other dimensions are 4ft x 2.5ft, 6ft x 4ft, and 10ft x 5ft) and come equipped with built-in filter unit (just add medium). Ideal for holding stock in a shed or garage for either isolation purposes in the event of ill-health, or for quarantining, or for holding more delicate varieties undercover during winter. A further pondlining service in GRP (Glass-reinforced plastic) is also offered. Full details from: MEDWAY MOULDING LTD, Vicarage Lane, Hoo, Rochester, Kent ME3 9LB. (Tel: 0634 253032).

NEW PRODUCTS

CLEAN GRAVEL — COURTESY OF INTERPET

Cloudy aquarium water is not a pleasant sight and, although a good filtration system will help keep it clear, you should also try to stop it forming in the first place. Dislodged detritus from the substrate is often to blame, especially with foraging fishes such as Barbs and Goldfish. INTERPET's new Aquarium Gravel Cleaner will do much to prevent the build-up of detritus in the substrate. It will also maintain the efficiency of any biological filter by allowing good waterflow through the gravel. A special agitating action swirls the gravel around for excellent dirt-separation, no gravel being removed in the process. Keep your fish in a bright, clean (and healthier) environment for the modest outlay of £4.97. Details from: INTERPET LTD, Vincent Lane, Dorking, Surrey RH4 3YX. (Tel: 0306 881033).

BRILLIANT PLASTIC PLANTS FROM PENN PLAX

For something spectacularly eye-catching, especially in that aquarium with those plant-eating species, why not try PENN PLAX's new Neon Aqua Plants? 'Five popular styles in six different sizes' is a description hardly likely to impress but the constructional details certainly will — foliage is super lush, root systems realistic — but the colours! These are extra-vibrant and include brilliant red, orange, blue, pink and (of course) green. Each plant has a unique Planter-Pod which ensures firm anchorage in the

substrate. It remains to be seen whether Penn Plax follow it up with a range of sunglasses — for the fish or fishkeeper? If you fail to spot them at your dealers then details of availability are obtainable from: BRYAN SHARPLES MARKETING, 2a Post Office Avenue, Southport, Merseyside. (Tel: 0704 44662).

GOLDFISH STICKS FROM TETRA

If your Goldfish tend to lose their sparkle in the aquarium, it is quite likely to be because of a deficiency in their diet of naturally-occurring substances. A completely balanced diet of all the necessary vitamins, proteins and trace elements can now be easily provided by TETRA's new Goldfish Foodsticks. There's even a pigment enhancer to bring back that glow to their cheeks (and other parts). Aquarists have already found the practicalities of using other Foodsticks for tropical and pond species (Doramin and Tetrapond), and now Goldfish keepers can also benefit from the convenience of this type of food. Foodsticks absorb water quickly to soften them but stay floating for ages — but don't worry, in the unlikely event of your fish leaving them unattended (small fish nibble them, large fish gulp them), Foodsticks are 'less-mess' foods, and like all Tetra foods, will never cloud the water. A 34g pack costs 95p, the 93g size costs £1.85 (nearly three times as much for just only twice as much!) Full details from: TETRA INFORMATION CENTRE, Mitchell House, Southampton Road, Eastleigh, Hampshire SO5 5RY.

WATER TREATMENTS FOR KOI

Koi are not only attractive additions to any pond, but they can also be highly prized and extremely valuable. With this in mind, INTERPET have produced a new range of carefully formulated water treatments that cater for the special needs of Koi. Each Pondwater Treatment's formula is exactly balanced to give accurate dosage, and therefore gives safer and more reliable results than mixing your own chemical concoctions.

Koi are particularly resistant to chemicals and, therefore, the treatments have a high potency level, which enables quicker



and more effective results. However, it is important to note that this makes the Koi Pondwater Treatments unsuitable for treating mixed fish ponds, especially those containing sensitive fish such as Orfe or Rudd.

INTERPET's Koi Pondwater Treatments include:

- Anti-Fungus and Bacteria
- Anti-Parasite PS (for parasites with a free swimming stage)

They are available in 250ml and 1 litre sizes for a five-day course of treatment for up to 2250 litres (500 gallons) and 9000 litres (2000 gallons) respectively.

Koi Pondwater Treatments are available from aquatic and pet shops, garden centres and hardware stores at around £3.35 for the small size and £8.49 for the large size.

Further details from: INTERPET Ltd, Vincent Lane, Dorking, Surrey, RH4 3YX (Tel: 0306 881 033).

Colour and vibrancy from Penn Plax Neon Aqua Plants.



Coldwater jottings



Stephen J. Smith

Variety for Retailers

I recently dropped in to half-a-dozen or so High Street retailers and a handful of garden centres in the spring, to check out just what stocks of Fancy Goldfish were available.

Amazingly, only one shop had anything resembling what I would term "Fancy Goldfish"; while, perhaps less surprisingly, the garden centres did provide a little more variety.

The ubiquitous Common Goldfish was available at all the outlets which I visited — ALL were imported stock. The most common "Fancy" was the Moor (often mistakenly labelled "Black Moor" — as if they might be any other colour . . . !); while the Fantail was also quite popular.

(One shop had a rather overcrowded tankful of Fantails — labelled as "Orandas"!)

The point of this, though, is not to criticise retailers for their "mistaken identities" (though I often wonder: do bird retailers use the wrong names of our feathered friends, or are dog breeds sold with incorrect nomenclature?).

No, it is evidently that the vast majority of the buying public — and that includes you and me — is being sold short. Not only that, but retailers themselves are missing out on a huge potential market.

After all, what is better from a retailer's point of view — to sell ten Fancy Goldfish at £15-

£20 each, or 50 Common Goldfish at 85 pence each?

In terms of time, purchase and running costs, etc, the answer would appear to be obvious.

However, the majority of retailers would retort with two statements: i) There isn't the demand; and ii) there is no reliable and economical source of supply.

My answer would be: just give it a try. The demand is evident from the amount of interest shown in Goldfish-keeping, and its rapid and continuing increase in popularity; while scores of importers, as well as specialist breeders, are scattered throughout the British Isles.

And to hobbyists: create the demand. If you don't ask, you won't get. True, at present, even when you do ask you may not get immediately, but with a little perseverance on the part of both the hobbyist and retailer alike, the appreciation of the

Goldfish in Britain will continue to flourish.

Why so common?

Despite the number of weird and wonderful varieties of Goldfish available today, still the most popular is the Common Goldfish.

Didn't we all begin the hobby with a fish won at the fair-ground, eventually to become bitten by the coldwater "bug" or to diverge our interest into other aquatic areas?

For many of us, the Common Goldfish is still the favourite of all the Goldfish varieties.

But what deed has it committed to deserve the most demeaning label which can be bestowed upon any living creature?

The term "common" is hardly appropriate for such a graceful and colourful fish — surely we can find a more fitting description.

Frank Orme provides a most

apt suggestion in "Fancy Goldfish Culture": "... common in form it may be, but Royal by lineage!"

So, might I suggest that a new name is adopted for the so-called Common Goldfish? I would be delighted to receive suggestions from readers, but meanwhile, I should like to set the ball rolling with . . . Royal Goldfish.

Any ideas . . . ?

Never mind the quality . . .

With the coldwater show season almost upon us, preparations are already in progress to bench, perhaps for the first time, the results of last season's spawnings.

Some dedicated enthusiasts have already produced fish for showing from this season's offspring.

So, what on earth do they do to achieve such rapid growth? I have even heard of Goldfish which have been "forced" to reach sexual maturity within six months. Surely this cannot be right.

I would bravely suggest that fish which have been "turbo charged" to impress the judges must be consequently weaker, as must their subsequent offspring.

I am sure readers would be interested to hear the views of those who have achieved such rapid growth, and whether faster growth has an inverse correlation to lifespan.

To those who despair when they compare the size of some of the fish in the breeders classes with their own fish, take comfort in the fact that quality is better than quantity. And, after all, your fish may well take another three years to reach a similar size, but I would hazard that it will possess far more potential show-winning years than any "instant goliath".

STOP PRESS

The Midland Koi Association Open Show will be held at Baginton Village Hall, Baginton, Coventry (just off the A45 — at the end of the M45) on Sunday, 3 July. Full details from David Twigg, (Secretary), 24 Cocksparrow Street, Warwick CV34 4ED. Tel: (0926) 495213.



Above, the Chocolate Oranda has become a firm favourite among Goldfish-keepers over recent years, yet is rarely seen in retail outlets.

Below, new varieties should be encouraged by retailers, who seem reluctant to "have a go" with Fancy Goldfish. Who knows, with their support, new strains such as this Redcap Phoenix may well become, in future years, as popular (and as profitable) as the Moor, for example, is today.



CARY LEWIS

New UK Toad Tunnel

As part of the FFPS 1988 Toads on Roads campaign, the UK's second FFPS/ACO toad tunnel was opened in March near Stamford Bridge, Humberside, to help save thousands of migrating toads from death on the road. The toad tunnel is situated one mile south of Stamford Bridge, on the Fangfoss minor road, where thousands of toads face death each year as they cross the road on a traditional migration route.

Following an awareness campaign by local residents, the toad tunnel has been installed by Humberside County Council Technical Services Department with support from ACO Polymer Products Ltd, and the Fauna and Flora Preservation Society.

Each spring, toads migrate to ponds to spawn, but they need help because the number and quality of ponds in rural areas is declining. Toads tend to use traditional routes to their ponds and the new toad tunnel will help save toads from death on the road because guide fences funnel the migrating adults into the tunnel entrance, allowing them to pass safely under the road. In addition, the toad tunnel is good for road safety, as motorists will no longer be forced to swerve to avoid migrating toads.

The FFPS urges the sympathetic design of all new and widened roads to incorporate inexpensive signs, fences and tunnels for toads and other wildlife.

Further information on toad tunnels: Derek Humphries, ACO Polymer Products Ltd, Hitchin Road, Shefford, Bedfordshire SG17 5JS. Tel. (0462) 816666.

Further information on toads: Tom Langton, FFPS. Tel. (01) 387 9656.

Note: Following the success of the first UK toad tunnel, in June 1987 (reported in *A&P*) an ACO toad tunnel was installed at Schleswig-Holstein, North Germany and in November 1987 two ACO tunnels were installed in Massachusetts, USA at a migratory crossing for Spotted Salamanders.

'Aquarian' Advisory Service Lecture Tour

For many years an important part of Dr. David Ford's work as Head of the 'Aquarian' Advisory Service, has been his visits to aquatic clubs and societies around the country to lecture about fishkeeping and talk with aquarists about the hobby.

For the remainder of 1988 David has a busy schedule of talks ahead of him. He will present a double bill, 'The Aquarian Story' which outlines the development of the 'Aquarian' range and 'Fishkeeping around the world' a personal view of fishkeeping in sixteen different countries. In the case of the Koi societies he will present a special lecture on these very unique fish.

If you would care to join David and his hosts for an evening of lectures and discussions, he can be found on the following dates lecturing at shows and meetings as outlined below. All the host societies and clubs will be delighted to welcome newcomers and members alike — if you're not a member of your local society, here is an excellent opportunity for you to meet the members

and join the club.

2 July: Shrewsbury Aquarist Society. An evening lecture. For further details contact the Secretary, Mrs M. Highfield, 30 Severn Street, Castlefields, Shrewsbury, SY1 2JA.

12 July: Bracknell & District Aquarist Society, Station Hotel, Station Approach, Ascot, Berks. An evening lecture starting 7.30pm. For further details contact Mr Ian Legge, 17 Clive Green, Bracknell, Berks, RG12 4JT.

8 August: Breckland Aquarist Society. An evening lecture at the Adult Training Centre, Rashies Green Industrial Estate, Toftwood, Dereham, Norfolk. For further details contact Mr Paul Blanchette, 70 Gravel Hill, Stoke Holy Cross, Norwich, NR14 8LH.

4 September: Cardiff & District Fishkeeping Society's Annual Open Show. For further details contact Chairman, Mr Graham King, 12 Dickens Avenue, Llanrumney, Cardiff.

6 September: Preston & District Aquarist Society. An evening lecture starting 8.00pm. For further details contact the Sec-



Dr. David Ford

retary Mr A. McFarlane, 70 Princess Way, Euxton, Chorley, Lancs.

1 October: Midland Koi Association. An evening lecture. For further details contact Secretary, Mr D. P. Twigg, 24 Cocksparrow Street, Warwick CV34 4ED.

New Koi Centre opens in York

On Saturday 19 March at 11.00am a brand new purpose-built Japanese Carp centre opened at Acaster Malbis, near York. The event marked the realisation of a long-standing ambition for local enthusiasts, Pauline and Ken Smith who, with the help of York businessman Bob Sumner, will be operating this 30,000 gallon Carp centre.

The completion of this purpose-built development, known as Clear Water Koi Direct, follows the increasing interest shown in Britain by 'Koi' fanciers. Although expensive specimen Koi will be available, Pauline Smith points out that at Clear Water Koi Direct, there are prices to suit all pockets.

Clear Water Koi Direct at Acaster Malbis is open daily from 11am to 7pm, seven days a week. In addition to a constantly changing display of quarantined fish there is also a wide range of accessories and feeds with plenty of free advice and guidance for newcomers.

For further information contact Bob Sumner (0904) 611777.

To help frogs, toads and newts, just call hopline!

A telephone help-line to put pondowners and aspiring frog breeders in touch has just been launched in Milton Keynes.

The service — "Hopline" — is a joint venture between the Milton Keynes Development Corporation and the Milton Keynes Natural History Society. It will help conserve Britain's amphibians, such as frogs, toads and newts, which are under constant threat from loss of their natural habitat. Thousands of amphibians also die every year as they cross busy roads to reach breeding grounds.

Hopline is a simple information service, mainly for the Milton Keynes catchment area. For instance, anyone wanting spawn for their pond can call

Hopline and be given the name and telephone number of someone who has spare spawn.

Information will also be available on what makes the best pond and how to look after its prospective aquatic residents.

"This is a marvellous chance for everybody to do something towards conservation," enthused Jan Phillips, the Corporation's environmental education officer. She stresses that callers must be prepared to allow their names and telephone numbers to be given to other Hopline callers.

The Milton Keynes Hopline is open Mondays to Saturdays from 3.30pm to 5.30pm. Just dial Newport Pagnell (0908) 614735 and ask for Mr or Mrs Page.

Letters

Water change — A benefit to the fish — A fertiliser for the plants

Most people I know who keep tropical fish seem to keep house plants as well.

I am useless with plants — I find it very difficult to keep even a cactus. But(!), some time ago, I noticed that the plants growing in the area of the garden where I was emptying my aquarium partial water changes, were extremely healthy and "fruitful". I thought about it and came to the conclusion that these partial water changes were extremely good fertilisers. So, I started watering my last surviving plant indoors, which was a rubber plant with a death sentence, with this aquarium water. Since then, it has not only survived, but grown tremendously.

As a result, I now have a houseful of healthy plants and fish and, since I now have so many plants in my tanks, I have to carry out a lot of regular water changes, with the fish, obviously, thrive on. So, don't make that partial water change a chore and pour all that plant food down the drain — just give it to the plants; both they and your fish will thank and reward you.

Ricky Williams
Barnsley,
South Yorkshire.

International Cichlid Conference (Preliminary Notice)

The American Cichlid Association (ACA) is hosting an International Cichlid Conference (ICC) in Orlando, FL on 10-13 August, 1989. As a member of the Steering Committee, I would like to provide you with the preliminary planned activities.

Some of the activities we are scheduling include: Seminars by the world's leading experts on cichlids — both Old World

and New World, a special seminar on the recently discovered "Angelfish Disease", an auction of cichlids — both wild-caught and domestic-raised, fish farm tours, interchange among cichlid groups around the world, a mini-trade show, and tours of the aquarium exhibits at Epcot Center and Sea World. We feel this line-up of activities, plus the close proximity of family tourist attractions such as Walt Disney World, Sea World, and Florida's extensive beaches, will make this conference attractive to many hobbyists and their families from the United States, Europe and maybe even other countries.

The early support of our conference has been very strong by aquarium industry leaders and fish farmers in the United States. This has given us the encouragement to move into the next phase of planning and secure commitments from speakers and sponsors.

Dr John Gratzek has already agreed to participate and we anticipate several other researchers joining in. We feel this aspect of the ICC will be of considerable interest to the hobbyist, the fish farmer and the industry at large.

With proper advanced publicity and planning, we are hoping for a strong European attendance. We feel it is time for the cichlid enthusiasts around the world to come together to share in the beauty and fascination that makes cichlids the most popular aquarium fish in the world.

David D. Herlong
ACA Steering Committee
International Cichlid Conference

Editor's Note

Thank you, David, for the

"early" news of the ICC. We, at A & P, will be pleased to help you publicise the conference in the coming months and hope that this will lead to the type of response which such an important event deserves. Any A & P readers interested in receiving further details should contact David at 131 Brannigan Pl. Cary, NC 27511, USA.

John Dawes

Sexual equality in North Bucks

The North Bucks Aquarist Society lives and meets in the 'New City' of Milton Keynes. It has some 40 members — and wives! Wives are extremely useful; not only do they make the tea, but they also do the washing up. It is the strangest thing that this fascinating hobby of ours is almost entirely a male preserve, not to mention a hotbed of sexist remarks. I wonder why.

Let me give you some examples: "Ladies," called our Chairman when allocating jobs for the forthcoming Closed Show, "You'll 'man' the canteen won't you?" — he didn't even pause for an answer! And how often have you heard the Guest Speaker extolling the virtues of a plump female Platy with "I like my females well-rounded..." Oh, snigger, ha ha... yet never a mention of a gonopodium! Well — this year the North Bucks wives strike back with a stand for equality!

We are having a 'Ladies Nite'. We will organise the events and run the show. Just to quell any nervousness we

might be feeling, we've been told by the male members that we won't have to do anything on fish if we don't want to... Well — really! But try finding a female aquarist guest speaker; I can tell you they are few and far between — and when did you last see a lady judge? Yet there are plenty of us who enjoy the hobby every bit as much as our male counterparts, and some of us even win the odd trophy or two. Come on ladies — where are you?

We shall enjoy showing the men in our club what we can do outside the kitchen — maybe even teach them a thing or two (like how to convert a cutlery drainer into a large box filter, perhaps), and guess what — we've actually persuaded the men that on that one night of the year, they will do the teas. (We're bringing flasks!)

Jo Ann Field
Vice Chairman,
N.B.A.S.

Thanks for the thought

As the lucky winner of the recent Tetra "Food for thought" competition, I would like, through your pages, to thank all concerned for a truly wonderful weekend in London.

Thank you Tetra for putting up the prize, and Jackie King and Ian for their company on Saturday afternoon (superb meal and visit to London Zoo) and A & P for an excellent aquatic monthly.

D. Weaver

Editor's Note:

And "Thank you", Mr Weaver for your kind note.

John Dawes

FRED THE PIRANHA.



News from the societies

Catfish Association of Great Britain

(Northern Area Group)

The Northern Area Group was formed in 1979 when a group of northern aquarists and a C.A.G.B. member joined together to discuss and share experiences on keeping and breeding catfish. Since then, the Group has gone from strength to strength, with the present membership being in excess of 100.

The Group meets monthly (usually on the third Friday of the month) and gatherings generally consist of a talk and/or slide show on a subject associated with catfish, such as breeding, feeding, diseases and water chemistry, much of which is equally applicable to other types of fish. The remainder of the evening is usually occupied in a less formal way, with table shows, raffles, auctions and conversation with other fish-keepers.

The Northern Area Group also holds outside events such as Open Shows, Auctions and



an Annual Convention.

Single membership: £3.50; Family: £4.25; Junior: £1.00.

Telephone or write to J. T. Morris, 102 Cale Lane, New Springs, Wigan, WN2 1HB. Tel: (0942) 42386, who will forward an information pack containing full details of the dates and venues for future meetings and a list of forthcoming events.

Association of Aquarists

1. The Tableau Competition which will be held in conjunction with the 'Aquarian' Fish-keeping Exhibition at Sandown

Park on 18-19 June, will be judged as follows:

Criteria	Points
Fish/Aquatic Content	20
Design/Originality	20
Environment/Technical Expertise	20
Visual Attraction	20
Theme/Information/Fun	20

The sponsors are hoping for an increase in the quality of display, with each tableau to have a definite, clearly understood theme, or provide information which explains what the tableau represents. To this end, they have altered the expenses as follows:

Expenses per stand increased to £60.00.

Prize monies as last year.

Mileage band as last year.

An additional award of £100 worth of free 'Aquarian' food will be made to a society where the sponsors feel that the display is of a high standard and meets the above guidelines.

2. Big is Beautiful

Have you a large fish, the bigger the better? There will be a special 'display only' class at Sandown this year for BIG AND BEAUTIFUL fish. No entry fee will be charged, but every exhibit will receive a donation from the sponsors. Details from Adrian Blake (0256) 465461 (Business hours - 8.00 a.m. - 5.30 p.m.)

Halifax Aquarist Society

The new Secretary of the H.A.S. is Stuart Hardie, 120 Allangate, Rochdale Road, King Cross, Halifax, West Yorkshire, HX2 7HD. Tel. (0422) 45978.

Diary dates

Northumbria Goldwater Fish & Pondkeepers Society

The Annual Open Show of the above society is scheduled to take place at the Moorside School Community Centre, Beaconsfield Street, Newcastle-upon-Tyne on 5 June. Benchling: 11.00 a.m. - 1.30 p.m. Judging: 1.30 p.m. Exhibitors: 15p/entry. Visitors: 15p each. Further details from Harry Kennard (Secretary), 22 West Park, Morpeth, Northumberland, NE61 2JP.

British Aquarists Study Society

B.A.S.'s second spring meeting will take place on Saturday 11 June in the Watling Room of St. Stephens Parish Centre, Bricket Wood, nr. St Albans. Time: 2.00 - 5.00 p.m. For further information, contact the General Secretary, V. B. Hunt, "Caeglas", 120 London Road, Widley, Nr. Portsmouth, Hants

PO7 5EW. Tel. Waterlooville 250 160.

Cannock & District Aquatic Society

This year's C.D.A.S. Open Show will be held on 12 June at the Avon Road Community Centre, Cannock. Details from the Secretary, Mrs Anita Davies, 45 Milton Road, West Chads Moor, Cannock, Staffs.

Deal & District Aquarist Society

The D.D.A.S. 1988 Open Show will be held on Sunday 12 June at the T.A. Centre, Middle Deal Road, Deal, Kent. Contact Mrs Avis Hayward, 9 Meryll Gardens, Walmer, Deal, Kent. Tel. (0304) 366 835, for further details.

Newton Aycliffe & District Aquarist Society

The 5th N.A.D.A.S. Open Show will take place on 12

June at the Elmfield Community Centre, Rowan Place, Newton Aycliffe. Booking in: 11.00 am - 1.00 pm. Further information from Jeff Chalklands, 7 Allan Walk, Newton Aycliffe, Co Durham. Tel: (0325) 313035.

Staveley & District Aquarist Society

The 5th S.D.A.S. Open Show will be held at Middlecroft Leisure Centre, Staveley, Chesterfield, on 12 June. Contact Mrs Caryl Yates (Secretary), 47 North Road, Clowne, S43 4PG. Tel: (0539) 811220 for further information.

Workington & District Aquarist Society

W.D.A.S. are holding their 1988 Open Show on 12 June at the Carnegie Arts Centre, Workington. Schedules, etc., from the Secretary, G. Chestney, "San Juan", Jack-

trees Road, Cleator Moor, Cumbria, CA25 5AY. Tel. (0946) 810 116.

North Bucks Aquarist Society

The N.B.A.S. Open Show will be held at Wolverton and New Bradwell Youth Club, Alesbury Street West, Wolverton, Milton Keynes on 19 June. Contact the Show Secretary, D. Black, 48 Durham House, Somerset Close, Bletchley, Milton Keynes, MK3 7HL. Tel. (0908) 641 391 for further details.

Romford & Beacontree Aquarists' Society

The 1988 R.B.A.S. Open Show will take place on 26 June at the Parkside Community Centre, Goodmayes Lane, Goodmayes, Essex. Schedules, etc., from the Show Secretary, B. Brown, 12 Tiptree Crescent, Clayhall Avenue, Ilford, Essex, IG5 0SZ.

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

Tropical Axolotl problem

One of my Axolotls is having difficulty feeding. I use meat scraps, including liver and raw beef. The affected specimen accepts the food readily but then spits it out, after chewing it as though it is causing pain. Please advise me on what to do.

Sorry to read of the problem with the Axolotl but there is not enough evidence to make a realistic diagnosis. You should take it along to your local vet, but ring first to make sure (s)he feels able to deal with the animal (if not, (s)he has contacts within the profession who can advise, but it is better if this takes place before your visit).

Your diet of meat scraps may cause problems, being deficient in essential nutrients, particularly Calcium. You should insert a good-quality flake food in the chunk of meat and try other chunky foods. The rule is that if you can eat it, they can eat it!

Koi How often — how much?

How often, and how much, should I feed my Koi?

It is difficult to be specific on this question as many factors affect the feeding behaviour of

Koi. Health, weather, and time of year, all affect the amount of food to be given, quite apart from the size and quantity of Koi concerned.

In general terms, Koi should be fed as much as they can eat within a period of five to ten minutes. It should be remembered that Koi do not have a stomach, like us, and cannot store food away for digestion later. Therefore, to keep them healthy, and to get the best growth possible, we should feed our fish little, but often. Over-feeding, apart from being expensive, can be unhealthy, as uneaten food will decay and eventually pollute the pond.

It is easy to work out the quantity you personally need to give your Koi. Just keep adding a little food at a time for five to ten minutes. The idea is that your fish should be feeding consistently for the time allowed, and that little or no food is left at the end of the period. Do this on two or three occasions and you should have a good idea of the quantity to feed normally.

Some adjustment will have to be made to this quantity due to weather conditions. The colder it is, the less food will be eaten, so adjust your quantity accordingly. It is better to underfeed slightly than overfeed.

If you find food left after feeding your usual amount, and the weather has not changed, then observe your Koi. If it happens more than once, then your fish may be suffering from a parasitic infection, so call in advice if you do not feel confident in diagnosing any problem that may have come to light.

Marine Best possible start

After many years of "nearly" setting up an aquarium I have finally decided to go ahead and do it. I am only interested in

tropical marine creatures, and so, my first aquarium will measure 72in x 20in x 18in vertical height.

I intend to purchase the following equipment:

3 powerheads operating three 24in undergravel filters

1 external powerfilter (high capacity model)

3 fluorescent light tubes

1 ultraviolet steriliser

1 ozoniser

1 protein skimmer

My stock will include fishes, invertebrates and algae. These are my plans. I would appreciate your comments and advice.

What a pleasant change it is to find an absolute beginner who is prepared to invest in a good-sized tank from the outset. Your new six foot long tank will have a gross capacity of 936 gallons. After allowing for water displaced by the coral gravel/coral sand filter bed and living rocks it will hold approximately 80 gallons of seawater. Such a large volume of seawater will obviously be much more biochemically stable than the 18 or so gallons of seawater in the usual beginner's three foot tank, and so, your likelihood of success is that much greater.

Since you indicate that you intend ultimately to stock invertebrates, algae and fishes, it is vitally important, in the interest of the invertebrates and

Coral reefs take countless years to evolve — so patience is the key when attempting to produce artificial equivalents in aquaria.



algae, that you don't try and economise on the lighting of this tank. For an 18in deep tank you will need at least four 5ft long fluorescent tubes which should be two "NORTH-LIGHTS", one "GRO-LUX" and one "ACTINIC BLUE" tube. If your lighting hood is made of aluminium, please make certain that the cover glasses are a tight fit and that the interior of the hood is well-covered in white paint. This will prevent the seawater splashes from forming toxic aluminium salts. Ideally you should use a plastic hood.

Once you have matured the two filterbeds, (ie the U/G and the powerfilter), to the extent that there is no toxic nitrite in the water, your system is ready to receive two or, at the most, three hardy beginner's fishes. In a tank as large as this I would recommend one Humbug Damsel, one Electric Blue Damsel and one Yellow-tailed Blue Damsel. Spend the next 2-3 months in learning how to feed these three fishes without causing a re-occurrence of toxic nitrates in the seawater. This "running-in" period will complete the maturation of the filtration system and at the same time give you invaluable experience in perfecting the golden rule of coralfish-keeping, namely, that never, even one uneaten morsel of food, be allowed to reach the floor of the tank.

At this stage I suggest that you carry out a one third water change before commencing to add two or three hardy invertebrates each fortnight. Whatever happens at this stage, do not be tempted to rush things by buying too many creatures too quickly. Each new animal which you add to the aquarium increases the biochemical loading on the filtration system and the nitrifying bacteria must be allowed time to multiply and cope with each new increase in the load.

Once your invertebrate collection is complete — and please realise that this slow building stage alone can take as long as six months — you are ready to add the final fishes to your collection. Again, add the fishes to the aquarium very gradually — say one new fish each fortnight. With 80 gallons of seawater as heavily filtered as this, you could increase the fish population to a maximum of one inch of fish to each four gallons of seawater, ie. 20 inches of



Lilaopsis novae-zelandiae, seen here in the foreground, is an excellent "lawn-producing" aquarium plant.

fish, less the three "starter" damselfishes, leaving around 16in of fish stocking remaining. However, in view of the considerable stock of invertebrates which you will have acquired by now, half this stock (ie. another 8in of fish) would be wiser. The presence of the invertebrates and *Caulerpa* algae means that you should only buy fishes from the following list: Wrasse, Dwarf Groupers, Anthias (Wreckfish), Cardinalfish, Gobies, Dragonets, Blennies, etc., ie. fishes which won't eat your invertebrates and algae.

One final word of warning — DO NOT attempt to rush things. The living reefs took many millions of years to evolve, and a replica in the home cannot be created in a few days, or even a few weeks. Patience is the keyword for success in creating a miniature living reef in the home.

Hydrometer nonsense

I gather that a hydrometer must be left floating in the aquarium to warm up before a reading is taken. Is this true?

Absolute nonsense! The coefficient of cubical expansion of glass is so low that there is absolutely no need to warm up hydrometers... unless (per- versely) you store yours in the 'fridge!

Plants Coldwater Top 5

What, in your opinion, would be the best five plants for a coldwater tank? Please include details of whether the plants are suitable as foreground, middle-ground or background subjects.

For the background I would select *Egeria densa*, *Ludwigia mulleritii* and *Myriophyllum elatinoideis*. As a specimen plant, especially for larger tanks, *Nuphar luteum* is unbeatable. My choice for the foreground would be *Acorus gramineus* var *pumilus*, and the diminutive lawn-forming plant from New Zealand, *Lilaopsis novae-zelandiae*.

Samolus & Black Amazons

Would you please supply me with basic information on Samolus floribundus and Echinodorus peruensis?

1. *Samolus floribundus* is native to North America. It is happiest in temperatures of 55°F-70°F (13-21°C). pH and Hardness readings are not critical. It likes a brightly lit position.

2. *Echinodorus peruensis* is an Amazon Swordplant commonly called the Black Amazon owing

to the brownish veining on the leaf blade. It is thought to come from the western side of South America, but this is not certain. The proper name for this plant is now *Echinodorus parviflorus*, but the old synonym is still used in the trade. It produces up to 50 leaves in the rosette. It also produces numerous plantlets from the flower spike. However, if large numbers are produced, the parent plant often dies. Remove the babies and replant when 3in in height. In all respects treat as for other Swordplants.

Coldwater Filtration suggestions

At present I have a tank holding "21 inches" of fish and will shortly be transferring them to a new 48in x 12in x 18in aquarium. I will be using "Algarde" under-gravel filtration powered by a "Whisper 800" pump. I don't want to use powerheads because I think that the currents they generate will not be suitable for my Fancy Goldfish. However, I plan to supply internal power filtration by means of a "Rena 225". I would be very grateful for your comments.

Your new tank will hold a maximum of 24 inches of fish, even with the filtration, and under-stocking is wiser than over-stocking. Fish suffer stress when living conditions are crowded and outbreaks of disease are a common occurrence under such a regime.

You are quite correct in stating that goldfish are not happy in continually turbulent currents. Though they appear to enjoy swimming into a strong flow on some occasions, they are not able to tolerate this for too long.

I see no reason why your choice of filtration (under gravel in conjunction with with Rena 225) should not give you excellent results. Providing that you do proper weekly tank maintenance, then all should be well.

The Whisper 800, like the rest of the range, is excellent and, in my opinion, good value for money. It will be quite capable of tackling the job you have in hand. In fact, it is designed to cope with 10 to 135 gallon aquariums.



Photoblepharon, from the Red Sea, has switch-on/switch-off light organs.

LUMINOUS FISH

Frank de Graaf, keeper of the Artis-Aquarium, investigates one of the more unusual phenomena of the fish world

The ability to produce light is one of the strangest and most remarkable characteristics of many of the organisms in our oceans. We find animals like this from the surface, down to a depth of 4,000 metres. The highest concentration can be found in an area about some hundred metres beneath the surface to where sunlight can no longer penetrate.

Almost every group of animals living in the sea has species that produce light themselves, or assist its production. You can find them not only among microscopically tiny creatures like 'Radiolarians' and flagellata (among them the producers of the marine phosphorescence), but also among sponges, medusae, corals, anemones, sea-feathers, crabs, echinodermata, worms, 'mantle-bearing' creatures such as cuttlefish (*Sepia*) and even fish.

The luminosity of all these sea animals, as well as a relatively few land animals able to do the same, such as glow-worms, is based on complicated chemical processes. The light is created when the compound *luciferin*, which is a part of certain cells, is combined with oxygen. The result is oxy-luciferin and water. To produce this kind of reaction you need the help of a catalyst — in this case *luciferase* — which induces the reaction, but does not change its own consistency.

The transformation of luciferin into oxy-luciferin is not a simple process of combustion. Rather, there's a couple of quick intermediate reactions which result in quite a few chemical substances merging into one another. The final result of all these processes is energy, visible as light. By the way, this process is reversible, which means that oxy-luciferin and water can recreate the original luciferin.

This system of luciferin and luciferase is

probably not exactly the same in all luminous animals. For instance, if you mix luciferin of one particular species with luciferase of another one, light will be produced only when the animals involved are close relatives.

Cold light

The effectiveness of the process is one of the most interesting features of light produced in the above described way. When producing light with the help of electricity, we gain heat as well. By doing so, more than half of the original energy is lost. But when organisms produce their light, there is no heat at all, and that means no energy is lost. The result of one molecule of luciferin mixed with oxygen is one unit of light. In this case we can speak of 'cold light'.

There are bacteria that can produce 'cold light' as well, and they also use the luciferin-luciferase system. These bacteria are responsible for the luminosity of decaying fish and other animals, as well as mouldering plants.

Many sea animals, especially prawns, cuttlefish and fish, use light-producing bacteria as a fluorescent source, and accommodate colonies of them. The bacteria are supported by the host, so that we can speak of a real symbiosis.

The light is always produced in certain organs, called *photophores*, regardless of whether the animal itself produces the light, or if it takes advantage of bacteria. In any case, this happens with higher animals. Lower animals like some anemones and sea-feathers very often do not have these particular organs.

The photophores of higher animals are different in shape, size and colour. They can be built either very simply, or in a very complex manner. In the latter case, they are equipped with lenses, reflectors and facilities

to switch the light on and off. Fluorescent organs like these consist of a cup-shaped cavity, the inner walls of which are covered with red or black pigments, where the light can pass through. This cavity also contains a film of a sparkling texture, that works as a reflector. On top of this texture there is a cellular fibre, where the light is produced and eventually concentrated by a lenticular fibre. The lens can have a diaphragm as well, opened or closed by muscles, so that the light is adjustable. Sometimes you can find pigmentary cells on the lens, which provide the light with a certain colour.

There are many luminous animals which can move their fluorescent organs by muscles, turning them like a spotlight in certain directions. A strong blood circulation is a distinct characteristic of all the fluorescent organs, for the blood provides the oxygen essential for the luminosity.

Bacterial light in fishes

Instead of the light-producing cellular fibres, in which the animals produce the light themselves, there are also colonies of bacteria which produce light for their host.

Nearly all luminous sea fish live in deeper water, where very little, or no sunlight at all, penetrates. We find the highest concentration at a depth of between 700 and 800 metres. About 70 per cent of the fish species at this depth have one, or more than one, fluorescent organ. They belong to the families Ceratioidae, Serrasidae, Myctophidae and the Stomatoidae. Altogether, these groups, always living in free water, provide about 600 of the known species. Near the bottom it is the Macrouridae that possess fluorescent organs.

It is exceptionally difficult to study the light production of sea fish living in the deep sea, for those fish caught in deep water remain alive for only a short time, and can therefore hardly be examined. This is the reason why a lot of attention has been given to the few fluorescent species living in shallow waters near the coast.

There are just five of these, and all of them are Perciformes; the well-known Soldier and Squirrel fish are two of them. Two others, the Japanese *Monocterus japonicus* and the Australian *Cleidopus gloriomaris* live at a depth of between 20 and 300 metres.

Photoblepharon palpebratus of the family Anomalopidae — not to be mistaken for those of the family Myctophidae — live in shallower water, and especially close to coral reefs. *Photoblepharon palpebratus* lives in the vast area of the Red Sea as far as the Western Pacific Ocean, while you can find *Anomalops katopron* in the Indian and Australian archipelago. Both species are quite numerous, while the Caribbean *Kryptophanaron* seems to be a very rare species.

All these five species use colonies of bacteria in their fluorescent organs. *Monocterus japonicus* and *Cleidopus gloriomaris* have a small simple organ on both sides of the top of their lower jaw. Each fluorescent organ produces a strong bundle of light pointing diagonally towards the front and bottom. The light shines permanently; it cannot be switched on or turned off, and is

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AREND VAN DEN NIEUWENHUIZEN

In *Monocentris japonicus*, the Pine Cone Fish, the red light-producing organ cannot be "switched off".

obviously used for finding food on the bottom.

The bacteria of *Photoblepharon palpebratus* are situated in a bean-shaped organ beneath each eye. Actually, these organs are big glands consisting of many tubes very close together, in which there are innumerable bacteria, nourished by blood-vessels. The blue-white light produced is exceptionally strong, but in contrast to *Monocentris japonicus* and *Cleidopas gloriamaris*, it does not shine all the time. *Photoblepharon palpebratus* can switch the light on or off according to its need.

Photoblepharon palpebratus regulates the light by pulling a black lobe of skin from below to cover the fluorescent organ. *Anomalops katoptron*, in comparison, can turn the organ downwards on its axis, until the light-producing surface comes into contact with the cellular fibre, which is shaped like a sack and situated beneath the fluorescent organ. The Caribbean *Kryptophanarons alfredi* uses both methods to turn off the light. If it wants to produce short flashes of light, it pulls a black skin-lobe over the fluorescent organ. If it wants to interrupt the light for a longer time, it turns the organ into a black pigmented "cave".

Photoblepharon palpebratus, *Anomalops katoptron* and *Kryptophanarons alfredi* are all active during the night. During the day they retreat into the darkest grottos. As soon as it begins to get dark, they leave their hiding places and go hunting for plankton in front of the reef. Particularly on dark nights they join together into groups of from 20 to 50. Their permanently working fluorescent organs help them to spot prey, which is attracted by the light. In addition to that, the members of the shoal keep in contact by using light signals.

In Artis-Aquarium we watched *Anomalops katoptron* producing light for about eight to ten seconds, and then turning it off for about five seconds, while swimming calmly. When they were excited as, for example, when they were being fed, they switched the light on and off at a frequency of about one or two seconds.

It is remarkable how they change their swimming behaviour when excited. They then swim in a zigzag manner at high speed. They probably show the same behaviour in their natural environment, when trying to escape their enemies, which, like the prey, are attracted by the light. The fast zigzag movements of the shoal confuse the enemy, so that it scarcely has a chance to catch a fish. By the way, it is said that the enemies are blinded by the bright flashes as well.

In Indonesia, the fishermen make use of the fluorescent organs of *Anomalops katoptron* to attract fish at night. They either attach the fluorescent organs to the fishhook, or hang a basket filled with *Anomalops katoptron* underneath the boat!

Anomalops katoptron, as well as *Cleidopas gloriamaris*, have been kept alive for a couple of years in a tank in the Artis-Aquarium. The tank is always kept as dark as possible, for these species get terribly nervous in daylight. If it suddenly becomes very bright, they might even die of severe shock. Therefore, you cannot call them just ordinary guests!