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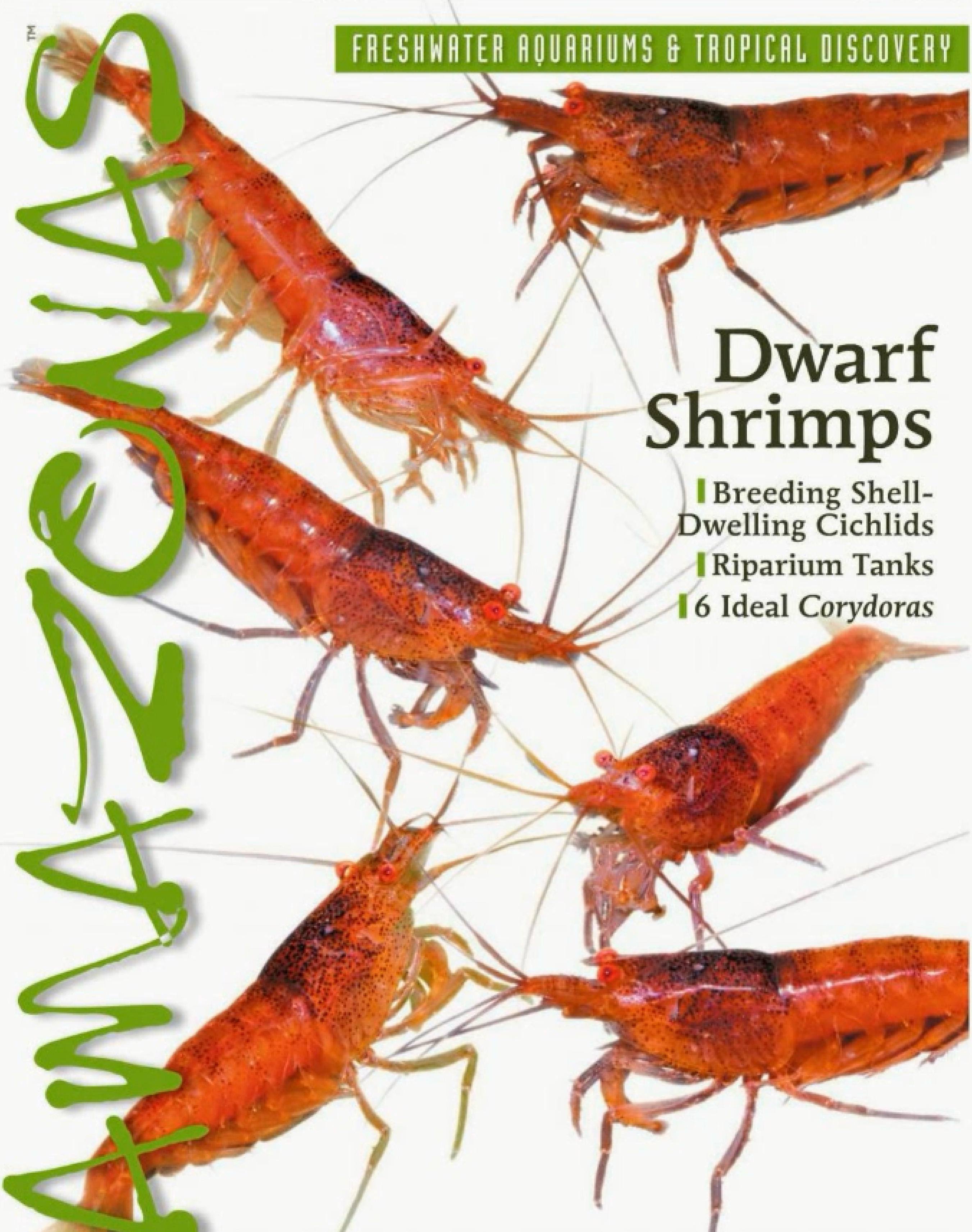

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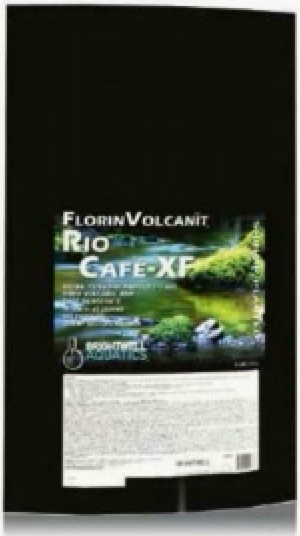

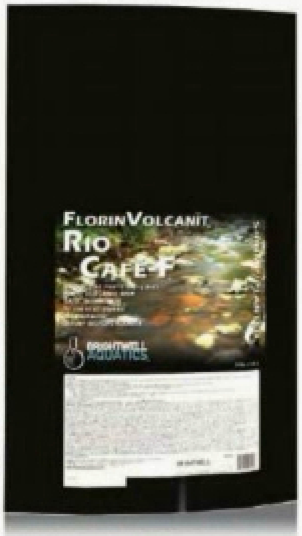

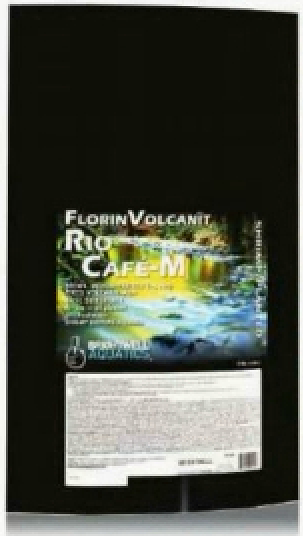

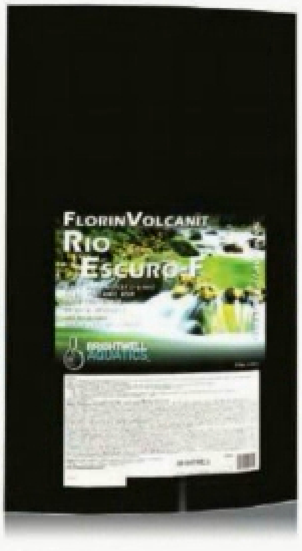

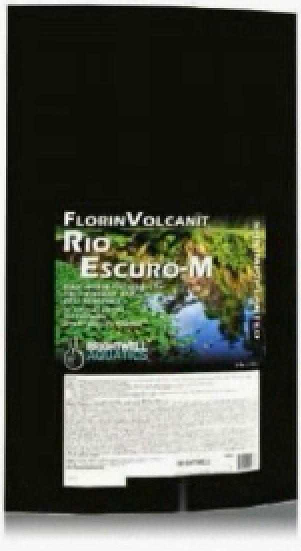

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AMAZONAS

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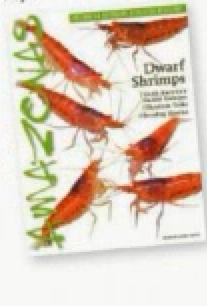
COVER:
Red-Spotted Shrimp, *Caridina* sp.
Photo by H.-G. Evers



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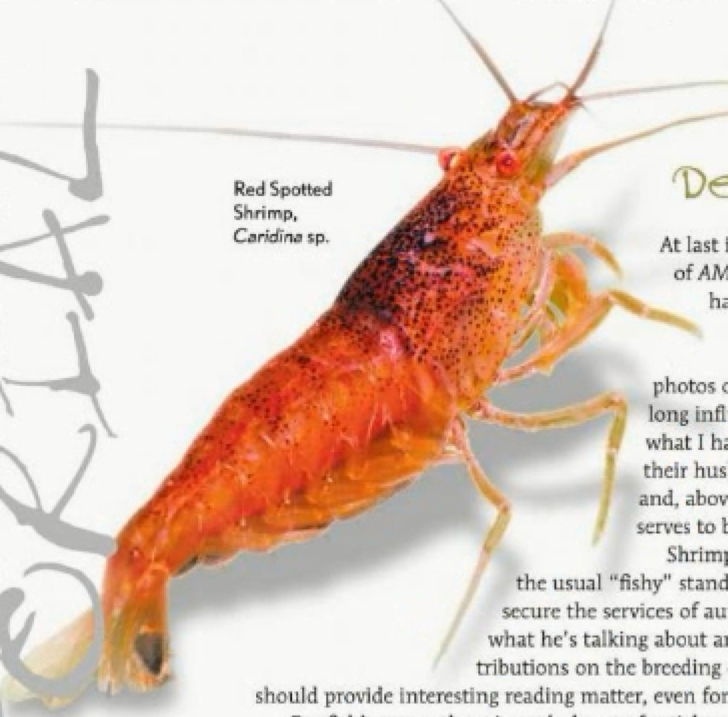

Red Spotted Shrimp, *Caridina* sp.

Dear Reader,

At last it has come to pass. You are holding the first issue of *AMAZONAS* to have shrimps as its main theme. We have, of course, always been happy to cover invertebrates, so it was just a matter of time before we addressed the subject in more detail. Stunning photos of some unbelievably beautiful dwarf shrimps have long influenced the aquarium scene, but as an aquarist, what I have always found lacking is good information on their husbandry. In my opinion, the successful maintenance and, above all, the breeding of these little crustaceans deserves to be a priority.

Shrimps are quite unlike fishes and cannot be judged by the usual "fishy" standards. I am very pleased that we have managed to secure the services of author Kurt Mack, an established breeder who knows what he's talking about and doesn't beat around the bush. Additional contributions on the breeding of dwarf shrimps complement his lead article and should provide interesting reading matter, even for the "fins-only" crowd.

For fishkeepers, there is a whole set of articles on fairly small species to discover and appreciate. Besides introducing an unusual rainbowfish and a very desirable dwarf cichlid, this issue includes a report on the first tentative steps in breeding a goby species that produces extremely tiny eggs.

We heartily welcome you readers who have just discovered the new English-language edition of *AMAZONAS*. We know that more than a few of you around the world are receiving both the German and English versions, and close reading will reveal that they do not match each other page for page or word for word. All the most important material is here, made even more international with new contributions from authors in the United States, the UK, and elsewhere. For example, good friend and *Corydoras* expert Ian Fuller, from the UK, has contributed a fine article on some armored catfishes he recommends to new aquarists; Devin Biggs of the United States writes about ripariums—fascinating new aquariums that are either half full or half empty, depending on your point of view; and Mary Bailey talks about a plant tough enough to stand up to the most rugged of cichlids.

We hope that *AMAZONAS* enhances your enjoyment of freshwater species and systems, and that we will earn your loyalty by delivering the type of articles and images that fuel the passion for freshwater aquariums that we all share!

Yours sincerely,

Hans-G. Evers

I. FULLER


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Portrait of the new arawana from Myanmar.

A new arawana from Myanmar

For some time there has been talk among Asian fish exporters about a new arawana, purportedly sighted in Myanmar (Burma). Ever since we heard the first rumors of these fishes we have been trying to get more information, and now we have managed to find photographs of a specimen. This makes *AMAZONAS* the first magazine in the world to present this new *Scleropages* species to the public. The species may not show much color, but it is the unique patterning on the large scales that makes this fish so attractive.

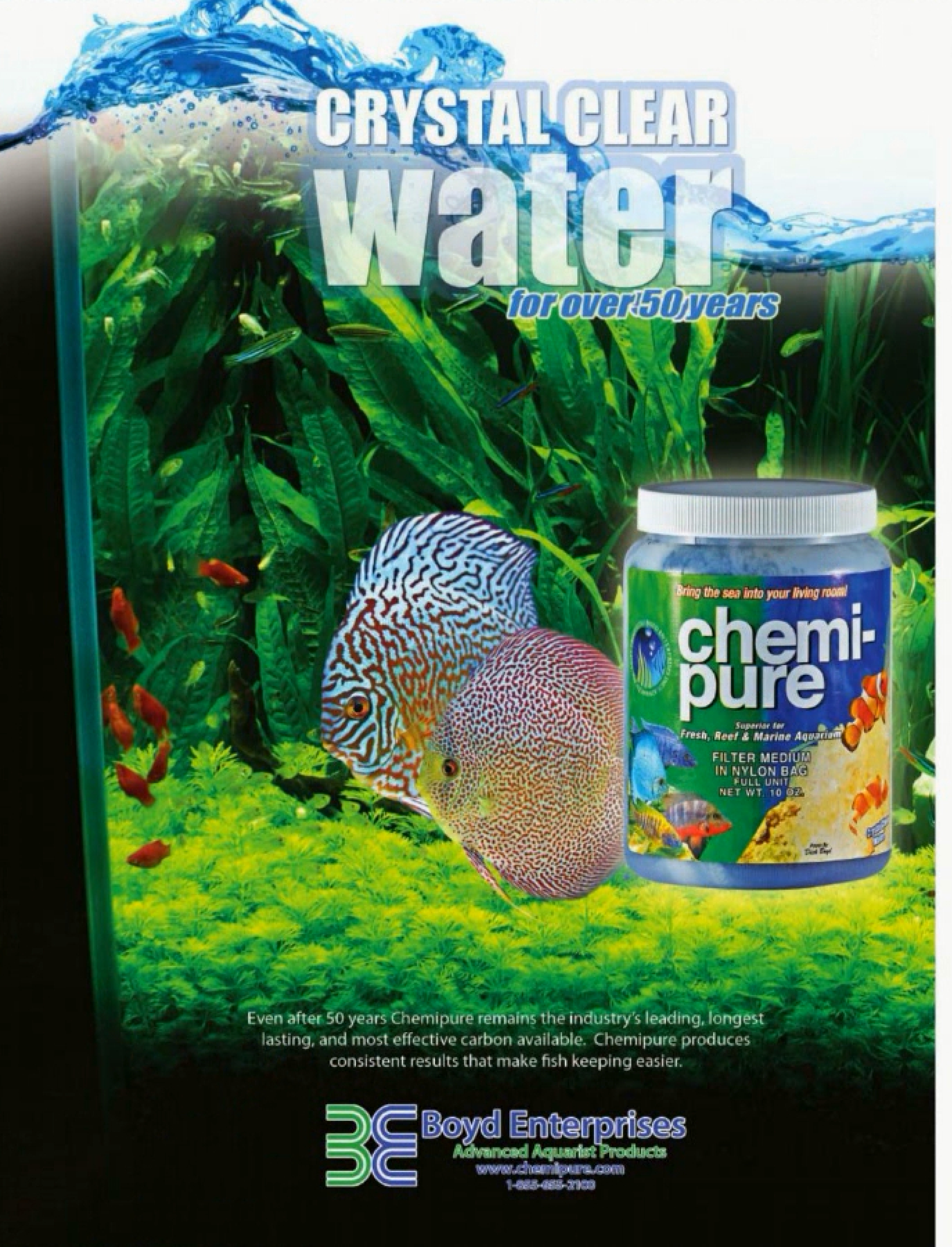
Most aquarists in the western world may be less than excited about the discovery of a new dragonfish, but Asian fishkeepers are enthusiastic about the new species, which apparently is somewhat smaller than the Asian Arawana, *Scleropages formosus*, and the other species from the Southeast Asian mainland. The fish's precise provenance remains a secret, and it cannot be assumed that large numbers of these fishes will be exported from Myanmar. Our correspondent Kamphol Udomrhitthiruj photographed the specimen shown here in an aquarium in Myanmar.

In Asia, the breeding of arawanas requires a major investment, but good breeders can earn big money with some species even though the first exports are not likely to be cheap. Only *Osteoglossum bicirrhosum*, the Silver Arawana, can legally be sold in the United States.

—*Editors*

Scleropages sp. from Myanmar, lateral view.

K. UDOMRHITTHIRUJ



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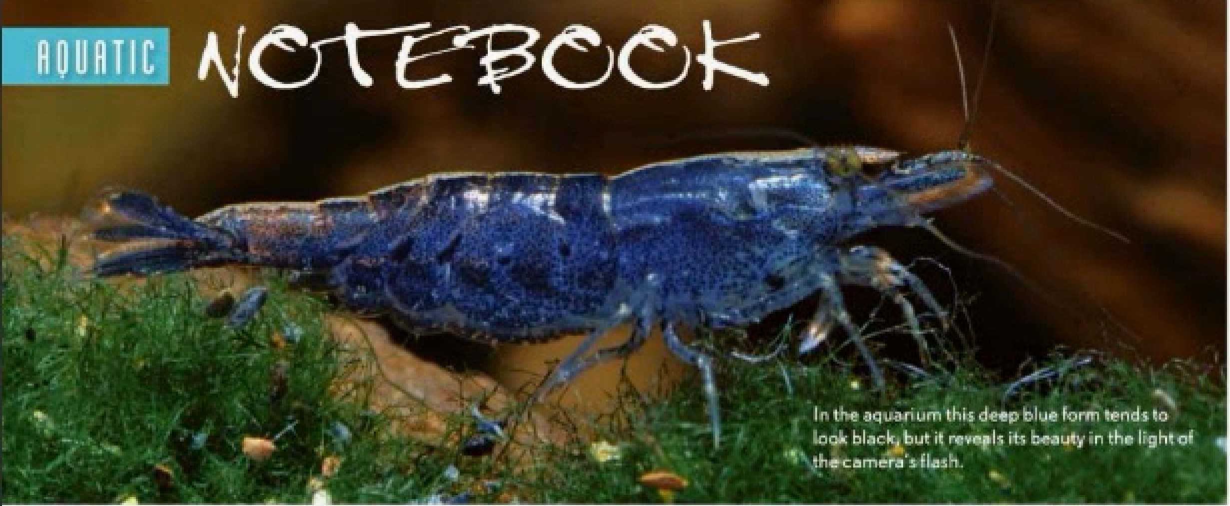


In the aquarium this deep blue form tends to look black, but it reveals its beauty in the light of the camera's flash.

Green shrimps • *article and images by Hans-G. Evers*

Grass-green *Neocaridina heteropoda* whose parents were a Chinese wild form.

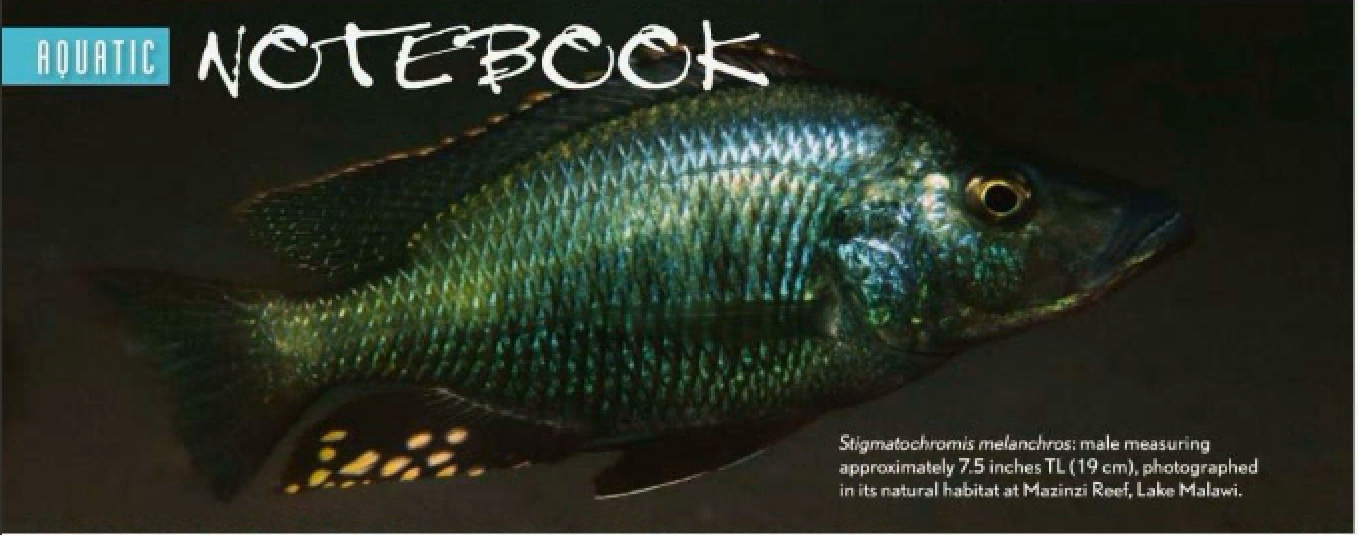
Neocaridina heteropoda's propensity for mutation has long been known. But sometimes new color forms occur for quite different reasons. Some time ago I obtained some *N. heteropoda* from Gerd Arndt of Aukrug, Germany, who had a number of specimens with very unusual green or dark blue coloration that had cropped up in different aquariums and from different strains.

Arndt had discovered a number of greenish specimens among the offspring of his brightly colored Yellow Fires. On close examination it can be seen they actually have a green-blue or turquoise base color. However, this coloration is very mood-dependent and can change to a pale green-gray within a few minutes. Water parameters may also play a part: Arndt's shrimps live in water with a slightly alkaline pH and an electrical conductivity of 600 µS/cm. When these unusually colored shrimps are transferred to soft, acid water, they lose their blue-green coloration and become gray or transparent.

The offspring of a wild-colored strain from Taiwan repeatedly include some that are very dark, almost black in color. The camera flash illuminates these specimens and reveals that they are deep blue, similar to the popular color form of the Tiger Shrimp. Interestingly, dark specimens like this occur only if there are fishes in the aquarium. Does the perceived threat of predation cause some specimens to change color? This phenomenon also occurs in the Red Cherry or Sakura Shrimp, which often exhibits its loveliest colors when small, peaceful fishes are also present in the aquarium.

Arndt also discovered a few small specimens that were grass-green, sometimes even bright neon green, that developed from a transparent wild form from China. This variant, too, becomes transparent again if it isn't maintained in hard, slightly alkaline water. These shrimps also lose their color when stressed, for example by transportation or transfer. It is strange that there are so few of these specimens; apparently they represent a genetic mutation that becomes evident under certain environmental influences on the phenotype. As far as I know, such phenomena have been little studied in shrimps and offer an opportunity for further work by shrimp enthusiasts.

Unusual progeny of a Yellow Fire.



Stigmatochromis melanchros: male measuring approximately 7.5 inches TL (19 cm), photographed in its natural habitat at Mazinzi Reef, Lake Malawi.

New species from Lake Malawi • *by Mary Bailey*

The genus *Stigmatochromis* is endemic to Lake Malawi in the East African Rift Valley, and comprises a small group of piscivores that feed on small fishes. Hitherto the genus has contained four described species: *S. woodi* (the type species), *S. modestus*, *S. pholidophorus*, and *S. pleurospilus*, plus a number of apparently distinct undescribed species. Various *Stigmatochromis* are sometimes seen in the aquarium hobby but have never achieved the popularity of some other Haps or the Mbuna, although they are not unattractive.

Stauffer, Cleaver-Yoder, and Konings have published a new paper describing two new species, *Stigmatochromis macrorhynchos* and *Stigmatochromis melanchros*, both of which are found in the southern part of the lake.

The type specimens of *Stigmatochromis macrorhynchos* were caught by the Malawi Fisheries Department off Domwe Island, the large island at the northern end of the Nankumba Peninsula, which separates the two southern arms of the lake. The largest specimen measured, the holotype, was about 5 inches (12.8 cm) long (SL). The name is from the Greek *makros* (large, long) and *rhynchos* (snout), referring to the elongate snout of the species.

The type material for the second species, *Stigmatochromis melanchros*, was collected by one of the authors (Jay Stauffer) at Mazinzi Reef, which lies to the east of the Nankumba Peninsula in the southeastern arm of the lake. In this case the maximum length (SL) measured, again the holotype, was about 6.25 inches (16.1 cm). The name *melanchros* is from the Greek *melas* (black) and *khros* (skin) and refers to the black color of breeding males. The species is very similar to *S. woodi* and is found sympatric with it, but the two differ in their breeding behavior: *S. woodi* males build nests on the open sand away from any rocks, while territorial *S. melanchros* males defend the vertical face of a large boulder on the sand near other rocks.

Although the paper doesn't mention this, *Stigmatochromis macrorhynchos* has previously been termed *S.* sp. guttatus in the aquarium hobby literature (Konings 2007), and *S. melanchros* is the same as *S.* sp. tolae (Konings, pers. comm.). *S. melanchros* is also known to occur at Mbenji Island and Chimwalani Reef and possibly elsewhere, while *S. macrorhynchos* is common in the southern part of the lake and has also been found off the Tanzanian shore in the north of the lake, where it has been collected for the aquarium hobby (Konings 2007).

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Left, *Stigmatochromis macrorhynchos*, non-territorial male measuring approximately 4.75 inches (12 cm), and right, female (right) measuring 6.75 inches (17 cm) TL, both photographed in the natural habitat at Mazinzi Reef, Lake Malawi.

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by Peter Günnel, Sr.

Color: sometimes less is more!

When I bought a dozen *Microgeophagus ramirezi* Electric Blue from a wholesaler friend in the fall of 2010, I had no idea of their genetic potential. My first thought on seeing these Butterfly Dwarf Cichlids was that I needed to change their appearance for the better. In physique they bore no resemblance to the normal *M. ramirezi*; their elongate body form was more similar to that of an *Apistogramma*. Their health also left a lot to be desired. What could be more natural than to change all this by in-crossing them with my normal Rams?

The F1-generation offspring were very similar to the normal *M. ramirezi* in coloration and body form, although they had a higher percentage of blue than the normal Butterfly Dwarf Cichlids and the females had three or four times as many emerald green dots on the middle of the body, leading me to offer them in the trade as *M. ramirezi* Emerald.

Because I planned to alter the physique of the *M. ramirezi* Electric Blue, I had to breed the F1 generation further. The results were as follows: Emerald 50%, Electric Blue 25%, normal 25%. To my surprise, however, there were also a few oddities among them. At first glance these looked to be "ugly ducklings," and only on closer examination did they turn out to be true jewels.

Sometimes less really is more. It isn't for nothing that *Microgeophagus ramirezi* (aka *Mikrogeophagus ramirezi*) is sometimes known as the Butterfly Dwarf Cichlid. A butterfly reveals its full splendor only when it opens its wings and flutters above us, and so it is with my ugly ducklings. When they spread their fins and "flutter" at

Opposite page, top: Pair of the Electric Blue cultivated form.

Opposite page, bottom: Bathed in light from the side (here in a rearing tank), the new cultivated form *Microgeophagus ramirezi* Brilliant, with its gorgeous iridescent blue scales, looks like it is covered in jewels! This page: Male of the Brilliant cultivated form in the aquarium.

LEFT AND OPPOSITE PAGE, TOP: H.-G. EVERS; RIGHT: A. GÜNNEL


adult form of the new species

Above left: Male of the Emerald cultivated form. Above right: Compared to the wild form, females of the *Microgeophagus ramirezi* Emerald variant have more metallic blue scales, particularly in the middle of the body.

each other like butterflies, and turn their bodies broadside to the light, they are splendid.

Now I am trying to fix this strain to breed true. The first fry are already free-swimming, and I can hardly wait for them to color up so I can see whether I have succeeded. In the process of breeding these fishes, I have created two new color forms: my Emerald and another that I have christened Brilliant.

I also have several additional new color forms swimming in my tanks, and my original specimens of *Microgeophagus ramirezi* Electric Blue have produced good quality youngsters that are very similar in habitus to normal Butterfly Dwarf Cichlids.

I hope this article will encourage other breeders to extract even more from the Electric Blue gene pool.

A. GÜNNEL

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Has the bell tolled for the Black Prince, *Characodon audax* El Toboso?

by Günther Schleussner

Five after midnight for the Black Prince?

Aquarists interested in the status of wild fishes are used to hearing bad news from the countries where our aquarium fishes are found. Recently we heard a tale of woe from the highlands of Mexico that will make fans of the Mexican goodeids (Goodeidae) very unhappy.

The two or three surviving species of the goodeid genus *Characodon* (Günther 1866) occur only in the drainage of the El Tunal and Mezquital Rivers in the northwest Mexican state of Durango. They have been considered extinct in the river system itself since the 1960s. Relict populations are now found only in residual still waters with no direct link to the main rivers.

It is generally agreed that all populations living upstream of the El Saltito waterfalls in the Rio El Tunal/Rio Mezquital should be assigned to the species *Characodon audax* (Smith & Miller 1986), known as the Bold Characodon. The type locality is some kilometers northeast of the city of Duran-

go in a spring-fed rock pool with an outflow at the village of El Toboso. The pool is called "El Ojo de Agua de las Mujeres" in the original description by Smith & Miller, but we also find the name "Manantial las Mujeres" on newer maps. The males from this location, known in the aquarium hobby as *C. audax* El Toboso, are characterized by velvet-black fins and silvery metallic flanks. This coloration, which is not found in any other *Characodon* form, has earned the fish the common name of Black Prince.

Unlike the habitats of most other *Characodon* forms, up until now the site for the Black Prince has been regarded as relatively secure. The pool is fairly large, with a surface area of some 10,385 square feet (964 m^2) and a depth of up to 80 inches (2 m), and the spring that feeds it is productive enough that there is no significant drop in water level during the dry season. Because the pool plays an important role in supplying water for El Toboso, the inhabitants of the village have a serious interest in its preservation (Artigas Azas, pers. comm.).

In the original description, Smith & Miller indicated that they were unable to find any other fishes in the pool—an observation confirmed by subsequent visitors, for example Uwe Dost (2001). But Dost also mentions the numerous Blotched Gambusias (*Gambusia senilis*) in a spring and its outflow in the yard of El Toboso's village school. He warns that these could be introduced into the Ojo de Agua, for example by playing children. Members of the genus *Gambusia* have already impressively demonstrated their invasive capabilities in waters all over the world, almost always to the detriment of the native fish species.

Uwe Dost's warning back then has turned out to be prophetic, as that seems to be precisely what has happened. The Mexican aquarist Juan Miguel Artigas Azas, well known in aquarium circles in the US and Europe, has been regularly visiting all the known locations for *Characodon* for around 20 years to get an overview of the situation at first hand. There was an unpleasant surprise awaiting him on his last visit to El Toboso, towards the end of the 2011 dry season. The spring-fed pool was full and the water quality was good. But the pool was now teeming with gambusias! Artigas went back to his car and fetched a net, but despite intensive efforts he was unable to catch even a single specimen of the Black Prince that day.

A good 10 years ago, the news of the purported extinction of the Black Prince pervaded the literature and the Internet (Ellenberg 2001). The announcement was quickly debunked by J. M. Artigas on that occasion. The report had been based on the statements of visiting aquarists from Europe, who had confused the Ojo de Agua de las Mujeres with the Laguna del Toboso at the other end of the village—which contains water for only part of the year.

This time the situation is quite different. Of course, Artigas's failure to catch any specimens of *Characodon audax* El Toboso is not conclusive proof that the form is extinct in the natural biotope, but when someone so familiar with the habitat is unable to find a single specimen, we have to assume that the Black Prince has at least become extremely rare.

This disturbing news should be reason enough for aquarists keeping the Black Prince to be even more careful than they were before about maintaining the aquarium population of the species.

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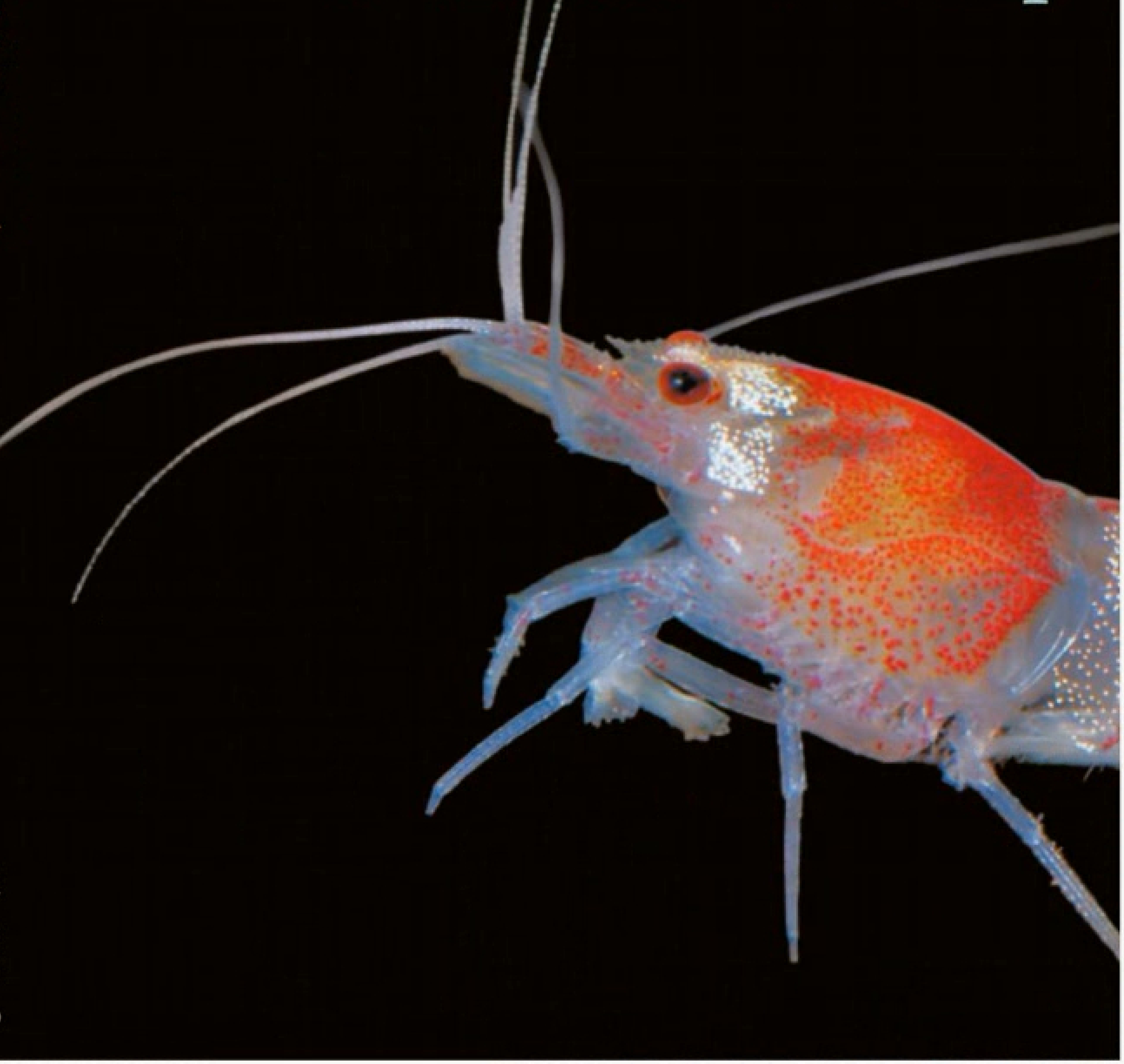


breeder for the world

The market is hungry—hungry for shrimps. In Europe and Asia, and now in North America (and probably wherever freshwater aquariums are kept), everyone is clamoring for these little freshwater crustaceans. Where do all these amazing shrimps come from? Are they all wild-caught? The *AMAZONAS* team has been hot on the trail.

—by Hans-Georg Evers

H.-G. EVERS

The basic Crystal Red has given rise to numerous other cultivated forms, such as this Red Bee Hinomaru.

H.-G. EVERS

Over three generations or more, Indonesia has established a tradition of being active in the international ornamental-fish trade. The bulk of the fishes exported from Indonesia to destinations all over the world don't originate from the rivers and lakes of this huge island nation, but instead are bred in captivity. For some years now, ever since the beginning of the dwarf-shrimp boom in the aquarium hobby that started in Japan and moved on to Taiwan and then central Europe, dwarf shrimps have also been bred there in huge numbers for the export trade.

It all began with the Red Fire or Red Cherry (as it was also known some years ago), a brilliant red form of *Neocaridina heteropoda*. The mass production of this shrimp caught on very quickly in Indonesia, and the initially high price was rapidly driven down by competitive price undercutting. I well remember the despondent complaints of the German mass-producers who found themselves unable to compete. But it has again become worthwhile to breed these little red shrimps at home; the big Indonesian breeders have turned their attention to more lucrative species and strains.

Crystal Reds

The name Crystal Red Shrimp (CRS) is on everyone's lips. Not the high-priced Red Bee Shrimp line-bred from it, but the good old Crystal Red, hundreds of thousands of which are being exported all over the world from Indonesia every month. Every major fish breeder on the island of Java, chiefly in the cooler highland area around Bandung, where the majority of fish farms are situated, now has one or more rooms dedicated to the breeding of *Caridina* sp. (Crystal Red).

During my visits to Indonesia in recent years I have been well placed to see the rapid advances that have been made in the commercial breeding of dwarf shrimps. I have even stealthily obtained a bit of insider information from my friend Jeffrey

The aquariums at Maju sit on welded metal stands and are blacked out at the rear with plastic sheeting.

Christian of CV Maju Aquarium, including a few tips that might be useful for breeders everywhere.

Essentials of successful CRS breeding

The main challenge with breeding the CRS, at least if you want to produce really large numbers of them, is guaranteeing permanently good water quality. Water, electricity, and labor are relatively cheap in Indonesia, so costs are a lot lower there than they are in Europe or North America, for example. Even so, a certain amount of expense is involved. Maju Aquarium is situated not in the cool of Bandung, but in the lowlands south of Jakarta. Every room used for breeding shrimps—currently three—must be air-conditioned to an ambient temperature of 73.5–75°F (23–24°C). The shrimps are most productive when the water temperature does not exceed 77°F (25°C), and a couple of degrees lower is better.

The water must be absolutely clean and free of pollutants. Maju's water comes from their own well and is stored in a huge tank. The aquarium uses large tanks with a volume of 132 gallons (500 L).

A glimpse of one of the air-conditioned rooms used for shrimp breeding.

H.-G. EVERS

The tanks are arranged in blocks of four. The filter is set into the floor; the filtered water is returned to a "post-filter chamber" at one side, then pumped back into the aquariums.

Newly set up 132-gallon (500-L) aquarium for breeding Crystal Reds, which have just been fed bloodworms.

Many of the popular strains of dwarf shrimp breed with direct development of perfectly formed juveniles and no larval stage. Egg clutches carried by the larger females can range in size from 10 to more than 100, depending on species, strain, conditioning, and age of the female. Newly hatched shrimp start feeding immediately on biofilms.

H.-G. EVERS

The breeding room at a business in Bandung, where there is no need for air-conditioning. The individually filtered tanks are noticeably less productive than the ones at Maju Aquarium.

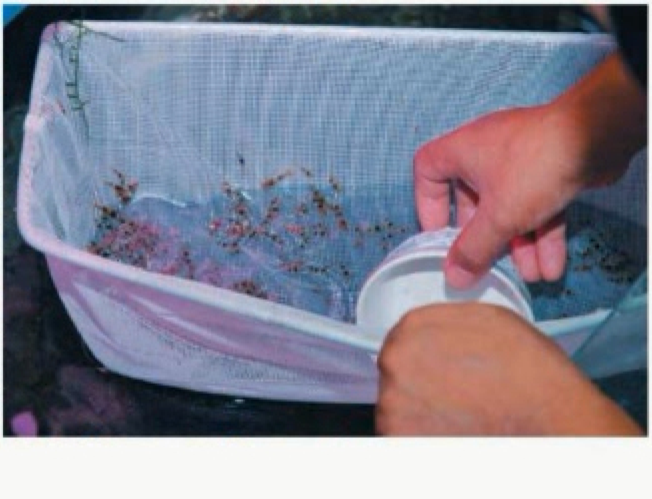
Every set of four such tanks is connected via a shared filter system, so the overall volume of each block of tanks is more than 660 gallons (2,500 L). Twenty to thirty percent of tank volume is changed every day. The result is that the water is extremely stable and immune to fluctuations in its parameters. The pH in all the tanks I checked was always around 6.5—occasionally somewhat higher, but never lower.

Powerful pumps return the filtered water from the central filter, pouring it into one end of each aquarium and thereby creating adequate oxygenation as well as driving off CO_2, thus stabilizing the pH. Water is siphoned off from the other end of the tank through a perforated, mesh-covered plastic tube and then disappears into the central filter set into the floor below. Cool water, plenty of oxygen, and a pH just below neutral are the three pillars of the successful breeding of the Crystal Red. Different conditions apply for other shrimp species, and are provided accordingly.

The tanks are initially set up with a layer of sand around 2 inches (5 cm) deep on the bottom. The décor consists of two small towers made of PVC pipes that serve as caves. Artificial lighting is used. Within a few weeks the Java Moss has grown immensely and serves the shrimps as shelter and a feeding place.

The initial population of each tank comprises 100

Day after day, the staff can be seen catching out the tank-bred shrimps that are ready for sale.



Punishing work: a yogurt container is used to sort the shrimps —for hours on end, seven days a week.

H.G. EVERS

This aquarium is planted with *Cryptocoryne pontederifolia*. The breeder increases the productivity of his aquariums by selling the plants. But catching shrimps in a tank where Java Moss is growing is easier: you can simply push the plants out of the way with a large net and drive the shrimps into it with your other hand.

Crystal Red with a high percentage of red.

Juveniles have contrasting bands.

shrimps. After around two or three months in operation the harvest can begin, and the half-grown CRSs are netted out to be sold. Each aquarium has a life of a year at most, usually somewhat less, before it is cleaned out thoroughly and set up again with a new population. Interestingly, the shrimps are fed on frozen bloodworms and spinach, both generally cheap in Indonesia.

Maju breeds mainly CRSs, but the first aquariums have also been set up for Red Bee forms, chiefly the Tiger Tooth and the somewhat more expensive Hinomaru variants that are suggestive of well-bred Kohaku koi.

A Japanese customer of Maju has recently sent them a few hundred specimens of valuable cultivated forms so that these can be produced in large numbers exclusively for him. They also have Blue Tiger Shrimps (*Caridina* cf. *cantonensis* Blue Tiger); the foundation stock on which their strain is based originated from Germany. They also plan a project involving Black Tiger Shrimps (*Caridina* cf. *cantonensis* Black Tiger).

A growing market

Japan is no longer able to satisfy the constantly increasing demand for these little red and white shrimps. Indonesian breeders satisfy a major part of the demand, but China has spotted the marketing opportunity and plans huge breeding projects. Maju currently employs 10 staff exclusively for the shrimp-breeding department, which to date comprises 300 aquariums producing around 30,000 shrimps for sale every

TOP: H.-G. EVERS; BOTTOM LEFT: H.-G. EVERS; BOTTOM RIGHT: R. BLANKENHAUS

Crystal Reds with a large percentage of white. Many aquarists consider them the most attractive variant.

month. But Maju also markets stocks from other breeders, so around 100,000 CRSs are shipped every month.

At one of the farms in Bandung I saw other types of aquatic plants being used in the shrimp-breeding tanks, mainly *Cryptocoryne* species rooted in a sand-gravel mix. According to the breeder, these tanks are just as productive as his Java Moss tanks, and he says that each of them produces around 300-400 shrimps per month.

Probably one of the most monotonous jobs for a shrimp breeding operation is the catching and sorting of the CRSs for shipping. I rather think this would make a good punishment with which to threaten impudent children—"Do as you're told or I'll send you away to harvest shrimps!" Hour after hour, day after day, the workers sit bent over the aquariums with large nets and yogurt containers, sorting dwarf shrimps.

So next time you purchase a few CRSs, it may well be that they started life somewhere in Indonesia. Well-traveled little chaps, aren't they?

A German tank-bred specimen. Individuals like this, in which some parts of the body are transparent, are bred in large numbers in Indonesia.

TOP: H.G. EVERS; BOTTOM: R. BLANKENHAUS

One of my racks of small shrimp-breeding tanks.

Maintenance and breeding of DWARF SHRIMPS

In my experience it is virtually impossible to stop any of the *Caridina* and *Neocaridina* species of the specialized-reproduction type from breeding, provided they are maintained correctly. Nevertheless, many enthusiasts struggle to keep their shrimp populations going in the long term. • *by Kurt Mack*

I maintain all my shrimps in tap water, which remains consistent in quality through the year. The conductivity is 300 µS/cm, general hardness 10–11°dGH, carbonate hardness 3–4°KH, temperature 71.5–77°F (22–25°C), and nitrate (NO_3) 10 mg/L; there are very small amounts of environmental toxins. I regard only the water temperature as being of any real importance, as my Bee and Crystal Red Shrimps usually stop breeding at temperatures in excess of 79°F (26°C). As long as the pH of the source water remains between 6.5 and 8 and the general hardness is in the range of 3–15°dGH, it should be possible to breed the majority of dwarf shrimps. I will detail below, in order of decreasing importance, the factors that are responsible for most problems.

Go easy on the food

The shrimp enthusiast will find long lists of food types on Internet forums. Unfortunately, none of these state how little food a shrimp actually requires each day. I liken dwarf shrimps (and crayfishes) to fuel-efficient cars, as they can get by for a very long time on small amounts of nutrient-poor "fuel" such as dead leaves and mulm.

Even today I still regularly lose the occasional shrimp through overfeeding, even though I scrupulously measure out the food and have arranged my aquariums in such a way that any excess food should be quickly spotted. But if I am short on time I am apt to feed a bit too much.

Four or five years ago I noticed that deaths were rare if a group of shrimps was large enough. Breeding was sig-

K. MACK

I use the practical, easy-to-clean, air-driven sponge filter in the smaller tanks.

nificantly more successful using upwards of 100 to 150 shrimps, and proportionately more young shrimps grew on. I regard aquariums with a volume of 42 gallons (160 L) as perfectly suitable for growing 200–400 shrimps of various sizes, and this ensures the long-term survival of the strain. In summer, when there is less demand from the trade, I often have more than 1,200 shrimps in various tanks, without any losses occurring.

In addition, losses were frequently noticeable following the sale of a large number of shrimps. Initially I attributed this to molting problems resulting from stress due to the netting activity, but losses were far rarer among the shrimps that had been caught and sold. I now realize that I was simply failing to reduce the amount of food to adjust to the smaller population. Performing prompt, large water changes and cleaning out the filter proved helpful, though even then I initially suffered losses of as much as 90 percent.

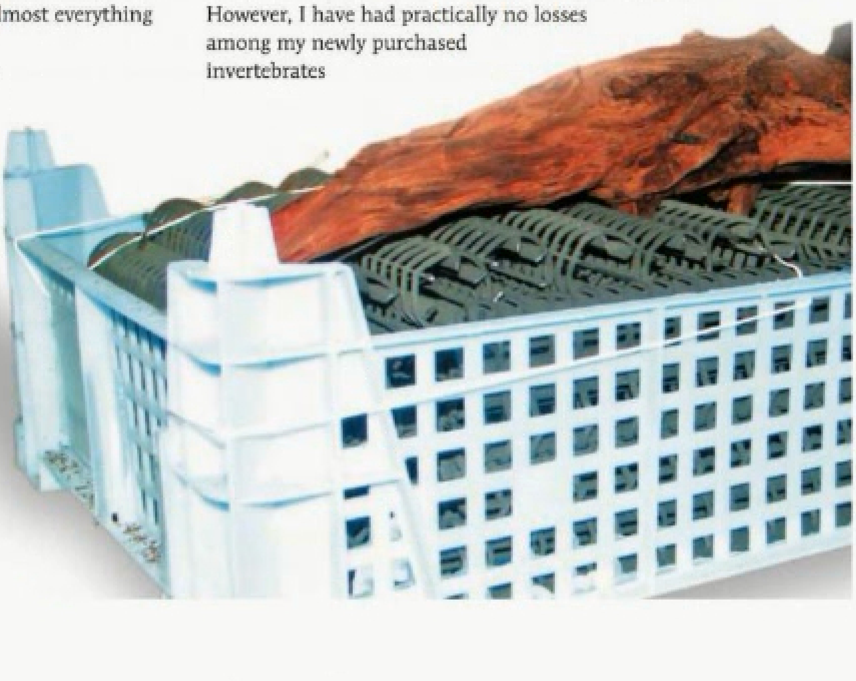
In order to ensure any overfeeding is spotted in good time, I run my shrimp aquariums without substrate and regularly siphon off large accumulations of mulm. The mulm becoming flaky and sticking to the bottom glass is a sign of incipient overfeeding. By this time the majority of the shrimps will be eating significantly less because of the deteriorating conditions. For this reason, in the event of overfeeding I halve their rations or feed only green foods and dead leaves for a while.

It is the multitude of available shrimp foods that represents the greatest danger of permanent overfeeding. In the beginning I tried several of the recommended types of food and mixed food sticks with lots of different individual elements, without establishing that they provided any particular benefits as regards growth, coloration, or willingness to breed on the part of my shrimps. I did notice that if the shrimps were hungry and the food didn't take a long time to soften, they happily ate almost everything with no leftovers.

After more than a year I gave up the search for the "ultimate food" and continued to feed only TabiMin tablets, pollen grains from the organic food store, dead leaves of the Sweet Chestnut tree (*Castanea sativa*), dried Stinging Nettle leaves (*Urtica dioica*), and frozen, organically grown chard (*Beta vulgaris*) (see box). In my experience, these foods are adequate for the long-term feeding of dwarf shrimps.

Quarantine new arrivals

It is in the first weeks after purchase that shrimps frequently die for apparently inexplicable reasons. I don't believe there is any such thing as a sick shrimp—only healthy or dead ones. This is due to their poor resistance to unfamiliar bacteria, viruses, fungi, or protozoa, referred to simply as "microbes" in the following text. However, I have had practically no losses among my newly purchased invertebrates



Not pretty, but practical: I fill vegetable baskets with plastic mesh to create easy-to-clean "climbing frames" with room for many hundreds of shrimps.

H. MACK

I dispense with bottom substrate, and where the population density is high I always use a diffuser as well as the Hamburg filter mat.

H. MACK

and fishes since I started using quarantine with accompanying acclimatization to unfamiliar microbes. The idea is to accustom the livestock to the new water parameters in an environment with a low bacterial count, and then condition their immune systems with small quantities of unfamiliar microbes prior to transfer to their long-term home.

To this end I try to buy the livestock with as much water as possible from their original aquarium—ideally enough to fill a small aquarium, so that the animals, already stressed by capture and transportation, do not have to get used to different water parameters as well. The quarantine tank contains only a clean sponge filter, some clean sand, and a few plants or other hiding places (which may come from another tank that is functioning well, but should be cleaned before reuse). I then use small water changes (every three days using aged tap water) to slowly acclimatize the shrimps to my water parameters.

If the transportation water cannot be used because of deaths or other pollution, I use the drip method to acclimatize the new arrivals to the new water parameters over a number of hours. This involves placing the livestock in a black bucket with the transportation water and using an airline and airline valve to introduce aged tap water drop by drop until around 10 times the amount of the original water has been added. I then place the livestock in a newly set-up tank as described above. If the tank has already been set up for a few days, then before introducing the livestock I perform a complete water change using aged tap water. This brings the microbe populations back down to the levels of a newly set-up tank. Over the days that follow I perform a 30- to 50-percent water change every three days and feed sparingly. This will ensure that nitrite levels rarely become critical, and in practice this never happens in my aquariums.

When, after two to three weeks, the new arrivals are well acclimatized and feeding properly, I add microbe-rich water from the aquarium to which the animals are eventually to be transferred, at the rate of 2.4 pints (1 L) per 14 gallons (54 L) of aquarium volume every day for 14 days. At the same time I add water from the quarantine tank to the destination aquarium, so that the residents can become accustomed to any new microbes and their immune systems will be prepared for the introduction of the new shrimps. Many aquarists regard these precautionary measures as excessive, but I now experience practically no losses among my new acquisitions, even if they are in generally poor condition when purchased.

A small quarantine tank with a volume of only 3–6.5 gallons (12–25 L) is adequate for shrimps, and in an emergency a semitransparent plastic container can be used. A 10-gallon (38-L) tank will suffice for the majority of fishes, and can be purchased cheaply as a complete setup.

Snails, filters, and substrate

Many shrimp-keepers and -breeders populate their aquariums with lots of snails, and although these may

Clean pieces of wood are a standard component of the décor in my shrimp tanks.

take care of any excess food, they also produce large amounts of mulm and contribute to rapid deterioration of the water quality. In time the mulm accumulates in the popular Hamburg filter mat (Poret Brand) beneath the cushions of moss and in the substrate, where it can result in clogged anaerobic zones. Toxic substances then develop, including hydrogen sulfide, even a tiny amount of which is lethal to shrimps. But even before that occurs, the large amounts of mulm are often an indication of a high bacteria content in the aquarium. Over time this weakens the shrimps, and is one reason for a phenomenon that frequently occurs in Crystal Red and Bee Shrimps, where a number of shrimps die regularly over an extended period without there being any obvious reason for the losses. Copious water changes can help to lower the microbe population in the short term and also to stem the losses after a while, but it is better to reduce the amount of food, and thus indirectly the number of snails and the amount of mulm.

Some shrimp-keepers and -breeders run their aquariums successfully with a deep substrate, abundant snail population, dense plantings, and a coarse Poret filter mat, and have no complaints about a shortage of young shrimps, but only the most experienced manage to avoid occasional major losses over the years. I personally also like to use filter mat, as it is cheap and simple. However, instead of the usual blue filter sponge I use a commercial foam, about .75–1.25 inches (2–3 cm) thick and with a volumetric weight of 24–27 kg/m³. Caution is required with any foam not specifically made for aquarium use, as many contain insecticides, flame retardants, or other toxins lethal for delicate organisms.

The fine-pored foam I use has the great advantage that virtually no food particles are sucked into it. Shrimps and fishes "graze" on the surface of the filter and thus consume more food particles than they would with a mat with large pores. Unfortunately, however, the foam gets clogged up after four to six months, and in any case needs to be cleaned appreciably earlier than that.

For some months I have been using the JBL TekAir sponge filter and have only good things to say about it. It is a solid, well thought out plastic device that will last for many years. It consists of individual sections that fit together so that it can be used in different depths of water (4.5 inches [11 cm] upward). The filter medium is a fine, porous foam that can be cleaned quickly and easily.

Pollutants

Because decorative wood available in aquarium stores is collected in the wild, it should always be checked out before you use it in the aquarium. I soak it for a number of days, changing the water every day and using live water fleas to find out whether it contains toxins. If the water fleas survive more than 24 hours in the final soaking water, the wood should no longer represent any danger to shrimps. The most suitable woods are the driftwood, mangrove wood, and bogwood sold in aquarium stores.

Even tiny amounts of insecticides are harmful to

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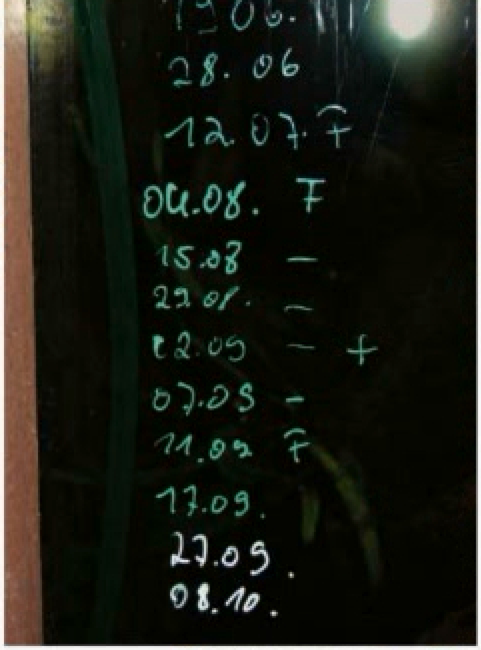

Left: A food clip makes it possible to feed the shrimps without too much intrusion into the aquarium.

Above: Every water change or other maintenance task performed is noted on the aquarium log.

shrimps and can eliminate an entire population in a matter of hours. Aquatic plants sold in the trade are sometimes treated with insecticides during greenhouse culture and should be soaked for 6–10 days, with daily water changes, as a precautionary measure.

The flea treatments used for dogs and cats are also very dangerous. A friend of mine stroked a visitor's dog while cleaning one of his shrimp tanks. Shortly after that his shrimps began dying, and he was able to save some of them only by performing several large water changes. When he asked the dog owner about it he learned that the dog had been treated for fleas with a topical "drop treatment" a few days before.

When it comes to purchasing green foods, I recommend organic products, as there is then only a very small likelihood that they have been exposed to pesticides. It is even safer to collect them from the wild, purchase them from an organic grower, or grow your own in the garden.

Rain or spring water?

Increasing numbers of shrimp-keepers are using rain or spring water to save money. I can only advise against this, as despite filtering over activated carbon there is always a residual risk of losses, either immediately or over time, due to pollutants from the air, the soil, or the rainwater container. More and more serious breeders are becoming rainwater users, but I believe that the risk is out of all proportion to the savings.

Tap water is constantly tested. Even so, a water change should never be performed with fresh tap water. Water companies often disinfect municipal water with chemicals that can harm shrimps. The water should always be aerated for 24 hours before it is used for a water change. If the water company regularly treats the supply with chlorine, it is advisable to filter the water over activated carbon prior to use. A small, air-powered, home-made internal filter is ideal for the purpose, and can be run in a bucket full of water between water changes so that bacteria don't cause it to stagnate. These precautions are a nuisance, but our pets should be worth the effort.

H. MACK

A female *Neocaridina* cf. *zhangjiajiensis* (White Pearl or Snowball) carrying eggs.

I would recommend a demineralizer to anyone who has only unsuitable tap water available and cannot afford a reverse-osmosis unit. I have long used cation and anion filters and performed the regeneration myself. By the third regeneration the process is routine, and the costs are negligible. The ion-exchange resins can be regenerated over and over again for many years. An alternative would be to use a mixed-bed de-ionizer, but I don't have any experience of the costs involved or the possibilities for exchanging the used resin.

Many North American shrimp breeders do use reverse-osmosis systems (RO) or reverse-osmosis/de-ionization (RO-DI) to ensure that chlorine, chloramine, medications, agricultural chemicals, phosphates, and other impurities that sometimes found in tap water are removed.

Demineralization produces water that is extremely low in minerals with a conductivity of 10–30 µS/cm, which can then be mixed with normal tap water to produce the desired water parameters. Too low a carbonate hardness can be rectified by putting some crushed coral in the aquarium. Anyone who wants to completely avoid using untreated tap water can create the desired water chemistry using proprietary hardening salts. But I recommend the natural way, using neat, or if necessary part-treated, tap water.

The water should be allowed to run for a while where there is new copper piping or the coil in the water heater contains copper, as water that has been in contact with copper pipes for any length of time may contain levels of dissolved copper harmful to shrimps. As a precaution, any aquarist who has moved to a new home or had alterations made to the drinking water supply should test his tap water for copper. Suitable test kits are available from numerous manufacturers.

My shrimp aquariums

I breed my shrimp strains in aquariums with a volume of 14 or 34 gallons (54 or 160 L). Each tank is filtered with an air-driven filter mat made of foam or a sponge filter. In addition I keep a low-output airstone in one corner to ensure an adequate oxygen supply if the filter stops or becomes clogged.

In order to be better able to siphon off any mulm that occurs and spot any uneaten food promptly, I have dispensed completely with substrate in my breeding tanks. Every two months I use a scraper to remove the coating of algae that develops. On such days I don't give the shrimps any dried food, because they prefer to eat the algae scrapings.

In tanks with a low population I provide the shrimps with a few pieces of wood as hiding places; I prefer the type sold as driftwood. In order to make sure the young shrimps also have shelter, I saw a number of slits, .125 inch (2–3 mm) wide and .5–.75 inch (1–2 cm) deep, in each piece of wood. I avoid large amounts of mulm accumulating beneath the wood by propping it up in the corners of the aquarium so that only one end is in contact with the bottom glass. I sometimes experimentally suspend the wood just above the bottom glass.

In tanks with dense populations I instead provide hiding places in the form of small,

The females of all dwarf shrimp species carry their unlaid eggs in the neck region; they can be seen particularly clearly in the White Pearl form.

H.G. EVERS

Mass production of *Neocaridina heteropoda*. This works only if you can maintain consistently good water quality, via a through-flow system, for example.

stackable plastic vegetable boxes filled with the filter mesh sold for trickle filters and small pieces of wood. These occupy almost half of the tank.

Moss and assorted ferns rarely survive long in the shrimp tanks, as their growth rate under the indirect illumination from the ceiling light is usually unable to keep up with the depredations of the numerous hungry shrimps. I feed greens and dead leaves using food clips attached to short pieces of string, which makes for ease of replacement or removal. Because the food isn't spread around the tank, it is easier for me to tell when the time has come to feed the shrimps again.

Where the shrimp population is high, the relatively low carbonate hardness (3–4°dKH) of my tap water rapidly drops to less than 1°dKH, and the pH can fluctuate dramatically because of the lack of buffering. To remedy this, I suspend a net bag of coarse crushed coral in each tank. A grain size of .125–.375 inch (5–10 mm) has proved effective. I use 1 ml of crushed coral per liter of aquarium water. This doesn't dissolve noticeably at a pH above 7, but nevertheless the carbonate hardness doesn't drop much below 2°dKH.

When I want to pair particular shrimps, or allow youngsters to grow on separately from other shrimps, I use suspended tanks with a volume of 1.75–3 gallons (4–12 L), which I have made myself out of old acrylic tanks. In order to ensure a constant throughput of water, I have cut a hole around 3 inches (8 cm) across on each of two opposite sides and covered these with fine mesh. The holes are sited 1.25 inches (3 cm) above the bottom of the suspended tank, so that the shrimps aren't left high and dry during water changes in the main aquarium. Additional aeration guarantees an adequate oxygen supply.

In addition I populate each aquarium with a number of tower snails, but I never let their numbers get out of hand in the tank—no more than 50 snails .5–1.5 inches (1–4 cm) in size per 26 gallons (100 L) of volume.

In the event that *Cyclops*—which are harmless as a rule—get into the aquarium, I add a number of *Corydoras* fry that have just started feeding and catch them again later at a size of .375 to at most .5 inch (1–1.5 cm). The *Corydoras* eat the *Cyclops* nauplii and hence significantly reduce their numbers in the space of a few weeks, but they never touch the young shrimps. Other small fishes or their fry have either proved ineffective at keeping the *Cyclops* down or have even consumed young shrimps. I have experimented with the Forktail Blue-Eye (*Pseudomugil furcatus*), the Threadfin Rainbowfish (*Iriatherina werneri*), the Emerald Dwarf Rasbora (*Danio erythromicron*), the Celestial Pearl Danio (*D. margaritatus*), larger Pygmy Corys (*Corydoras pygmaeus*), and Orange Chela Danios (*Chela dadiburjori*).

Regular maintenance

Every day I check the shrimp aquariums for dead shrimps and uneaten food, which I siphon off immediately if necessary. In addition I check that the filter and supplementary aeration are operating correctly. In the morning and evening I feed

In this gravid female *Neocaridina heteropoda* (Red Fire) the eggs can be seen through the red armor.

H.-G. EVERS

The grass-green *Caridina cf. babaulti* can breed so prolifically that some aquarists regard it as a pest.

tablets or pollen grains and check the green food and dead leaves to see if they need renewing.

Every 7 to 10 days I change a third to at most half of the water for aged, aerated tap water from a 105-gallon (400-L) tank. The water level in this container is kept constant via a cheap toilet-tank ball valve, and the water is vigorously aerated and heated to 71.5°F (22°C). When performing small water changes I don't turn off the water supply to the container, so the temperature of the water used for the change may drop to 64.5°F (18°C) because of the inflowing tap water. This is permissible only if you are sure that the tap water isn't chlorinated. During larger changes I turn the water supply off.

If the water temperature rises above 79°F (26°C) in summer, I shorten the intervals between water changes by half. Temperatures of more than 82.5°F (28°C) for several days should be avoided if your shrimps are normally maintained at 71.5–77°F (22–25°C). But temporary lowering of the water temperature with ice or cold water is more harmful than beneficial, as it means additional stress for the shrimps.

Many heat-plagued shrimp-keepers use special cooling units for their aquarium hoods to prevent a buildup of heat from the lighting. The aquarium water is simultaneously cooled by the increased evaporation. It is often sufficient to raise the hood using a couple of spacers, for example wooden laths 1–1.5 inches (3–4 cm) thick, reduce the lighting period, and/or move the lighting period to the cooler morning hours. In extreme cases, however, the only options are to install a chiller, move the aquarium to a cooler spot, or switch to more warmth-tolerant livestock.

Depending on how dirty the filter mat is, I clean it every six to eight weeks, thoroughly washing it in old aquarium water or, after rinsing out the worst of the dirt, in the washing machine on the cold setting—without detergent, of course. Some of my foam filter mats are more than six years old and are only slightly the worse for wear from the regular washing. If the aquarium water rapidly becomes cloudy, I shorten the cleaning interval to a few days.

Large accumulations of mulm are removed as necessary. I use a plastic tube .375 inch (10 mm) in diameter and 20 inches (50 cm) long, attached to 40 inches (1 m) of suitably sized hose, to siphon the mulm into a light-colored bowl so that I can see if any young shrimps have been siphoned off in the process.

All work carried out, together with major changes in the shrimp population, is noted on the front of the tank. In this way I am better able to adjust the maintenance and get a feeling for the group more rapidly.

H.-G. EVERS

Catching the shrimps

When I need to catch large numbers of shrimps I remove part of the already-sparse décor from the aquarium and feed the shrimps with half a food tablet placed in a vacant corner. Then, after a few minutes, I catch all the shrimps that have assembled around the food. I use a goldfish net measuring 8 x 6 inches (20 x 15 cm), as smaller shrimps up to .5 inch (12 mm) in size can easily slip out through the large mesh. To allow them to do so I suspend the net, complete with my haul of shrimps, in the aquarium for a few minutes. The longer I wait, the more small shrimps can swim back into the aquarium through the wide mesh, and then they don't get in the way of my counting any more.

For counting and sorting I use a small acrylic tank with a volume of 1–3 gallons (4–12 L) and a small net to sort the shrimps or count out the required number.

The fancy shrimps of the Red Bee group are inbred and a challenge to produce. This is a specimen of the Tiger Tooth variant—the name refers to the divided red band on the central body.

Show tanks

In order to avoid accumulations of mulm I use a layer of fine gravel, at most .375 inch (1 cm) deep, in my show tanks and position wood and rocks in such a way that they occupy a minimal "footprint" on the substrate. For plants, I prefer to use various ferns and mosses, making sure I promptly prune back cushions of moss when necessary. Floating plants are also very suitable, but I don't like Duckweed (*Lemna* spp.).

Filters need to be cleaned regularly, hence I don't use filter mats in display aquariums. I like to use old Eheim canister filters, which I fill with filter wool and crushed lava with a grain size of .125–.375 inch (5–10 mm). To prevent any young shrimps from being sucked into the filter, I cover the inlet with foam of a medium pore size, cut to size. An alternative for smaller tanks is the air-powered sponge or foam filters. I change 20–30 percent of the water each week.

Fertilizer isn't usually necessary. When feeding I offer just a little dried food, plus Stinging Nettle, chard, or spinach, but only when almost all the previous food has been consumed. In addition, I provide a few dead leaves (Sweet Chestnut [*Castania sativa*], Oak [*Quercus*], Beech [*Fagus*], or Walnut [*Juglans*]), which I replace only when they are eaten down to the leaf skeleton. Maple would be a good choice for North Americans. I find that one to three leaves per 2.5 gallons (10 L) of tank volume is a useful rule of thumb, depending on the number and size of the shrimps.

Middle: Something to make shrimp fans go weak in the knees: the Mosura variant of the Red Bee cultivated form. In this instance the Japanese names have been adopted, though there have been other attempts at classification as well.

Left: If a shrimp is eating, then it's healthy. Here a Bee Shrimp, *Caridina cf. cantonensis*, is nibbling at a morsel of food.

H.-G. EVERS

I have been breeding the Spotted Shrimp (*Caridina* sp.) for many years.

Types of food | *The following types of food offer a number of benefits and are used as described*

Tetra TabiMin tablets, as the staple diet

- Small tablets, easily divided into pieces
- Disintegrate into small bits without being reduced to powder
- Relatively cheap and available in numerous stores
- A proven dried food that should always contain the same high-quality ingredients

I feed these tablets almost daily where the shrimp population is high. As a general rule of thumb, 100 shrimps with a length of .5 inch (1.5 cm) or more are given 1–2 tablets per day.

Pollen grains from the organic food shop, as a treat

(Yes, the yellow bits that honeybees carry around on their back legs!)

- Rich in important vitamins, minerals, and trace elements
- High-quality vegetable protein
- Tested for pollutants

I feed pollen grains once or twice per week instead of the TabiMin tablets (and in the same quantity). Unfortunately, the pollen grains rapidly disintegrate into small, dust-fine, heavy particles that rapidly sink into gravel or coarse sand, where they are inaccessible to the shrimps. To avoid this, I use a fine tube (.125 inch [8 mm] diameter) to deposit the pollen grains on a flat piece of wood or stone.

Autumn leaves of the Sweet Chestnut tree (*Castania sativa*), for hunger between meals

- Large leaves that can be easily collected and dried
- Not too rich in tannins and acids
- Solid leaf skeleton
- Good roughage; support growth of edible biofilms

I feed these leaves via a plastic food clip attached to a short string, using this to secure one to three leaves by their stems before suspending it in the aquarium. When, after a while, little more than the leaf skeleton is left, I put the same number of leaves in the aquarium to soften, and then swap them for the remains in the clip a few days later.

Dried Stinging Nettle (*Urtica dioica*) leaves, as a filler

- Rich in vitamins and trace elements
- Available everywhere and at almost any time
- Greatly enjoyed by the shrimps
- Eaten completely by the shrimps

I either cut young Stinging Nettle tips with six leaves in spring, or harvest the large leaves in summer from plants growing in the shade. If large Stinging Nettles are cut down in summer and autumn, then the young shoots preferred by the shrimps will soon sprout again. First I dry my Stinging Nettles in stackable plastic fruit trays in the sun, and when they are almost completely dry, I finish them off in the shade. The leaf stems need to be completely dry and hard before storage, as otherwise mildew is likely. I store the dried Stinging Nettles for up to a year in small boxes in a cool, dry place. I feed the leaves using a food clip and replace them only when they have been eaten completely. Because they are long-lasting, I can feed them in addition to the appropriate amount of tablets and pollen grains, as a fallback. If the shrimps take longer than four days to eat them, I reduce the amount of other food offered. If the Stinging Nettle leaves have been eaten in only two days, I increase the other rations.

I do not recommend using Stinging Nettle tea purchased from the natural foods store. I found that when I used it, almost all my shrimp strains suffered losses after a while.

Chard (*Beta vulgaris*) leaves from the organic food store

- Can be used instead of Stinging Nettle leaves if you can't obtain the latter
- Are eaten almost completely by the shrimps until only a thin, transparent membrane remains

I feed chard leaves in exactly the same way as Stinging Nettle leaves. I freeze the leaves in boxes after removing the stems, and take out the required amount shortly before feeding. Blanching isn't necessary, as the leaves are softened by the freezing process.

H.-G. EVERS

The so-called Leopard variant of the Black Tiger Shrimp isn't solid black, but also has light areas.

BLACK AND RED:
Selective breeding of two shrimps

Dwarf shrimps are rather variable in their coloration, so it is often possible to line-breed special color variants from the wild forms. Bright colors are particularly popular, so it is no wonder that the Black Tiger Shrimp and the Red Spotted Shrimp have aroused a lot of interest.

• *text by Kurt Mack; photos by H.-G. Evers*

Black Tiger Shrimp

The Black Tiger Shrimp is generally regarded as one of the more difficult cultivated forms to breed. Some shrimp-keepers, including myself, are unable to maintain their populations for a long time.

Some years ago I purchased 15 Black Tiger Shrimp of various color forms from Kai Quante. After careful acclimatization, they were obviously thriving and I regularly saw the males mating with females. Some of the females were also carrying eggs, but to my disappointment some of them discarded their clutches for no obvious reason. And a lot of the young shrimps that did hatch subsequently disappeared.

Dorsal view of the Leopard variant. There are attractive black spots on the legs.

In this intermediate form the tail is slightly reddish in color and the black areas on the body are more strongly linked. The eyes are normal in color.

A change to softer water and experiments with different types of food failed to achieve any long-term improvement. I hoped that the next generation of young would do better in the conditions provided, as is often the case with aquarium fishes. Unfortunately this wasn't the case here. Good spells, with relatively large numbers of youngsters, were always followed by inexplicable losses, so that ultimately only one sexually mature male and two females remained from more than 100 young. In sheer frustration, I "exiled" them to a small, unfiltered tank with a temperature of 59°F (15°C) on a windowsill in the garage. Apart from slime algae and dead insects there was nothing for the shrimps to eat. I occasionally topped up the water and marveled at how robust the Black Tiger Shrimp can be.

By now I was convinced that it was not unsuitable maintenance conditions that were responsible for the problem, but the fact that the shrimps were too closely related. In the case of a simple recessive gene such as that responsible for the "more black" characteristic, it is sufficient to back-cross to the original form in order to obtain Black Tiger Shrimps within two generations, and, given sensible mating, these are no longer too closely related. To this end I acquired 50 Tiger Shrimps of the appropriate original form from two different sources, sorted out the females with nape spots, and put them in a suspended tank for 10 days to make sure they hadn't already been inseminated by a normal Tiger Shrimp male. Only the male survived the transfer of the Black Tiger Shrimps from the garage to a new aquarium. The females died shortly after molting. Despite this bad start, the "old man" was able to inseminate eight normal Tiger Shrimp

Dorsal view of the Leopard variant. There are attractive black spots on the legs.

females before he, too, died. The eight females produced around 150 normal-colored Tiger Shrimps of separate genetic makeup, and these formed the basis for further breeding.

In order to diversify the gene pool even further, I allowed the young Tiger Shrimps to mate at will. Despite

There are red areas between the black "tiger stripes" in this form.

Portrait of a Black Tiger Shrimp. The legs are blue-black with transparent bands.

initial concerns about them all having the same father, the Tiger Shrimps of both maternal strains grew and bred without problems. To my joy, the first batches of youngsters were 10–15 percent black, and I was able to grow them on in a suspended tank. The various color variants were split in about the same proportions as my original stock from Kai Quante:

- 10% with a black component of less than 50%
- 60% with a black component of 50–80%
- 20% with a black component of 80–100%
- 10% solid black with a blue sheen and light eyes

I used the first 50 attractively colored offspring to create a separate breeding group in a 42-gallon (160-L) aquarium. The shrimps grew on without any major losses and diligently produced offspring of their own. After a year or two I had a population of approximately 200 sexually mature Black Tiger Shrimps and planned to start selectively breeding for the solid black characteristic. But the delicacy of the initial stock, the small number of

The camera flash suddenly reveals hints of red and blue on Tiger Shrimps that appear black under the aquarium lighting.

young shrimps with a black component of less than 50 percent, and above all the frequency of Leopards with a black component of 50–80 percent (which I like a lot) caused me to abandon the idea.

I had no reason to regret this decision later. The Black Tiger Shrimps continued to breed readily and the percentage of different color variants had shifted somewhat in favor of solid black because I had used the extremely striking solid black Tiger Shrimp males with light eyes, rather than the other males, as breeding stock.

I continued to maintain the original, mixed-strain group and divided the Black Tiger Shrimps that continually turned up among their offspring between the three breeding groups I was maintaining at that point. In this way the gene pool was constantly diversified, with the hope that the strain would continue to be robust and easy to maintain. Future breeding projects may include trying to produce pure strains of solid black Tiger Shrimps with light eyes and the Leopards that I find so attractive, but without losing the robustness and readiness to breed of the existing strain. But that will require time and space that I don't have at present.

Above: Black Tiger Shrimp with orange eyes.

Right: Hints of red can be seen on the back and legs of this solid black Tiger Shrimp.

Well-colored Red Spotted Shrimp.

Red Spotted Shrimp

I obtained my first dwarf shrimp species, the Spotted Shrimp, from Uta Hanel a lot earlier, in 1998. Luckily (in hindsight), I started with a reasonable number—50 individuals. The shrimps bred well right from the start and also survived some of my maintenance mistakes. Despite regular sales and some losses due to those errors, after around two years I had built up a population of approximately 1,000 Spotted Shrimps. Among them there were a number or reddish and bluish individuals.

The 40 Spotted Shrimps with the most attractive red were given their own tank, where they, too, bred well, but the percentage of Red Spotted Shrimps among their offspring was appreciably smaller than I had hoped: just 30–35 percent exhibited red coloration. This is what I call a "feel-good" color, the intensity of which fluctuates depending on certain factors that I am only partially

The black spots of the normal form are also seen in the red color form.

Reds sometimes swim to and fro in the open water.

aware of. One thing that is clear is that newly molted Red Spotted Shrimps are milky beige and don't regain their red color for a few days.

Experiments with different water parameters failed to produce any definite and long-term improvement in the intensity and permanence of the coloration. The coloration of Red Spotted Shrimps becomes more intense in well-illuminated, planted aquariums, while in bare, unlit quarters they lose it almost entirely. For this reason I assume that color intensity is linked to the intake of slime and thread algae. Feeding with thread algae from the wild also leads to the development of more intense coloration. Unfortunately, feeding thread algae also rapidly leads to the introduction of planarians, Hydra, or other pests, and for that reason I have toyed with the idea of deliberately cultivating it outdoors. There should be no problem producing a decent growth of thread algae in an old aquarium with a bit of liquid fertilizer and regular water changes using old water from my shrimp tanks.

The number of young red shrimps produced by the first matings didn't accord with any genetic theory I could think of, so I sorted out all the normal and light red Spotted Shrimp youngsters and put them in suspended tanks for a few weeks so I could later reassign any recently molted Red Spotted Shrimps that had shown no color at the time of capture.

After three years of continuous removal of normal and poorly colored Red Spotted Shrimps before they reached sexual maturity, only red offspring were being produced. In the following years I discovered fewer than 10 normal Spotted Shrimps among around 1,500 youngsters. For this reason I believe the strain is breeding true. Further selection for the intense bright red Neon form didn't cause the intensity of color in the strain to improve.

Unfortunately, with the passing of time the strain has become somewhat problematic and the shrimps aren't as easy to breed as they were in the beginning. This is very probably due to an error on my part; I sold so many that I allowed the population to drop to fewer than 50 individuals, making the gene pool more limited. At present, however, the group has begun to breed again and I will try not to let the population drop below 200.

I want to avoid back-crossing to the original form because of the long period of selection that would entail. In addition, test crosses have shown that when Red Spotted Shrimps are in-crossed from another strain the shrimps no longer breed true. As a last resort, however, I have kept a residual population of normal Spotted Shrimps so that one of these days I can perform a back-cross or simply mix the strains.

I hope that I have reported my experiences and the reasons for what I have done in a comprehensive and comprehensible manner, but in the event that there are any questions, they can be raised on the forums at www.garnelenforum.de or www.crustawelt.de, where I check in several times a week. Because I may not always have the time to answer in detail, I would ask you to be patient. Questions via email are less welcome, as I may find myself answering the same or similar queries several times.

The Red Spotted Shrimp looks as if it is illuminated from inside.

TIPS

Developing a stable strain

- Use at least 30, but ideally 50, individuals of a species to avoid the offspring being too closely related. Starting with fewer specimens means that developing a strain that will remain viable for years is purely a matter of luck or requires precise mating of shrimps that aren't closely related over a longer period. The main difficulty is that most shrimps cannot be recognized individually, and keeping them singly before and after planned mating is very time-consuming and expensive.
- If possible, use wild-caught stock or cultivated shrimps from several unrelated strains.
- Right from the start, avoid using specially prepared water or special maintenance measures. Good, cheap, simple husbandry, of the sort anyone can manage, including good tap water and tried-and-true food products, should be adequate. Many a strain has been saved by a large water change in the event of a sudden spate of deaths, and it's no good if the water has to be treated first. Plus I have no faith in water whose natural parameters have been altered excessively.

Expanding the gene pool

- Groups of females should be successively inseminated by different, unrelated males and the offspring reared separately. Planned matings between the separately reared shrimps will expand the gene pool and make the strain easier to maintain and more robust.
- To avoid the work involved in this separate rearing, you can try removing as many as possible of the sexually mature males of a population over a period of months and substituting a number of males that aren't related to the strain.
- Develop two strains and then separate the sexes every two generations and in-cross them into the other strain.
- In order to rear the young shrimps resulting from planned matings, I am thinking of making a special suspended tank with maybe four compartments measuring 8 inches (20 cm) long, 6 inches (15 cm) wide, and 8 inches (20 cm) deep. The bottom will be half glass and half 2-mm mesh. In this way I will be able to feed on the glass area, and the young shrimps will be able to escape through the mesh and grow on undisturbed in the large tank below. Each compartment will have room for four to six females and one male. The males will be exchanged for new males every four to six weeks or placed with another group of females. The whole thing has the advantage that I can be sure of obtaining a larger number of young shrimps that are not directly related to one another.

The BLUE TIGER Shrimp

Tiger Shrimps, *Caridina cf. cantonensis* Tiger, are naturally highly variable in their coloration; their colors and patterns can be enhanced or even altered by selective breeding. Some strains, for example the popular Black Tiger Shrimp, are mainly black (see the article on page 38). And then there is the Blue Tiger Shrimp. • *Text and photos by Roland Blankenhaus*

The Blue Tiger Shrimp, like the Black, is the result of mutation. There have long been Tiger Shrimps with orange-colored eyes, the so-called Orange Eye or Golden Eye variants, and nowadays there are also very boldly colored dark-blue Tiger Shrimps that are sold under the name Deep Blue and are so dark in color that they look almost black. This is probably because there is a brownish coloration overlying the dark blue like a thin coat.

A splendid Blue Tiger Shrimp with orange eyes. Every breeder strives for specimens as attractive as this one.

One of my breeding aquariums for Blue Tiger Shrimps. It holds around 21 gallons (80 L).

When breeding my Tiger Shrimps I very soon noticed that the offspring included specimens with light-colored eyes that sometimes exhibited the Tiger pattern but also had hints of blue. There were also really blue individuals among them, so that I had every color variant from the normal Tiger Shrimp to the Deep Blue form, though I never found any Black Tiger Shrimps among my youngsters.

To date I have been unable to find any differences in the breeding of the normal Tiger Shrimp and the Orange Eye, Blue Tiger Shrimp, and Deep Blue variants. Even the number of eggs and young is identical. However, an adequate number of appropriate individuals is an important prerequisite for breeding success. The shrimps used for breeding should be suitable in terms of color, pattern, size, and overall appearance. If only a limited number of stock specimens are available, then the shrimps should be bred once and the most suitable specimens selected from among the offspring for further breeding.

Aquarium setup

The breeding aquariums can be set up in the same way as those for normal maintenance. You can, of course, also breed in a normal aquarium as long as it doesn't contain any animals that have developed a taste for baby shrimps. An aquarium of at least 3 gallons (12 L) is required; larger is better. It should contain substrate, the color of which should be tailored to the species and coloration of the shrimps. Most crustaceans don't like a smooth bottom.

Dark livestock will be difficult to see against a substrate of dark sand or gravel. However, too light a substrate can lead to behavioral disturbances, as the shrimps won't feel happy in such light surroundings. A medium gray or medium brown substrate is suitable for many species. The lighting shouldn't be too bright, but it should be light enough so that you can easily see the shrimps.

I use my tap water for breeding Tiger Shrimps, and its parameters are as follows: carbonate hardness around

9°dKH, general hardness 17°dGH, and pH 7.5–8. The temperature is set at 71.5–75°F (22–24°C). The ideal breeding temperature for *Caridina cf. cantonensis* is around 73.5°F (23°C), but slight fluctuations are acceptable. The maximum temperature in which this species will survive unscathed is around 80.5°F (27°C). Tiger Shrimps can undoubtedly tolerate even higher temperatures for short periods, but that isn't ideal.

For the décor I use bogwood and a number of aquatic plants, invariably including mosses. *Riccia* is a good floating plant. The little shrimps will find plenty to eat in Java Moss and *Riccia*. For filtration I usually use a Poret filter mat or, now and then, an air-powered internal

Two views of one of my breeding tanks. I provide the shrimps with plenty of hiding places and fine-foliage plants like Java Moss.

Deep Blue, normal blue, and Orange Eye Tiger Shrimps feeding on chard.

sponge filter. Under no circumstances should the filter be motorized; young shrimps will hunt for food in every tiny nook and cranny, and if there is the tiniest gap between the inlet and the protective sponge fry-guard, it will be all over for the little ones—they won't be able to escape the suction.

A varied diet

My breeding aquariums have a volume of 8–34 gallons (30–130 L). If possible, I put 50 shrimps into a 34-gallon (130-L) aquarium all at once. I believe that breeding goes better when lots of individuals are involved. When the shrimps have settled in and are thriving, it is virtually impossible to prevent them from breeding. However, a number of fundamental criteria must be met. First, the Tiger Shrimps must find the water parameters to their liking. The water should not be too soft and the water temperature should be around 73.5°F (23°C). The aquarium should be well planted with plenty of fine-leaved, feathery plants. There should also be bogwood, hiding places, and dead Beech (*Fagus*) leaves or something similar.

The breeding aquarium should be matured before use and the filter should be functioning. It is not enough to set up a breeding aquarium and run it for three weeks. The tank must be "inoculated" and "fed" so that bacteria will colonize the filter. The best way to do this is to add some filter media and/or plants/substrate/water from a healthy established aquarium. Feed the new tank lightly without adding livestock to allow the beneficial bacteria to multiply. Water changes should be performed twice a week. Only when nitrite is no longer measurable should the shrimps be introduced. The importance of this point should not be underestimated, as many a shrimp has gone to the great aquarium in the sky because the filter wasn't functioning.

The breeding stock should be fed sparingly, but with a variety of foods, for the first few days. To work out the correct amount I use "food troughs" (ashtrays, for example), so that any uneaten food can be removed very easily. I feed my Blue Tiger Shrimps the following foods:

- freshly hatched brine shrimp (*Artemia*)
- a mixture of one-third rabbit pellets and two-thirds chinchilla pellets

A Deep Blue with Tiger pattern.

- proprietary shrimp food
- frozen *Cyclops*
- frozen bloodworms
- microworms
- chard (*Beta vulgaris*), Stinging Nettles (*Urtica dioica*), and dandelions (*Taraxacum officinale*)
- a homemade food mix containing peas, *Spirulina*, River Shrimp (*Gammarus pulex*), and flower pollen

My shrimps are usually fed twice a day, as very often there are youngsters in the aquarium as well. If the shrimps get too little food then they may stop breeding and start eating conspecifics. And the shrimps that molt first will be the first to perish. Because the little shrimps molt almost daily, they are often the victims.

Because I breed a number of fishes, I have freshly hatched brine shrimp nauplii constantly available, and I also feed these to my shrimps, occasionally mixed with CYCLOP-EEZE®. When this food is added to the aquarium the shrimps immediately become restless and hunt for it. I have observed something similar when I feed microworms, which I feed sparingly.

Mating and molting

If the shrimps are doing well, the females develop eggs in their ovaries (in the neck region). Around four weeks later they molt. They release pheromones (sexual attractants) into the water and "mating swimming" then takes place. This terminates with a male attaching a sperm packet in the vicinity of the female's sexual opening. The eggs are generally expelled within the next 24 hours, fertilized, and attached to the swimmerets. After around four weeks the little shrimps hatch. At this point the females often retire into dense areas of plants.

The young shrimps don't need to be deliberately

A so-called Orange Eye with a strong blue component.

Normally colored Tiger Shrimp, *Caridina* cf. *cantonensis*.

The Red Tiger Shrimp, a cultivated form, is quite popular.

fed; in a properly functioning aquarium they will find infusoria, algae, and leftover food in adequate quantities. During the early stages of their lives they usually remain in hiding among the *Riccia* and Java Moss. Now and then you may be lucky enough to spot a baby shrimp. During these early stages they molt almost every day. Only after a good two weeks will you see them more frequently, as they are now constantly moving around looking for food. After two to three weeks they will be seen consuming the food given to the adult shrimps.

In some specimens the blue color appears immediately, but in others this may not occur until they attain a length of .375 inch (1 cm). Not all individuals become blue, but in good strains more than 90 percent of the offspring will.

When the shrimps are half-grown they can be given away or transferred to a rearing aquarium. The water parameters of the two aquariums must be identical at the time of the transfer. If this is not the case then the shrimps should be slowly acclimated to the new water using the drip method (described on page 30).

After around three months the little Tiger Shrimps are sexually mature and have a length of around .75 inch (2 cm). A female can lay eggs several times in immediate succession, but there will be also be pauses from time to time. Eggs often ripen in the ovaries even though there are already developing eggs attached to the swimmerets.

I hope that you, too, will try keeping and breeding Tiger Shrimps. If you do, you should sit in front of the aquarium where you can quietly observe the shrimps at close quarters. You will then see how lively and comical these little dwarfs are in their behavior. It was after I watched them this way that shrimps and dwarf crayfishes won a place in my heart.

A Blue Tiger Shrimp during the molt.


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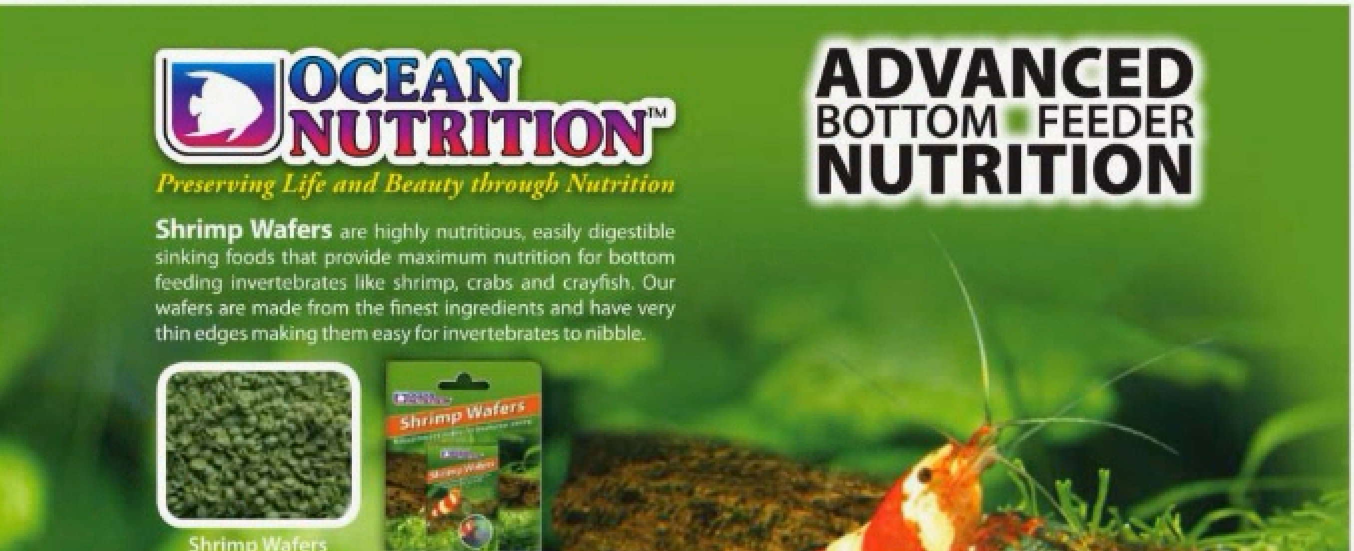
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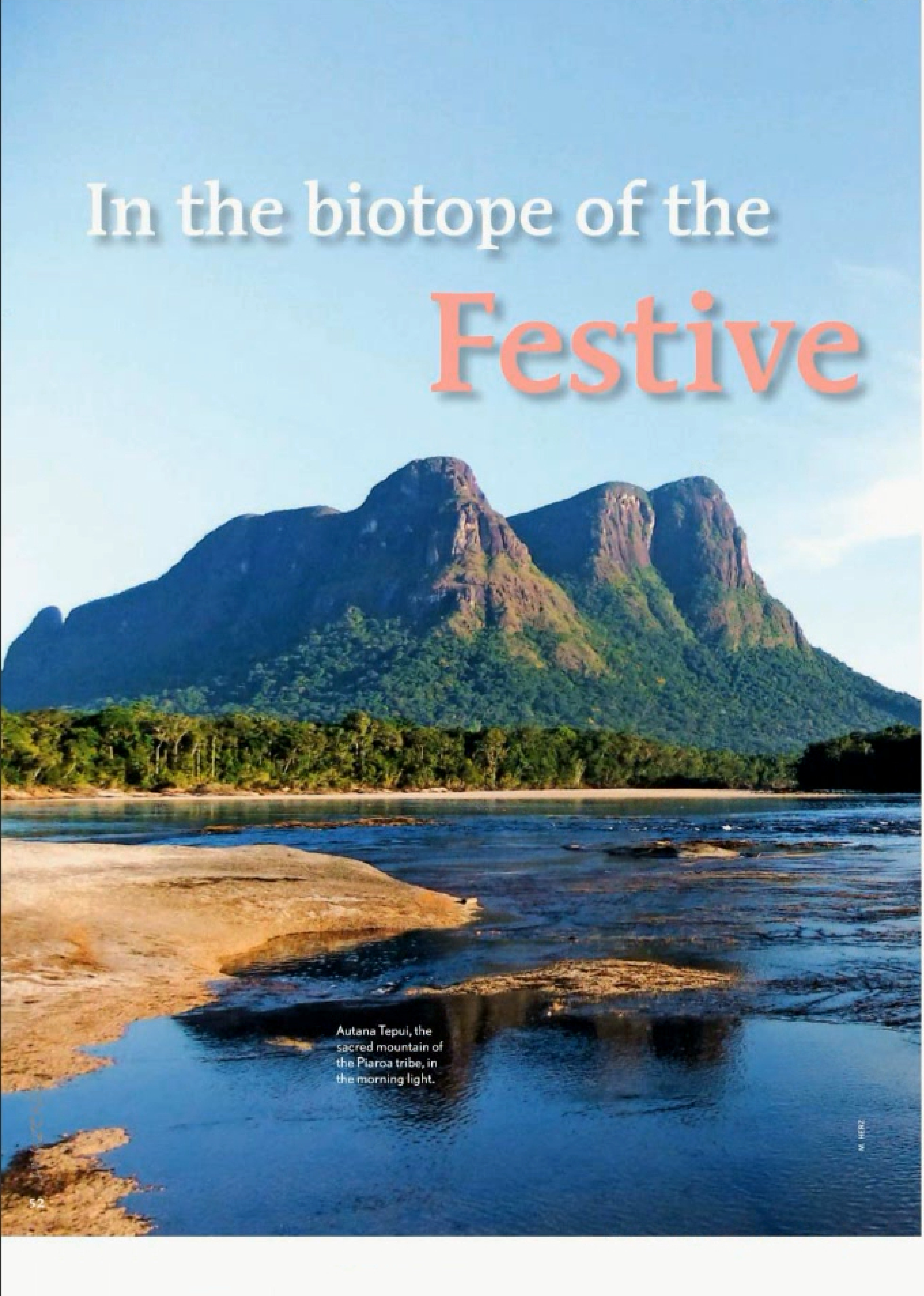
In the biotope of the Festive



Autana Tepui, the sacred mountain of the Piaroa tribe, in the morning light.

M. HERZ

Cichlid

Observing the natural habitat can be very useful when setting up an aquarium to simulate the biotope and improve the maintenance of the fishes. Because we keep mainly South American cichlids, our interest was naturally in South America. Inspired by films and photos as well as Roland Rietsch's personal experiences, we chose Venezuela as our destination, hoping to catch Altum Angelfishes and Festive Cichlids and observe them underwater.

by Mario Herz and Roland Rietsch

A group of *Mesonauta insignis* swimming elegantly across the sandy bottom of the Rio Autana.

We chose the Orinoco and its tributaries, the Sipapo, Autana, and Atabapo, as the destination for our travels. At the end of January 2010 we flew to Venezuela for three weeks during the dry season. After a night in the capital, Caracas, we set off for Puerto Ayacucho, the starting point for our 15-day boat trip. At the harbor in Samariapo (*apo* means "river" in the Piaroa language), we loaded our luggage and equipment onto the boat that would be our home for the next couple of weeks.

While the Orinoco is a whitewater river, the Sipapo, Autana, and Atabapo are blackwaters. We planned to study the biotopes and record the water parameters in the Orinoco, Autana, and Atabapo. The Autana empties into the Sipapo, and the Sipapo flows into the Orinoco.

Autana

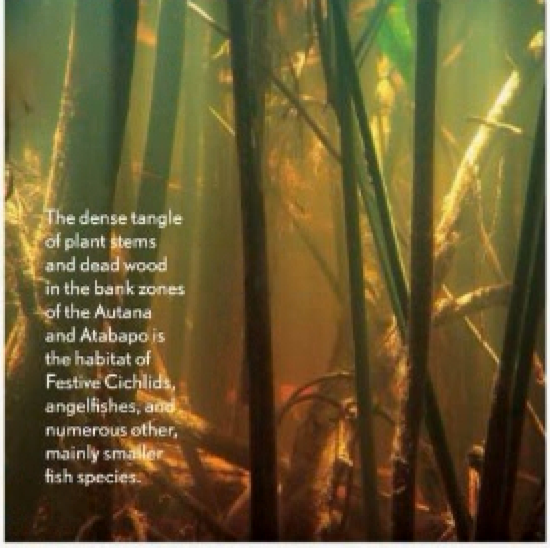
After a voyage lasting several hours we reached the Autana. Here we saw *Mesonauta insignis* in several places, usually near the bank, both while we were snorkeling and while simply looking down from above through the very clear, tea-colored water. There were juveniles of various sizes swimming in protective shoals of six to ten individuals in the shallow water near the shore. Weidner (2009) mentions shoals of juveniles numbering up to 20 specimens.

Mesonauta insignis is the member of the genus that has long been established in the aquarium hobby. Although the names *Mesonauta insignis* and *M. festivus* both date back to the Austrian scientist Heckel, who

Bird's eye view of the Rio Autana and the dense surrounding rainforest.

TOP: S. TERLETZKI; BOTTOM: W. HERZ

Half-grown Altum Angelfishes, *Pterophyllum altum*, hiding among trailing bank vegetation.



The dense tangle of plant stems and dead wood in the bank zones of the Autana and Atabapo is the habitat of Festive Cichlids, angelfishes, and numerous other, mainly smaller fish species.

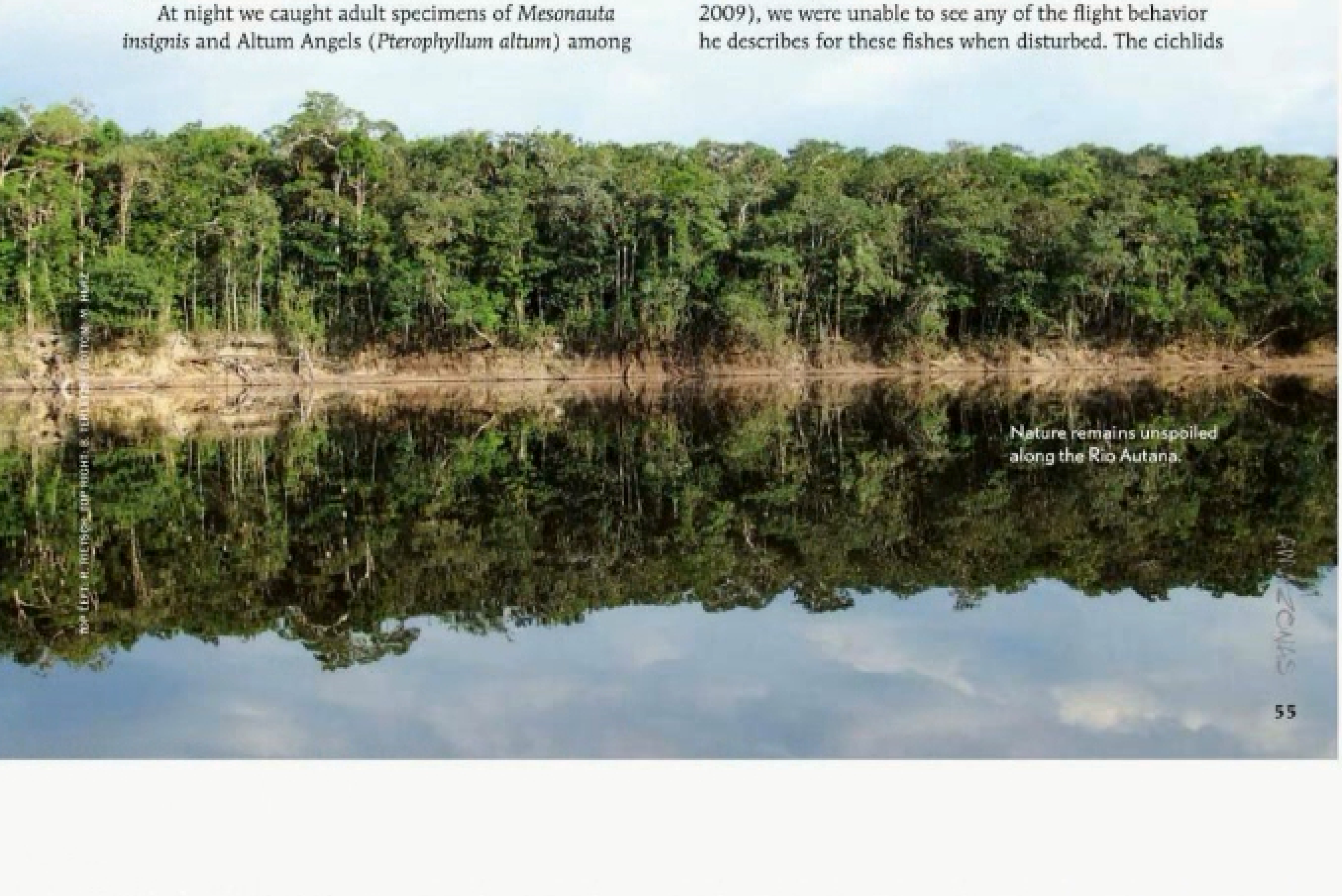
described two separate species in 1840, they were subsequently lumped together as *Cichlasoma festivum* for many decades, so early imported specimens were inevitably identified as that species—hence the popular names Festive Cichlid and Festivum. The species is also known as the Flag Cichlid, but that name is potentially even more confusing, as it is also used for another quite different cichlid, *Laetacara curviceps*.

The numerous fallen trees in the water provide these fishes with excellent shelter among their branches. Such hiding places are important protection against the predators that share the biotope—piranhas, pike cichlids (*Crenicichla*), and the Speckled Peacock Bass, *Cichla temensis*. Both banks were clad with dense scrub and small trees, and the bottom was fine, pale sand. We found no vegetation in the water.

At night we caught adult specimens of *Mesonauta insignis* and Altum Angels (*Pterophyllum altum*) among trailing plants and roots and beneath floating meadows in a quiet lagoon where, as luck would have it, fishes were very numerous. The size of the *Mesonauta* ranged from 1.25 to 7.5 inches (3–19 cm) long and the Altums were 3–14 inches (8 to 35 cm) high. The juvenile *Mesonauta* in this stretch of river had red tails. As previously reported by Weidner (2009), juveniles smaller than 1.25 inches (3 cm) are neither seen nor caught in the dry season.

We established that Festive Cichlids also occur in slow-flowing waters. The fishes were very shy in areas where the Piaroa people lived on the banks, but in other places they were very inquisitive when we visited them underwater, swimming right up to our masks while we were snorkeling.

Contrary to the observations of Weidner (1995, 2009), we were unable to see any of the flight behavior he describes for these fishes when disturbed. The cichlids



Nature remains unspoiled along the Rio Autana.

A splendid specimen of *Mesonauta insignis* shortly after capture.

Our wild-caught specimens retained their attractive yellow coloration in the aquarium.

simply made for the nearest fallen tree or other dead wood in the water. We were, however, able to watch *Mesonauta insignis* feeding on biocover. We also discovered that juveniles of this species swim together in mixed groups with other fishes, for example *Heros severus*, *Crenicichla* sp., and various characins.

San Fernando de Atabapo

We traveled up the Autana to the *tepui* (table mountain) of the same name, which the Piaroa tribe regards as sacred. We climbed the mountain with a Piaroa Indian guide. From the top there was a wonderful view across the wide expanse of forest with its green treetops. Then we went back downstream to the Orinoco and reported to the local police station in the village of Raton, as a permit is required to travel the rivers in the tribal regions. Additional permits are needed for collecting and transporting fishes.

We next headed along the Orinoco in the direction of the Rio Atabapo. The Autana, the Orinoco, and the Atabapo all have similar biotopes. It is easier to catch and observe fishes during the dry season—the time of our visit—than at high water, but, unfortunately, not all the rivers are permanently navigable at low water. This applies in particular to the Atabapo south of the town of San Fernando de Atabapo, the last major settlement we came to as we traveled south up the Atabapo. A special feature of this town is that it is the meeting place of rivers flowing from all points of the compass—the upper Orinoco from the east, the Atabapo from the south, and the Guaviare from the west, all combining to flow north as the Orinoco.

River	Orinoco	Autana	Atapabo
pH	5.3–5.4	5.4	6.5
Conductivity	160–180 µS/cm	65 µS/cm	160 µS/cm
Water temperature at the surface	88°F (31°C)	88°F (31°C)	89.5°F (32°C)
Air temperature	88°F (31°C)	86°F (30°C)	100.5°F (38°C)

The gorgeous *Satanoperca daemon* also lives in the tributaries of the upper Orinoco.

TOP LEFT: M. HERZ; TOP RIGHT: R. RIETSCH; BOTTOM: H.-G. EVERS

Image: *Paratheraps melanurus (synspilus)*, courtesy Ad Konings

Such splendid specimens of the Royal Plec, *Panaque nigrolineatus*, can be caught only further downstream in the vicinity of Puerto Ayacucho. The species is actually native to the llanos.

Low water

Although everyone familiar with the Atabapo said that the river was at its lowest level in 25 years at the time of our visit, we decided to continue south. The landscape was characterized by gleaming white sandy beaches lining the shore and sandbanks in the river. Our fears proved groundless, as our *capitano* was a local man who found a navigable channel along the river, though we did have to disembark from the boat a few times in order to make it lighter. It now became clear that we had been right to forego the 66-foot (20 m) boat we had considered and instead hire this smaller vessel, only 40 feet (12 m) long and a lot lighter.

The Atabapo forms the boundary between Venezuela and Colombia, and our first stop was on the Colombian side, where we spent the night. This stretch of shore provided splendid conditions for snorkeling and for watching and collecting fishes, but unfortunately we also discovered numerous plundered nests of an aquatic turtle (*Podocnemis* sp.). On the other hand, fallen trees lying in the water provided cover for various fish species such as *Mesonauta insignis*, *Heros severus*, *Satanoperca daemon*, piranhas, *Crenicichla* sp., *Geophagus* sp., *Aequidens* sp., and assorted catfishes. Loricariid catfishes proved easy to capture simply by lifting pieces of wood out of the water and gathering the fishes that fell out of them. We were surprised how many fishes could be found living in a single piece of wood.

Red-brown lagoons

Elsewhere along the Atabapo we were able to watch and catch *Mesonauta insignis* and *Pterophyllum altum* in a pool surrounded by rock formations. The red-brown water was so clear that the underwater visibility was up to 3.5 feet (100 cm) in the bright sunlight. According to Staeck (2002), the intense brown color of this black-water river means that angelfishes rear their broods not on the bottom but in the middle layers of the water. We were able to observe *Mesonauta insignis* and *Pterophyllum altum* very readily underwater. We established that in the habitat we investigated, groups of six to eight adult *Mesonauta insignis* sometimes share the same hiding place. In quiet spots we saw these fish leaving their retreats in pairs. In the case of juveniles, we noticed that the smallest individual was shoved out of the hiding place by the rest of the shoal, perhaps to check whether there were any predators around.

Using a seine net, we captured splendid yellow Festive Cichlids around 8 inches (20 cm) long and Altum Angels 12–14 inches (30–35 cm) high. Although *Mesonauta*

M. HERZ

Large Altum Angelfish, *Pterophyllum altum*, from the Atabapo, shortly after capture.

insignis doesn't usually exceed that length, which was the maximum we recorded among the specimens we caught, this species can grow larger than normally stated (Weidner 2009). Roland Rietsch has maintained a male 9 inches (23 cm) long.

In addition we caught an impressive number of adult *Crenicichla* sp., juvenile *Aequidens* sp., juvenile *Heros severus*, and adult *Geophagus* sp. The *Crenicichla* proved a tasty addition to our evening meal. There were no fallen trees or other dead wood and no plants in this rather unusual biotope, and the bottom of the pool was sandy, without any noteworthy accumulation of leaf litter. The crevices among the granite rocks were the only shelter available to the fishes. Paepke (2003) and Linke (2000) have reported similar biotopes, including in other distribution regions of *Pterophyllum* species. Both authors cite Ladiges (1951) as a reference. Linke (2000) remarks that such biotopes are a matter of "no option" during the dry season.

However, the area we visited consists of granite rock formations with no sheltering trees for most of the year, even though the water level rises considerably during the rainy season. A broad, white sandy beach, extending around 130 feet (40 m) to the edge of the forest on higher ground, is typical of this region.

Collecting aquarium fishes

During our trip to the Atabapo we had the opportunity to visit a Piaroa family on the Colombian side of the river who earned their living collecting fishes for the aquarium trade. Unfortunately we weren't allowed to take photos of their catch, but we were impressed by the number of tetras caught in the meshes of their fixed nets in the river. They also had rays and various L-catfishes waiting for transportation to the wholesaler. The collector proudly told us that with a bit of

The snow-white sandbanks of the Rio Atabapo.

luck he could catch up to 50,000 tetras in a day, and that he was selling 200,000 aquarium fishes to the wholesaler every week.

We will never forget the impressions and experiences (and hardships!) of our journey. The unspoiled nature and the apparently uncompromised environment along the Orinoco invites a return visit. We advise every keen aquarist to undertake an expedition to the natural habitat of his or her fishes.

Acknowledgments: *We would like to thank Andreas Stelzig in Altenburg (www.aquanet.tv) for help with preparing for our trip; Axel Kelemen of Cruisingtours (www.axel-expedition.com) for arranging the details of our travels in Venezuela; and our fellow travelers, Horst Engbrecht (Berlin) and Sven Hofmann (Brandenburg an der Havel), for all their help and support with catching fishes in the field.*

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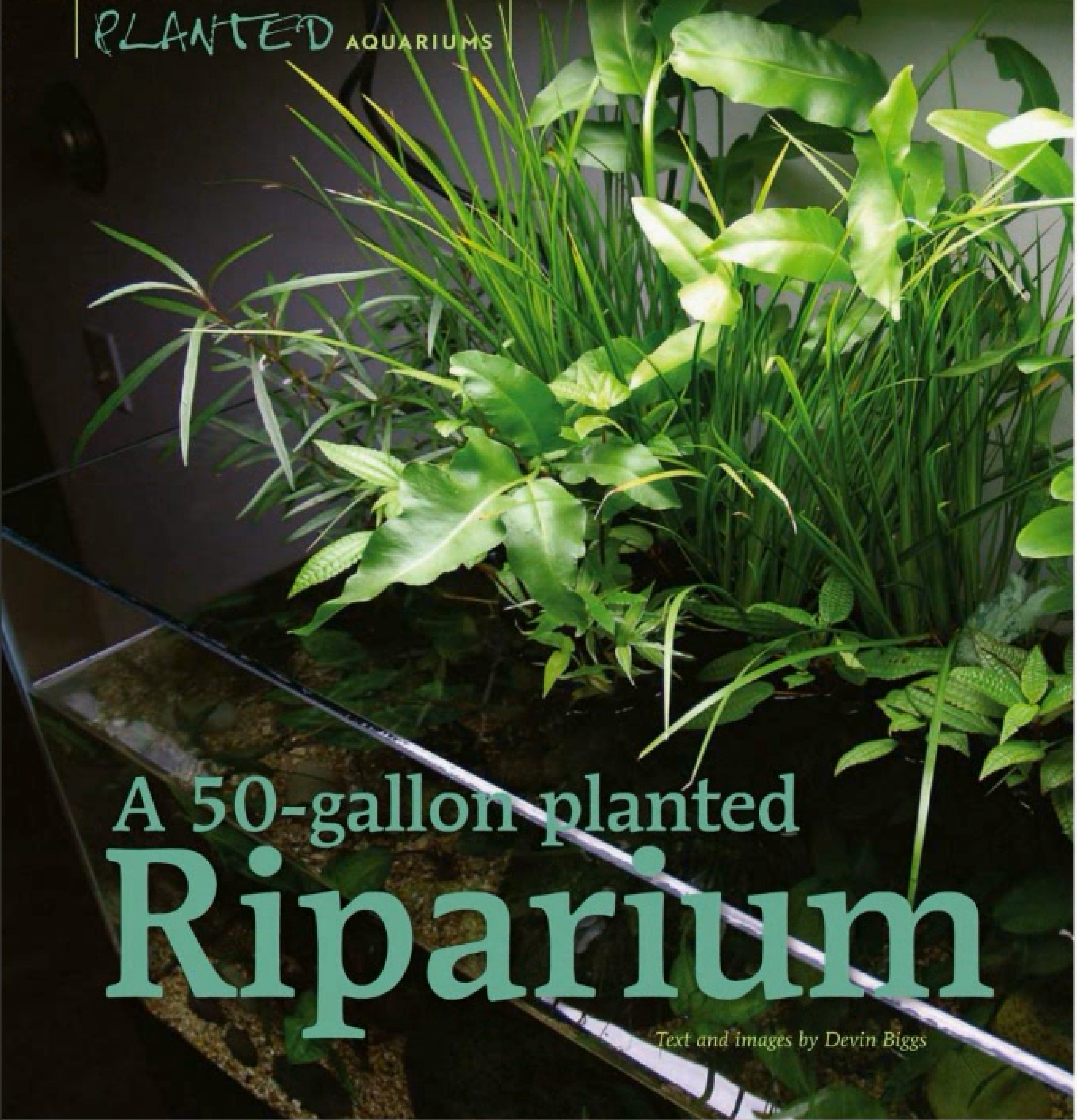
Bizarre rock formations line the Río Atabapo.

Above: Habitat of *Pterophyllum altum*, *Mesonauta insignis*, *Aequidens sp.*, and *Crenicichla sp.* in the Rio Atabapo: no dead wood or vegetation here. The Festive Cichlids and angelfishes spend the day in the numerous crevices in the rocks.

M. HERZ



A 50-gallon planted Riparium

Text and images by Devin Biggs

Aquarists through the ages have used their hobby experience, scientific knowledge, and artistic inspiration to create beautiful models in miniature of aquatic ecosystems. Today, with water parameters and natural materials often closely matched to those of wild habitats, such living displays are perfect homes for aquarium livestock and plants and satisfy our human desire to connect with nature. I am especially drawn to the beauty of planted aquariums. The cold, gray winters here in the Great Lakes region of the United States drag on for months and seem to last much longer than the summers. But the radiant emerald green of a planted aquarium serves as an uplifting reminder of the beautiful summers and a refuge from the bleak landscape outside.

D. BIGGS

Most freshwater aquarium displays emphasize the underwater aspects of lakes, rivers, ponds, and streams. However, just as characteristic as the underwater gravel bars, weed beds, and rock piles of aquatic ecosystems are the vegetated shorelines where the water meets the land. Depending upon their specific growth habits and habitat context, the plants that grow in these areas are variously referred to as *marginal*, *emergent*, or *rheophytic*, among other terms. Such plants grow with all or most of their foliage above water, but they are rooted in the muddy sediments in shallow water or right along the shoreline.

Like other *edge habitats* (areas where two distinct habitat types meet), shorelines provide unique combinations of resources for wild animals and plants. Stands of shoreline plants, sometimes referred to as *riparian* (from the Latin *ripa*, meaning "edge") vegetation, are the habitats of choice for many of the most popular aquarium fishes. Small, active fishes find plenty of food among the roots and foliage while enjoying protective cover from larger fishes that cruise the open waters. Shoreline plants include some of the most attractive and botanically intriguing species. While they often benefit from the abundant light, water, and nutrients, shoreline plants must contend with anoxic (oxygen-poor) conditions in their root zones, fast-flowing water, and other special challenges.

During the past few years the planted

A 50-gallon (190-L) riparium system created by the author is more than an *objet d'art*—it improves air quality in the home and offers multiple delights to the observer. The background is anchored by several clumps of grass-like Japanese Sweet Flag, *Acorus gramineus*.

The system is illuminated by a suspended fixture housing HO T5 6000K lamps. Circulation and filtration are provided by an external canister filter.

A school of Dwarf Chain Loaches, *Yashuhikotakia sidthimunki*, zooms around a riparium containing two good low-tech submerged plant species: *Cryptocoryne* and *Marsilea*.

riparium, a new kind of planted aquarium that features shoreline plants, has been developing in the United States, where it is gaining popularity as a compelling new option for fish-keeping and aquarium gardening. Ripariums make use of the hardscapes, aquarium fishes, and underwater plants that are standard elements of aquarium habitat displays, but they also incorporate shoreline vegetation that grows with its roots down in the aquarium water and holds its foli-

Betta macrostoma are great leapers, so a riparium, with its lowered waterline and plant cover above, is an ideal place for them.

Standard 50-gallon breeder tank with top rim removed. Note that the water level in this setup is less than halfway up the side of the aquarium.

age up in the air. Ripariums resemble another kind of model habitat display that has been around for many years, the *paludarium* (from the Latin *palud*, meaning "swamp"), but the two setups have key differences. Paludariums combine planted terrestrial areas with aquatic portions—you can also think of paludariums as terrariums with water features—but ripariums use planters, either commercially fabricated or DIY versions, to hold the shoreline plants on the rear pane of aquarium glass. In a paludarium the terrestrial area is built up with various combinations of natural materials (soil, stone, driftwood) or synthetic materials (foams, plastic) that are integrated parts of the visual design. The planters in a riparium, on the other hand, are hidden behind the riparium plant foliage and roots to create a natural scene. Paludariums can be very good habitats for amphibious animals (frogs, fiddler crabs, mudskippers), but since ripariums have no real land area they are less suitable for these sorts of livestock. Nevertheless, ripariums have other features that make them especially useful for the care and display of aquarium fishes and a wide variety of shoreline aquatic plants.

In this article I use a 50-gallon setup that I currently maintain in my home to explain aspects of equipment configuration, plant care, and visual design for planted ripariums.

Equipment

Aquarium enclosure and life support

The following list summarizes the aquarium equipment included in this setup:

- 50-gallon (190-L) breeder aquarium, 36" (90 cm) wide
- Tek Light 4 X 39-watt pendant light fixture
- Giesemann PowerChrome Midday HO T5 6000K lamps
- Fluval 205 canister filter
- Power strip, GFCI outlet adaptor, and light timer

The glass aquarium deserves special mention. Since their growth extends beyond the aquarium top, plants growing in open-top ripariums look best if the tank is rimless. During the past couple of years more manufacturers have begun to offer rimless tanks in the United States, but availability and pricing are still limiting. I made a good compromise by removing the top plastic rim of a standard 50-gallon breeder aquarium, a model that is economical and widely available. I voided the product warranty by doing this and I wouldn't necessarily recommend that anyone else take the rim off a fish tank, but I have had this aquarium setup for several years with no trouble. It certainly shouldn't be more than about three-quarters full: the several inches of glass above the water line is beneficial because it has thwarted escapes by leaping fish. Accounting for the lowered water level and displacement by substrates, the tank holds about 20 gallons of water.

One piece of equipment that I selected very carefully was the T5 fluorescent lighting, Giesemann PowerChrome Midday 6000K lamps that illuminate with a bright and convincing natural spectrum light. Plants and fish look very good under this lighting and I can see a better depth of color in the plant foliage, a broader range of subtle green shades, than I've seen with any other lamp that I have tried.

Riparium planting accessories

Two kinds of accessories hold the riparium plants on the rear pane of aquarium glass. The riparium hanging planter is a clear plastic vessel equipped with a pair of suction cups, and it holds a fine gravel substrate along with the plant roots. The best kinds of planter gravel are various baked clay products, including a few that are also popular as planted aquarium substrates (e.g., Seachem Fluorite). Clays have a unique chemical property, cation-exchange capacity (CEC); their small particles grab nutrient ions from the water column, then make them available to plant roots. Aquarium water diffuses through the hanging planter via a few holes in the bottom and back surfaces. Plant roots also escape through these holes to grow in the open aquarium water.

Riparium trellis rafts are machine-cut from a buoyant, closed-cell foam of a dark gray color. Numerous holes in the trellis raft hold plant stems and roots, while the curved and broken outline of the trellis raft helps it to blend in with the plant foliage. Trellis rafts and hanging planters are equipped with plastic snap fasteners so that the rafts can snap securely into place on the front rims of the planters, level with the waterline. You can also snap two trellis rafts together to form a larger raft of growing riparium stems. Hanging planters, trellis rafts, and other riparium accessories are available from the Riparium Supply online store (www.RipariumSupply.com).

Riparium Plant Selection and Aquascaping

This section will further detail the use of riparium planting accessories, along with strategies that I used in selecting plants for riparium aquascaping. There are several distinct ways to use plants in a riparium layout.

In nature, all good riparium plants occur in very wet situations. They are thus pre-adapted to grow with their roots in permanently wet substrates and are good representations of shoreline or wetland habitats.

Riparium background plants in hanging planters

This group includes most riparium plants. There are hundreds of different species and varieties that will potentially grow well in riparium hanging planters. Background plants can be further divided into foundation, accent, and centerpiece plants. Foundation plants fill several planters and have sturdy foliage, while centerpiece and accent plants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add more visual interest with varied foliage colors and textures. The following list includes most of my favorite foundation background plants:

- Peace Lily (*Spathiphyllum* spp.)—Grows very well in lower light levels and combines well with other tropical-looking riparium plants. It throws dense shade, so it is a good companion for shy fish that appreciate subdued light and overhead cover. Wild *Spathiphyllum* grows in Central American and South American rainforests along streams or in swamps. Peace lily is a popular houseplant, and there are dozens of horticultural varieties available.
- Umbrella Sedge (*Cyperus* spp.)—Tidy and sturdy foliage combines well with a wide range of plants. Light penetrates through its fine leaves, so other plants can grow very well beneath it. Good riparium species/varieties include *C. involucratus* Baby Tut and *C. alternifolius* var. *gracilis*. Horticultural *Cyperus* are most often grown as pond plants, but they are very easy to grow in ripariums.
- Baby Panda Bamboo (*Pogonatherum crinitum*)—A wonderful small-growing (to about 14" tall) plant with fine foliage that is perfect for nano-riparium setups. Baby Panda Bamboo is not a true bamboo, but it is a grass, as are bamboos. This plant usually suffers after transplanting and it is slow to establish, but well worth the wait.
- Cat Palm (*Chamaedorea cataractarum*)—There are hundreds of species of palms, but Cat Palm is a true *rheophyte* (stream-associated plant) and it is fairly easy to find for sale as a houseplant or landscape plant for warmer areas. It has a good growth habit for riparium-scaping. While a previous iteration of this riparium setup used *Cyperus* plants as the foundation foliage, the current planting relies upon Cat Palm in several planters to fill out the background area. The Latin *cataractarum* means "near waterfall," and Cat Palm grows along the edges of rainforest streams in southern Mexico and Central America, so it is both well adapted to growing in a riparium and a good representation of the tropical streamside environment. This is the first riparium in which I have tried it, and it is now one of my favorite plants. The finely divided and gracefully arching leaves are elegant in themselves and make a perfect backdrop for other tropical plants. It requires some patience to establish Cat Palm because it takes a couple of months for it to take root in the riparium planters, but it grows at a moderate pace thereafter.

Riparium accent or centerpiece in hanging planters

There is a very large number of possibilities in this category. The following are just a few of my favorite accent plants:

One of the author's Riparium Island kits, with a hanging planter to be affixed to the rear wall of the aquarium with suction cups. The dark gray trellis raft is designed to hold mid-ground stemmed plants erect. The *Bacopa* in the cup will fill in and eventually hide the raft.

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Dwarf Taro, *Colocasia fallax*, makes a good riparium plant with its attractive foliage and a maximum height of just 14 inches (36 cm).

- *Echinodorus* spp. swordplants, especially *E. cordifolius* and *E. palaefolius*.
- Leather Fern (*Acrostichum danaeifolium*)—An easy plant with a wonderful, prehistoric fern appearance. Grows well in fresh or brackish water.
- Mexican Petunia (*Ruellia brittoniana*)—Readily blooms in the riparium. Grows fast, but size is easy to control by pruning.
- Spider Lily (*Hymenocallis* spp.)—These plants grow from onion-like bulbs and flower with amazing snow-white, fragrant blooms.
- Mangrove trees, especially Black Mangrove (*Avicennia germinans*), Red Mangrove (*Rhizophora mangle*), and White Mangrove (*Laguncularia racemosa*)—Botanically and ecologically intriguing plants that adapt very well to riparium growing. Salt tolerance varies by species, but mangrove trees can be grown in freshwater or brackish setups with varying salinities. Growing them in riparium planters limits the size of these trees because their root spread is controlled; you can also control the size and shape with light pruning.

Plants with especially handsome or showy foliage are selected as centerpiece plants, and it is best to choose a single good-sized individual in the riparium layout. In my experience, the best centerpiece plants are various water-loving aroids in the family Araceae. Several elephant ear taros of the genera *Xanthosoma* and *Colocasia* perform very well and look great in ripariums, but can quickly grow very large. I control their size by cutting back the largest leaves. The Dwarf Taro, *Colocasia fallax*, grows to only about 14 inches (36 cm) tall and has very attractive satiny foliage.

The current layout in this tank does not have a conspicuous centerpiece plant, but it does include an especially unique and rare aroid, *Lasia spinosa*. This spiny, imposing plant grows wild in swamps in Southeast Asia and India. My specimen has elongate arrowhead-shaped leaves, but there are a couple of other, different forms in the same species. It took me a long time to track down this plant, which I received in trade from another tropical plant hobbyist, and I am very pleased that it has grown so well in my riparium.

Two other species, *Echinodorus palaefolius* and *Spathiphyllum phryniifolium*, serve as additional accent foliage. This *S. phryniifolium* is a true species plant and thus is unusual among cultivated peace lilies, most of which are hybrids selected for showy and long-lasting blooms. I grew mine from seed.

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Riparium mid-ground on trellis rafts

The riparium mid-ground plants are essential for the development of a convincing layout. The trellis rafts snap onto the fronts of the hanging planters and extend out into the middle of the aquarium, thus adding visual depth to the planting. A layout that features background plants in the hanging planters but no mid-ground plants can have a decidedly two-dimensional appearance. As they grow in the trellis rafts, the plants cover and obscure the rafts and the hanging planters.

Since they grow with their roots suspended directly in the water, there is a more limited selection of plants that perform well on trellis rafts. Without careful water-column dosing, most plants would suffer nutrient deficiencies if grown directly in the aquarium water, whereas good trellis raft plants perform well with the more limited nutrient availability.

My favorite kinds of plants for growing on the trellis rafts are various *Pilea* species. This large plant genus has representative species in warmer areas on most continents and belongs to the stinging nettle plant family, Urticaceae. My favorite *Pilea* for use in ripariums, *P. grandifolia*, does not sting, but it does resemble the *Urtica* stinging nettle that grows wild in our area. It has an attractive lime green color and orderly pleated leaves. It looks especially good in a riparium when planted onto several trellis rafts to form a mid-ground hedge. In this riparium layout I used just two different mid-ground plants, *P. grandifolia* and *P. cadieri*. The latter of these is also known as the Aluminum Plant and is frequently offered for sale as a house plant. Planting the *Pilea* plants on the trellis rafts is very easy. I just stick the cut stem ends through the holes in the rafts, and they soon root in the aquarium water.

Underwater foreground

While not essential, a few underwater plants usually look good in the riparium layout. I like to select vivid green aquatic plants, as opposed to darker reds or browns, because the bright green brightens the underwater area, which is shaded by the above-water riparium plants. If enough light and nutrients are provided, it should be possible to grow almost any kind of aquarium plant in the underwater portion of a riparium, but I prefer to select plants that can grow well without very bright light, CO_2 injection, or careful fertilizer dosing. Good choices include crypts (*Cryptocoryne*), swordplants (*Echinodorus*), and Java Fern (*Microsorum*).

Substrates and hardscape

Along with bright green plants, light-colored gravels or sands will further brighten the riparium underwater area. I found a coarse construction sand at a local hardware store and screened it to remove the finest particles. This yielded a natural, fine, multicolored gravel, which combined very well with the rounded river stones to create an authentic river bottom-scape. I have set up a few ripariums that did not have any underwater plants at all, but instead incorporated carefully arranged underwater hardscapes. This is a good strategy to use with fish that might destroy underwater foliage, including many cichlids.

Livestock

As is obvious from my plant choices, I did not plan this display with any kind of strict biotope theme. My fish likewise originate from several different far-flung geographic areas. The first ones that I acquired were a group of seven Lake Tanganyika catfish, *Synodontis lucipinnis*. I purchased them as *S. petricola*, but after seeing a picture of the juvenile fish an Internet acquaintance suggested that they were more likely the similar *S. lucipinnis*. My *S. lucipinnis* hide most of the time during the day, but emerge with gusto and swim like mad during feeding time. These are wonderful fish and an especially good option as a gregarious, long-lived group.

I have kept a few different kinds of species livebearers, but the best that I have tried for planted display is my current group of about a dozen *Limia vittata*, a Cuban species. The other poecilids that I have kept have been content to just mill around all areas of the aquarium, but these *L. vittata* usually swim in a school and spend most of their time up near the front pane of glass. Their gold coloration contrasts wonderfully with the green plant foliage, and I also appreciate the unique black-splotched flanks that adorn each fish.

Another species that I sought out specifically for this setup was *Thoricthys ellioti*, a cichlid from southern Mexico. Unlike most other Central American cichlids, *T. ellioti* is fairly peaceful most of the time and it can be kept in small groups. I have seen occasional flaring but never any real fights or pursuits among this group of five individuals. This small to medium cichlid can reach a length of more than 4 inches (10 cm), which would be a chunky fish for this 36-inch (90-cm) tank, but mine are slowing their growth at only about 2 inches (5 cm).

This aquarium is heavily stocked, but with the combination of a well-established biofilter, vigorous riparium plant growth, and weekly water changes it maintains excellent water quality. The broader footprint of the breeder aquarium also has a favorable water surface area to volume ratio—this better promotes gas exchange at the water's surface—and relatively more swimming room.

Conclusions

Planted ripariums combine established methods of aquarium plant and livestock care with new techniques that facilitate the culture and enjoyment of shoreline aquatic plants. With myriad new options for plant selection and aquascape design, ripariums have special appeal for plant hobbyists. Riparium methods also make it easier to incorporate live plants into active fish displays; riparium plants can maintain vigorous growth with no need for CO_2 injection, they grow algae-free, and they are up and out of the reach of rowdy fish. Fish directly benefit from riparium plants due to natural overhead cover and robust plant-based filtration.

I have thoroughly enjoyed this 50-gallon riparium setup and I think that I have made a few useful discoveries with it, including the use of Cat Palm as a riparium background plant. I have many other plant ideas in mind and I'm already dreaming about my next riparium project. I'm keen, too, for the ice to melt in the springtime so that I can once again enjoy the rich array of wild plants inhabiting the shorelines of our diverse Wisconsin lakes and streams.

Devin Biggs *hails from Madison, WI, and is an aquarist, photographer, and the mind behind the online presence at http://www.ripariumsupply.com.*

A NEW

Rhinogobius SPECIES

text by Frank Strozyk and Thomas Ackermann • photos by Frank Strozyk

Top: Adult males are impressive fishes with striking fin markings.

Bottom: Adult males fighting for dominance.

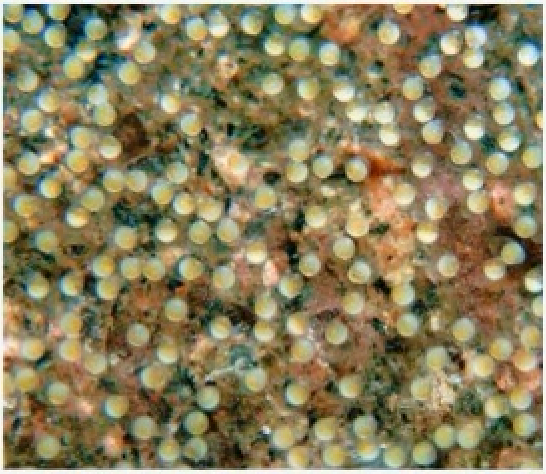
63-gallon (240-L) aquarium for the maintenance and breeding of *Rhinogobius* sp.

The genus *Rhinogobius* is found in Asia, where it is known as Yoshinobori. It contains almost innumerable species and variants of small to medium-sized freshwater gobies. Very few of these ever turn up in the trade, although the various geographical forms of the easy-to-breed White Cheek Goby (*Rhinogobius duospilus*) and its closest relatives are regularly seen. Now and then, importations include a few specimens that on close examination turn out to be a completely different species.

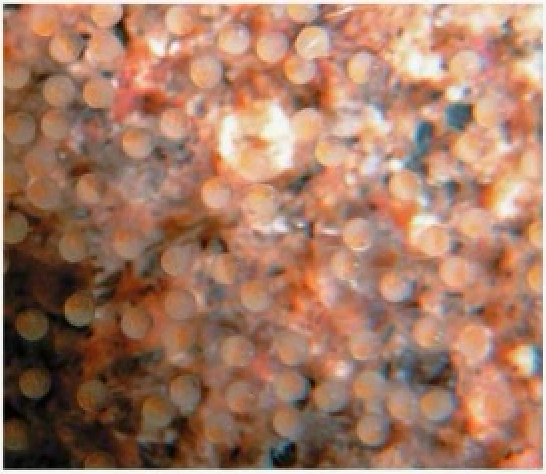
In 2004, one of the authors purchased two not-yet-full-grown pairs of a goby species that was being sold as *Rhinogobius wui*, but looked quite unlike that species. There was an irregular pattern of stripes on the cylindrical body, and the head was considerably beefier and more pike-like than that of *R. duospilus*. The bright red stripes on the gill covers are horizontal, not vertical as in *R. duospilus*. This character can also be used reliably to differentiate young specimens of the two species.

The new gobies are similar to *Rhinogobius flumineus* and, in particular, *R.* sp. "Orange", but they differ enough in numerous details, such as fin markings and overall size, that they may well be a distinct species. Their closest relatives appear to be the gobies known as Tou-Yoshinobori. Photos of the latter on the Internet differ from the species portrayed here only in the finest details

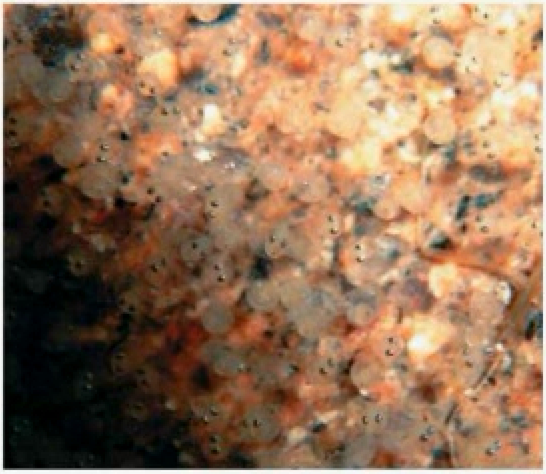
Female *Rhinogobius* sp., patterned in shades of gray and brown, are easily distinguished from *R. duospilus* females by their long, slightly subterminal mouths. The belly of a female that is full of eggs has a yellow hue.



Fresh spawn of *Rhinogobius* sp.



Eggs hanging from the spawning substrate a day after they were laid.



After 3 days the eyes of the larvae are clearly visible.

(primarily the form and size of the bright blue spot on the first dorsal fin).

During almost four years of our keeping them, the males grew on to a length of almost 4 inches (10 cm), far larger than *R. duospilus*, which looks almost dainty by comparison. Females are somewhat smaller at 3 inches (8 cm) and their coloring is much less conspicuous. The species is remarkable not only for its impressive size, but also for its thuggish social behavior. Our fishes had frequent territorial squabbles and struggles for dominance, and the species is clearly more inclined towards serious battles, with injuries inflicted, than is *R. duospilus*. A kind of pecking order developed among both males and females, but under certain circumstances—for example, when the tank was rearranged or its population changed—hostilities would break out again.

"Sand Tiger Shark" mysteries

In the absence of a scientific name, and in view of the ferocious behavior of these gobies, we spontaneously christened them "Sand Tiger Sharks", but it would have been enormously helpful to know the true identity and provenance of this interesting goby species in order to provide the correct conditions for their husbandry and breeding.

After some effort, we managed to make contact with the Taiwan Fishbase, but the result was rather disappointing. Professor I-Shuing Chen did cautiously come up with the name *Rhinogobius leavelli*, but so far no comparative pictorial material has been available for evaluation. As a result, the precise origins of the species unfortunately remain unknown, though a large number of apparently very closely related species originate from Thailand. Still, numerous questions remained unanswered when we started keeping these attractive gobies. Were they inhabitants of fast-flowing rivers with rapids or of calm inland lakes? Did they live and breed exclusively in fresh water, or did they live near the coast and have an amphidromous reproductive strategy, with the larvae and/or fry developing in brackish or salt water? Lots of questions remain that will be answered only with extensive experimentation and observation.

Easy maintenance

The maintenance of this species initially proved fairly easy. A 120-L (32-gallon) tank ought be adequate for four individuals. In accordance with the assumed ecology of the species, we decorated ours with a thick layer of fine sand, large slabs of rock lying on the bottom or leaning at an angle, and some large pebbles. This suited the gobies well, and they were able to use their color and markings to merge with their surroundings. Planting appears to be less important and a matter of the individual aquarist's tastes.

Both filtration and water changes were fairly standard (30–70% once to three times per week), and the fishes proved very adaptable in terms of water parameters and did well in the water used (2°KH, 5°dGH, pH 7). Room temperatures between 61 and 82.5°F (16–28°C) with seasonal fluctuations were well tolerated as long as the oxygen supply was adequate. Although it didn't appear to be absolutely necessary, a moderate to strong current seemed to suit the active nature of the fishes and encourage their goby-typical behavior. In addition, the water circulation was a great help in concentrating mulm and uneaten food in particular places. The gobies weren't fussy about food and seemed to enjoy all the usual frozen and live foods, such as glassworms, bloodworms, mosquito larvae, water fleas, *Artemia*, and small shrimps. When fed with river shrimps (*Gammarus*), stone-fly larvae (order Plecoptera), and water hoglice (*Asellus*), they displayed their hunting skills to the fullest, even in the strong current.

Newly free-swimming fry of *Rhinogobius* sp.

Perhaps because of competition for food in the natural habitat of these gobies, they were inclined to be greedy and overeat. The result was little "pot bellies"—their body depth could double in just a few minutes. On the other hand, it seems that heavy feeding and a varied diet are prerequisites for the development of eggs. It is easy to tell when females are ripe, as their bellies become permanently distended and the yellow color of the eggs shows through. Once the fishes have settled in properly, they proceed to breed fairly quickly and without complications.

Breeding caves beneath rocky slabs

When the "Sand Tiger Sharks" bred, it rapidly became obvious that, unlike *R. duospilus*, this goby is a "small-sized egg" breeding type. The fishes produced significantly larger clutches (200–400 eggs) of smaller eggs (around 2.5 mm long and 1.5 mm wide) than the "big-sized egg" species (for example, *R. duospilus*, which produces 50–70 eggs per clutch).

The breeding caves had a diameter of up to 1.5 times the body length of the males, and were invariably excavated beneath slabs of stone (calcareous sandstone or slate) lying flat on the sand. It was apparently important that the slab be large enough to accommodate a cave up to 6 inches (15 cm) across in both directions. If a round boulder was used, the sand tended to keep sliding back into the cave, or additional entrances to the cave appeared. The fishes quickly abandoned such caves; a lack of suitable stone slabs could completely prevent spawning. A tried-and-true slab was generally used over and over, and as observant aquarists we rapidly learned where to look for brooding males. For example, the highest-ranking male repeatedly selected a piece of dark slate measuring around 14 x 10 inches (35 x 25 cm) and .75 inch (2 cm) thick.

The actual spawning took place in the privacy of the cave and sometimes lasted for more than 24 hours. Only rarely could we see a head at the entrance to the breeding cave. Sometimes the entrance would become completely blocked with substrate as a result of the activities inside. In typical goby fashion, the eggs were attached overhead, hung from the ceiling of the cave on short stalks. The male guarded and fanned the spawn assiduously and continuously. Any invaders, such as snails, were transported outside in the mouth and spat out. Depending on the temperature, the larvae hatched after four or five days and, at around 3 mm long, were significantly smaller than the larvae of *R. duospilus*. Because the adult gobies hunted and ate their offspring, it was necessary to remove the spawn immediately before hatching. We found that moving and transferring the spawn can trigger premature hatching—for example, when a spawning substrate with a 2-day-old clutch was removed, the larvae swam free a few minutes later and were correspondingly

Three-day-old fry.

Ten-day-old fry.

underdeveloped. It was thus advisable to wait as long as possible before the transfer.

After swimming free, the larvae initially swam actively with spiraling movements towards the light, but during their first hours of life they repeatedly sank back towards the bottom. Only after around 12 hours did their swim bladders, by then clearly visible, appear to be fully developed, and the larvae then remained floating in the open water close to the surface. At first they still had large yolk sacs, but these were completely used up after two to four days. During this period the larvae grew to around 4–5 mm in length, but looked considerably less well-developed than the fry of other fish species at a similar size. Because of their drifting mode of swimming and jerky movements, they looked more like a collection of glassworms than a shoal of fry.

Rearing problems

Our first rearing attempts took place in a cube-shaped aquarium with a volume of around 6.5 gallons (25 L) with an old-fashioned airlift filter, a dense growth of Java Moss and Water Nymph (*Najas* sp.), and a cushion of green algae at the back. The front part was left clear as swimming space. No salt was added. The water parameters exactly matched those in the aquarium occupied by the adults at the time (temperature around 77°F [25°C], 2°KH, 5°dGH, pH 7).

The fry were fed a variety of foods, including powdered and liquid fry food, infusoria, vinegar eels, and microworms. *Artemia* nauplii were noticeably too large and caused the fry to exhibit a flight reaction. The fry mainly seemed uninterested in very small sinking particles and organisms—they approached them (jerkily), examined them, and then turned away. They appeared to show the greatest interest in slipper animalcules (*Paramecium*) and other infusorians. From the 10th day on they stalked newly hatched *Artemia* nauplii and probably bit pieces off them, as betrayed by the orange color of their bellies. The fry fed by approaching potential prey, slowly curling themselves into an S-shape, and then leaping forward with a jerk to snap at the prey. This behavior is indicative of active hunting of small organisms and excludes food uptake via filter-feeding.

Despite their apparent acceptance of *Artemia* nauplii and intensive efforts on our part, on every occasion there was a high mortality rate after the fry had been swimming in the open water for a few days, and by the 14th day after hatching at the latest, none of them were left alive.

Limited success

Only on one occasion did we manage to rear five youngsters successfully under the conditions described, using a cocktail of all the types of fine foods listed above in large doses several times a day. After the five fry had survived the apparently critical first 20 days and were eagerly eating *Artemia* nauplii and microworms, we had no further problems rearing them.

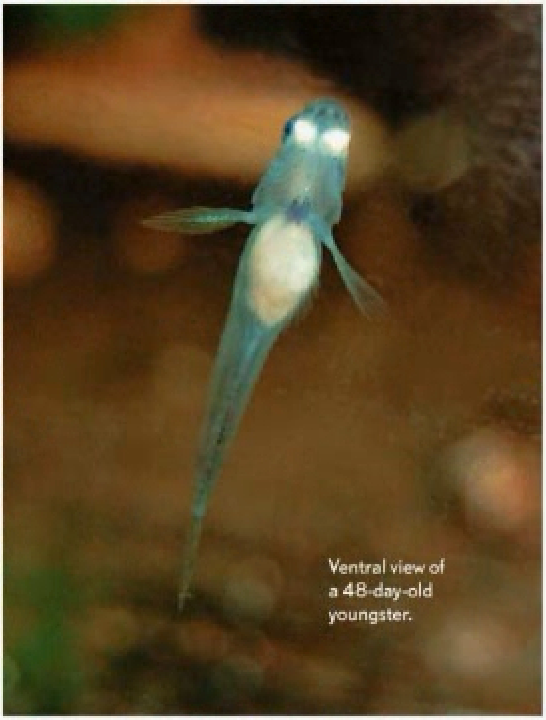
Interestingly, it was precisely 48 days before the fry abandoned their floating-drifting mode of swimming and exhibited goby-typical bottom-oriented behavior. At this point they also used their attachment organs (formed by modified ventral fins) for the first time. But the ultimate size of these tank-bred youngsters—all males, by the way—fell far short of that of the parent fishes, which may be due to problems in the first stages of rearing.

In this partially successful rearing attempt, no salt had been added to the water. We believe that this seems to argue against an amphidromous way of life of certain other goby species in which, in the wild, the larvae are washed downstream by the fresh water of the river to grow on in brackish or sea water at its mouth.

Quite the opposite: the water was relatively soft, with a conductivity of less than 150 µS/cm. But because these fish otherwise display all the characteristics of amphidromous reproduction, their mode of breeding may represent a relict form in which the larvae undergo a period of drifting between the time when they become free-swimming and when they start to feed, and are adapted to still, nutrient-rich water during an initially planktonic phase of development.

This type of reproduction may represent a primitive form whose further development in other species led to the "big-sized egg" types, whose young can thrive in flowing waters.

Fry after 25 days.



Ventral view of a 48-day-old youngster.

On the basis of our observations of the feeding behavior and the small size of the larvae of this *Rhinogobius* species, we feel it is very unlikely that they develop in fast-flowing water in the wild. Another point to bear in mind is that amphidromous species may not require a certain degree of salinity per se, but the associated low number of pathogens may be a decisive factor. That could perhaps be substituted by appropriately soft water.

The main problem in rearing appears to be providing the fry with an adequate and suitable food supply. Both of us have tried rearing a number of broods in a wide variety of water types, with all the usual (and less usual) sorts of food (including *Paramecia*, rotifers, various other infusorians, sieved pond water, assorted liquid preparations, sieved copepods, and phytoplankton), but we eventually lost even those fry whose light-colored, full bellies signified successful food uptake.

Unfortunately, after more than four years of maintenance and intensive breeding attempts, all the fishes died within a few months, so we can now only hope to come across more specimens in the future. Perhaps then we can make a further attempt at the breeding of these impressive and really interesting gobies, following our rather disappointing total of five youngsters reared out of several thousand larvae hatched.

Exchange of information invited

This goby species is a classic example of the numerous fish species that are relatively easy to get to spawn, but whose breeding ultimately founders in the rearing of the fry. "Extreme cases" of this sort are known from many goby genera (*Hypseleotris, Stiphodon, Gobiopterus, Awaous, Mugilogobius, Sicyopterus*). Only a small number of specimens are imported, and their "unbreedability" means that they usually soon disappear from the scene again—which is too bad, as they deserve more than a marginalized existence as transients in our aquariums.

The desirability (and the difficulty) of breeding such species is good reason for an active exchange of information between those maintaining them. There are occasional reports of chance breeding successes. In such cases we should join together and work methodically, yet often there is a lack of communication and exchange of practical knowledge. We will be very happy if this article on a fish species that has shown us our limits emboldens other aquarists to share their experiences with "marginalized fishes" like these. Only when we do this can any success in maintenance and breeding be of use to others. Anyone looking for detailed information or able to make a contribution is heartily invited to participate in further discussion. Marine aquarists may also have a part to play, as they have appreciably more practical experience with rearing and feeding planktonic larvae.

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Top: Male *Neolamprologus signatus* in display coloration. Female, bottom, exhibits a plainer coloration but has an iridescent side.

Opals with fins

—*Neolamprologus signatus*

Normally I don't have any special interest in cichlids, but one day I saw some little *Neolamprologus signatus* in a retailer's tank. I lost my heart to them and took two pairs home, where they were installed in a 80-L (21-gallon) species tank. • *article and images by Ole Arnold Schneider*

Unfortunately, *Neolamprologus signatus* can sometimes be hard to find in the trade. I haven't seen this species for sale since I bought my original fishes. But it is one of the most attractively colored of all the shell-dwelling cichlids. When I first saw them in the shop I was struck by these fish, and especially by their brilliant blue eyes, which can easily hold their own with those of the lamp-eyes or ricefishes. This feature is obvious even when they are in their pale fright coloration. But these fish don't exhibit their full glory until they start displaying.

Opal glow

Females are normally a slightly translucent gray-brown in color, with a violet-gold sheen on the belly region. The entire body is covered with a reticulated pattern created by the dark margins of the scales. Females that are ready to spawn also have a noticeable dark gray, almost black patch on the body just in front of the anal fin, and at this time the fins, too, become dark, smoky gray and less transparent than usual. This change is particularly noticeable in the spinous part of the dorsal fin.

Males, by contrast, exhibit an iridescent blue-green area on the anterior part of the body just behind the head, reminiscent of the gleam of an opal. The entire body is adorned with a vertical stripe pattern, but these chain-like bars are absent from the fins. Instead there is a pattern of light barring on a chocolate-brown background on all the unpaired fins. The dorsal and upper caudal fins also have a broad black margin and a lighter submarginal band that can turn a bright, coppery red when the fish is displaying. The pectoral fins are milky white in both males and females.

However, the sexes can be distinguished by other characters in addition to their differing coloration. The most striking morphological difference is in size: females are significantly smaller, with a total length of 1.5–2 inches (4–5 cm), while males can attain 2.25–2.75 inches (6–7 cm).

"Clearance work" can be seen throughout the day.

Décor and tankmates

Females in courtship dress have a smoke-colored central body and fins.

The shell-dwelling cichlids do not constitute a related taxonomic unit, but are grouped together on the basis of their way of life. Moreover, *Neolamprologus signatus* isn't a typical shell-dweller. Unlike the true shell-dwelling cichlids, it rarely utilizes empty snail shells as shelter and spawning sites in the wild, instead preferring tunnels excavated in the mud. In the aquarium, however, these fishes happily accept empty snail shells and should be provided with an adequate number of these little dwellings.

As with other Lake Tanganyika shell-dwellers, any type of suitably sized spiral shell can be used as long as it is scrupulously clean and no longer contains any part of its original occupant, which could pollute the tank. The shells of the edible snail *Helix pomatia*, known as the Roman Snail or escargot, have proved particularly useful for the purpose and can usually be purchased from delicatessens or begged from French restaurants. Some aquarium stores may provide them along with the fishes. But empty Dog Whelk (*Nucella lapillus*), Apple Snail (family Ampullariidae), and even large garden-snail shells can be used in a pinch.

Once a pair has formed, they will occupy a territory centered on a number of shells and defend it against intruders. In the event of any disturbance in the aquarium, the females, in particular, will retreat into their shells. By contrast, the males will vehemently threaten any intruder with outspread fins and are not afraid to attack significantly larger "enemies," such as their owner's hand. But because these shell-dwellers are in general rather bottom-oriented, if the tank is large and deep enough they can usually be kept without problems with surface-dwellers such as halfbeaks of the genera *Dermogenys* or *Hemirhamphodon*, or Tanganyika cypricichlids such as *Cyprichromis* and *Paracyprichromis*.

In addition, the aquarium should contain a number of large rocks to break the space up into natural territories and avoid major disputes where more than one pair is kept. The tank can also be planted for this purpose. *Neolamprologus signatus* do like to dig within their own territory, especially during the prelude to courtship, but the plants can be protected from this activity by growing them in clay pots or between large stones. They can also be surrounded by large pebbles or plants that can be attached to rocks, for example Java Fern (*Microsorum pteropus*). In any case, *Neolamprologus signatus* doesn't dig excessively, as tiny "Multis" (*Neolamprologus multifasciatus*), for example, do.

Nurseries with spiral staircases

Once a pair have established a territory and arranged it to their liking, spawning soon follows, and, given a rich and varied diet of live, frozen, and manufactured foods, they will lay eggs at regular intervals.

As a prelude to spawning, the male woos the female with fins erect, displaying his loveliest colors. Little can be seen of the spawning itself, as the pair retires into one of their shells for the purpose. And because the fishes often spend time together in a shell at other times, spawning isn't always identifiable as such. For this reason the appearance of tiny fry "hopping" around among the

The fry are fairly independent and swim around among the adults soon after leaving the snail shells.

The males often swim just above the collection of snail shells and explore the terrain.

young all look like the female; only thereafter do the males assume their typical coloration. At this stage they are best sold or given away, as they will begin to exhibit the territorial behavior typical of the species.

These fish are not very difficult to breed successfully as long as attention is paid to their requirements, including the need for very good quality hard, alkaline water. In addition to their elegant coloration, their incredibly varied spectrum of behavior makes *Neolamprologus signatus* a fascinating fish. Let's hope that this species becomes as well-established as many of its little shell-dwelling relatives in the aquarium hobby.

shells usually comes as a surprise. They should be left in the tank initially, as the parents know best how to look after their offspring and will ensure that they don't leave the safety of the immediate vicinity.

In order to avoid attacks on your hand, it is best to feed the fry with a long pipette so that a cloud of *Artemia* nauplii can be squirted immediately above the nursery. From a length of around .5 inch (1.5 cm) upward the fry will start to squabble among themselves and the parents will begin to chase them from the territory, making them vulnerable to predation by any tankmates. So if you want to rear the young, at this point they should be removed from the tank and grown on in a large rearing aquarium with lots of places to hide.

Up to a length of around 1.25 inches (3 cm), the

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PHYLOGENETIC DIFFICULTIES

Neolamprologus signatus is endemic to Lake Tanganyika in East Africa. These fishes first arrived in the aquarium hobby at the end of the 1980s and were initially thought to be an undescribed species (Puttberg 1989, 1990), but were eventually identified as *Neolamprologus signatus*. The species is considered to be closely related to *Neolamprologus ornatipinnis*.

Neolamprologus signatus is assigned to the catch-all genus *Lamprologus* by some authors, though most prefer to split the genus into a number of separate genera. This was first suggested in a revision by Colombé & Allgayer (1985), in which the genus *Neolamprologus* was first erected, along with the genera *Variabilichromis* and *Paleolamprologus*. The taxonomic classification of some lamprologines remains hotly disputed, and a whole series of Lake Tanganyika cichlids are regularly shunted to and fro between the genus *Lamprologus* and its "offshoot" genera.

The situation is further complicated by the fact that the type species of *Lamprologus*, *L. congoensis*, is one of a small number of fluviatile (stream-dwelling) species found in the Congo River that are thought to derive from a Lake Tanganyika ancestor. Although this hasn't as yet found wide acceptance, work by Sturmbauer et al. (1994) and Stiassny (1997) indicates that the fluviatile species constitute a discrete phylogenetic group—that is, a genus—to which the name *Lamprologus* should be restricted, leaving the Tanganyika species in taxonomic limbo until they can be assigned a new name of their own. It has been suggested that the genus name *Lamprologus* should be used in quotes as an interim measure, to indicate that the name isn't strictly correct.

Starting with

My interest in "corys" started in 1974 when, as a novice aquarium keeper, I bought a group of six *Corydoras pygmaeus* for my one and only community tank. Unfortunately, this tank developed a major problem and became unsuitable for the catfishes, so I sorted them into what I thought were three pairs and put them in three candy jars on the mantelpiece, where I thought it would be warm enough for them. There was no way I could effectively filter these jars, which contained about a quart of water each, so I decided it would be best if at least a third of the water was changed each morning and evening. I filled a bucket with water and added an airstone to drive off the chlorine.

STAMP: ALEXANDER ZAM/SHUTTERSTOCK

The Bearded or Banded Cory, *Scleromystax barbatus*, formerly known as *Corydoras barbatus*, is a large and hardy species appropriate for novices and experts alike.

Corydoras

article and images by Ian Fuller

I did a water change the following morning and intended to do another on returning home from work that evening, but I had to alter my plans when I found eggs stuck in the corners of all three jars. I kept the three pairs in the jars for the next two days, by which time the problem with the main community tank had been resolved. I transferred the adult corys back to the community tank and added an airstone to each of the jars containing the eggs. Two days later I had literally dozens of tiny fry.

From that day on there was no looking back. These little guys had me hook, line, and sinker, and I have never been without a group of *C. pygmaeus* since then.

Basic considerations

So, what is the best way to go about keeping *Corydoras*, ideally without such dramas? Well, before deciding to keep any species, whether common or rare, there are a few things that must be considered and some questions that have to be answered.

For many years the genus name *Corydoras* encompassed most of the species known in the hobby. There are, in fact, a total of four closely related genera, and the

Sterba's Cory, *Corydoras sterbai*, is a handsome, medium-sized catfish from the upper Guaporé River between Bolivia and Brazil. It was named in honor of ichthyologist Günther Sterba.

collective scientific name for them is Corydoradinae, a subfamily in the family Callichthyidae. They are known as "corys"—a nickname that has been used for *Corydoras* as far back as I can remember and now covers the entire group. The Corydoradinae include *Aspidoras*, a genus of 18 species that are relatively small, slender fishes reaching a maximum body length, or standard length (SL), of 2.125 inches (5.5 cm); *Brochis*, whose three species are some of the largest members of the group, ranging in size from 3 inches (7.6 cm) SL to reportedly over 6 inches (15 cm); *Corydoras*, which has the largest number of species, currently totaling 153, with a size range of 1–4 inches (2.5–10 cm) SL; and, finally, the tongue-twister *Scleromystax*, a genus that currently consists of six species, with a size range of 2–4 inches (5–10 cm) SL.

The most important consideration is the basic environment in which they will be housed. The majority of *Corydoras* species will live quite happily in a relatively small aquarium; a single pair of fish in a 12 x 8 x 8-inch (25 x 20 x 20 cm) tank will be fine, but what if you want to give them some company—say another three or four members of the same species to make up a potential breeding colony, or maybe a few tetras or barbs to create a balanced community? In that case, a larger tank is a must. One measuring 24 x 12 x 12 inches (60 x 30 x 60 cm) would be a good way to start.

To a certain degree, the equipment and decoration are matters of personal choice, but there are some elements that should be carefully thought out, the main one being the substrate to be used. I recommend a very fine, smooth-grained sand of a maximum depth of .625 inch (15 mm). This depth will allow all but the smallest species of cory to forage down to the bottom glass of the tank and reach all the particles of food that have penetrated deep into the substrate. For the smaller species, a shallower layer would be in order. Using smooth-grained sand is extremely important when it comes to keeping *Corydoras* in the best of health and condition. Any sharp-edged sand or gravel can very quickly damage the delicate barbels of these busy little fishes, which can lead to bacterial infection and fungal attack, conditions that may ultimately prove fatal.

What filter?

The second major consideration must be the filtration system to be used. With the fine-grained sand substrate, an undergravel-type system would soon become choked with debris, so I suggest one of the following three alternative methods. The first is the simple internal, air-powered sponge or box-type filters that are also ideal for small breeding or fry-rearing tanks and are operated using a small diaphragm pump. Sponge filters are particularly good in fry-rearing tanks because small fry cannot be drawn into them. There are two basic types of sponge filter: the stand-alone, weighted-base unit with a central uplift tube, which is readily available in most aquarium stores, and the "Hamburg" or "mat" filter, which is not currently commercially available and must be custom-made to fit the individual aquarium. These are very simple in design and consist of a piece of inert, 30- to 40-ppm (bubbles per square inch) sponge approximately 1.5 inches (40 mm) thick, cut to fit across the entire back or end glass of the aquarium, and a suitably sized uplift tube. The sponge is placed at the rear or end of the

A good choice among the smaller cory species is the Salt & Pepper Cory, *Corydoras habrosus*, from the upper Rio Orinoco watershed.

The Salt & Pepper Cory, like most members of its family, is best kept in groups of six or more.

Corydorus trilineatus, the Threestripe Cory, is a medium-sized cory; females mature at about 2.5 inches (6.4 cm).

tank, leaving a .75- to 1-inch (2- to 2.5-cm) space between it and the glass where the uplift tube is placed, and a hole the same diameter as the uplift tube is cut through the sponge at water level. The uplift tube outlet is located in this hole. The space behind the sponge permits a more even water flow through the sponge, making this a very efficient system.

The second type of filter that can be used is the internal canister type. These are electrically powered and are designed to house all the necessary filter elements required to adequately filter a given amount of water per hour. They come in a variety of sizes and designs to suit both the needs and the pocket of the aquarist.

The third choice is the external canister filter. These may be the most expensive, but they are also the most versatile inasmuch as they are simple to maintain without having to disturb the contents or the inhabitants of the tank. This type of filter also comes in a wide range of shapes, sizes, capacities, and price levels to suit all sizes of aquariums and budgets.

Lighting and water chemistry

Remember, *Corydoras* are bottom-dwelling fish and therefore would not usually be exposed to bright light in the wild. If the tank in which they will be housed is a community tank and part of the household furniture, then I would recommend that you furnish it with a reasonable number of plants, both bottom-rooted and floating, leaving plenty of open spaces so the corys can work the sand for particles of food.

Water conditions also need to be considered, but for general purposes hardness and alkalinity are not overly important as long as you avoid the extremes. A hardness of 5–15°dGH and a pH between 6 and 8 will be fine. A temperature range of 70–78°F (21–25.5°C) will be suitable for most species.

Conditions will need to be more exact if you intend to attempt breeding your fishes, and in that case I would

A pair of Pygmy Corydoras, *Corydoras pygmaeus*, a species suited to nano tanks. Note the size of the female, rear, compared to her mate.

The Emerald Cory, *Brochis splendens*, is a robust species that should be kept in a group in an aquarium holding at least 20 gallons (80 L).

recommend a little research into the natural environmental conditions for the species in question, to find out more about their requirements. But, that being said, there are still many species that will successfully breed as long as the water is perfectly clean. The cleanliness of both water and substrate is of paramount importance. Contamination of either can, and will, eventually cause serious health problems. So always keep to a good maintenance regime that includes regular water changes. Apart from one or two very specific species, my own cory tanks undergo a minimum 30-percent water change every week.

A wide choice of species

Give some thought to tank furnishings, tankmates, and, of course, the species of *Corydoras* you would like to keep. There are many species to choose from, ranging in size from as small as 1 inch (2.5 cm) up to a maximum of around 4 inches (10 cm), and probably as many as 50 species are available in the hobby at any one time—but not all in the same store! Color may also be a major consideration, and there is certainly a wide range of natural color forms: there are contrast-rich black-and-whites and vivid green, gold, or even orange and red forms. These are a far cry from the brown catfishes that eat garbage from the bottom and which many people believe are the only sort of catfish available.

The following are a few of the species that I recommend to anyone wishing to venture into the world of corys: two of the best small, "pygmy" species (1.25 inches/4 cm) are *Corydoras pygmaeus* and *C. habrosus*. Among the medium-sized species (2.5 inches/5 cm), *C. sterbai* and *C. trilineatus* are good choices. For those who like larger fishes, I suggest *Brochis splendens* and *Scleromystax barbatus*, both around 3.5 inches (9 cm).

Corys are gregarious animals, and for the most part prefer to live in large family groups; for this reason it is best to keep them in shoals of at least six, and for the pygmy species I would suggest at least eight. If choosing stock for breeding, I recommend selecting two males per female, as it often takes the attentions of more than one male to coax a female into mating. There are species that prefer to be kept cooler and some that much prefer warmer temperatures than what we normally consider the average tropical range of 72–80°F (22–26.5°C). I have listed two of them: *S. barbatus* (cooler) and *C. sterbai* (warmer). (See the box on page 88.)

Note that the tank sizes I have provided are suitable for species tanks holding the recommended numbers of individuals; of course, any of these fishes can be kept in a general community of peaceful fishes, provided the basic requirements discussed earlier are met.

What to look for when purchasing *Corydoras*

The final and most important thing to consider is the health and quality of the fish you are buying. Here are some pointers to help you to choose good, healthy fishes.

Look for fishes that exhibit the following:

- Active, lively behavior
- Barbels present and intact
- Bright eyes
- Plump body
- Fins held erect
- A sheen on the body

Don't buy fishes with the following issues:

- Worn or no barbels
- Sunken eyes
- Reddened gills
- Hollow or pinched body
- Pinched or clamped fins
- Deformities of any kind

SIX IDEAL STARTER CORYDORAS:

Corydoras pygmaeus (Pygmy Cory)

Best kept in groups of six or more.
Size: male 1 inch (2.5 cm) SL, female 1.25 inches (3.2 cm) SL
Minimum tank size: 2 gallons (7 L)
Water: pH 6–8, but ideally 6.8–7.2
Hardness: 6–10°dGH
Temperature: 72–75°F (22–24.5°C)

Corydoras habrosus (Salt & Pepper Cory)

Best kept in groups of six or more.
Size: male 1.125 inches (2.85 cm) SL, female 1.5 inches (4 cm) SL
Minimum tank size: 2 gallons (7 L)
Water: pH 6–8, but ideally 6.8–7.2
Hardness: 6–10°dGH
Temperature: 72–77°F (22–25°C)

Corydoras sterbai (Sterba's Cory)

Best kept in groups of six or more.
Size: male 2 inches (5 cm) SL, female 2.25 inches (6 cm) SL
Minimum tank size: 7–10 gallons (27–39 L)
Water: pH 6–8, but ideally 6–7.2
Hardness: 4–10°dGH
Temperature: 76–85°F (24.5–29°C)

Corydoras trilineatus (Threestripe Cory)

Best kept in groups of six or more.
Size: male 2.25 inches (5.7 cm) SL, female 2.5 inches (6.4 cm) SL
Minimum tank size: 7–10 gallons (27–39 L)
Water: pH 5–8, but ideally 6.5–7.2
Hardness: 6–10°dGH
Temperature: 73–80°F (23–26.5°C)

Brochis splendens (Emerald Cory)

Best kept in groups of six or more.
Size: male 3 inches (7.6 cm) SL, female 3.25 inches (8.25 cm) SL
Minimum tank size: 20 gallons (80 L)
Water: pH 5–8, but ideally 6.0–7.2
Hardness: 4–10°dGH
Temperature: 73–80°F (23–26.5°C)

Scleromystax barbatus (Bearded or Banded Cory)

Best kept in pairs, or two females to one male; larger groups can be housed together in large aquariums.
Size: male 4.25 inches (10.8 cm) SL, female 4 inches (10 cm) SL
Minimum tank size: 20 gallons (80 L)
Water: pH 6–8, but ideally 5–6.5
Hardness: 2–8°dGH
Temperature: 68–72°F (20–22°C)

Feeding *Corydoras*

Feeding *Corydoras* is a fairly simple task, and the choice of foods is almost endless. Most, if not all, of the commercially manufactured flake and tablet foods are very good. Flake food should be held in the water at the surface for a moment until it has become soaked, and only then released, so that it will sink to the bottom straightaway, ensuring that the corys get their share. Failure to do this may cause the flake to remain on the surface and be eaten by the other fishes, with very little getting to the bottom for the catfishes. All of the tablet foods that I have used sink straight to the bottom and are quickly found and consumed by the corys.

The only foods about which I would offer a word of caution are the high-protein, compressed granular types; these come in various grades and should be given only in small amounts. If the granules are small enough for the *Corydoras* to swallow whole, there is a danger that they will be eaten before they have had time to absorb water. This then happens inside the gut of the fish; the food swells up and can cause serious problems with the digestive system. The final outcome can be, and often is, death. If, on the other hand, the granules are too large for the fishes to swallow whole, they can simply mouth them as they disintegrate, and there is seldom any problem. More recently, granulated foods that do not swell as they soak up water have been manufactured especially for catfishes.

Live foods are excellent for conditioning potential breeding stock or to help keep your fishes in tiptop condition, but, unfortunately, they are not always available. For times when live foods are scarce or unavailable, there is a wide range of commercially prepared frozen foods on the market. These include *Daphnia*, *Tubifex*, bloodworms, *Cyclops*, gnat larvae, and brine shrimp (*Artemia*). Another great (and free) alternative is finely chopped earthworms. These will bring corys into breeding condition and enhance their coloration more quickly than anything else I know of.

Corys will eat almost anything offered to them, but remember that it is always better to underfeed than to overfeed; if you feed too much, the tank can become polluted with rotting, uneaten food.

All in all, the genus *Corydoras* has something to offer aquarists of all abilities and ambitions, and can be recommended to everyone.

Ian Fuller *has specialized in corydoradine catfishes for almost 40 years, and he has successfully bred 125 species. He is the author of three books about catfishes and is president of the Catfish Study Group in the UK. His website: www.Corydorasworld.com.*

by Mary Bailey

Java Fern: a plant for all reasons

As a cichlid keeper I soon learned that while some cichlids (for instance, softwater dwarfs) can be kept with most plants, most plants can't be kept with the majority of cichlids. The same applies to many other fishes too, of course. Anything large or remotely vegetarian can wreak havoc in a planted tank. In my case it doesn't help that I seem to lack anything akin to an aquatic "green thumb"—even a splendid potted (no root disturbance) Amazon swordplant (*Echinodorus* sp.) tends to curl up and die within weeks under my care.

The Java Fern variety "Windeløv" is characterized by fingerlike extensions that arise from the main leaf. These extensions detach and form new plants.

Then there is the problem of lighting. It is a fact that many fishes do not like bright light, but they do like plant cover, and plants usually need bright light to grow well, if at all. How to reconcile that anomaly in a glass box? In the wild, many popular aquarium plants actually grow emersed for much of the year, so they tend to rot away when kept permanently underwater in the aquarium.

In the wild, of course, fishes and plants manage to get along just fine, because the scale is quite different. There is far more space, the plant density is much higher, and the fish population density is much lower. So it doesn't matter if finned vandals rip up a square foot or so of greenery in order to clear a breeding site, or an army of herbivores passes through, chomping away as they go. There are plenty of plants left to recolonize bare areas, and the grazing damage per plant is usually limited. The tropical sun beats down relentlessly for much of the year, but the aquatic vegetation is so lush that it provides shade for light-sensitive fishes and other denizens. In the final analysis, Mother Nature is good at achieving a balance so that all survive—but aquarium keepers often are not.

A lot of aquarists, when confronted with this problem, simply resign themselves to doing without plants or using plastic ones. Firstly, this often isn't biotope-correct, and secondly, plants are useful not only as cover, but also because they remove metabolic pollutants like nitrate from the water. If healthy, they are aesthetically pleasing—often an important factor when the tank is sited in the living room as a showpiece and family members insist on something that looks nice. So plants are usually desirable for a number of reasons, even if your first passion is fishes or shrimps.

An unexpected answer

I found the answer when someone brought me a piece of Java Fern (*Microsorum pteropus*). I had heard of it, but I had never seen it for sale, and looking at my leathery, rather tatty, dirty-green present, this didn't surprise me—it wasn't at all attractive. But the donor was waiting expectantly for me to immerse it in one of my aquariums,

MR. HEPWORTH

Microsorum pteropus "Philippine". This variety of Java Fern has attractive "hammered" leaves. It grows well submerged, but will grow emersed as well, which makes it very interesting for aquarium design work.

Java Fern attaches itself to driftwood and helps create secure areas and defendable spawning sites for the fishes that use them. In this photo, the orange-colored discus have claimed that nice "bower" for themselves. This space is ideal, and no intruders will be allowed past the perimeter.

so I attached it to a stone with a rubber band, as advised, and positioned it carefully in a tank with some *Uaru amphiacanthoides* (plant destroyers *par excellence*) in my fish house. If it survived them, it would survive anything. Then we retired to the house for coffee. I expected to come back later and find just the woody "root" (actually a rhizome), as *Uaru* will normally eat anything green.

But they didn't. They chewed a few bits off and spat them out; the bits drifted to the surface and floated there. Subsequent experiments with other cichlids produced the same result. They would sample and reject it, and having done so, mainly leave it alone unless it was seriously in their way. The Java Fern soon developed into a splendid plant with long leaves extending up almost to the surface. The older leaves often looked leathery and discolored like the original piece, but the younger growth was a lighter green and more attractive.

Eventually the older leaves began to look really shabby, but I've never been one for maintenance gardening, in water or out—and in any case, dead leaves on the bottom provide excellent cover for fry, which will often graze on them, presumably eating the microorganisms that are

At Tropica Nurseries, where this photo was taken, many of the plants that will live in the aquarium are grown on in the emersed state in very humid conditions.

busy taking the dead leaves apart. It is often much easier to rear fry in a unkempt tank with rich bottom litter than it is in one that is squeaky clean. And thus it was that I discovered another marvelous feature this unusual plant has to offer. Old, dying leaves produce little plantlets at their tips and along their edges, and these new plants eventually detach and drift away. I also discovered that if I didn't remove any pieces of leaf chewed off by the resident vandals, but left them floating, they, too, would produce plantlets. Before I knew it I was up to my eyes in Java Fern, much of which managed—as it does in the wild—to attach itself to décor without my assistance and grow there. Perhaps the best example was the plantlet that lodged on the glass shelf supporting the cover glass at one end of the tank, the end I left alone because a pair of *Steatocranus tinanti* were regularly spawning there, so it was politic to perform feeding and water changes at the other end. Left to its own devices beneath the undisturbed cover glass, this plant burgeoned to form an extensive, partially submerged, partially emersed canopy of greenery. Presumably there was sufficient atmospheric humidity to keep the emersed growth healthy.

I was interested to note that most of my plantlets—which, incidentally, served very nicely as floating plant cover—eventually grew heavy enough to sink, usually at a leaf length of about 2 inches (5 cm). This in itself must be an "intentional" natural mechanism, as the plant certainly grows much faster and more vigorously once it has settled and rooted. Floating is simply a temporary state of being and allows the plant to migrate and colonize new territory.

Propagation in this species isn't limited to plantlets, whether triggered naturally or by deliberately cutting off a piece of leaf to stir it into action to ensure genetic survival. Once attached, Java Fern produces a long, horizontal rhizome from which roots grow downward to anchor the plant, as well as leaves that grow upward (or sideways, if growing on a shelf at the surface). The rhizome can be chopped into pieces (1 inch/2 cm is a good length) to create multiple "adult" plants that will then grow their own long rhizomes that can be chopped up. I rarely bother to do this unless pruning has become necessary in order to see other decor elements in a tank—the fishes, for example. Plantlets are a lot less effort.

Artificial attachment

In the wild, plantlets are probably swept some distance before they manage to attach to a suitable substrate, and quite probably many never achieve this state of Nirvana and are eventually carried out to sea. In the modern aquarium with typically strong (or excessive) filtration and water movement, they may also find themselves condemned to drift forever like the legendary Flying Dutchman or be flattened against the filter inlet—not that this will kill or even seriously damage them, but they may clog the filter. Or they may be dislodged by inquisitive or foraging fishes. So the wise aquarist will help them along by attaching them to a suitable piece of stone or wood while they go about attaching themselves independently with their roots.

As mentioned earlier, I attached my original plant with a rubber band, because it was quick and easy and the materials were at hand. However, I don't recommend this, because if you forget to remove the fixture when the plant has attached, it will disintegrate and may cause pollution, or worse, be eaten. Cotton thread is safer, but the best of all is nylon fishing line, which will last practi-

Once attached, the fern can form a dense thicket that conforms to the shape of the substrate.

Rhizome and root system of *Microsorum pteropus* "Windeløv".

N. HEPWORTH

Anyone can grow Java Fern. Even if the fishes tear it to pieces, they are just encouraging the propagation of the plant.

plastic cable ties, but these are rather obtrusive and more difficult to remove without disruption. There is no need to buy fishing line if you know a fisherman; most of them regularly replace their line, as it weakens with age and their quarry starts getting away. It's still more than strong enough to attach Java Fern!

If you want to cover a rock or a piece of wood with Java Fern, a useful labor-saving method is to sever a leaf from an adult plant and attach it at both ends to the chosen substrate. It will then produce plantlets (or use a leaf already doing so), which will attach themselves naturally without going through the "migratory"

cally forever, or at least until you remember to remove it by snipping and then pulling the free end. This operation can normally be performed without removing the plant and its substrate—an important consideration if it is attached to a large piece of bogwood. Some people use

floating stage, saving you a lot of time-consuming fiddling around with thread or fishing line. The parent leaf will eventually disintegrate when its work is done and you can then remove the ties used to secure it. Alternatively, if there are no fishes or current to dislodge the leaf—for

Microsorum pteropus "Narrow".

TOP: N. HEPWORTH; BOTTOM: AQUASPOT WORLD example, in a "plant nursery" tank—and the planting surface is horizontal, you can weight it with pebbles.

It is often stated that Java Fern won't root in gravel. In my experience this isn't entirely true, but these plants actually attach to the grains of gravel rather than putting down roots into the substrate, and hence tend to dislodge easily. If you want to try it, simply hold the rhizome down with a stone—though it's quite likely that the plant will attach to that as well.

Essential habitat parameters

I have been unable to find out much concrete information about this plant in the wild, except that it is widespread in Southeast Asia, including, presumably, Java. We can reasonably extrapolate from its aquarium behavior that "widespread" means it will adapt to virtually any conditions in which it finds itself.

I know from personal experience that Java Fern has no objection to water that is very hard and alkaline or very soft and acid, and it is reputed to thrive in brackish water, though I haven't tried this personally. Temperature? It is certainly happy at up to 85°F (29.5°C), and has continued to grow and reproduce, albeit more slowly, in tanks with no fishes when I turned off the heating to save money and the temperature was around 50°F (10°C). Lighting? This plant will thrive under either strong illumination or weak. I've even seen it survive for months in a fishless aquarium in which the light was turned off. It does not require fertilizer or CO_2 to thrive, and I fear it would take over the aquarium completely if encouraged in that way. It will survive for hours or even days in the humid air of a plastic bag without any need for water, or in a dry bucket while you rearrange the tank. If the leaves dry out a bit this will simply provoke it to produce more plantlets!

"Versatile" doesn't even begin to describe this plant, but to utilize it to full advantage the aquarist must think laterally too. Many are too conditioned to plants rooting in the bottom substrate to think of attaching Java Fern not to a stone on the bottom, but to the top of a tall piece of décor, thus creating a fish paradise—plant shade overhead and no lower level full of stems that reduce the amount of swimming space available. (Discus [*Symphysodon* spp.] enthusiasts, please note!) So don't be afraid to improvise, as this plant will probably cooperate.

Finally, if you find you have too many plants for your own needs, please don't throw them away. It is even worth devoting a spare tank to their culture, as bags of Java Fern can fetch very good prices at fish auctions. There are plenty of deprived aquarists out there who will thank you for a starter plant, as it is still rare to find this splendid plant offered on the retail market.

Mary Bailey *is the author of numerous articles on cichlids and aquarium husbandry. She lives in Devon, England, and is the German-to-English translator of AMAZONAS.*

Cairnsichthys rhombosomoides—

An Ugly Duckling among Rainbowfishes?

by Hans-Herbert Boeck

I have been an aquarist for 45 years, and for 25 of them I have worked with rainbowfishes and blue-eyes (*Pseudomugil* spp.). During that time I have kept and bred practically every species of the genera *Chilatherina*, *Glossolepis*, *Melanotaenia*, *Iriatherina*, and *Rhadinocentrus*. The only rainbowfish still missing from my collection was the species with the unpronounceable name *Cairnsichthys rhombosomoides*, the Cairns Rainbowfish.

I keep my *Cairnsichthys* with Pacific Blue-Eyes, *Pseudomugil signifer*, a combination that occurs in the wild and works well in the aquarium.

Cairnsichthys rhombosomoides was first discovered in 1921 in Australia by the American H. C. Raven in a tributary of the Babinda Creek drainage near the town of Babinda, downstream of Cairns, Queensland. The distribution of the species lies between Cairns and Innisfail, where it occurs in small streams that rise in the Bellenden Ker mountain range. The streams are sometimes fast-flowing and lack any large stands of plants, and their bottoms consist of shingle and rocks. *C. rhombosomoides* is common in these biotopes and probably will continue to be, as a number of the biotopes lie in the Bellenden Ker National Park.

Nowadays the best-known location for *Cairnsichthys rhombosomoides* is Harvey Creek, a habitat it shares with *Melanotaenia splendida splendida*, *M. maccullochi*, and *Pseudomugil signifer*. The genus *Cairnsichthys* is monotypic (having just one species) and fairly closely related to the genus *Rhadinocentrus*.

Clean water, elegant fishes

The water parameters in these natural habitats are similar in every case, with a pH of 7.2–7.6, a general hardness of 10°dGH, and a temperature between 64.5 and 77°F (18 and 25°C). My tap water has similar values, which makes it ideal for the maintenance and breeding of *Cairnsichthys rhombosomoides*. What this rainbowfish really needs to have is clear, clean water. A weekly water change is a must. I change up to 50 percent of the water every 7–14 days. The vitality of the fishes is clear evidence that this suits them. They are graceful swimmers that prefer large, long aquariums. The minimum depth and width should both be around 16 inches (40 cm) and the length at least 40–60 inches (100–150 cm). The elegant body form of these accomplished swimmers can be seen to best effect in such tanks.

Males measure around 3–4 inches (8–10 cm), while females are around .75 inch (2 cm) smaller. The body form is moderately high-backed. The normal coloration is muddy brown, and a narrow black stripe runs along the middle of the body from the gills to the caudal peduncle. The anterior part of the underside is silvery gray and the fins of males are slightly yellow in color. A striking feature of adult males is that the operculum (gill cover) looks as if it is coated with gold; the outer ring of the eye is the same color. The iris is large and deep black.

Most authors of articles and books on rainbowfishes state that *Cairnsichthys rhombosomoides* is not exactly colorful, but they must not have seen this fish in real life. Early in the morning, after the aquarium lighting has come on, these fishes become almost unrecognizable. Because they usually spawn in the morning, the coloration of the males alters and they exhibit a fawn-colored body with brilliant yellow fins.

It takes two to tango

I first saw *Cairnsichthys rhombosomoides* during a visit to the rainbowfish expert and breeder Gilbert Maebe in Mechelen, Belgium. Although I had made the long trip on account of other rainbowfishes, I spotted some slender, unfamiliar specimens in one of Gilbert's aquariums, and he told me that they were the last of his *Cairnsichthys rhombosomoides*. As usual, I was unable to resist the temptation and took eight large tank-breds home with me.

We spent the night with a friend in Holland and set off early the next morning for Freienwill, in northern Germany. Although, according to the literature, "Rhombos" are regarded as extremely susceptible to transportation stress, the eight fishes arrived home in good shape and were placed in a 26-gallon (100-L) quarantine tank. During my routine inspection the next morning I found that there were only six *Cairnsichthys rhombosomoides* in the aquarium. I surmised that two must have used the small hole for the heater cable and airline as an escape route. It wasn't until a long time later that I found their corpses behind the aquarium while rearranging the fish room.

After a quarantine period of around three weeks, the remaining six individuals were placed in a 120-gallon (450-L) aquarium and grew on to a length of 2.75 inches (7 cm). Even on the closest inspection I couldn't see any differences that might denote the sexes. In terms of coloration the fishes definitely belonged in the "gray mouse" category. Naturally, that didn't stop me wanting to breed them. The breeding aquarium was quickly prepared using a tank with a volume of 26 gallons (100 L), two spawning mops, and three *Anubias* plants. The plan was to allow the fishes to enjoy their sex life for eight days and then remove them, after which the first fry should appear swimming at the water's surface.

Nothing happened, even after three attempts. Did I have just females? During each breeding attempt I had checked the mops and found not a single egg. According to the literature, males are supposed to develop a hint

Yawning female *Cairnsichthys rhombosomoides*.

of yellow at the edges of their fins and grow somewhat larger than females. My specimens were all the same size and the yellow fin color was missing, confirming my suspicion that I had only females. My subsequent attempts to obtain male specimens came to naught. It was the old, old story—not particularly colorful rainbowfishes are not much in demand and usually don't remain in the hobby for long. I couldn't even find anyone in the International Rainbowfish Group (IRG, http://www.irg-online.de) who was keeping *Cairnsichthys rhombosomoides*. I promised myself that if I ever ran across this species again I would get some.

Fresh blood

In mid-2006 I received an email from Johannes Graf to the effect that he was planning to import some fishes from Australia. Naturally, that got me fired up: this would mean I could inject new blood into my stock and perhaps also get something new. My wish list included a number of blue-eyes from Australia, for example, *Pseudomugil tenellus*, as well as two local variants of *Pseudomugil signifer*. I ordered 10 specimens of each of the three species. The date drew closer, and then was postponed for a week only seven days before the fishes were due to arrive. At the same time, *Pseudomugil signifer* and *Cairnsichthys rhombosomoides* from Harvey Creek were added to the list of species on offer. I seized the opportunity to order 10 *Cairnsichthys*.

Now, as already mentioned, *Cairnsichthys rhombosomoides* is purportedly sensitive to transportation, and I had my doubts as to whether the fishes would survive the journey from Australia. Johannes and I had arranged that I would collect the fishes directly from Frankfurt Airport. At 6:00 in the morning I set off by train and arrived at the airport 6½ hours later. So there I was, a country bumpkin waiting at Germany's largest airport for Johannes to call me.

An hour later the call came. We were to meet at parking lot #14, but it wasn't so easy to find. An hour later, after four elevator expeditions and four visits to the information desk, I finally reached the parking lot, which was deserted. I was standing there holding my fish box, wondering what to do, when, luckily, two other IRG members arrived from Bayern, having arranged to meet Johannes at the same hand-off location. We had to wait for Johannes for another hour; the customs and veterinary checks took longer than anticipated. Because the fishes hadn't been shipped in separate packages for the individual customers, we now had to catch them out of the large bags and repack them in separate smaller ones in the middle of the parking lot. Johannes had brought oxygen with him, and after around ¾ of an hour I had my fishes safely packed in my styrofoam box. One bag contained 10 *Pseudomugil tenellus*, another held my dream fish, *Pseudomugil signifer* from Harvey Creek, and the last nine bags contained *Cairnsichthys rhombosomoides*. In selecting them I had paid attention to both sexing and size.

After we had said our goodbyes I took a train to Hamburg and finally arrived home around midnight. After a short acclimatization I put the fishes straight into the aquariums I had prepared for them. I couldn't sleep, and early the next morning I was switching on the light in my breeding room in the garage and checking the new arrivals. All the fishes had survived their 48-hour journey well.

Slow growth

I had set up a quarantine aquarium on the floor in the middle of the room. The floor is supposed to remain clear, but as we all know only too well, aquarists are always short of space. The 40-gallon (150-L) tank with integrated three-chamber filter was to be home to the "Rhombos" for the next three weeks. I provided vegetation in the form of large Amazon swordplants (*Echinodorus* sp.) growing in a plastic container. The fishes seemed well and I was able to make my first observations. There were six males and three females. I could see no signs of readiness to spawn, so I did as I usually do and floated a spawning mop attached to a cork in the tank. Over the days that followed I checked the mop morning and

H.-H. BOECK

Pair of *Cairnsichthys rhombosomoides* in the aquarium, female above. Note metallic appearance of the male's gill cover (operculum).

evening, but never managed to find any eggs.

After three weeks I placed a trio, a male and two females, in a specially prepared breeding aquarium with a volume of 26 gallons (100 L) that contained a number of *Anubias*, a Poret® foam filter, and a small mop as a spawning substrate. The water was from the tap and had the following parameters: pH 7.5, general hardness 10°dGH, conductivity 320 µS/cm, and temperature 75°F (24°C). Two days later I removed the spawning mop from the tank prior to the evening feed, in order to check it for the first time. To my great surprise, the mop was full of eggs around 1 mm in diameter.

In order to be able to rear some fry, I harvested 50 eggs and put them in a plastic container with aged water and a few drops of Methylene Blue to prevent fungus. The first fry hatched after 10 days, and I caught them carefully and transferred them to a small aquarium. They were very tiny and, contrary to the assertions of some authors, not yet able to take brine shrimp nauplii. Nowadays, having had several years of experience with *C. rhombosomoides*, I no longer go to the trouble of harvesting the eggs. If these fishes are maintained in a species tank, sufficient fry will survive and grow on. *C. rhombosomoides* is one of the few rainbowfishes that eats its own young, so their numbers will remain within the tank's limits.

Obviously I couldn't leave the aquarium standing there in the middle of the room, so I transferred the rest of the "Rhombos" into a newly set up aquarium of their own. In so doing I discovered around 20 fry in the first chamber of the filter. So the aquarium remained there after all and I used it to rear the other 50 youngsters. Their growth rate wasn't very rapid—after around six months they had grown on to 1.75 inches (4 cm) long.

An aquarium sitting in the middle of the floor isn't a very good advertisement for the aquarium hobby. I constructed shelving to hold three glass tanks, each measuring 31 x 24 x 15 inches (80 x 60 x 40 cm). (This is sometimes known as "proliferating tank syndrome.") I then transferred the adult, and later the young, *C. rhombosomoides* to these tanks.

After six months I was able to give away the first tank-breds to friends and members of the IRG. I hope that by so doing I have done my bit to establish an aquarium population of this species in Europe. This rainbowfish with the almost unpronounceable name isn't the right fish for the aquarist who is looking for gaudy colors and a new species to sell at auctions. But I can definitely recommend *Cairnsichthys rhombosomoides* to anyone who wants something a bit unusual to spice up the aquarium.

H.-G. EVERS

CALENDAR

compiled by Mary Sweeney

MARCH

4 — **Spring Auction**, Greater Akron Aquarium Society, Akron, OH
www.gaas-fish.net

10 — **Swap Meet**, North Jersey Aquarium Society, Nutley, NJ
www.njas.com

16–18 — **Convention**, Catfish Study Group, United Kingdom
www.catfishstudygroup.org

23–25 — **Convention**, Northeast Council of Aquarium Societies, Cromwell, CT
www.northeastcouncil.org

24 — **Auction**, Grand Valley Aquarium Society, Grand Rapids, MI
www.grandvalleyaquariumclub.org

APRIL

1 — **Swap Meet**, Brooklyn Aquarium Society, Brooklyn, NY
www.basny.org

6–8 — **Show**, Eastern Iowa Aquarium Association, Marion, IA
www.finflap.com

14 — **Auction**, Michiana Aquarium Society, Roseland, IN
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15 — **Auction**, North Jersey Aquarium Society, Nutley, NJ
www.njas.net

20–22 — **Workshop**, Missouri Aquarium Society, St. Louis, MO
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26–29 — **Convention**, American Livebearer Association/Gold Coast Aquarium Society, Dania Beach, FL
www.livebearers.org

MAY

25–27 — **American Killifish Association Convention**, American Killifish Association/Missouri Aquarium Society, St. Louis, MO
www.aka.org

JUNE

22–24 — **North American Discus Association Convention**, Atlanta Aquarium Association, Atlanta, GA
www.discusnada.org

23–24 — **Show & Auction**, New England Fancy Guppy Association
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SEPTEMBER

9–14 — **International Aquarium Congress (IAC)**, hosted by Two Oceans Aquarium, Cape Town, South Africa
www.iac2012.co.za

29–30 — **1st European Discus Championship**, Dortmund, Germany
www.european-discus-championship.eu/

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18–21 — **All-Aquarium Catfish Convention**, Potomac Valley Aquarium Society, Herndon, VA
www.catfishcon.com

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16–18 — **Extravaganza!** Ohio Cichlid Association, Strongsville, OH
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❶ NOTHOBRANCHIUS MICROLEPIS ❷ MACROBRACHIUM GRACILIROSTRE ❸ AKYSIS PRASHADI
❹ HYPHESSOBRYCON SP. RIO MIRI ❺ LUTINO AMBLYDORAS SP. ❻ RASBORA ENNEALEPIS

Small-Scaled Nothobranch, *Nothobranchius microlepis*

1 | The interesting and rather unusual killifish species *Nothobranchius microlepis* was described as long ago as 1897 by Vinciguerra, on the basis of specimens collected by V. Bottego in Somalia. In 1992 Wildekamp & Haas redefined the species and distinguished it from the two similar new species described in the same work, *N. fasciatus* and *N. bojiensis*. The redescription was based on specimens collected by Haas in January/February 1979, by Aweis & Ibrahim in May 1982, and by Wildekamp & Ibrahim in June 1983. The species lives in Somalia, in large depressions (*whars*) filled with rainwater. It has also been found in the basin of the Tana River in northeastern Kenya, where it was recorded at several sites by Forstner et al. in June/July 1983. Baer also collected it in seasonal waters along the road from Miriakani to Samburu.


Male *Nothobranchius microlepis*

In June 2008 the aquarist Béla Nagy made a trip to northeastern Kenya to collect the species *N. microlepis*, which had become rare in the aquarium hobby. He was able to track down not only *N. microlepis* but also *N. fasciatus* in the central Tana basin and bring them back alive to Europe.

Breeding and rearing these fishes is not easy. They have voracious appetites and require large amounts of live food on a permanent basis. Solid fare such as *Tubifex* worms is necessary to induce the females to ripen and keep the aggressive males in condition. When their bellies are full, the males become less active and leave the females in peace a bit more.

The breeding tank must be very clean. Typical of open breeders, this species spawns in peat, which should be removed and dried out after a few days, when the females are spawned out. I have yet to discover the precise timing; if I leave the eggs in the water for too long, they suddenly disappear, even in the absence of the parent fishes. Do they simply disintegrate? There are still many unanswered questions about *N. microlepis*, a killifish for the real enthusiast.

—Stefano Valdesalici

REFERENCES

Vinciguerra, D. 1897. Pesci raccolti dal la v. Bottego, durante la sua seconda spedizione nelle regioni dei Somali e dei Galla. *Ann Mus Civ Stor Nat Genova* 2 (17): 343–6.

Wildekamp, R.H. and R. Haas. 1992. Redescription of *Nothobranchius microlepis*, description of two new species from northern Kenya and southern Somalia, and note on the status of *Paranothobranchius* (Cyprinodontiformes: Aplocheilidae). *Ichthyol Explor Fresh* 3 (1): 1–16.

Red-Striped River Shrimp, *Macrobrachium gracilirostre*

2 | "Good grief! What on earth is that?" I thought when I saw the stately male of a very attractive shrimp species, new to the aquarium hobby, swimming around in the plastic bag it had arrived in. Aquarium Dietzenbach had just received a small number of specimens fresh from Indonesia. They were thought to be *Macrobrachium gracilirostre*, a species widespread throughout Southeast Asia.

The specimen in the photo is significantly more than 4 inches (10 cm) long, including the claws. Females lack the long anterior extremities, but are equally attractive otherwise. From an aquarium-hobby perspective, this shrimp can be classed as similar to its congener *Macrobrachium rosenbergii*. These shrimps have large appetites and are accomplished hunters that will also take small fishes. Hence they belong in a species tank, but this shouldn't deter shrimp fans from keeping such attractive creatures. They are simplicity itself to feed, and they don't molest aquatic plants, at least not in my experience. They enjoy all types of frozen and dried foods.

The male pictured here settled in very quickly and lost his shyness after just a few days. He now comes out of his hiding place when offered a tasty morsel,

S. VALDESALICI

which he grabs right away. He is a comical fellow whose cheekiness reminds me of our elderly dog, who has just rested his moist nose on my leg as I write these words—probably because of the tasty sandwich waiting uneaten nearby.

—**Hans-Georg Evers**

Indawgyi Stream Catfish, *Akysis prashadi*

3 | *Akysis prashadi* Hora (1936), the Indawgyi Stream Catfish or Prashad's Catfish, is one of the numerous but rarely imported dwarf catfishes of the genus *Akysis* Gill (1858), widespread in Southeast Asia. These catfishes are sometimes known by the very apt common name of wasp or hornet catfishes, on account of the genus-typical cryptic pattern of dark brown and light brown to orange stripes. The genus currently includes around 30 described species and a number of newly discovered, undescribed species. *Akysis* first came to the attention of aquarists in 2004 with the first importation of the species *Akysis vespa* (Ng & Kottelat), and small numbers of some species are now regularly seen in the aquarium trade.

TOP: H.-G. EVERS; BOTTOM: F. STROZYK

Akysis prashadi is found in the Irrawaddy River system in Burma, and the type locality is given as the area around Kamaing in the district of Myitkyina. This species is usually found among leaf litter and stones on the bottoms of cool streams. Maximum size is said to be more than 2.5 inches (60 mm) in females; males are usually smaller and more slender and dainty. In addition, females that are ripe with eggs have noticeably more rounded bellies.

The species can be easily maintained in small groups of four to six individuals. Use a small tank with

a good amount of current and water that is oxygen-rich, not too hard, and fairly cool (68–75°F/20–24°C). During the day and except at feeding times, these catfishes will bury themselves almost completely in the substrate or hide beneath leaves, among the moss, and in caves. Sometimes they wedge themselves between rocks.

Akysis exhibit hyperactive behavior when food is added to the water, and dash around wildly as they eagerly swallow mosquito larvae, *Cyclops*, *Artemia*, and water fleas.

Hence it is important to avoid overfeeding. Using a flashlight, it is possible to watch them searching for food all over the aquarium during the nighttime hours. Their eyes are poorly developed and it is obvious that they don't deliberately target food organisms but rely on finding them by luck.

A small number of species (*Akysis vespa*, for example) have already been bred successfully. This fish prefers to spawn at twilight, directly in the current of water from the filter. They are said to be easy to breed and rear, provided you can rescue the eggs before they are eaten.

—**Frank Strozyk**

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Ng, H.H. 1999. The *Akysis* of Myanmar: A Review (Teleostei: Akysidae). *Raff Bull Zool* 47 (1): 541–8.

Rio Miri Tetra
Hyphessobrycon sp. Rio Miri

4 | During a recent visit to my friend Martin Mortenthaler at Aquarium Rio Momon in Iquitos, Peru, I discovered a large shoal of an unknown species of tetra in a tank at the back of the premises. The little *Hyphessobrycon*, with the gleaming pink line along the center of the body, made me think of an old acquaintance from Brazil, the Glowlight Tetra (*Hemigrammus erythrozonus*), and also of *Hyphessobrycon amapaensis*.

The little tetras originated from the Rio Miri, a Peruvian affluent of the Rio Yavari (or Javari), which forms the border between Peru and Brazil. They had been brought in now and then by fishermen, together with a number of *Corydoras* from the region. But nobody wanted these attractive tetras, and Martin had almost forgotten about them.

Besides the striking longitudinal band, this species is apparently typified mainly by a small, almost circular spot just behind the operculum. I have so far been unable to assign this fish to any described species, so for the time being I am calling it *Hyphessobrycon* sp. Rio Miri. It would appear that German aquarists no longer have any interest in tetras; how else can one explain the fact that for years, one little Peruvian jewel after another has found its way into the hobby and then disappeared after a few months?

—**Hans-Georg Evers**

Rio Miri Tetra, *Hyphessobrycon sp.*

Lutino *Amblydoras* sp.

Lutino Talking Catfish, *Amblydoras* sp.

5 | Aquarium fishes with unusual color patterns, or even a complete lack of pigmentation, are all the rage among some aquarists. Normally these start out as chance albinos and lutinos (yellowish individuals with black eyes) occurring in normal broods. Deliberate selection and back-crossing has led to a whole range of these pale fishes in our aquariums. But the *Amblydoras* species lutino shown here swam in front of my camera lens in Peru. It measured around 3 inches (8 cm) and was one of three specimens of this doradid catfish caught in a tributary of the Amazon near Iquitos. Martin Mortenthaler of Aquarium Rio Momon drew my attention to this fish, which has already commanded a high price in Japan. It is rather surprising that several specimens of such a striking (and hence readily visible to predators) form of a normally well-camouflaged, muddy-brown-gray species were caught in their natural habitat. Mortenthaler has previously marketed other such individuals, as well as albinos and lutinos of other catfish species—for example, other doradids and the large loricariid species *Acanthicus cf. adonis*. Spontaneous mutations like this are apparently more frequent in wild populations of a number of species than was once believed. But fans of albinos have invariably been criticized on ethical and biological grounds, the argument being that such fishes have no chance of survival in the wild. So is it all just a question of taste?

—Hans-Georg Evers

Roberts's Rasbora, *Rasbora ennealepis*

6 | Fans of small cyprinids don't often have cause to celebrate the arrival of new species. So it is welcome news that Aquarium Dietzenbach has recently imported a large number of a rather small (around 2–2.5 inches/5–6 cm) species of rasbora, which in all probability is *Rasbora ennealepis*, a species described by T. R. Roberts in 1989. The fish were obtained from Maju CV in Jakarta and were caught in Borneo, which is also the distribution region cited for the species by Kottelat et al. in 1993 (unfortunately they are not more specific). However, the illustration in their paper of a preserved specimen looks like the fish now imported. In soft, slightly acid water these rasboras exhibit a thin, golden longitudinal band on the posterior two-thirds of the body. If the fish are really thriving, the caudal and dorsal fins of the males (which are smaller than those seen in females) color up to orange-yellow.

A number of specimens have gone to specialists, and we hope to learn a bit more about this little rasbora before long. In the meantime, the species is a welcome addition to the hobby.

—Hans-Georg Evers

H.-G. EVERS

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Kottelat, M., A.J. Whitten, S.N. Kartikasari, and S. Wirjoatmodjo. 1993. *Freshwater fishes of Western Indonesia and Sulawesi*. Periplus Editions, Hong Kong.

Small group of *Rasbora ennealepis*.

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