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COVER:
Cyrtocara moori, Malawi Blue Dolphin Cichlid, photographed at the Sagittaria Club Aquarium, Hamburg.
Photo: Hans-Georg Evers

ELEMENTAL CHLORINE FREE

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Dear Reader,

This issue came about because fans of African cichlids kept asking me when we were going to get around to running a feature story on Lake Malawi cichlids. Our readers were justified in wanting this—but how were we to go about finding something to publish that hadn't appeared in print many times before? The not inconsiderable number of articles on Utaka, Mbuna, and so forth that I have read in recent years have all seemed much of a muchness, covering and recovering pretty much the same ground.

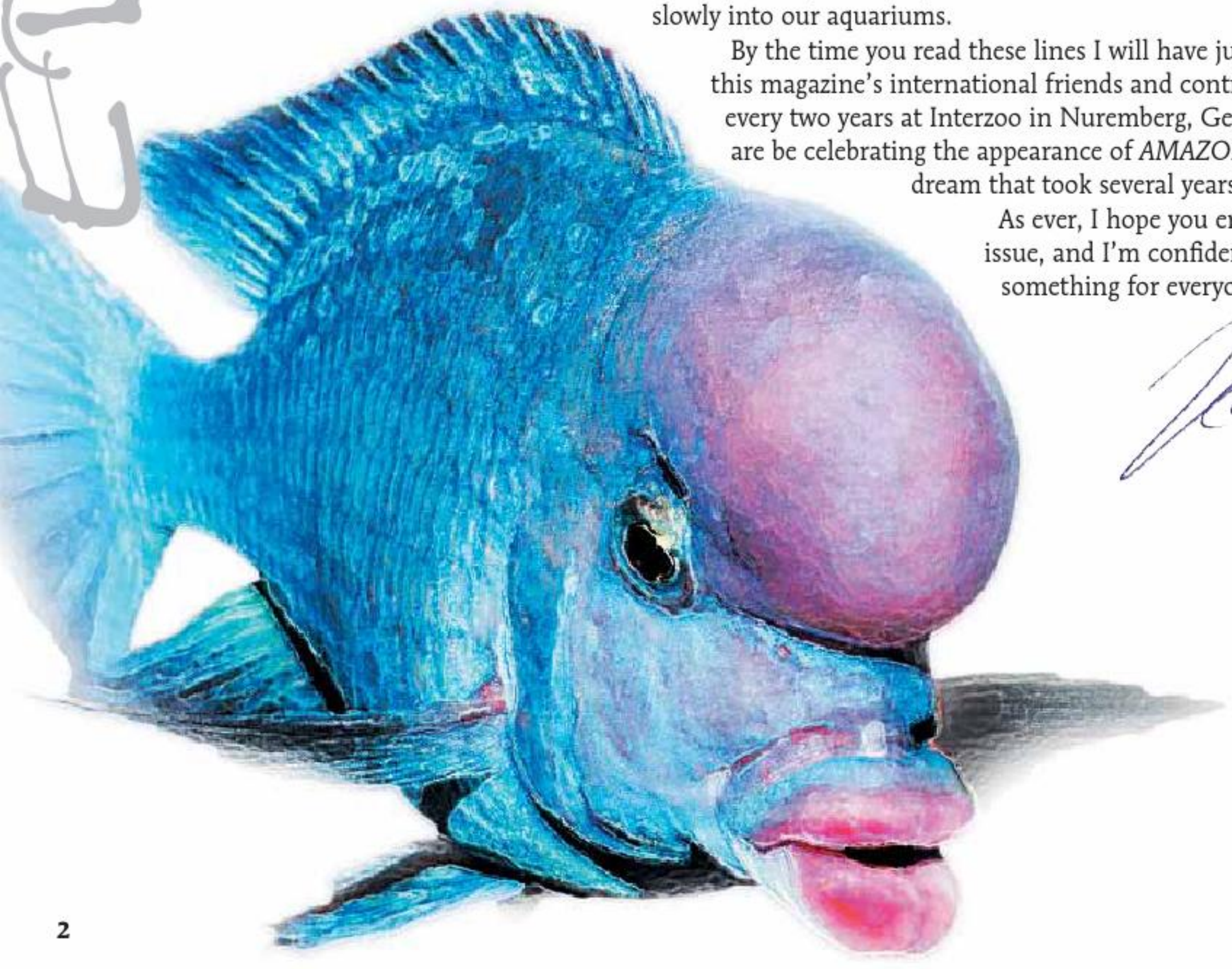
We didn't want to go down that well-trodden path, so we haven't included an introductory article on maintenance and breeding or an overview of the species. We chose to go straight to the "meat," most of it the work of new authors—although some well-known writers are also represented. Ad Konings shares new information about efforts to protect the endemic species of Lake Malawi from the biological mayhem caused by both those in the aquarium trade and food fishers, who destroy many small cichlids as bycatch. We also present new information on the practical aspects of keeping members of the *Copadichromis mbenjii* group, a subject about which little has been published previously. With husbandry and breeding articles on Aulanocara baenschi, and two dwarf *Pseudotropheus*, Malawi enthusiasts should find plenty to whet their appetites in this issue.

Never before has the description, immediately followed by the first importation, of snakeheads caused such excitement as it has in the case of two Burmese species, *Channa pulchra* and *Channa ornatipinnis*, that have come into aquarists' hands in recent years. Various aquarists have already managed to breed *Channa pulchra* in the aquarium, and this issue includes a breeding report on these fascinating "dwarf snakeheads."

Our articles on the natural habitat of the Dwarf Neon Rainbowfish (*Melanotaenia praecox*) and on the Eyestrain Rasboras (*Boraras* spp.) contrast nicely with the piece on African cichlids. Plant lovers will find their pulses racing when reading about the unique and beautiful members of the genus *Bucephalandra* from Borneo now making their way slowly into our aquariums.

By the time you read these lines I will have just met with many of this magazine's international friends and contributors, who gather every two years at Interzoo in Nuremberg, Germany. This year we are be celebrating the appearance of *AMAZONAS* in English, a dream that took several years to become a reality.

As ever, I hope you enjoy reading this issue, and I'm confident that it offers something for everyone.



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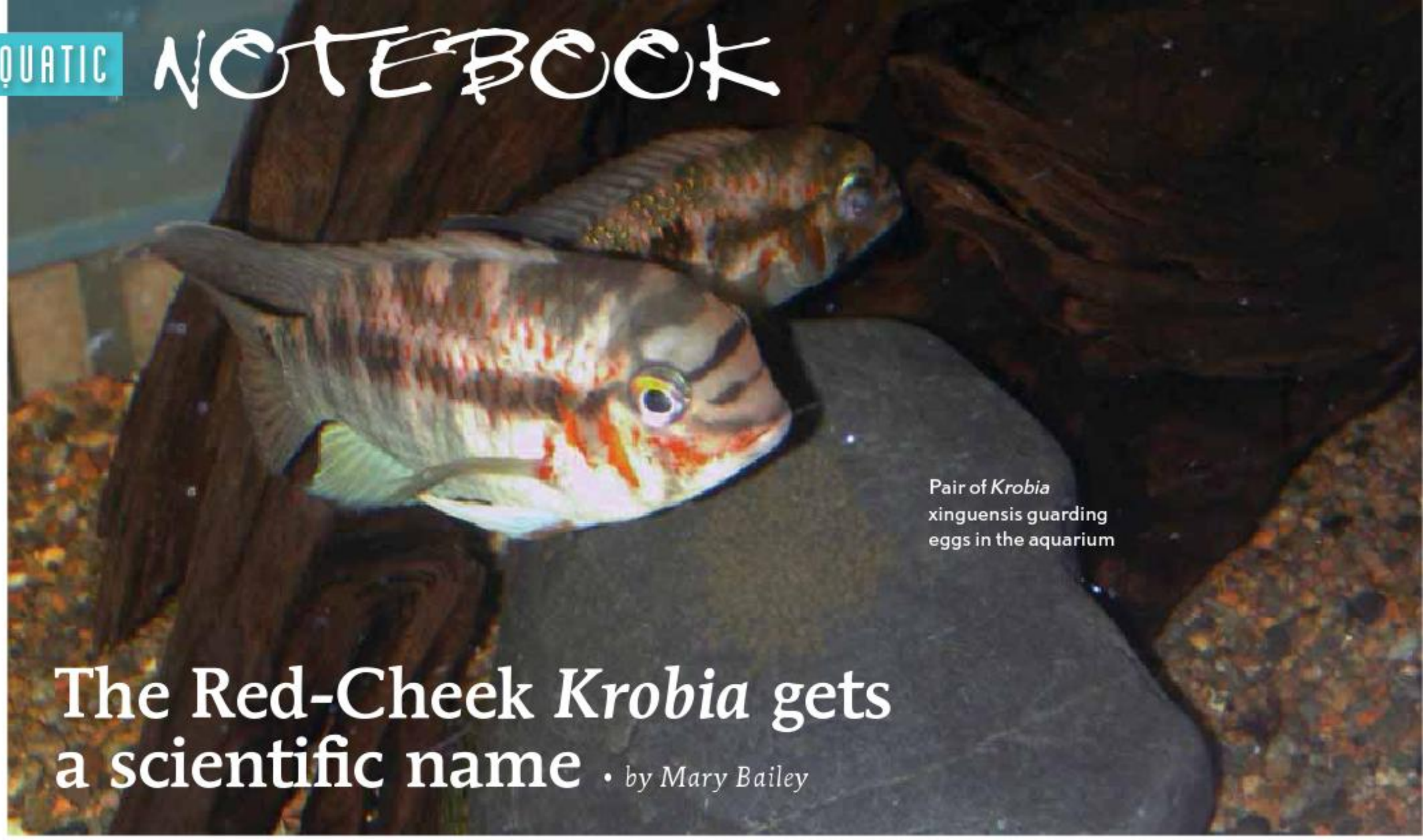

Pair of *Krobia* xinguensis guarding eggs in the aquarium

The Red-Cheek *Krobia* gets a scientific name

• *by Mary Bailey*

The genus *Krobia* was erected in 1989 by Kullander & Nijssen to contain two cichlids previously included in the catch-all genus *Aequidens*, namely *K. guianensis* and *K. itanyi*. Since then, and indeed previously, both the aquarium hobby and science have been aware of several other apparently distinct *Krobia* species, but all have remained undescribed. Hence the recent description of *Krobia xinguensis* by Kullander (2012) is a welcome step in the right direction. (The scientific name *xinguensis* means "of the Xingu," the river where it originates).

The species has been known to the hobby for some time, the first mention I can find being in Volume 1 of Stawikowski & Werner's mammoth 1998 work on neotropical cichlids (unfortunately available only in German), although they offer only a brief mention and a photo of a preserved specimen. Since at least around 2007, it has been imported for the hobby, variously as *Krobia* sp. "Red Cheek", "Xingu", and "Red Cheek Xingu".

The two previously described species are both from the Guianas. The overall known range of the genus is largely north of the Amazon, so the occurrence of this species in the Rio Xingu, a southern tributary, is unusual—especially as it is found in the headwaters as well as downstream at the Ilha Babaquara (the type locality), close to Altamira on the lower part of the river. It was apparently first discovered and collected in 1964 by Harald Schultz in the Rio Batovi, a headwater of the Xingu in Mato Grosso State. Unfortunately, the description, and hence the distributional data, is based largely on "old" material already preserved in museum collections, so the question of whether the species exists in the long stretch of the Xingu drainage between the Batavi and Altamira remains to be answered. Habitat data cited (from existing literature) in the paper are "a clear water habitat including a stream, a pool, and a small lake, with abundant vegetation and aquatic invertebrates" and "a small rocky stream."

Compared to *Krobia guianensis* and *K. itanyi*, *K. xinguensis* has a proportionally deeper and shorter caudal peduncle, a slightly deeper body, and a shorter snout. On the basis of the type series it is also smaller—about 3 inches (7.7 cm) SL for the largest specimen examined, versus around 5 inches (12.5 cm) TL for the other two species. However, type specimens are often smaller than maximum length seen in the aquarium, so it is wise to anticipate a larger size when housing these cichlids.

Unfortunately, there is scant information available on this species in captivity, but it appears to be peaceful and undemanding like its congeners, at least in terms of general maintenance. As with many Amazonian species, very soft, slightly to moderately acid water may be required for successful breeding. These cichlids spawn on a rock in the open; as might be expected, the male is larger than the female, as the photo shows.

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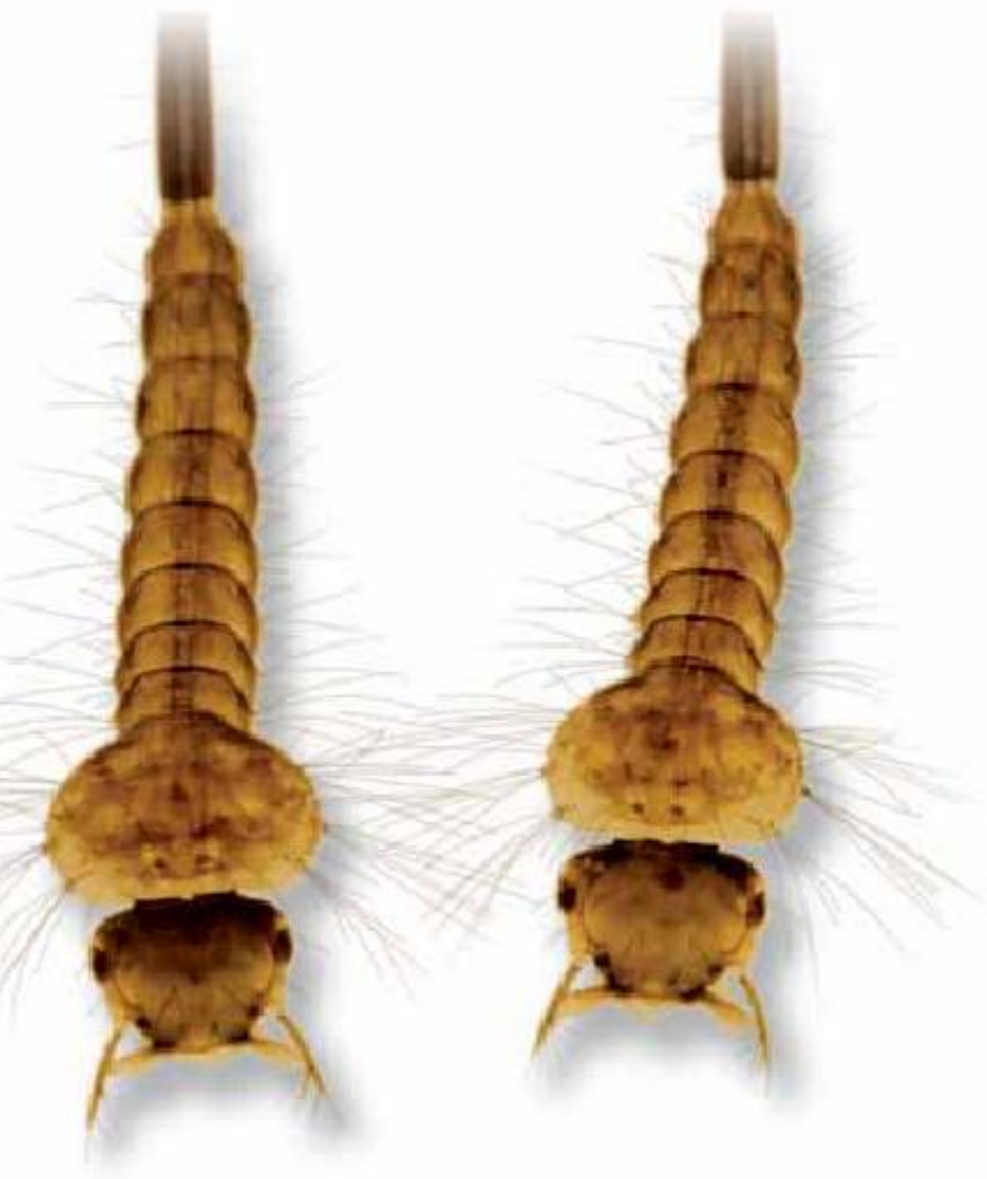
• *by Roland Schreiber*

Culturing your own mosquito larvae

Summer is the time of year when a wealth of foods is available for aquarium fishes. The daily dry food can be supplemented with all sorts of tasty live foods found in lakes and ponds. In addition to the well-known water fleas, glassworms (family Chaoboridae) and mosquito (Culicidae) larvae are particularly easy to catch. The hobbyist with little spare time can cultivate mosquito larvae in practically any container of water—without spending a dime.



Culex larvae hanging with their breathing tubes at the water's surface.

Practically everyone is familiar with the little black wormlike creatures you often see in a rain barrel—which, when disturbed, disappear like lightning into the depths and then reappear to hang at the surface to breathe.

However, there are a few things you should bear in mind when using them as fish food. The larvae (including those that aren't subsequently eaten in the aquarium by our fishes) develop within a few days into adult mosquitoes—biting mosquitoes, to be precise. These pests, which need to suck the blood of humans or other mammals to survive, can rapidly put an end to the aquarium-room idyll. Mosquito larvae should be

Bottom left: Egg mass

Right: There is room for a container like this in every garden!

introduced to the aquarium only in small quantities that will be eaten immediately.

We all dread the humming of mosquitoes on summer evenings, but for our aquarium fishes they are a nutritious delicacy. While glassworms are found only in clear, clean waters, mosquito larvae can be found anywhere that water collects, from rain barrels and cattle troughs to puddles or old tires. Because they breathe atmospheric air, it doesn't matter if the water is stagnant or even putrid.

Due to its undemanding way of life, it is possible for even the spare-time aquarist to produce this much-prized live food quickly and without expense. This involves nothing more complicated than putting some old aquarium water in a container of some sort—a large glass jar, a bucket, or even a jam jar will do. The container is placed outside (balcony, back yard, or garden) and left alone. Hardcore aquarists sometimes "spice" the water with some rotting vegetable material (dead leaves or stinging nettles), which speeds up the process. The rather putrid water attracts the female mosquitoes, which lay hundreds of eggs in small packets on its surface. Within three or four days these hatch into tiny larvae, which soon can be seen hanging at the water's surface. They can easily be fished out with a fine-meshed aquarium net or kitchen strainer and fed to the fishes.

Although their natural habitat might not suggest it, mosquito larvae make a very healthy live food. Their rapid flight movements trigger the hunting instincts of our fishes. When they eat live food, fishes become livelier and more colorful and get sick less often. The containers used for culturing them contain neither natural pests (such as fish leeches) nor the contaminants that might be found in streams and ponds misused for the discharge of clear waste water. And the danger of introducing fish diseases, which always exists when collecting water fleas from a pond containing fishes, is not an issue.

Live mosquito larvae are a great food for almost all fish species, with the exception of many bottom-dwelling catfishes and loaches. They purportedly contain not only a high-quality cocktail of proteins and vitamins, but also a number of still largely unknown neurotransmitters that have a stimulating effect on aquarium fishes. And for decades, some aquarists have sworn that certain fish species can be induced to spawn only by feeding them with these little tidbits. Given all these benefits, what are you waiting for? Treat your fishes to some of these home-grown delicacies!

TOP AND LEFT: R. SCHREIBER; RIGHT: H.-G. EVERS

Legally available at last:
Pseudacanthicus sp. L 273

New IBAMA list published! • *by* Amazonas *Editors*

Fans of Brazilian fishes have reason to celebrate. After many years of waiting, on January 3, 2012, the Brazilian environmental conservation authority, in collaboration with IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis), published a new directive that revises the number of species that can be collected in Brazil as aquarium fishes and exported. Appendix 1 of this directive contains a new list naming 725 species of Brazilian freshwater fishes that can be traded from now on.

These include not only numerous popular aquarium fishes, for example various cichlids (*Apistogramma*, *Satanoperca*, *Teleocichla*, *Retroculus*, and many others) and characins (numerous predatory characins including piranhas and *Acestrorhynchus* species), but also many favorite catfishes. There are approximately 70 mailed catfish species on the list, as well as a large number of armored cats whose capture and exportation has been banned in recent years—for example, the large *Pseudacanthicus* species, such as L 24, L 25, L 67, L 97, and L 273, as well as a number of *Hypancistrus*, including L 66, L 260, L 262, and L 333.

It is noteworthy that scientifically undescribed species are also included. And there is no longer any blanket dispensation for entire genera, as was formerly the case for *Hyphessobrycon*, *Corydoras*, and *Ancistrus*; only those species named in the list are permissible. Given that only eight *Ancistrus* species are included, this is bound to have repercussions, as a number of popular species, such as L 309 and others, are omitted.

IBAMA representative Henrique Anatole says that in the future, this list will be amended and even expanded on the basis of the latest scientific knowledge. But undescribed species will no longer be taken into consideration, only those that have a scientific name. An exception has been made for L-number catfishes; the livelihood of a large number of collectors and their families depends on selling them commercially.

IBAMA is also aware that following the export ban, many fishermen have reverted to prospecting for gold and clear-cutting the forest, and some continue to catch fishes illegally. The removal of controls on these fishes—with the exception of the protected Zebra Catfish, *Hypancistrus zebra*—will undoubtedly lead to a considerable reduction in smuggling.

Following the implementation of new rules governing the export of stingrays (not included in the list, but subject to quotas) and the appearance of the newly published list, the exportation of fishes will again be of more interest to Brazilian companies. However, it is most unlikely that prices will fall to the levels that existed prior to the turning point in 2005. In the future, anyone who wants to obtain a wild-caught fish from Brazil will have to pay accordingly, but this a welcome development as long as it indirectly benefits people and wildlife in that country.

H.-G. EVERS

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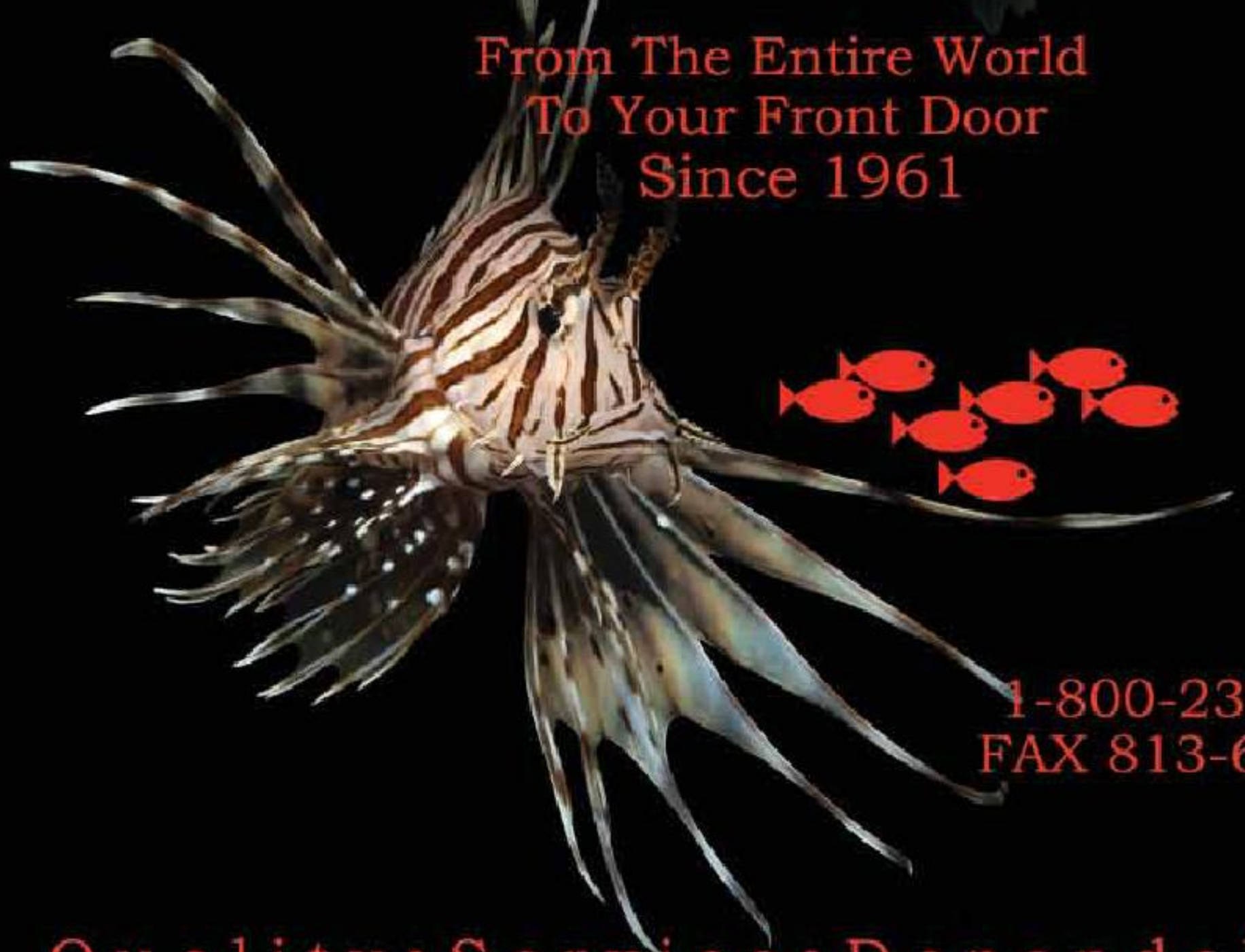

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• *by Ole Arnold Schneider*

The Freaky Fish Club—far from the mainstream

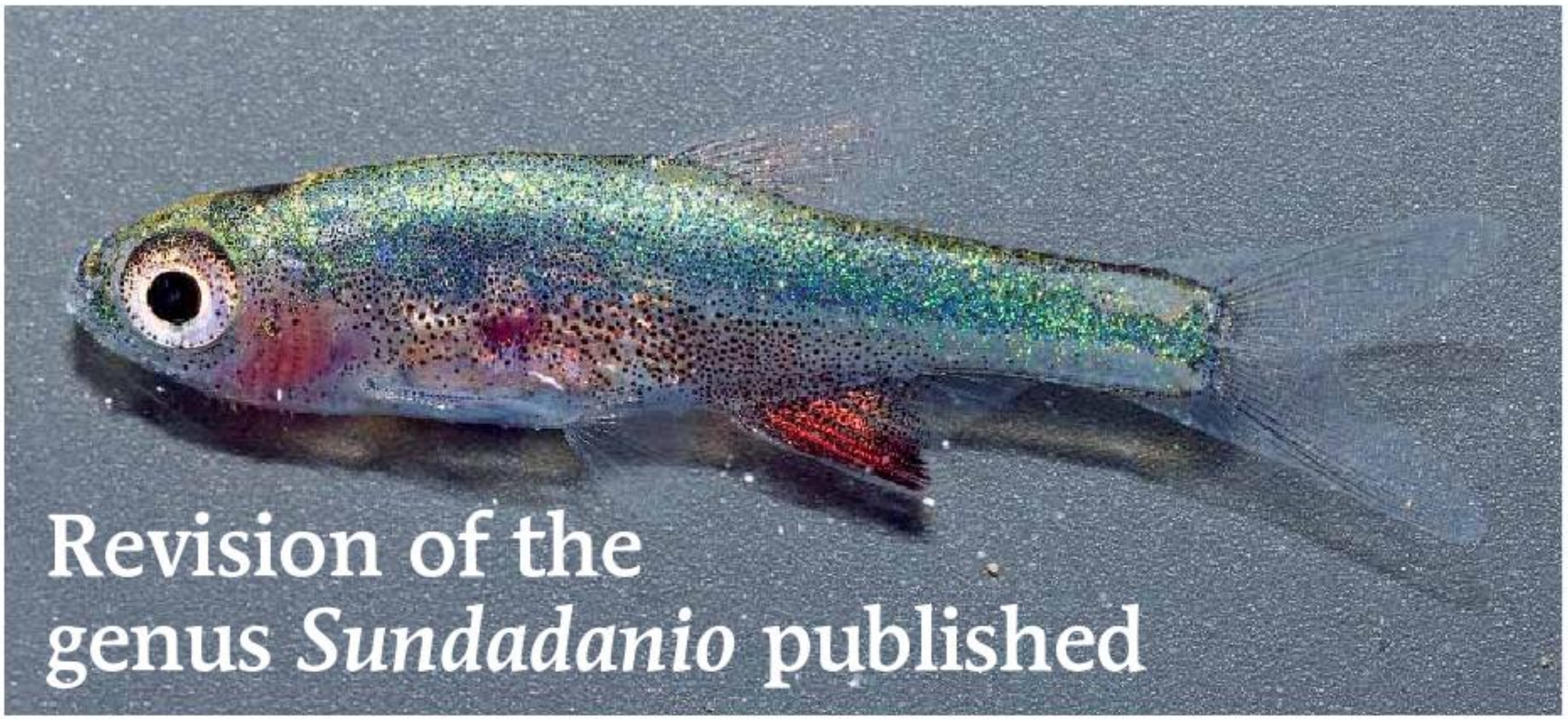
Germany has a new aquarium club: the Freaky Fish Club (FFC). There are many fish groups in the aquarium hobby for which there is no existing umbrella organization, and the FFC is intended to cater to those of us who are maintaining, breeding, and interested in the wide variety of fishes generally categorized as "oddballs." It concentrates on a large number of secondary freshwater fishes such as freshwater puffers, freshwater rays, and freshwater pipefishes, as well as typical inhabitants of fresh water like knifefishes and lungfishes. All in all, the range covered includes fishes from more than 20 orders and 60 families. For the time being, at least, the FFC is restricted to species from fresh and brackish water.

The FFC, which started out as a Facebook group, was officially founded at the Leibnitz Institute for Aquatic Ecology and Inland Fisheries (IGB) in Berlin. Many thanks to Marcus Ebert and the IGB, who made this possible. The website (www.freaky-fish-club.de) and the logo of the club (both devised by Ingmar Koglin) were unveiled at the meeting, and a constitution was adopted.

The well-known goby fan Michael Taxacher was elected president of the FFC. Other officers include Ole Arnold Schneider (business manager) and Mathias Kloster (treasurer). Jörn Strahl was appointed auditor. The FFC is a member of the German aquarium-club umbrella organization, the VDA.

The Internet will play a special role in communication within the FFC, which has no regional boundaries. The constitution mandates that voting at the annual general meeting will also take place online. In this way we hope to bring the aquarium hobby up to date, though naturally there will still be plenty of room for interesting observations and breeding. And who knows, perhaps you will even read about it again in *AMAZONAS* at some time in the future.

Marbled or Leopard Lungfish,
Protopterus aethiopicus



Revision of the genus *Sundadanio* published

Sundadanio axelrodi, above, from the island of Bintan is the type species of the genus.

In 1976 the American ichthyologist Martin Brittan described a dwarf cyprinid species in the aquarium magazine *Tropical Fish Hobbyist*. The description was based on three specimens that he had obtained from Herbert Axelrod, who in turn had found them at the premises of an ornamental fish exporter in Singapore. Brittan named the new species *Rasbora axelrodi*; he speculated about the actual location where it had been found and plumped for Sumatra. • *by Ralf Britz*

Sundadanio differs from all other cyprinids in a long list of anatomical characters, the most striking of which relate to sexual dimorphism. In males the pectoral girdle, the pectoral fins, and the first vertebra, as well as the musculature associated with the latter, are strongly modified. These fishes have evolved a so-called "drum muscle" that can probably move the fifth rib against the swim bladder like a drumstick. The fifth pectoral-fin ray in males has a much-thickened, serrated bony ridge, which can perhaps be vibrated against an extension of the pectoral girdle.

These modifications are probably responsible for the production of the croaking sounds reported several times in *Sundadanio*. These croaking sounds can be clearly heard when male *Sundadanio* are lifted out of the water in a net. However, whether or not the production of sounds is linked with reproductive behavior is a question that requires further research.

Roberts (1989) demonstrated that *Rasbora axelrodi* has a number of striking anatomical characters (for example, the possession of prominent spawning tubercles on the lower jaw) in common with the genus *Danio* and appeared not to be closely related to other *Rasbora* species. Kottelat & Witte (1999) confirmed this suggestion and erected the new genus *Sundadanio* for *S. axelrodi*. Since its description, differently colored specimens of *Sundadanio* have regularly turned up in the aquarium trade and have been labeled as blue, red, and green forms of *S. axelrodi*. Their provenance wasn't always clear, and it was uncertain whether they were different color forms or separate species.

Kevin Conway, Maurice Kottelat, and Heok Hui Tan have now studied all the museum specimens of *Sundadanio* and published their findings as a comprehensive revision of the genus in a recent issue of *Ichthyological Exploration of Freshwaters*. They have described no fewer than seven new species of the genus *Sundadanio* and clarified the provenance of Brittan's *Rasbora axelrodi*. The characters distinguishing the various species relate primarily to coloration, as well as the form of the scales and the spawning tubercles in males. Females can be separated only with difficulty, and hence the identification key included in the paper is expressly stated to work only with adult males with well-developed spawning tubercles.

By comparing the type specimens with other material, the authors have established that the type locality of *Sundadanio axelrodi* must be the little island of Bintan off the coast of Singapore, and not Sumatra, as assumed by Brittan.

The newly described *Sundadanio atomus* is, as its name suggests, the smallest species of the genus. It comes from the island of Singkep, a small island off the east

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Top to bottom:

Male *Sundadanio atomus*. The species is found only on the little island of Singkep off the coast of Sumatra.

Sundadanio goblinus lives in the area around Jambi in Sumatra.

Unfortunately, there are no live photos of *Sundadanio gargula* (male above, female below) from the island of Bangka.

Sundadanio rubellus is found in West Kalimantan, Borneo. This male originated from Ambawang.

Male Sundadanio echinus from Anjungan, West Kalimantan.

coast of Sumatra. *S. atomus*, which measures at most 0.625 inch (16 mm) long, is also the least pigmented of all the eight species. In life these predominantly transparent fishes exhibit a delicate light blue, sometimes greenish, sheen on the dorsum and a bright red spot on the anterior part of the anal fin.

Sundadanio goblinus, from the vicinity of Jambi on Sumatra, looks rather similar to *S. atomus*, but, at more than .75 inch (19 mm), grows somewhat larger and has unpaired fins powdered with black pigment cells. *Sundadanio gargula* measures about .75 (19 mm) and is one of the larger species. It is found on the island of Bangka off the east coast of southern Sumatra. The species is characterized by a well-defined black longitudinal band in preserved male specimens. Males of this species possess the best-developed and most numerous spawning tubercles.

Sundadanio rubellus, from West Kalimantan on the Sunda island of Borneo, is characterized mainly by the reddish coloration of the fins and belly region, and by the presence of a longitudinal band that is orange to red in live males. This latter character is shared with the other *Sundadanio* species from Borneo, namely *S. echinus*, *S. margarition*, and *S. retiarius*. Conway, Kottelat, & Tan conclude in their paper that the fishes sold as red *Sundadanio* in the trade are most likely the species *S. rubellus*. *Sundadanio echinus* has the shortest snout and the greatest body depth of all the species in the genus. It is most similar in appearance to *S. rubellus* and is also the closest in geographical terms, but can be

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Male *Sundadanio retiarius*, Kahayan, Kalimantan Tengah.

distinguished from the latter species via the two characters mentioned.

Sundadanio retiarius, which is known from Kalimantan Tengah, is distinguished from all other species by the dark longitudinal band in males extending the furthest down the flank, such that they have the narrowest lighter belly region beneath the band. The lower margin of the band is at the level of the lower half of the eye. Live males exhibit a predominantly reddish coloration and the anterior part of the anal fin is bold dark red to black.

The eighth and last species of the genus is *Sundadanio margarition* from Sarawak (part of Malaysia) in northwest Borneo. Preserved males possess the longitudinal band also seen in the other three species from Borneo; this band is not visible in live individuals, but is colored bright orange-red in the other three species.

All *Sundadanio* species are restricted to blackwater habitats on the Sunda Islands and therefore require strongly acid water with a very low conductivity for their maintenance and, above all, for successful breeding. It is difficult to establish what species have so far turned up in the aquarium trade, as the majority of the taxa have very similar coloration when alive. For this reason the determination of *Sundadanio* species in life is not easy, and the layman will probably be able to definitely identify only preserved adult males. Conway, Kottelat, & Tan's work demonstrates that it will require close investigation to determine the actual diversity of the dwarf cyprinid species.

Sundadanio species share their habitat with the species of the genus *Paedocypris*, which includes the smallest fishes known. Interestingly, *Sundadanio* is absent from the Malayan peninsula, while *Paedocypris* is currently still found there. The peaty forest swamps where the members of both genera live are acutely threatened by wholesale logging to make way for oil palm plantations.

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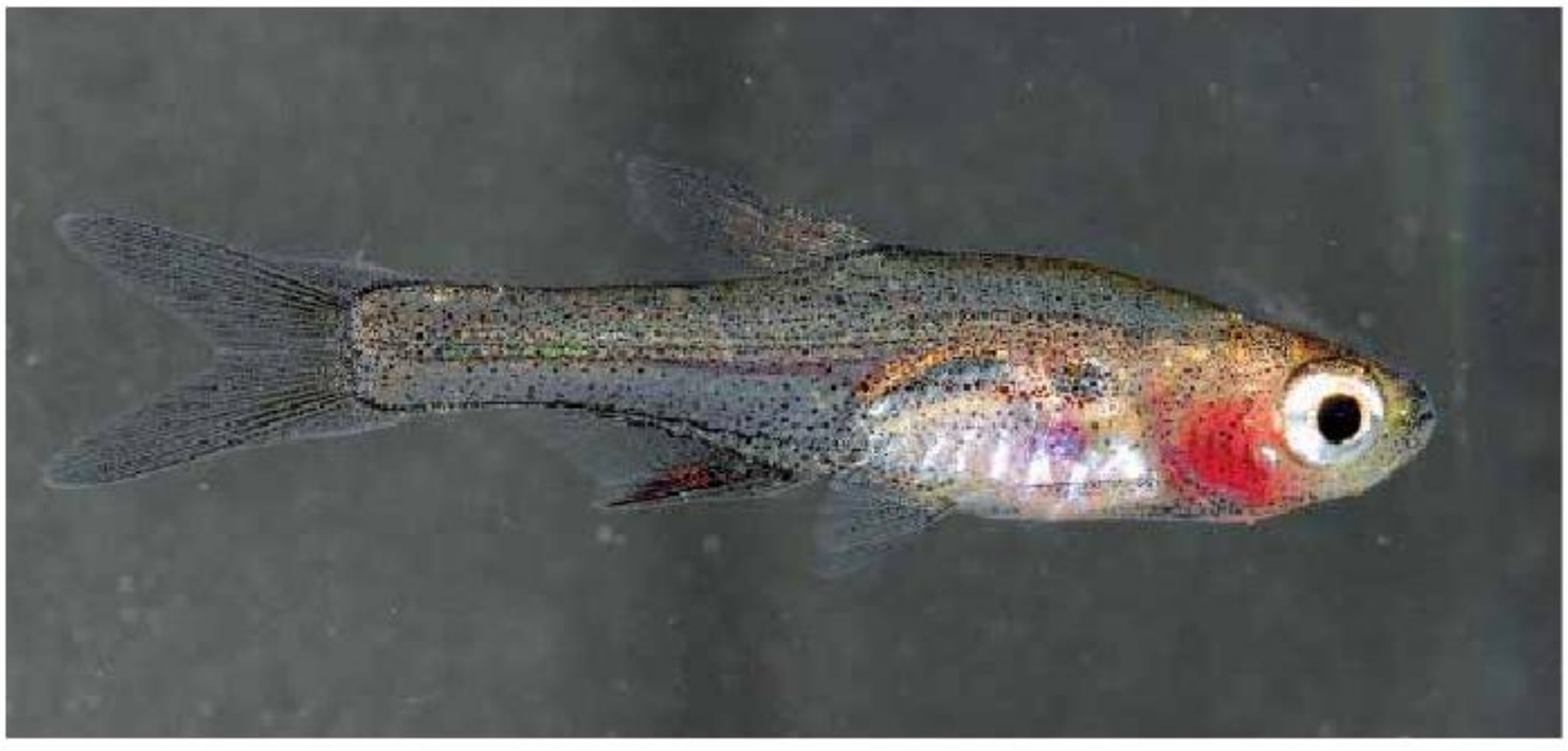

Sundadanio margarition comes from Sarawak in northwest Borneo.

H.H. TAN

"Wow!"

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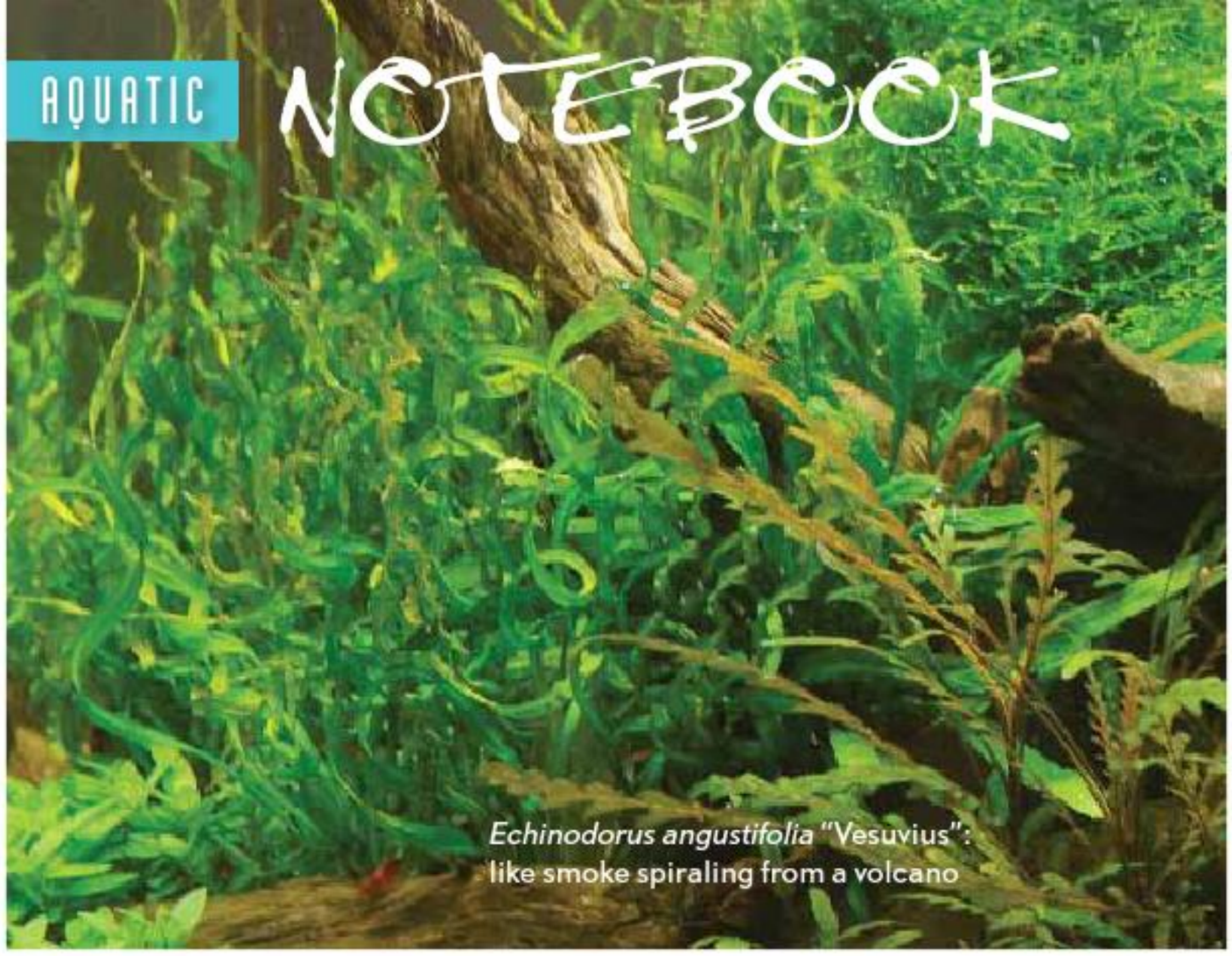

• *by Robert Paul Hudson*

Echinodorus angustifolia "Vesuvius"

Echinodorus angustifolia "Vesuvius" is an exciting newcomer on the aquatic plant scene. A variant of the grass-like *Echinodorus angustifolia* that was discovered at Oriental Aquarium in Singapore, "Vesuvius" is completely unique, twisting and curling as it grows. Up to this point, aquatic plant enthusiasts delighted in the contortions of the various cork-screwed *Vallisneria* species, but nothing in the hobby can hold a candle to the undulations of "Vesuvius".

Oriental Aquarium decided to market the plant through Stoffels International in the Netherlands, which markets plants all over Europe and Canada. Stoffels managing director Kelly Teo named it after Italy's Mt. Vesuvius because its growth habit reminded him of spirals of smoke coming from a volcano. The common names of plants often arise in such an offhand and simple manner, however whimsical it may seem.

Now, "Vesuvius" has established a footing in the United States through growers in Florida. After first spotting the plant at the big Interzoo show in Nuremberg in 2006, Brandon McLane of Florida Aquatic Nurseries in Fort Lauderdale was finally able to import some plants from Oriental Aquarium in 2009 and has been working ever since to produce commercial quantities. "Vesuvius" is now readily available.

McLane reports that submersed growth is much faster than emergent growth (with other plants it's usually the opposite), and that even the flower stalks curl inward, just as the leaves do. McLane says it may look more like a *Vallisneria* than an *Echinodorus*, but "the leaves actually curl rather than twist on their axes, which gives a much tighter twisting appearance. Like most chain swords, 'Vesuvius' reproduces via runners arising at the base of the plant."

This fascinating-looking plant is an example of a natural variation untouched by man. The mutation reportedly happened in a nursery facility and has not been discovered growing in any native habitat of *angustifolia*, but you never know! It grows to a maximum height of around 10 inches and thrives in the aquarium under moderate or strong light, and if you put it side by side with a Corkscrew Val (*Vallisneria spiralis*) or Contortion Val (*Vallisneria americana* "Biwanensis"), you will see just how unique "Vesuvius" is.

R.P. HUDSON

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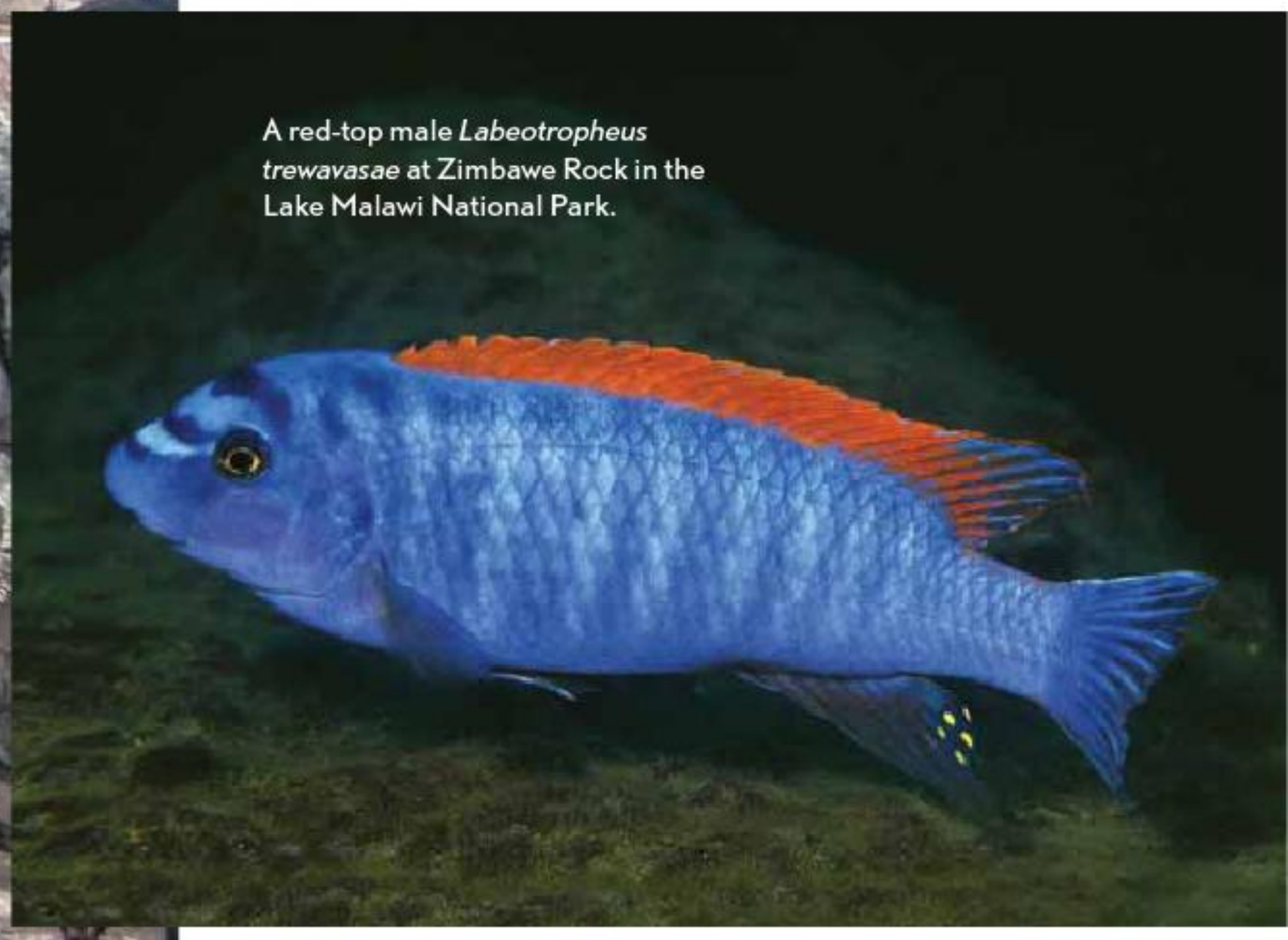
Conserving Malawi

in their natural

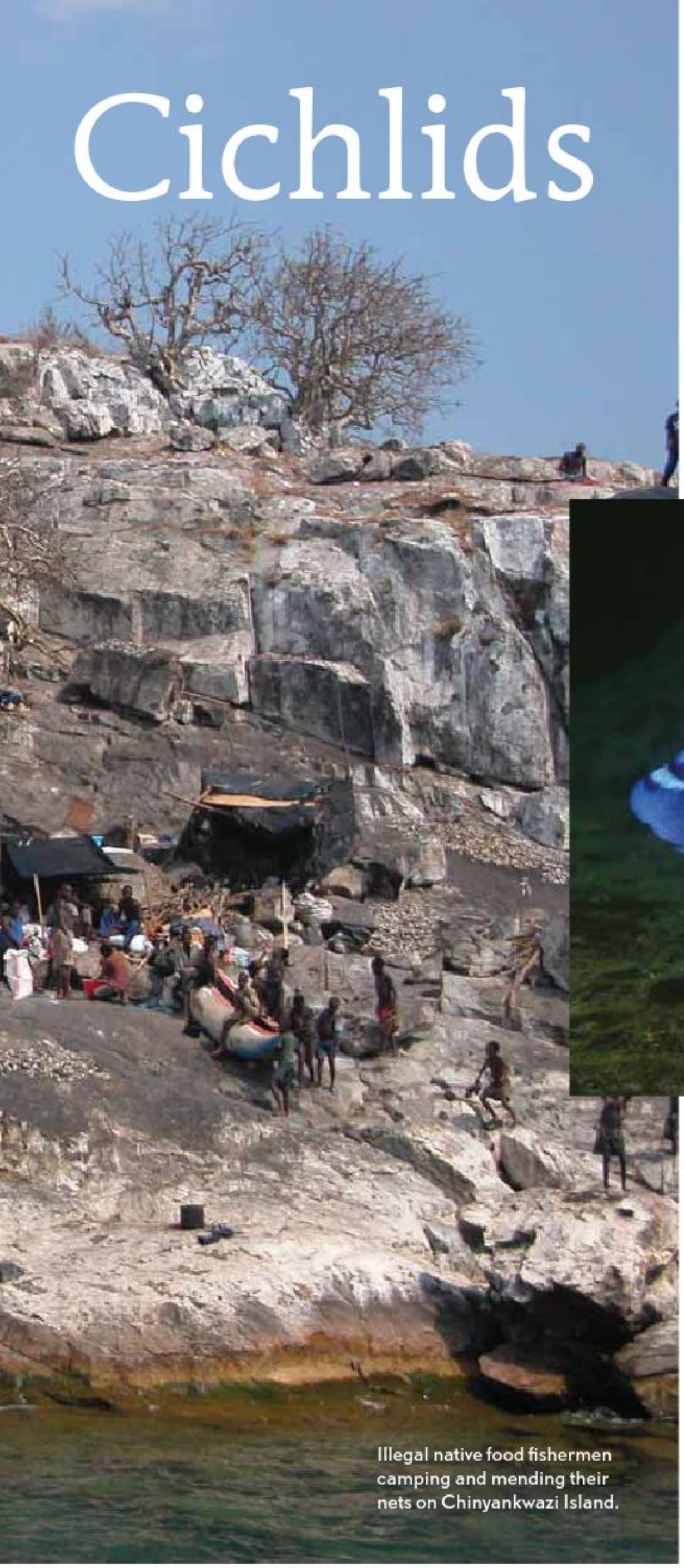
Cichlids

• *article and images by Ad Konings*

Lake Malawi is the eighth-largest lake in the world, accounting for nearly 15 percent of Earth's freshwater biodiversity, and boasts the largest number of freshwater fish species of any body of water on the planet. Most of these fishes are cichlids—the lake is home to more than 850 known species of them.



A red-top male *Labeotropheus trewavasae* at Zimbawe Rock in the Lake Malawi National Park.



Illegal native food fishermen camping and mending their nets on Chinyankwazi Island.

habitat

Competition for food, sexual selection, and the rising and falling of water levels in the Rift Lakes are credited with the evolution of the tremendous array of species and the behavioral and feeding specializations that make these fishes so fascinating. The cichlids most often kept in aquariums are divided into two groups: the mbuna, the smaller, mostly rock-dwelling species, and the non-mbuna, the larger haplochromine cichlids.

The cichlids of the lake include piscivores (fish eaters), invert eaters (feeding on crustaceans, insects, snails, and other small life forms), planktivores, algae grazers, and a number of specialists such as scale eaters (lapidophages), fin biters, cleaners, and those that feed on eggs and embryos stolen from the mouths of mouthbrooding females (paedophages).

Add intense parental care, in the form of mouthbrooding, and a palette of brilliant colors that make them among the most striking freshwater fishes known, and the cichlids of Lake Malawi are of profound interest to scientists and aquarists alike.

In many regions of the world such biodiversity is endangered by habitat loss and pollution, but in Lake

Native divers collecting aquarium fishes at Namalenje Island. The divers use a "hookah" system, whereby a long hose attached to a compressor in the boat provides them with air via a mouthpiece. Two divers can be provided with air simultaneously via two separate hoses (floating on the water). The fishes are placed in the blue plastic barrels, filled with lake water.

Malawi overfishing and exotic introductions are more immediate threats.

Translocations

Sadly, the aquarium trade must take the blame for the diversity-destructive introduction of exotic species in Lake Malawi, also known as Lake Nyasa. Although the term "exotic" is commonly used to denote species introduced from outside a body of water, in the context of Lake Malawi, where biodiversity is linked to geographical isolation within the lake, "exotic" is used for any species translocated within the lake to a site where it does not occur naturally.

Collectors of ornamental fishes are wholly responsible for the accidental and deliberate release of collected fishes in geographically different areas; the local food fisherman plays no role in this type of biological destruction. As aquarists, we should be very concerned about the nonchalant manner in which some collectors care for their live fishes, in particular when in transit on the lake. It is common practice to set plastic drums or other containers full of collected fishes overboard during an overnight stop, and the only thing that prevents the fishes from escaping into a new area is an old piece of netting tied across the opening of the container. New material is rarely used for such purposes, and the worn netting often

Pseudotropheus flavus—formerly known as *P.* "Dinghani"—is endemic to Chinyankwazi Island in the Lake Malawi National Park.

breaks and allows fishes to escape.

It is truly alarming to hear again and again that several drums of fishes were lost in a storm, almost always far from the place where they were collected. There are no laws governing such situations and thus no reprisals for or rectification of such mishaps. The introduction of exotics continues to this day; for example, drums full of *Metriaclima* sp. "Elongatus Chewere" and *Pseudotropheus* sp. "Elongatus Mphanga" were recently released at Chitande Island, where these species do not occur naturally.

In the 1970s, exotics were introduced on a massive scale in the Cape Maclear area in the southern part of the lake. Hennie and Peter Davies used to collect cichlid species at Likoma Island for the ornamental fish trade and then fly them to their station at Cape Maclear. The fishes were temporarily held in concrete vats, but after each order was filled the Davies would systematically release all the leftover fishes back into the lake near their premises, 125 miles (200 km) south of where many were collected. A dozen of these species became established, initially at Thumbi West Island, as reported by Ribbink et al. (1983), but several species have since migrated to other areas in the southern part of the lake. Stauffer et al. (1996) report on the hybridization of *Cynotilapia afra* (= *C. zebroides*) from Likoma Island with the local *Pseudotropheus zebra* (= *Metriaclima zebra*) at Thumbi West Island, indicating that the integrity of these species is slowly being eroded.

Metriaclima callainos, the Cobalt Zebra, from Nkhata Bay, was deliberately introduced at Cape Maclear and accidentally at the Maleri Islands. Nowadays this species has a very wide distribution in the southern part of the lake and is often the most common mbuna in the rocky areas. The Mozambique shore seems to be the only area of the lake where introductions of exotics have not taken place, or at least have not been reported.

Metriaclima sp. "Dumpy" is a small species found only at the Maleri Islands.

Overfishing

Although these exotic introductions can be heart-wrenching for the purist, they pale in comparison to the extensive and uncontrolled food fishing going on in Lake Malawi. The human population in Malawi has grown from 3.5 million in 1960 to about 16 million in 2011—more than a 400 percent increase in just 50 years, or about two generations.

Fish provides 65 percent of the animal protein in the dietary intake of Malawians—at least this was the case a few years ago, when about 50,000 tons of fish were caught each year. At its peak, in 1987, the figure was about 90,000 tons for far fewer people. Although an exact figure for the current catch is not available, it is definitely lower because overfishing has caused a shortage.

Of the species familiar to aquarists, it is mainly the utaka, the plankton-eaters of the lake, that have been affected by overfishing. And several species of the sand-dwelling genus *Lethrinops* have been extirpated by systematic over-exploitation of their shallow-water populations by repeated net dragging. The most famous species snuffed out by overfishing is the undescribed *Copadichromis* known as the Fire-Crest Mloto, which was very popular in the hobby in the 1980s but was last seen in the lake in 1990.

By the early 1990s, fish stocks in the southeastern arm of the lake and in Lake Malombe had collapsed. When I visited Lake Malawi in the late 1980s, beach seines were

Lake Malawi cichlid habitats in and around the Lake Malawi National Park (land areas shown in orange). Map by A. Konings.

Clockwise from top left: ❶ *Aulonocara jacobfreibergi* male at Otter Island in the Lake Malawi National Park. ❷ Prior to its recent (2011) scientific description, *Petrotilapia mumboensis* was known as *Petrotilapia* sp. "mumbo blue". It is named after Mumbo Island, one of a small number of locations where it has been found. ❸ *Petrotilapia* sp. "mumbo yellow" is known only from Mumbo Island in the Lake Malawi National Park. ❹ Male *Otopharynx lithobates* from the Zimbawe Rock population, the most colorful of the various forms of this popular aquarium fish. The species is found only in the Lake Malawi National Park, and hence cannot now be collected, so all aquarium stocks are captive-bred.

in common use and catches, although greatly reduced from what they had been 10 years earlier, were substantial. Nowadays beach seines are rare in the southeastern arm of the lake, simply because there are no fishes left in the shallow, sandy habitats.

The Lake Malawi National Park

In 1980 the rocky shorelines and the islands around the Nankumba Peninsula in the southern part of the lake were declared a national park, which was elevated to the status of a World Heritage Site in 1983. The park, the major part of which comprises the forest reserve on the Nankumba Peninsula, also embraces lake waters that lie within 328 feet (100 meters) of the terrestrial sections. Almost all of the park's shorelines are rocky: the goal was to include and protect as wide a variety of cichlid species as possible, many of which occur only in this type of habitat.

To date, a total of 220 species of rock-frequenting cichlids have been recognized within the park's waters. The total area of water protected under the National Park is 2.7 square miles (7 km²), a fraction of the lake's overall surface area of about 12,000 square miles (31,000 km²), but about 25 percent of the lake's cichlid species are represented in that area. Those of us who have visited and studied Lake Malawi believe it is a natural treasure of world magnitude and should be treated as such.

The Malawi government has taken on the difficult task of protecting an important section of this treasure for generations to come. Their mission is not simple and/or straightforward. Besides the preservation of the lake's riches, there is also a need to alleviate poverty among the people that currently live along its shores. However, the cichlids of the Lake Malawi National Park must never be exploited as a solution to that predicament.

Poorly regulated and uncontrolled fishing is without doubt a step in the wrong direction, but even controlled or sustainable use of resources in the park must be out of the question. The lake's cichlid diversity is not a resource that can be measured or controlled. Conservation is the only option, but it is difficult to carry out. Fishing in park waters is not allowed within 328 feet (100 m) of the shoreline, but the park lacks the manpower to enforce this law. Since most of the sand-dwelling cichlids around the lake have been wiped out, small-scale fishing efforts are now directed toward catching the rock-dwelling mbuna. I have seen several small-meshed gill nets containing hundreds of trapped mbuna right in front of park headquarters at the southeastern tip of Thumbi West

Island. This dreadful scenario used to be common around the Maleri Islands, where, over the years, beach seines tore the aquatic plants from the shallow sandy areas and left a bare, sandy bottom devoid of any fishes. Plankton-feeding mbuna were caught in *chirimilas* (purse seines), and trees on the islands were cut for firewood for the numerous illegal fishermen's camps then present on the three islands of the group.

Anti-netting devices

In 2006 a group of concerned Malawians was awarded a concession to "develop" the Maleri Islands by establishing a camp on Nankoma Island, a lodge on Maleri Island, and a single cottage on Nakantenga Island. They had to build everything to fit in with the natural settings, and where possible restore the original flora and fauna. They were also expected to assist in the enforcement of

Some of the new Anti-Netting Devices (ANDs) being deployed around the Maleri islands. The devices, described on page 28, are designed to foul the nets of food fishermen operating illegally in sensitive areas that are home to threatened cichlid species. Photo by Dmitri Giannakis.

Native diver breathing via hookah and deploying a net to collect aquarium fishes.

the no-fishing zone around the islands and to expel the illegal squatters. This group, called Waterlands, was initially funded by the Malawi Environmental Endowment Trust (MEET), which understood that local control of the overfishing situation would be most effective. In the following year (2007), Jay Stauffer and I founded the Stuart M. Grant Cichlid Conservation Fund (SMG Fund) in order to raise funds to support Waterlands in their efforts. Two leading members of this group, Nigel Cheal and Alan Pitman, set about developing and deploying anti-netting devices (ANDs) to hinder the illegal fishermen's attempts to pull a net at any point in the no-fishing zone around the three islands.

The first ANDs were set at the end of 2006. They had to be removed and cleaned after a few months because too many bits of netting had accumulated around them, making them ineffective at catching additional nets. By October 2007 more than 150 of these devices were protecting the cichlids around the Maleri Islands, and by the end of 2009 about 300 ANDs were in use. Most of these net-traps are suspended in the water column, attached to a very large anchor by a thick steel cable. The anchor consists of either a large boulder or, in sandy areas, a big drum welded up from scrap metal and filled with rocks.

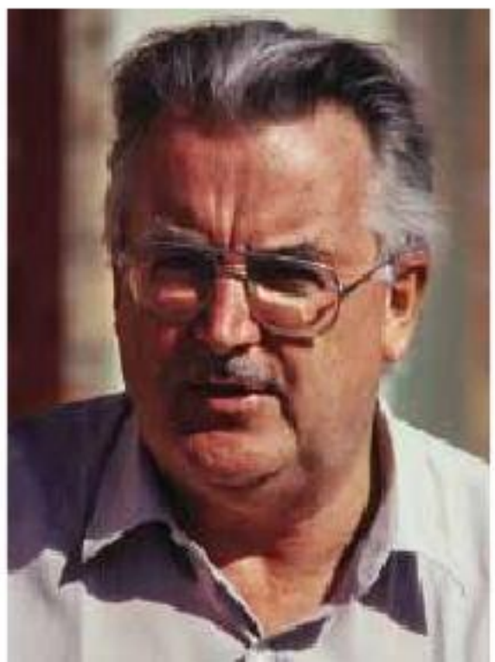
In 2010 Alan Pitman sold the Maleri Island concession to new, proactive owners Dimitri (Jimmy) and Chris Giannakis of Farmers World, Malawi, who are anxious to continue protecting Malawi fishes. In May 2011 Dimitri and I decided to replace the existing ANDs with much more durable ones that would remain functional for 10 to 25 years.

When I inspected a few of the old ANDs in October 2010 at Nakantenga Island, I was disappointed to see how quickly they had deteriorated. Worse, local fishermen were now trying their nets again, having noticed that many of the ANDs were either lost or, more likely, had sunk to the bottom where they are ineffective. We decided to construct a new type of AND from thick-walled PVC (locally available) and stainless steel (imported from South Africa). Each end of the new AND has a glued-on cap and a stainless steel collar. The top collar has three hooks to catch the nets, and the bottom collar has two eyelets for attaching the anchor line (4 mm stainless-steel cable). The whole construction, with up to 33 feet (10 m) of anchor cable, has plenty of buoyancy, so we will not see slowly sinking ANDs any more. The PVC is blue (one of the two colors available in Malawi), which is impossible to see from a boat when the ANDs are moored about 15 feet (4.5 m) below the surface. The only negative feature of the new contraption is its relatively high price of about $50 each.

Plant restoration

Shortly after the Giannakis brothers took over the Maleri Island concession, Leon du Plessis, a dive instructor who runs a dive school (Wamwai) in Senga Bay, offered to position the ANDs. He suggested that, instead of carting a rock from the islands (for an anchor), drilling holes in it, attaching the AND, and then hauling the whole system to its final resting place, the holes should be drilled underwater in rocks already in situ, with a pneumatic drill. Drills were purchased and tested underwater, operated from an extra SCUBA tank, and they performed perfectly for the purpose. If everything goes according to plan, Leon will have divers available who need 50–60 dives for their certification as dive master, 30–40 of which are just to build up experience and are not part of the training. During such non-training dives he will have these divers drill holes in the rocks and anchor the ANDs at specific places around the islands.

Anxious to do more for the environment, Leon also offered to start replanting



The late aquarium fish exporter Stuart M. Grant, after whom the Stuart Grant Fund was named.

the sandy area along the east coast of the main island (Maleri), which was covered with *Vallisneria* before fishermen hauled beach seines over them. On the other side of the island there are still a few clumps of *Vallisneria*, and using plants from there he is going to replant Bata Bay, the small bay on the east coast. First, he will strategically position some large rocks on the sandy bottom so that nets cannot be moved over the plants.

Leon and his wife, Ingrid, have also taken over as managers of the Maleri Island Lodge, and are now building a minimum-impact dive camp on the main island (the Lodge is on Nankoma, the second largest island of the group) near Bata Bay. Having a campsite right where the AND work is needed will be beneficial to the project and provide a place for volunteers to stay on Maleri Island. This promises to be an ideal destination on Lake Malawi for those who want to learn to SCUBA dive or become master divers. (More information can be found on the Internet under Wamwai Adventures; see below.)

For almost 18 months in 2010–2011, while the AND project was experiencing the upheavals detailed above, local fishermen started fishing again in some places. When the park authorities became aware of the problem, they installed a team of guards (paid by the Parks & Wildlife Department) at the islands and equipped them with a boat. Dimitri supports these men by providing fuel so that they can continue making their weekly inspection rounds, and the SMG Fund bought a diesel inboard engine for their boat. This engine uses far less fuel than the outboard did, so they can increase the frequency of their inspection rounds. In this way the cichlids will be protected using a two-pronged approach, and if Leon is successful in replanting Bata Bay, the nursery grounds for many utaka found at the Maleri Islands will dramatically expand.

Although there has been talk of turning the entire lake into a multinational park, preventing overfishing in selected areas has a more realistic chance of preserving the great biodiversity still to be found in this magnificent lake.

One of the first Anti-Netting Devices deployed at Nakantenga Island by Alan Pitman.

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INTERNET

Stuart M. Grant Cichlid Conservation Fund: http://cichlidpress.com/smgfund/smg-donate.html (Accepting tax-deductible donations to support cichlid conservation programs and the placement of anti-net devices)

Wamwai dive school and Maleri Island lodge: http://wamwai-adventures.com/

Aufwuchs-covered rocks at Mbenji Island. The attached algal growth typically contains other edible items such as diatoms, insect larvae, and small crustaceans. This biocover is exploited in different ways by different cichlids.

Lake Malawi habitats

One of fewer than 20 ancient lakes on Earth, Lake Malawi extends in a roughly north-south position in the western arm of Africa's Great Rift Valley. It plunges to a maximum depth of 2,300 feet (706 m), but the cichlids of interest to aquarists are found in the relatively shallow waters along the shoreline. The shores of the lake are variable in their topography, and different types of habitats alternate along its long coastline. Most of the lake's cichlids occur in particular habitats and although none are totally restricted to their preferred environment, by far the majority are. The habitats generally recognized are as follows:

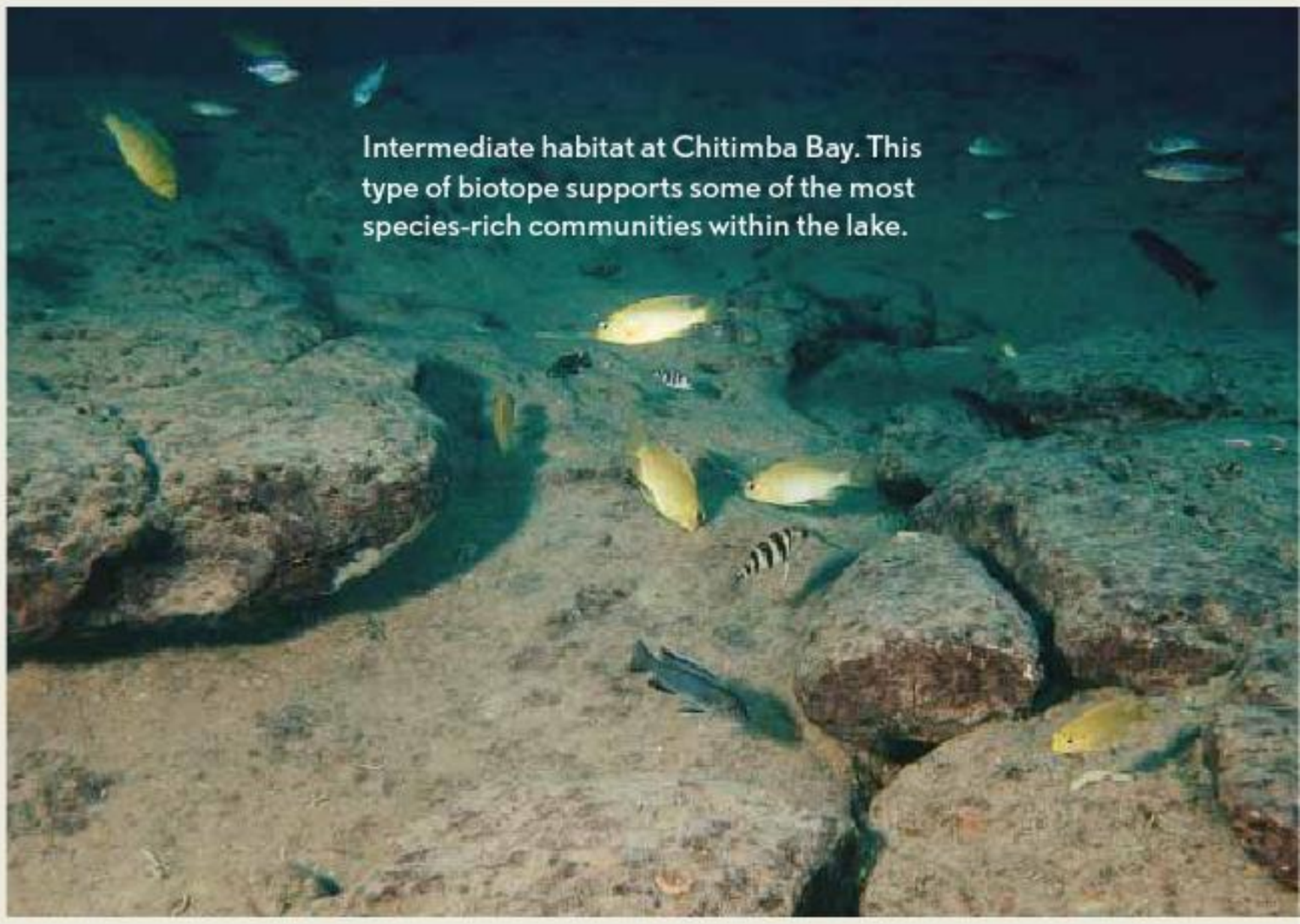
The rocky habitat. This habitat consists of rocky outcrops, small islands, and steep rocky coasts, and is normally populated by large numbers of cichlids. The size of the rocks may vary from football-size to huge boulders several tens of meters in diameter. The rocks are invariably covered with a layer of algae known as *aufwuchs* (pronounced "owfvooks"), which contains more green algae in the shallow areas. The *aufwuchs* consists of a variety of algae: the tough strands of some filamentous algae are attached to the rocks and form the matrix on which other algae, the so-called "loose *aufwuchs*," grow. The loose *aufwuchs* contains different types of algae strands, but the many unicellular algae (diatoms) also found in it constitute its most nutritious part. The *aufwuchs* contains not only algae but also enormous quantities of invertebrates (crustaceans, insect larvae, and other micro fauna), which are important sources of protein for the cichlids.

The rocks of this habitat create many caves and crevices that are used by the smaller cichlids, the mbuna (the local name for specialized rock-dwellers), as spawning sites. Because food is available in abundance, competition is mainly for territories, with all the available space claimed by one cichlid or another.

The surge zone. The upper 10–16 feet (3–5m) of the rocky habitat is usually regarded as a separate habitat, the surge zone, usually characterized by clean but turbulent water. This zone always has a substrate free of sediment, and the *aufwuchs* contains many firmly attached algal strands. Where the rocks are small the power of the turbulent water is efficiently deadened by the many cracks and caves. The face of a large rock receives the full force of the waves and only a few cichlid species are able to feed from such a surface during heavy swells.

The intermediate habitat (sand and rocks). This habitat comprises those sections of the coast that have both rocks and sand, and forms the transition zone between the pure rocky habitat and the sandy (or muddy) lake floor. The intermediate habitats can extend to very deep levels, where they harbor an entirely different cichlid community than do similar regions in shallow water.

The most common intermediate biotope, however, is found in shallow water, usually no deeper than 80 feet (25 m). Each stretch of intermediate-zone shoreline has its own mixture of cichlid species, and the mbuna in particular show extensive geographical variation. The intermediate habitat harbors the most species-rich communities of the lake.

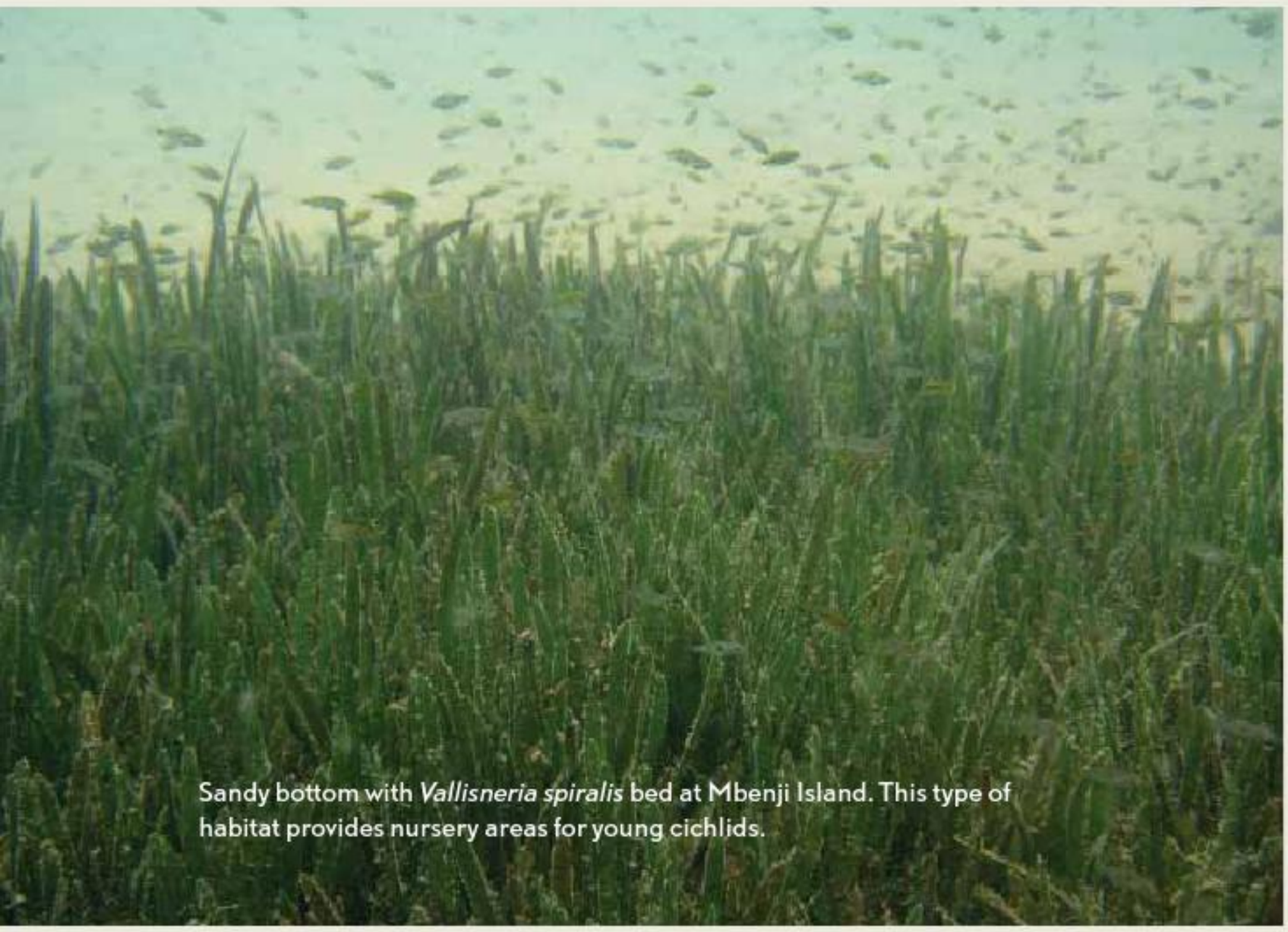


Intermediate habitat at Chitimba Bay. This type of biotope supports some of the most species-rich communities within the lake.

Sheltered bays with aquatic plants. Sheltered bays are characterized by muddy silt covering the sand and rocks on the bottom. The silt consists mainly of dead plankton and soil that has been washed into the lake, and is recycled by bacteria, snails, and aquatic plants. Only a handful of species of higher plants are known to occur in the lakes, and of these *Vallisneria spiralis* is the most common. Beds of this plant can be found at depths of up to 20 feet (6 m) in sheltered bays, providing shelter and food for several cichlid species.

The microorganisms that help recycle the sediment provide food for dense clouds of zooplankton, which is consumed by shoals of juvenile cichlids, sometimes numbering hundreds of thousands, that have been released in such bays for just this purpose.

The sandy habitat. More than half of the shoreline of the lake consists of pure sand, which alternates with swampy and rocky shores. This open biotope offers little or no protection to small cichlids, hence most of them are found in large groups or shoals. A single rock or tree trunk (washed down by floods) can provide a gathering point for several colony-breeding cichlids, while smaller species may also find shelter there. The sandy biotope is inhabited by one of the most successful cichlid genera, *Lethrinops*, which are gregarious bottom grubbers. Their schools are often encountered in somewhat deeper regions where the sandy plain is uninterrupted by rocks or plants.



Sandy bottom with *Vallisneria spiralis* bed at Mbenji Island. This type of habitat provides nursery areas for young cichlids.

Open water. The open-water habitat is not really well defined, but the cichlids found there—the plankton-feeders (utaka) and their predators—have traditionally been treated separately. Cichlids are primarily bottom-dwellers, and it is a testament to their great adaptability that a few of them have developed into truly open-water species. However, their breeding behavior remains virtually the same as it was before they took to foraging in the open water column, so they have to return to the bottom to spawn.

The *Copadichromis mbenjii* group

Copadichromis are open-water utaka species that do well when maintained in large aquariums, where they can cohabit with various other cichlids from Lake Malawi. The species of the *Copadichromis mbenjii* group are particularly interesting. Few of them get bigger than 6.25 inches (16 cm). • *by Harald Walz*

Above: The Mbenji Islands, Lake Malawi.

When I first became seriously involved with the genus *Copadichromis* in the mid-1980s, these cichlids were only rarely seen in the trade. *Copadichromis azureus*, the species most frequently available, was still being exported as *Haplochromis chrysonotus* "Mbenji" or *Haplochromis chrysonotus* "Maleri" back then. If you were very lucky you might have encountered *Copadichromis trewavasae*, which was often sold under the names *Copadichromis* sp. "Ivoryhead" and *Copadichromis* sp. "Mloto White Top".

Due to the revision of the genus by Stauffer & Konings (2006), three groups are now recognized within *Copadichromis*: the *C. quadrimaculatus* group, the *C. mbenjii* group, and the *C. virginalis* group. This article will deal mainly with the *C. mbenjii* group, which contains small species that attain a maximum length of 6.25 inches (16 cm) in the wild.

A. SPREINAT

The following species are currently assigned to the *Copadichromis mbenjii* group:

- *Copadichromis azureus* Konings, 1990
- *Copadichromis atripinnis* Stauffer & Sato, 2002
- *Copadichromis chizumuluensis* Stauffer & Konings, 2006
- *Copadichromis cyanocephalus* Stauffer & Konings, 2006
- *Copadichromis diplostigma* Stauffer & Konings, 2006
- *Copadichromis insularis* Stauffer & Konings, 2006
- *Copadichromis mbenjii* Stauffer & Konings, 2006
- *Copadichromis melas* Stauffer & Konings, 2006
- *Copadichromis parvus* Stauffer & Konings, 2006
- *Copadichromis trewavasae* Konings, 1999
- *Copadichromis verduyni* Konings, 1990

In addition to these, there are various local variants that probably belong to the *C. mbenjii* group, such as *Copadichromis* sp. "Kawanga", which Spreinat (1995) named *Copadichromis* sp. "Verduyni Deep Blue" because of its behavior and external resemblance to *C. verduyni*. On the basis of behavior and appearance, the species from Londo (Mozambique) termed *C.* sp. "Kawanga No Spot" by Konings (2007), which is occasionally exported, probably belongs to the *C. mbenjii* group. A similar cichlid is sometimes imported from Undu as *C.* sp. "Azureus Whitehead" and will probably be assigned to this group when eventually described scientifically.

Tankmates

The species of the *Copadichromis mbenjii* group can be kept in species tanks with a volume of 75 gallons (300 L) and up. If you want to keep other species with them, the minimum volume should be increased to 125 gallons (500 L), with the bottom area being more important than the depth. Tankmates I have had good results with include *Lethrinops* sp. "Dwarf Mbasi Creek" and *Lethrinops* sp. "Yellow Collar", as well as assorted local variants of *Aulonocara stuartgranti*.

I have kept *Copadichromis verduyni* with *Aulonocara baenschi* in a 100-gallon (400-L) aquarium without major problems, and *Copadichromis* sp. "Kawanga No Spot" with the somewhat smaller species *Aulonocara* sp. "Chitande Type East Coast". A friend maintained *Copadichromis azureus* with *Protomelas* sp. "Fenestratus Taiwan Reef" in a 125-gallon (500-L) tank for a long time. Both species spawned regularly in the tank and there were few confrontations.

Male and female (below right) *Copadichromis* sp. "Kawanga No Spot" belonging to the author, photographed at the cichlid exhibition in Duisburg in 2007.

A. SPREINAT

Above: *Copadichromis parvus* is, as its name suggests, one of the smallest species in the genus.

Left, top to bottom:

A fine specimen of *Copadichromis chrysonotus* "Jacksoni". This species is currently assigned to the *C. quadrimaculatus* group.

Copadichromis diplostigma is one of the seven species first described in 2006.

The specific name of *Copadichromis cyanocephalus* refers to the blue head in males. This species was long known under the trade name *Copadichromis* sp. "Verduyni Blue Face".

The species of the *Copadichromis mbenjii* group are best maintained in the ratio of one male to at least two females. I have had good results keeping smaller members of this group, such as *C. verduyni*, in groups of at least five males and seven females, but this didn't work at all with *C. azureus*, *C. trewavasae*, or *C. melas*, even in very large tanks measuring around 80 inches (2 m) in length.

I strongly advise against keeping *Copadichromis* species with the cichlids known as mbuna, because of their different feeding requirements and temperaments. I have even had repeated bad experiences keeping them with *Labidochromis caeruleus* "Yellow", an mbuna which is often recommended as a suitable tankmate for every possible Malawi species.

Don't overfeed

Suitable foods include a variety of types of frozen and live plankton for open-water feeders. My fishes get frozen foods such as *Artemia*, krill, and occasional glassworms to bring them into breeding condition. However, I always feed *Spirulina* after meals of frozen food to aid their digestion. I give the majority of my *Copadichromis* a staple diet of *Spirulina* flake and the special flake foods designed for Lake Malawi cichlids, available from a variety of manufacturers. As a precautionary measure, pelleted foods should be soaked until soft before feeding, so that they don't swell up in the gut! This can sometimes lead to problems with greedy feeders, which most cichlids are.

In fact, it's a good idea to impose a "fasting day" once a week and avoid overfeeding, which can lead to digestive problems in most cichlid species from Lake Malawi. I always make sure that my fishes have a "straight" belly

I tried keeping *Copadichromis trewavasae* in a 100-gallon (380-L) tank with *Aulonocara stuartgranti*, but things went awry after the *C. trewavasae* settled in because the male regarded the entire tank (dimensions 48 x 24 x 20 inches/120 x 60 x 50 cm) as his territory. Thus, despite plenty of cover being available, the *A. stuartgranti* were confined to the corners of the aquarium until I moved them to another tank. For this reason I recommend a minimum aquarium size of 125 gallons (500 L) when keeping members of the *C. mbenjii* group with other species. It is also better to avoid keeping different *Copadichromis* species from the same group together. The species will not only hybridize, but also probably regard each other as competitors for food and territory on account of their similarity.

CLOCKWISE FROM BOTTOM LEFT: A. KONINGS (2); N. KNAAK; A. SPREINAT (3)

A male *Copadichromis mbenjii* above its "sandcastle" nest at the Mbenji Islands.

Copadichromis females (this is *C.* sp. "Verduyni Deep Blue" at Luhuchi Rocks) often move around in large groups in the lake.

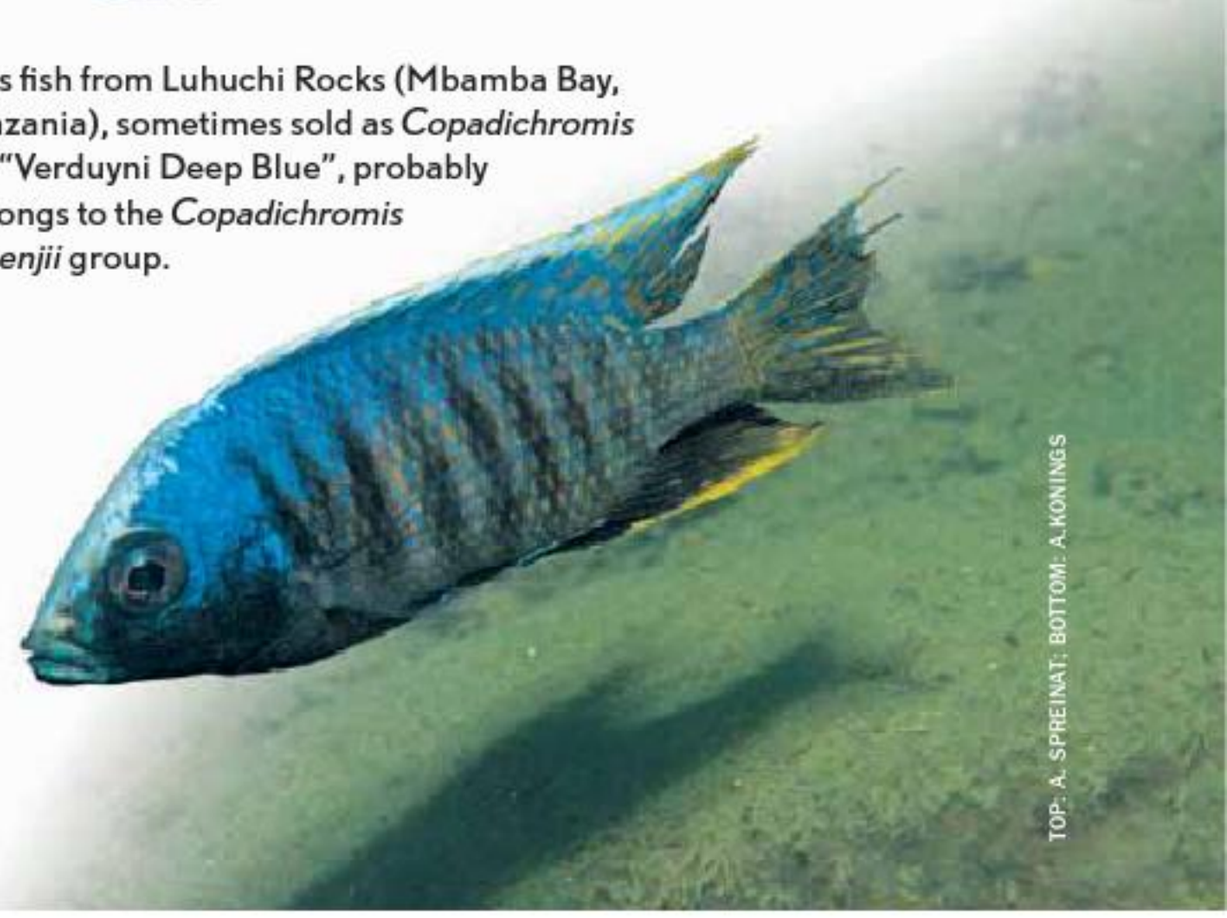
profile—not too fat, but not emaciated.

I strongly advise against feeding bloodworms to Lake Malawi cichlids. I have found that all too often, a wide variety of Malawis (not only *Copadichromis* species) come down with the dreaded "Malawi Bloat" a few days after feeding with commercial bloodworms. And once they are stricken, it takes a lot of luck and prescription medication to cure them.

Generally speaking, the species of the *Copadichromis mbenjii* group are very rewarding and not too demanding to keep, as long as the advice given here is borne in mind. And the males of the majority of *Copadichromis* are a match for the *Aulonocara* species in terms of their coloration, as can be seen in the accompanying photos.

In the event that your regular dealer doesn't have these fishes in stock, it shouldn't be difficult for him or her to obtain the species discussed here from a specialist wholesaler.

Copadichromis melas has long been known in the hobby as the Midnight Mloto.



This fish from Luhuchi Rocks (Mbamba Bay, Tanzania), sometimes sold as *Copadichromis* sp. "Verduyni Deep Blue", probably belongs to the *Copadichromis mbenjii* group.

TOP: A. SPREINAT; BOTTOM: A.KONINGS

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Portrait of my male
Aulonocara baenschi

Aulonocara baenschi, the New Yellow Regal Peacock

Courting *Aulonocara baenschi* males are a splendid bright yellow with contrasting blue on the mouth and throat region.

Malawi Peacocks certainly deserve their name. Their intense, striking colors have been enchanting African cichlid fans for decades. The bright yellow *Aulonocara baenschi* is a deservedly popular species.

• *article and images by Janita Webeler*

As in all *Aulonocara* species, females of *Aulonocara baenschi* are plain gray-brown in color.

There are several populations of *Aulonocara baenschi* in its home in Africa, Lake Malawi; unfortunately, it still isn't clear whether or not they are all the same species.

The first scientific description of a population of yellow *Aulonocara* was published by Meyer & Riehl in 1985. The fishes in question were discovered by Stuart Grant at Nkhomo Reef, close to the town of Benga. Meyer & Riehl named the species *Aulonocara baenschi* in honor of Dr. Ulrich Baensch, the founder of the Tetra company and the inventor of enriched flake food for aquarium fishes. Two years later it was suggested that the forms found in the vicinity of the Maleri Islands and the village of Chipoka should be regarded as conspecific with *A. baenschi* because they exhibited no consistent differences in morphology and coloration. So from a scientific viewpoint there is only one species of yellow peacock recognized from Lake Malawi—*Aulonocara baenschi*—although some authors believe that the Maleri and Chipoka populations may be a separate species. The species has a number of popular names in the hobby, including Sunshine Peacock, Yellow Regal Peacock, and Benga Peacock.

Body and fins are largely yellow in males, which measure up to 4.75 inches (12 cm) in length. Another unmistakable color character is the metallic blue of the lower part of the head and the pattern in the caudal fin. In contrast, the females, which are smaller, are an unremarkable brown to olive-green with a number of darker vertical bars, making them virtually indistinguishable from females of other *Aulonocara* species. This fact should deter aquarists from keeping several similar-looking peacocks in the same tank—cross-breeding would be almost inevitable.

Like all *Aulonocara* species, *A. baenschi* has enlarged sensory pores on the lower head and cheek regions, permitting it to detect small organisms concealed in the sand, which it captures by diving into the substrate.

Naturally these fishes must also be able to find prey in the aquarium, and should be fed on live and frozen foods. They particularly enjoy *Artemia*, which also ensures particularly attractive coloration in these fishes, but they will take dry foods such as flake and granulate. When using such foods, a high content of natural carotenoids (astaxanthin, for example) is important to ensure the development of good color. Variety is the alpha and omega.

Rocks, sand, and hard water

In Lake Malawi *A. baenschi*, a utaka or open-water species, inhabits the intermediate zone between sand and rocks, so similar conditions should be provided in the aquarium. A number of rocky structures at the rear will leave plenty of open swimming space and expanses of sand at the front. All these components are essential, as the New Yellow Regal Peacock requires both hiding places and sandy areas for hunting food and courting.

Anyone who wants to include plants will be pleased to learn that *Aulonocara* rarely attack them, provided the plants are placed in the tank before the fishes. Any greenery introduced after the fishes will usually be seen as an intrusion and dug up in short order. The plants you choose must be able to cope with hard water. On this basis, the most suitable are *Anubias* species, Giant Vals (*Vallisneria gigantea*), and Water Onion (*Crinum thaianum*). During the breeding period, however, even these plants will be in danger, as the males peacocks dig deep

I often see my fishes foraging in the sand for anything edible.

pits during courtship. The only solution is to protect the plants' roots with large stones right from the start.

As for substrate, light-colored sand or black, very fine-grained gravel are best. Both have their advantages and drawbacks. If the substrate (or the entire aquarium) is too light, then the fishes will often be very shy and nervous. If the background and substrate are dark, the fishes tend to lose their timidity and be active and visible in the tank all day. However, in my opinion the impressive coloration of *A. baenschi* can be better appreciated against light sand.

A. baenschi poses special demands in terms of water parameters. In Lake Malawi these fishes enjoy clean, crystal-clear, oxygen-saturated water with a hardness of 8–10°dGH, though they will do very well at 25°dGH or more in captivity. The temperature should be 75–80.5°F (24–27°C) and the pH 7.8–8.4. An additional powerhead or current pump can be very helpful in producing surface movement and oxygenating the aquarium water. In order to maintain the correct pH, wood should not be included in the décor, and it is advisable to filter over crushed coral, crushed shell, and/or limestone chips as a pH buffer.

Breeding in a species aquarium

The New Yellow Regal Peacock is essentially a peaceful cichlid that simply ignores fishes of other species. Only at breeding time is there any danger of females suffering the over-enthusiastic attentions of the males, which can be quite boisterous at this time. It is best to avoid keeping two males if the tank isn't large enough to provide enough territory for both, as the stronger fish will pester the subordinate one even outside the breeding period. On the other hand, the dominant male will exhibit permanent bright yellow coloration in the presence of a rival; without one, this intensity of color is evident only at breeding time.

Anyone who wants to set up a species tank for breeding the species would do well to use a group consisting of one male and four to six females. It is also possible to keep a minimum of three males, with at least two females per male; the dominant male's attention is then

Only a few young survive in tanks containing adults. They are colored like females.

Top, right: *Labidochromis caeruleus* "Yellow" is a peaceful fish, which makes it a suitable tankmate for *Aulonocara baenschi*. Bottom: In large aquariums (60 inches/150 cm and up) *Cyrtocara moorii* can be kept with Malawi Peacocks. These fishes can develop impressive nuchal humps in a very large aquarium. Photographed at the Sagittaria Club aquarium in Hamburg.

shared among the others and no single fish is constantly under attack. In this case the aquarium must have a volume of at least 55 gallons (210 L). The behavior of *A. baenschi* can be studied very nicely in a suitably large tank, with the females and young often swimming in groups and the males displaying as they stake out and defend their territories.

During the breeding period the males excavate regular "craters" and then use vigorous quivering with outspread fins to attract their intended mates. Now and then a cave is also used as the love nest. During spawning the two fishes repeatedly swim in circles. The female lays her eggs and takes them into her mouth, and at the same time tries to collect the "dummy eggs" (eggspots) on the anal fin of the male. In this way she takes in the sperm of the male and the eggs are fertilized.

Aulonocara baenschi is a maternal mouthbrooder: the eggs, larvae, and eventually the fry are tended by the female alone. The time from fertilization of the eggs to release of the fry is normally around 20 days. For some time thereafter the female will sometimes take the 20–30 fry back into her mouth, especially when danger threatens.

If a brooding female is spotted in the aquarium, it is advisable to catch her and put her in a separate rearing tank. It is sometimes possible for fry to evade their hungry congeners until they are large enough to avoid being eaten, but this isn't normally the case. Besides, the continuing course of the brooding period can be better observed in a separate tank. The female carrying eggs often swims in the vicinity of the filter return where the water is better oxygenated, and continually moves the eggs around with chewing motions so that they are supplied with oxygen. The majority of females take little or no food throughout the entire brooding period, so as time goes by the buccal cavity becomes ever larger and the belly ever more concave. After around 20 days the little fishes are released from their mother's mouth for the first time. In 90 percent of cases this takes place after the aquarium light is switched off.

The female can be watched tending her brood for a few days thereafter, but then she should be returned to the main tank. The fry should be fed several times per day, and it is almost impossible to overfeed them. They will take powdered food (such as finely crushed flakes) and/or CYCLOP-EEZE, and are even fonder of frozen or live *Cyclops* and *Artemia*.

The tiny fishes, which appear to be no more than bellies and eyes for the first few weeks, prefer a rich and varied diet right from the start and will respond with rapid growth. At a length of around 2.75 inches (7 cm) the males begin to slowly color up, though this can take somewhat longer in subordinate individuals. The fishes are also sexually mature at this stage and may start producing offspring themselves.

Tankmates

Because *Aulonocara baenschi* is a mainly peaceful, nonmbuna species, keeping it with other species is usually fairly trouble-free. The question is, which ones? Mbuna species, for example *Pseudotropheus*, are unsuitable—they are too aggressive and boisterous and the rather easy-going *Aulonocara* may feel intimidated. One exception is the well-known yellow form of *Labidochromis caeruleus*,

BOTTOM RIGHT: H.-G. EVERS

which, although an mbuna, is fairly peaceful in temperament. The blue of *Cyrtocara moorii* contrasts nicely with the yellow of the peacocks, and this species is another potential tankmate, although this will work only if the tank is large, because these fishes can attain a length of 8 inches (20 cm) or more. Members of the genus *Copadichromis* can also be kept with *A. baenschi*.

When it comes to catfishes as tankmates, the only real contenders are *Synodontis* species, for example *Synodontis grandiops*, also well known as the Cuckoo Catfish on account of its unusual breeding habit of getting mouthbrooding cichlids to care for its eggs. (Editorial note: the species *Synodontis multipunctatus*, whose name is usually applied to the Cuckoo Catfish in the aquarium hobby, is actually a different species, probably not yet maintained in captivity.) Although *Ancistrus* are often introduced to control algae, they have no place in a Malawi aquarium—they have totally different water chemistry requirements.

An alternative way of combating algae is to use grazing Nerite snails, which are not only very useful but also look nice with their attractive zigzag patterns. There is no danger of a plague of snails: although they can be kept in fresh water, they breed only in salt water.

Crayfish, shrimp, and crab enthusiasts have a hard time with *Aulonocara baenschi*. To these fish, shrimp are tasty little snacks, and it is difficult for crabs to secure a suitable place to live in a cichlid tank. But the crayfishes include one species that is particularly suitable for keeping with these cichlids—*Cherax quadricarinatus*, the Redclaw Crayfish. It does very well in this water chemistry and is large enough not to be eaten. It also knows how defend itself without injuring fishes in the process. But this crustacean must have a safe retreat, as it is completely defenseless immediately after molting.

Finally, it should be reiterated that while it may be possible to keep several *Aulonocara* species together without problems, this isn't always advisable. The danger of cross-breeding is extremely high, and such hybrids should not be allowed to get into the trade under any circumstances!

Aulonocara baenschi is well worth keeping, not just on account of its lovely yellow color, but also because its behavior is very interesting, especially during courtship and the brooding period. It may not be suitable for beginners because of its special requirements, but this lovely fish is warmly recommended to aquarists with some experience. As long as its requirements are met, the New Regal Yellow Peacock will reveal its full beauty and gladden the hearts of all observers.

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Males of *Pseudotropheus saulosi* have a contrast-rich pattern.

Two Dwarf *Pseudotropheus* from Lake Malawi

Among the Lake Malawi cichlids, the members of the genus *Pseudotropheus* haven't always enjoyed the best of reputations, and many aquarists often characterize them as aggressive and badly behaved toward more peaceful species. But this isn't always so, as I have found with two dwarf species, *P. saulosi* and *P. pulpican*. • *article and images by Jens Hamann*

Adequate tank size is a prerequisite for the successful maintenance of *Pseudotropheus* species, as they are active swimmers. Even in the case of the smaller species discussed here, 55 gallons (209 L) is the absolute minimum, which means that we are really only interested in a larger Lake Malawi community aquarium 48 inches in length (150 cm) and up.

Because *Pseudotropheus* belong to the mbuna group, the rock-dwelling cichlids of Lake Malawi, they should always be provided with large-scale rockwork so that low-ranking individuals and/or mouthbrooding females have a place to shelter. Because these fishes dig a bit now and then, sand and fine-grained gravel are the most suitable substrate materials. The species described here won't hurt robust plant species such as *Anubias*, Java Fern (*Microsorum pteropus*), and *Cryptocoryne aponogetifolia*. These cichlids are very adaptable with regard to total hardness and will do well at values between 10 and 30°dGH. A pH between 7.5 and 8.5 is advisable.

Pseudotropheus saulosi "Saulosi"

Known as the Saulosi, *Pseudotropheus saulosi* brings a lot of color to the aquarium—both sexes are attractively colored. While females are yellowish orange all over, males exhibit six dark blue vertical stripes on a light blue background and one to three eggspots on the anal fin.

In Lake Malawi these fishes are found only at Taiwanee Reef, a small, very species-rich submerged reef around 6.25 miles (10 km) northwest of Chizumulu Island. Here they live in fairly shallow water with strong current, where they like to graze algal mats growing on the rocky reef. The invertebrates, microorganisms, and diatoms found in the green biocover form the natural diet of *Pseudotropheus saulosi*. The females and non-territorial males swim through this rocky biotope in large groups of up to 50 individuals, while dominant males occupy relatively large territories 40–80 inches (1–2 m) in diameter among the rocks.

Because *P. saulosi* prefer to remain in the upper half

of the aquarium, the rockwork should be tall enough to permit this. The fishes will then spawn on a flat surface at the highest point and won't molest more peaceful species living near the bottom. *P. saulosi* will exceed a length of 4 inches (10 cm) only with the heaviest of feeding and if housed in a really large aquarium.

These fishes can be kept with significantly larger species of the genera *Copadichromis* and *Cyrtocara*, as well as with other mbuna. In fact, a large aquarium containing a mixture of several genera is the best way to observe the interesting behavior of this species. One *P. saulosi* male can be kept with several females; three or more males will make for a lot of activity in the aquarium. The upside of this is that any aggression is shared and it won't necessarily always be the same male that is dominant. What doesn't usually work is keeping two males, as the "underdog" will be constantly chased around and often can obtain peace and quiet only by reverting to female/juvenile coloration.

The aggressive potential of the males increases along with the frequency of spawning activity. Each spawning will produce up to 25 fry that are brooded in the mouth of the female for a period of around three weeks, though it isn't uncommon for them not to be released until as many as four weeks have elapsed. They are about 0.5 inch (8 mm) long on release and exhibit the orange coloration of the female. The little males slowly begin to color up from the age of around six to eight months, when they have attained a length of 1.5 inches (4 cm). They attain sexual maturity at around 2 inches (5 cm) in length.

Pseudotropheus pulpican "Kingsizei"

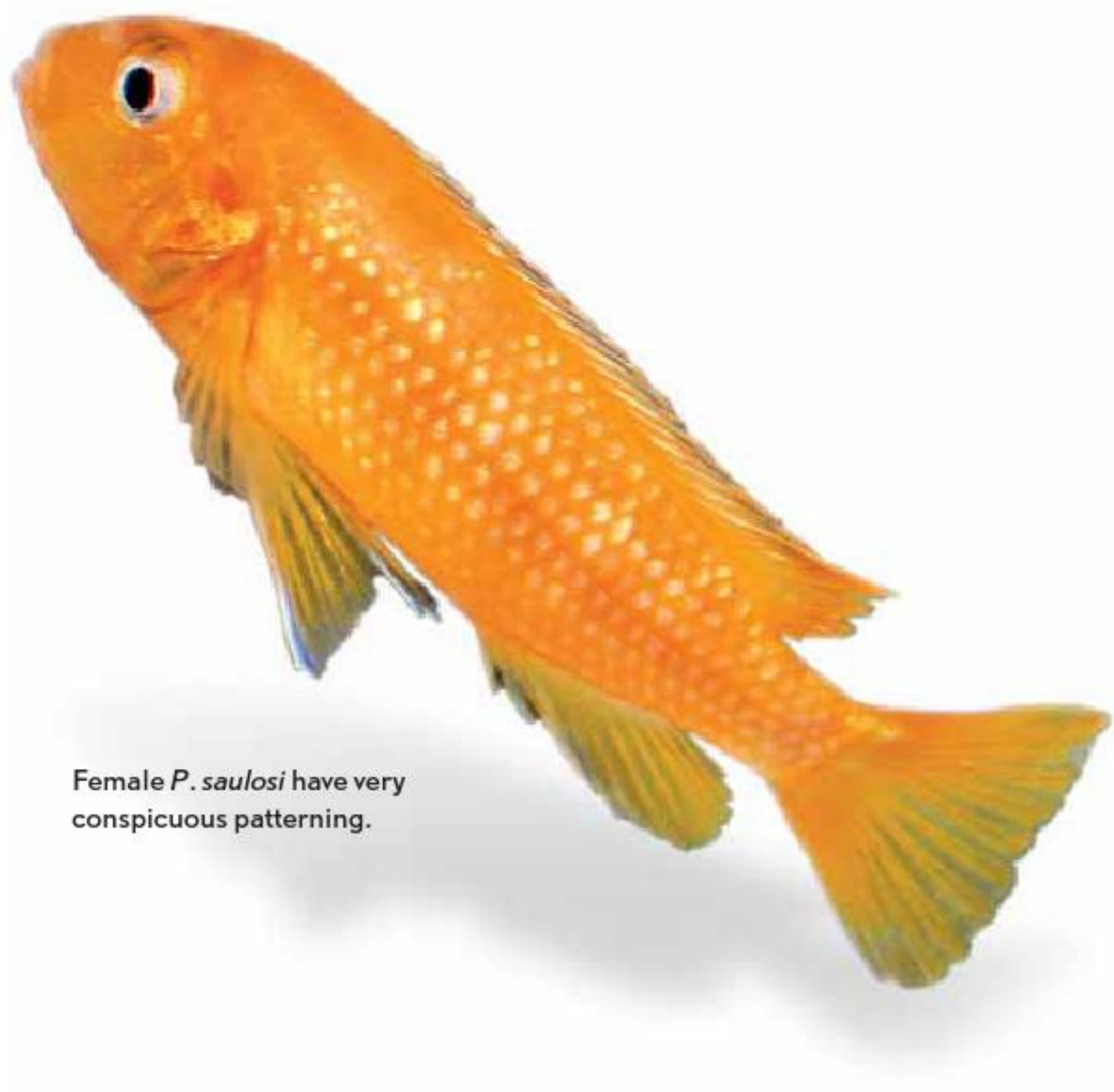
Another putative member of the genus *Pseudotropheus* bears the burden of unresolved problems regarding its correct nomenclature. The first specimens appeared in the trade at the beginning of the 1990s as *Pseudotropheus* "Kingsizei", a name in use until Tawil described the species as *Cynotilapia pulpican* in 2002. The generic placement was challenged on a number of grounds and by various authors, including Spreinat (2006), who proposed the name *Pseudotropheus pulpican*, a suggestion that I will follow here. Others agree with Tawil or believe the species should be assigned to *Metriaclima*.

The natural distribution of the species initially appeared to be geographically very limited, being restricted to the channel between the islands of Likoma and Maingano, but populations have subsequently been seen on the Mozambique shore—although they differ in coloration from the Maingano population discussed here. Males of this form exhibit a sky blue base color with five dark blue vertical bars. The anal fin is also dark and has one to three eggspots, while the dorsal fin is white and may also have such spots on its posterior tip.

In this species the females don't offer a color spectacle comparable to that of the males, but have only faint vertical bars on a gray background with a slight blue sheen. A small eggspot is almost always present as well.

Compared to *Pseudotropheus saulosi*, *P. pulpican* is not such an active swimmer and prefers the middle and bot-

Pair of *Pseudotropheus saulosi* spawning. The female takes on a dark bar pattern at this time.



Female *P. saulosi* have very conspicuous patterning.

Head study of *Pseudotropheus pulpican*.

Right: Adult male *Pseudotropheus pulpican*.

tom areas in large aquariums. While the majority of Lake Malawi cichlids are not territorial outside the breeding season, many mbuna, including *Pseudotropheus pulpican*, are exceptions. The males occupy strategically favorable positions among the rockwork and vehemently defend them against intruders. This can quickly lead to problems if multiple males are kept in too small an aquarium with insufficient rockwork.

These plucky little dwarf cichlids will drive away intruders up to a third larger than themselves, for example *Sciaenochromis fryeri* and *Aulonocara* males. But *P. pulpican* avoids confrontation with opponents twice its own size by swimming head down.

Easy to breed

Breeding *Pseudotropheus pulpican* and *P. saulosi* presents no problems and follows the pattern seen in the majority of mouthbrooders from Lake Malawi. The courting male uses quivering motions to entice the female to a readily defensible spot, where egg-laying and fertilization take place in the so-called T-position: The male nudges the female's belly to stimulate the release of eggs, and when she turns to collect them in her mouth he tilts slightly to one side and displays the egg dummies on his anal fin. The female tries to pick these up as well, in the process ingesting the male's sperm to fertilize the eggs already in her mouth.

Although water temperature plays a subordinate role in the Lake Malawi cichlid aquarium, the development of the eggs and larvae is affected by it. A temperature of 75°F (24°C) is adequate for the well-being of the adult fishes, but larval development is accelerated at 79°F (26°C). Higher temperatures are unnecessary, unless you want to support the electric company.

The females hide during the first half of the brooding period and do not feed. During the second half they sometimes take a bit of flake, which probably benefits only the brood. Even if you want to rear the fry, it is best to avoid isolating the female for weeks—remove her to a separate tank after 18–20 days.

Feeding and rearing the fry is pretty easy. They will eat the same food as the adult fishes from day one, as long as it is sufficiently fine in size. As for all mbuna, it shouldn't be too protein-rich and should contain plenty of vegetable material. *P. saulosi* in particular likes slices of cucumber and zucchini as well as other fresh vegetables. *Artemia* nauplii aren't essential but will accelerate growth. Full-grown adult length is just over 3 inches (8 cm).

In *Pseudotropheus pulpican* the sexes can be distinguished after just a few weeks, as the little males sometimes partially color up at just over an inch (3 cm) long and start performing little threat displays among themselves.

If you are looking to expand the population of your Malawi cichlid aquarium, you would do well to consider these plucky and colorful dwarfs.

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Juvenile *P. pulpican*, like females, are plain gray in color.

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Into the wilds of West Papua in search of the Neon Rainbowfish

In 1920 a Dutch expedition collected a small, unknown *Melanotaenia* species in the Mamberamo River drainage in West Irian Jaya. The preserved fishes served as the basis for the description of *Melanotaenia praecox* by Weber & de Beaufort in 1922. But for almost 70 years, nobody knew what the living fish looked like. • *by Johannes Graf*

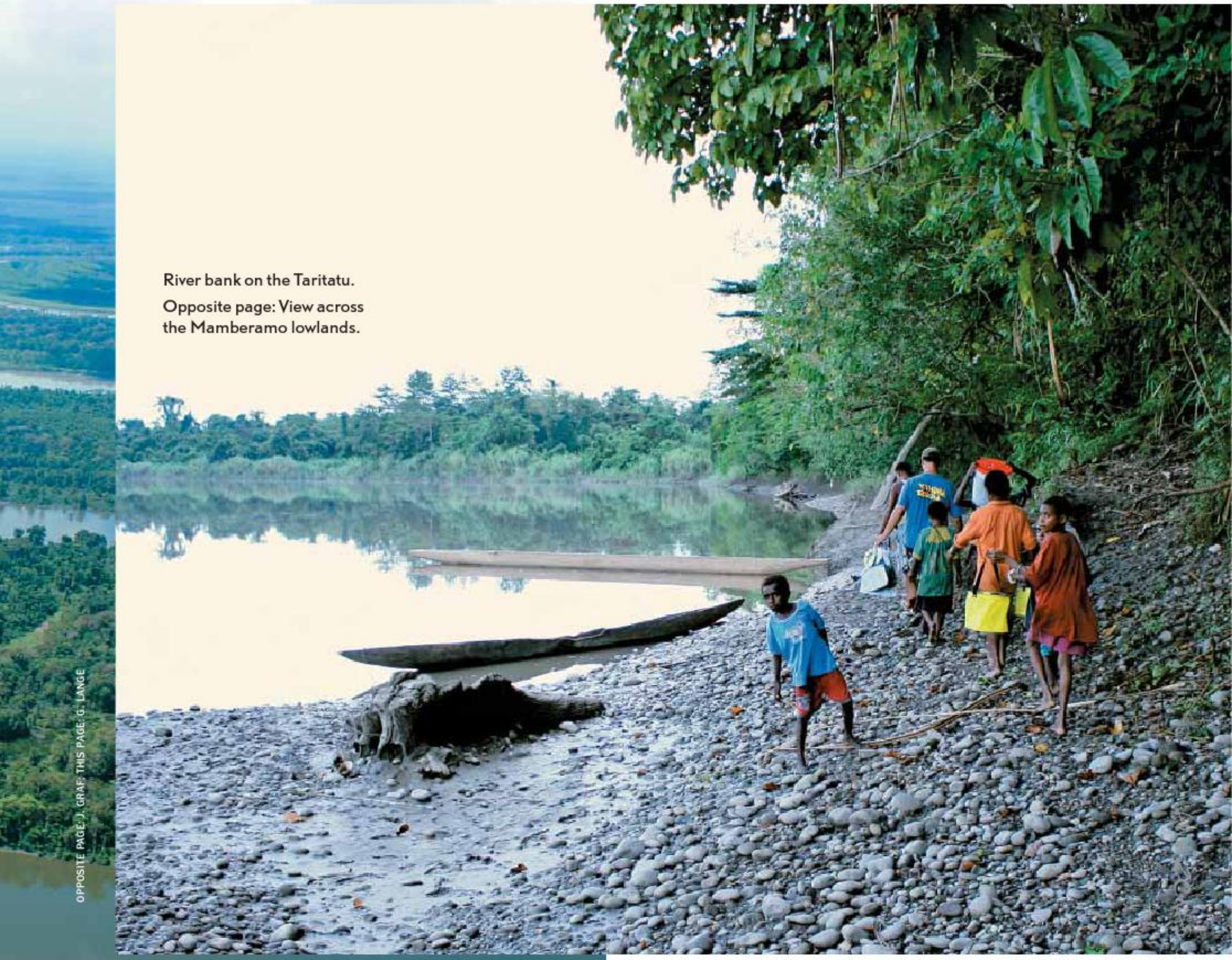
Ever since Gerald Allen discovered live *Melanotaenia praecox* in 1991, with Heiko Bleher importing these fishes the following year, the Neon Rainbowfish has been an indispensable part of the range stocked by aquarium dealers. With its brilliant, metallic blue body color and blood-red fins, *M. praecox* is a very attractive fish, an ideal size for aquarium maintenance, and relatively easy to keep. Practically all stocks of *M. praecox* originate from the first specimens imported, which were collected in the vicinity of Dabra in the Mamberamo lowlands of New Guinea. To the best of my knowledge, to date there has been no organized commercial exportation of freshwater aquarium fishes from New Guinea. Only a comparatively small number of specimens of *M. praecox* derive from a further importation by C. Nishihira, from whom I obtained a number of juveniles in 2004. I subsequently line-bred them as a strain.

Until now, the only reliably documented locations for *M. praecox* have been Dabra and Iritoi (Allen 1996) in the Mamberamo basin, and the region around Siewa, to the northwest in the Wapoga system. The specimens known from the Siewa region are noticeably slimmer than those from the Mamberamo basin and differently patterned, but were regarded by Allen as simply a variant of the species.

Two mighty rivers, the Taritatu and the Tariku, meet near Dabra to become the Mamberamo, which then makes its way northward to the Pacific Ocean. Iritoi (or Iratoi) was a camp of the Dutch expedition in 1920–21 and lies far to the west of the Mamberamo, on the upper course of the Tariku.

Travels in the Mamberamo basin

Finding *Melanotaenia praecox* in the wild had long been one of my dreams. A trip through Papua New Guinea in August 2008 took me to the Mamberamo lowlands,



River bank on the Taritatu.

Opposite page: View across the Mamberamo lowlands.

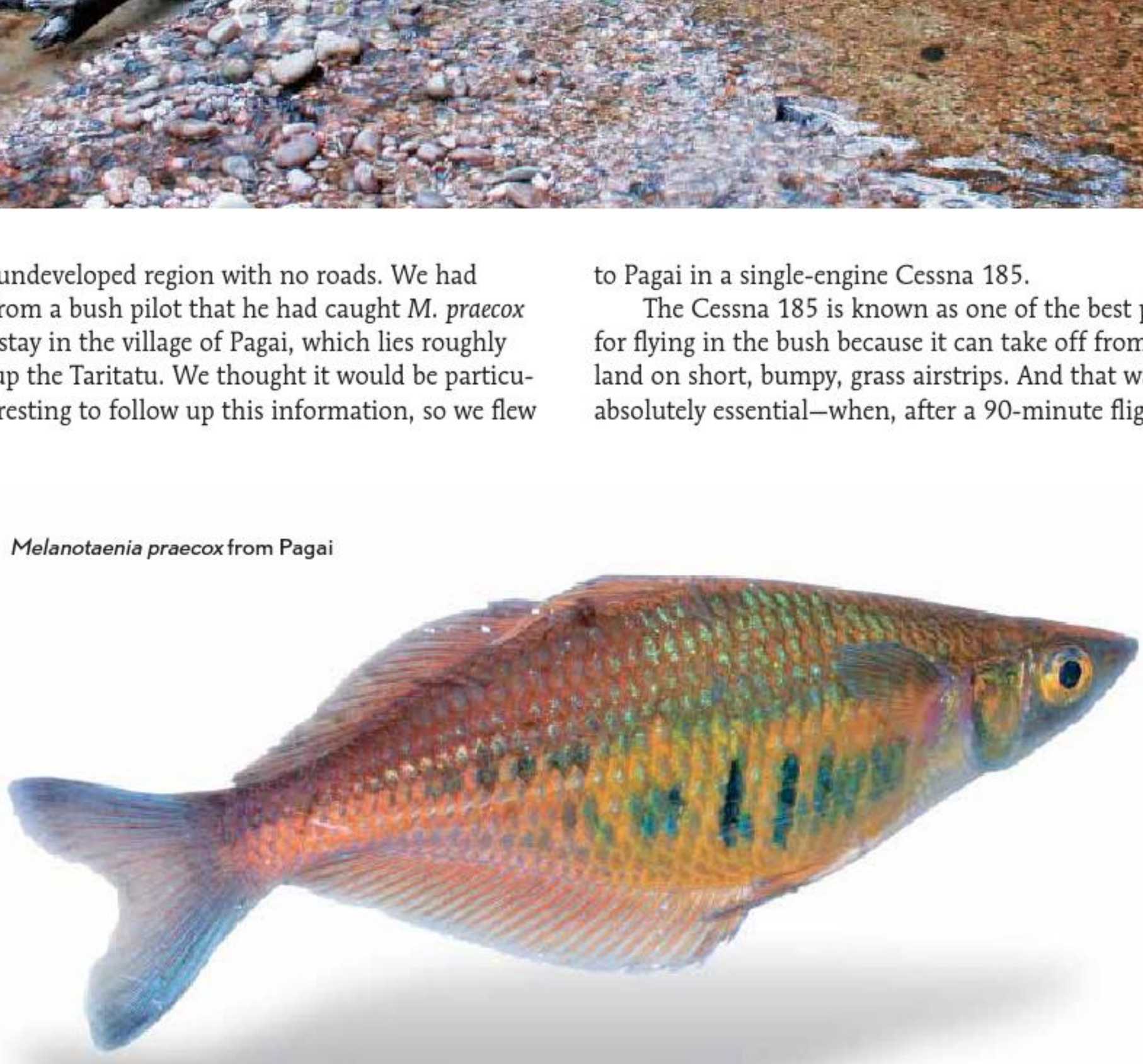
OPPOSITE PAGE: J. GRAF; THIS PAGE: G. LANGE

Searching for *Melanotaenia* in the Pagai River.

a largely undeveloped region with no roads. We had learned from a bush pilot that he had caught *M. praecox* during a stay in the village of Pagai, which lies roughly halfway up the Taritatu. We thought it would be particularly interesting to follow up this information, so we flew to Pagai in a single-engine Cessna 185.

The Cessna 185 is known as one of the best planes for flying in the bush because it can take off from and land on short, bumpy, grass airstrips. And that was absolutely essential—when, after a 90-minute flight from

Melanotaenia praecox from Pagai



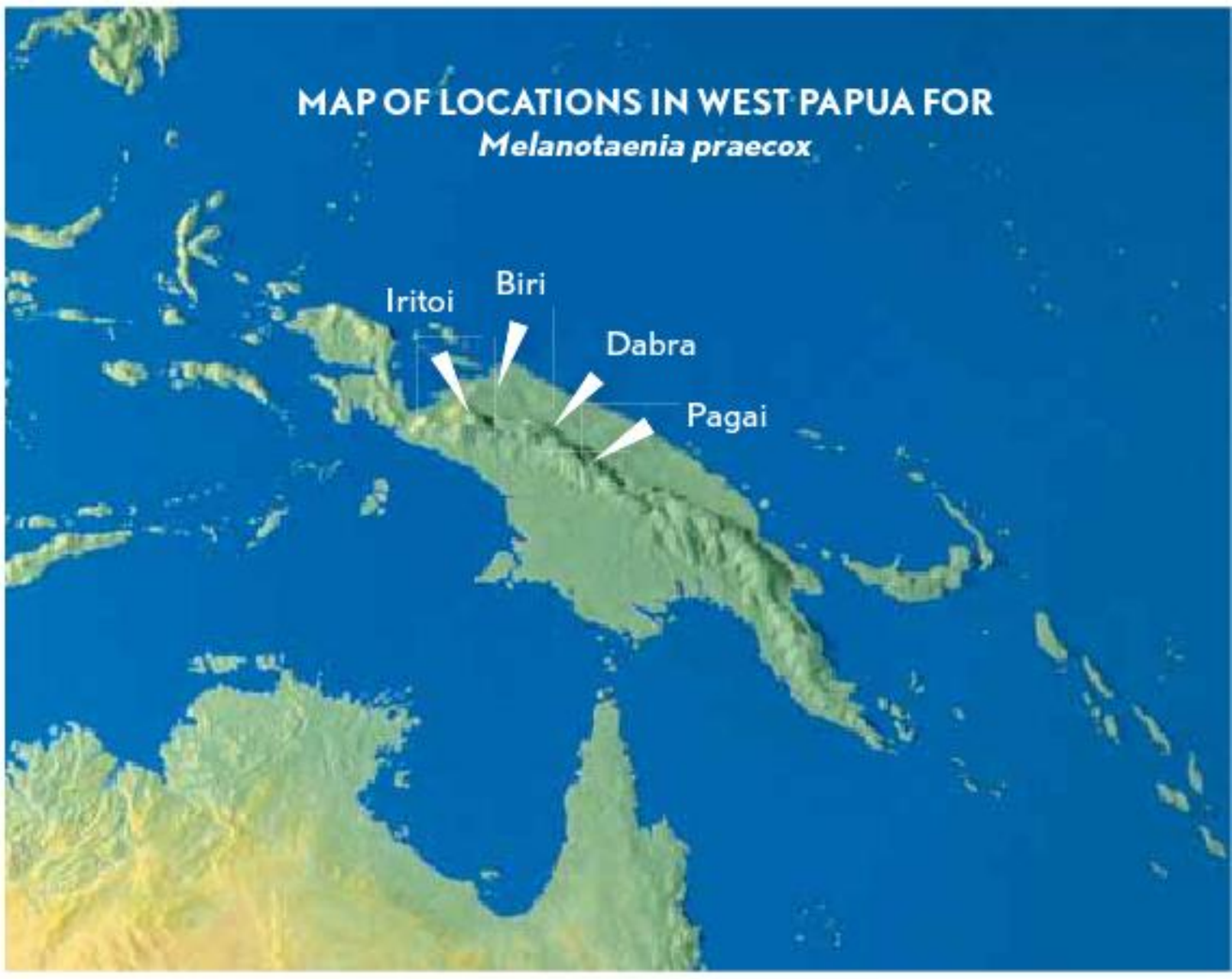
J. GRAF

Sentani, the airstrip at Pagai came into view, it turned out to be a grassy track that ran in the direction of the Mamberamo and ended abruptly in a drop of around 165 feet (50 m) down to the river. Pagai is an isolated village and very few flights land there; we were the first white people to stay there. The people there knew only the pilots who arrived, unloaded, loaded, and flew off again. It was rare for one of the pilots to actually stay there, and nobody else ever came to the village, so our arrival immediately created a minor sensation. We rented an empty house to stay in, and, surrounded by villagers, carried our baggage inside.

Gorgeous *Chilatherina*

While still in the air we had spotted a small river flowing with brown water (instead of the milky white of most rivers in the area). We figured that must be the right place to find *Melanotaenia praecox*, so we were eager to look for it. We stowed our equipment in our backpacks and off we went, surrounded by a huge throng of children and accompanied by a number of men from the village we had hired to help with the seine net. To our surprise the path didn't lead straight through the forest to the little river, but along the airstrip to the bank of the Taritatu, which was called the Mamberamo by the locals although it is one of the tributaries of the big river.

The large rivers of the Mamberamo system aren't at all attractive to look at, as they carry a heavy sediment burden and the water is dirty gray. The banks consist of mud and clay and are extremely difficult to negotiate, and this one was no exception. We had to walk some distance downstream along the steep bank, an extremely dodgy undertaking, as we were in constant danger of slipping down into the dirty water. Leaving aside the fact that these rivers are home to Saltwater Crocodiles (*Crocodylus porosus*) up to 26.5 feet (8 m) long, the prospect of ending up in the "soup" wasn't at all pleasant. Stumbling and sliding, we made our way along the path, marveling at the way the children ran along the top of the bank as if it were an athletic track. We continued a short distance through the forest and finally reached the bank of the little river. With its clear, tea-colored water flowing over a bottom of sand and round, water-worn rocks, this little river looked like paradise in comparison to the main river, which it joined only a short distance away. Everyone was filled with enthusiasm. This had to be *praecox* country!



Chilatherina sp. from Pagai

J. GRAF

Biotope of *Melanotaenia praecox* in Pagai.

Donning diving masks and snorkels, we explored among the branches of trees lying in the water, looking for fishes. And there they were! Two men were stationed downstream of a large accumulation of driftwood with the seine, and the entire throng of children drove the quarry through the branches and into the net which, when lifted, contained more than 40 glittering fishes! We had caught a gorgeous, colorful *Chilatherina* rainbowfish species, measuring up to 5 inches (12 cm) long. Using a hand net we carefully sorted out a number of medium-sized specimens, as these were best suited for transportation, and left the rest for the villagers to eat. This was a very good beginning!

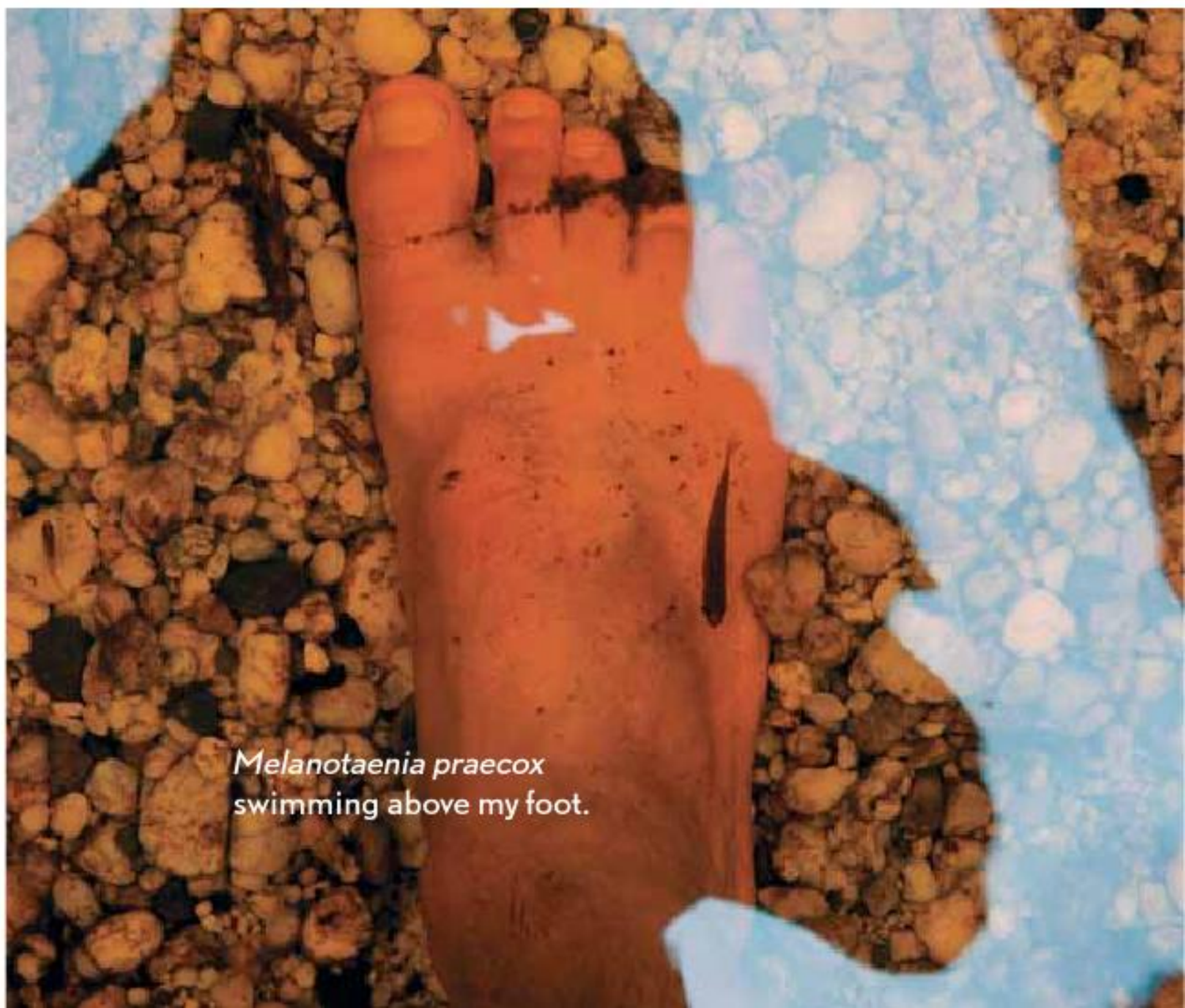
Carrying the heavy, wet net on our shoulders, we walked upstream and tried our luck in lots of other places, but didn't catch anything except more *Chilatherina*. Where were the *Melanotaenia praecox*?

We embarked on another attempt in a small side arm completely overgrown with palm-like *Pandanus* shrubs. Using machetes, we hacked away their sharp-thorned leaves and extended our net once again. The children drove their way through the water, but there was not a single fish. Another failure. The little river had by now become no more than a shallow stream, so continuing further made no sense, and we turned around. On our way back we continued to survey the water. By now we had developed an eye for the *Chilatherina* and saw them all over the place.

In one calm spot I saw a large number of *Chilatherina* fry swimming at the surface.

Melanotaenia at last!

We were almost back to our starting point when one of the residual pools at the side of the riverbed caught my eye. The little pool was perhaps 20 inches (50 cm) deep and no more than 10 feet (3 m) long and 40 inches (1 m) wide, and lay around 65 feet (20 m) from the river itself. The water was murky and there was no movement to be seen.



Melanotaenia praecox swimming above my foot.

The Goo Obo Gudgeon, *Allomogurnda nesolepis*, is widespread in the north of New Guinea.

We spread the seine at one side of the pool and two of the children jumped into the water on the other side (there wasn't room for more), and when we raised the net there was a gleam of blue—we had caught not just one *Melanotaenia praecox*, but at least 20! Three lovely males went into the cuvette to be photographed, and the rest were put into a bucket. A few more sweeps of the net produced more specimens, so that we eventually ended up with around 70 fishes and started back with joy in our hearts. The slippery path no longer seemed as bad, even though we still fell several times.

Arrived back in our hut, the first thing we wanted to do was tend to the fishes. When we asked where we could wash ourselves and obtain water for our fishes, we were told we would have to walk some distance. Armed with face cloths, soap, and a bucket, we headed once again across the landing strip and into the forest at the far end. Two children showed us the way. We followed a path through fully grown but recent secondary woodland, clambered over fallen tree trunks, and came to a small water hole. Not good water, we were told—we must go a bit further. Another, even narrower path led us to a small, shallow stream with hardly any current. In the water we saw more fishes.

Naturally, we had to take a closer look before having our bath. We didn't have any nets with us, but it was only a matter of minutes before we saw that they were *M. praecox*. So catching the species could have been a whole lot easier, but then we would never have seen the fabulous little river. In addition to the rainbowfishes, we spotted some little gobies and a very nice aquatic plant growing in dense stands along the edge of the stream. Only then did we take a thorough bath. How many people can say they have taken a bath with *M. praecox* flitting around their feet? That was a very special moment. The fishes weren't at all shy and we were able to catch both rainbowfishes and gobies in our hands.

We later identified the gobies as *Allomogurnda nesolepis*, a species widespread all over the northern part of New Guinea and known to aquarists as the Goo Obo Gudgeon. The identity of the aquatic plant eluded us, but it certainly wasn't a *Cryptocoryne*.

Additional locations

We subsequently discovered *Melanotaenia praecox* at a third site, a muddy, swampy lagoon in the vicinity of the village. But there weren't many there, and the habitat there apparently wasn't optimal—they were emaciated and in poor condition. This biotope was inhabited mainly by Sepik Rainbowfishes, *Glossolepis multisquamata*.

I subsequently learned that *Melanotaenia praecox* has also been found at Biri, on one of the north-south–flowing tributaries of the Tariku in the Van Rees Mountains in the northwestern part of the Mamberamo region. Here, too, the site is a small stream with brown-colored water. According to the local people, in the Biri area *M. praecox* is found only in this stream and one other one further away. There are no noticeable morphological or color differences between those populations and the specimens from Pagai (which is practically at the opposite end of the Mamberamo region). I now know that there are no genetic differences either (P. Unmack, pers. comm.).

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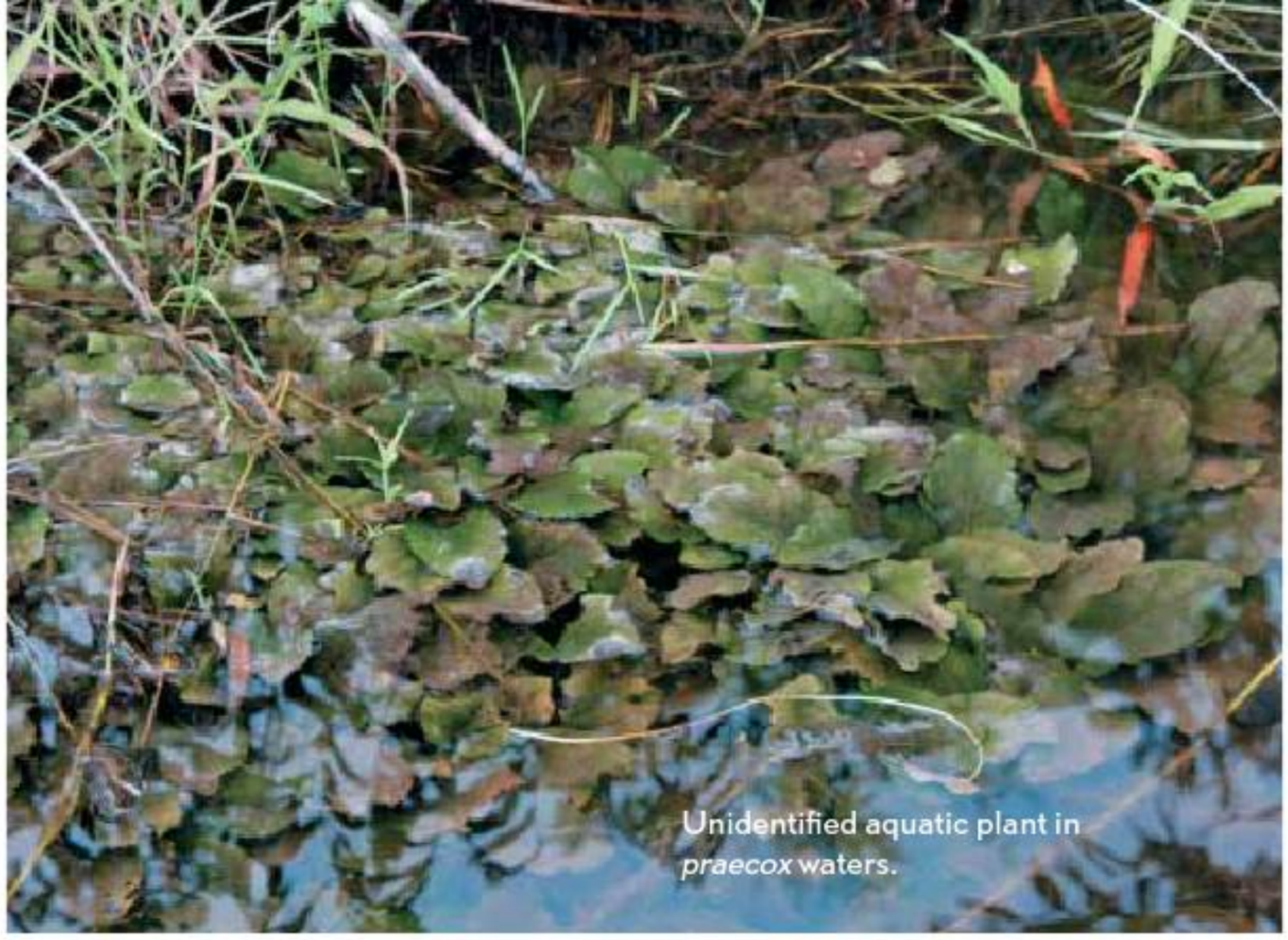

Unidentified aquatic plant in *praecox* waters.

On the basis of the locations now known, it can be assumed that *M. praecox* occurs throughout the entire Mamberamo region and is very common at suitable sites. The species is an inhabitant of standing water and is found in running water only if the current is very slight. At all sites the water was warm (82.5–86°F/28–30°C) and stained brown by plant residue. These fish prefer clear blackwaters, and cloudy water is not a favored habitat.

The *M. praecox* that we sent back to Europe arrived in good condition. The day after their arrival they were already a splendid sight, with their brilliant blue bodies and red fins. After only about two weeks of good feeding I found the first eggs on the spawning mop (a prerequisite for any rainbowfish aquarium) in the quarantine tank.

As can generally be expected with *Melanotaenia praecox*, rearing the fry presented no problems at all. During the first week or two they were fed on infusoria and green water until they were capable of taking larger foods, such as *Artemia* nauplii, microworms, and vinegar eels. This injection of new blood should be very useful for improving existing breeding strains of the species.

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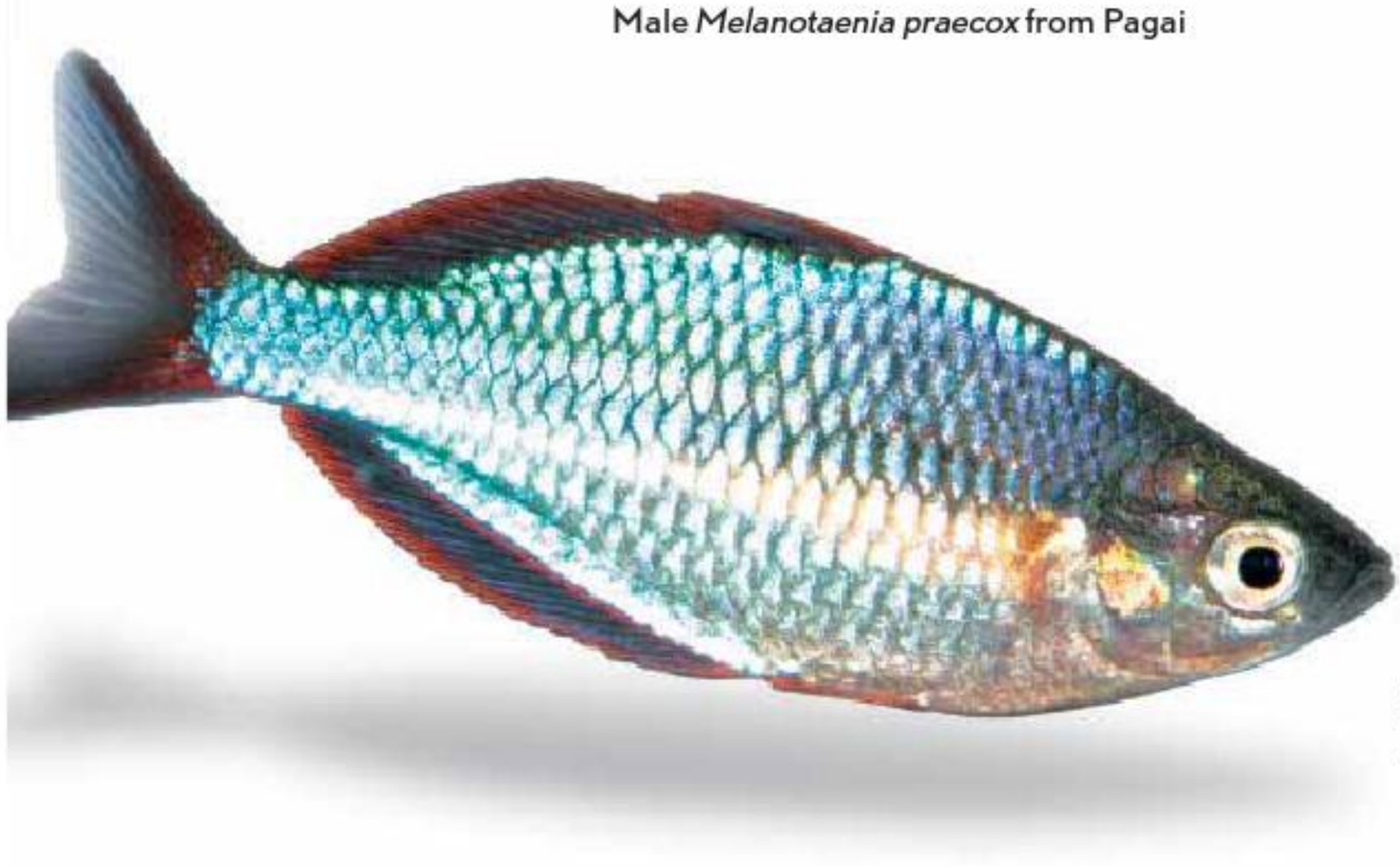
Male *Melanotaenia praecox* from Pagai



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Miniature rasboras of the genus *Boraras*

Brilliant things in tiny packages

As an enthusiastic cichlid keeper, I have always espoused the view that when it comes to aquariums, bigger is better. However, the remarkable popularity of modular and nano ("desktop") aquariums suggests that a respectable number of aquarium keepers have bought into the idea that smaller can be quite alluring. • *by Paul V. Loiselle, Ph.D.*

Above: Chili Rasbora, *Boraras brigittae*, dominant male

Left: This aquarium is set up for *Boraras* species with *Cyperus helferi*, fine sand, stones, and driftwood.

P.V. LOISELLE

While clearly a boon to the space-limited hobbyist, a mini-aquarium system is not an unqualified blessing. Because managing the nitrogen cycle is on the whole much easier in a large volume of water, a 3- to 8-gallon mini-aquarium does not represent the ideal beginner's tank.

On a positive note, the commercial success and affordability of these systems has stimulated a lively interest in fishes and invertebrates suitable for inhabiting them comfortably. Many of these miniature species are newcomers to the aquarium scene.

Others are under-appreciated aquarium residents of long standing. Prominent representatives of the latter group are the miniature rasboras of the genus *Boraras*.

Most of these fishes were originally in the genus *Rasbora* and are listed as such in older reference books. Many aquarists regard such name changes as both aggravating and arbitrary. Abandoning a familiar name for a fish can be annoying, but a brief account of the history of the genus *Boraras* will show that such changes are not arbitrary.

Minnow dumping ground

The type species of the genus, *Rasbora rasbora* (Hamilton 1822), is a robust, torpedo-shaped species from the Ganges River that can measure 6 inches (15.0 cm) from the tip of its snout to the base of its tail. As loosely defined, *Rasbora* comprises close to 80 recognized species, and new ones continue to be discovered and described. By contemporary standards, the genus was never rigorously defined and over the years became something of a dumping ground for a wide range of Asian minnows characterized by an absence of barbels, simple lips, variable lateral line development, and five branched anal fin rays. The late Dr. Martin Brittan made the first serious attempt to sort out the relationships of this important cyprinid group (Brittan, 1971), but his efforts did not result in major changes in the generic placement of the species he reviewed. More recent efforts (Kottelat and Vidthayanon, 1993; Kottelat and Witte, 1999) have erected new genera for the more atypical species previously shoehorned into the genus.

The first group to benefit from more intense taxonomic scrutiny were the dwarf species of the genus. Kottelat and Vidthayanon found that of the six nominal species in this assemblage, five were characterized by the lack of a lateral line, a reduced number of rays in the pectoral and ventral fins, fewer tooth rows on the lower pharyngeal bone, fewer rakers on the first gill arch, fewer lateral scales (22–9), and several skeletal peculiarities—including fewer abdominal than pre-caudal vertebrae, a reversal of the pattern seen in other nominal rasbora species.

Their most immediately obvious shared feature is a color pattern consisting of either a dark mid-lateral stripe or a series of black spots on a translucent amber to olive grey background. The sixth member of the group, *Rasbora axelrodi*, was subsequently found by Kottelat and Witte to share a number of specialized anatomical characteristics with representatives of another cyprinid group, the danios, and was placed in a genus of its own, *Sundadanio*.

A logical new name for this assemblage of diminutive rasborines, *Microrasbora*, was unavailable, having already been used for another diminutive and quite unrelated Burmese cyprinid genus. Kottelat and Vidthayanon, presumably inspired by the reversed ratio of vertebral elements in their newly recognized assemblage of species, proposed calling the new genus *Boraras*, an anagram of *Rasbora* formed by reversing the two syllables of the old generic name. Never let it be said that ichthyologists lack a sense of whimsy!

Note that *Boraras* was largely defined by a set of shared absent features. While such elements as a reduced number of fin rays or pharyngeal teeth may well reflect shared common ancestry, these features may also, as Kottelat and Vidthayanon quite correctly pointed out, have come about as the inevitable consequence of selection for diminutive adult size. However, a subsequent and more detailed anatomical study (Conway, 2005) revealed the existence of four additional shared skeletal specializations that confirmed the common ancestry of all five *Boraras* and removed any lingering doubts that the genus

Chili Rasbora, *Boraras brigittae*, female

Exclamation Point Rasbora, *Boraras uropthalmoides*, female

P.V. LOISELLE

might be other than a natural grouping of species. More recently published works (Baensch and Fischer, 2002), as well as most on-line aquarium references, recognize the new generic placement of these species while continuing to use rasbora—uncapitalized and un-italicized—as a common name for all the species formerly included in the genus *Rasbora*.

Eyestrain rasboras

Diminutive is indeed the operative word for these species—it is no exaggeration to describe them as "eyestrain rasboras." The cyprinids of southeast Asia appear to be engaged in an evolutionary competition to be the smallest life-support package that can be wrapped around a functional pair of vertebrate gonads. The gold medal to date goes to the genus *Paedocypris*. The largest female in the type series of *Paedocypris progenetica* Kottelat, Britz, Tan and Witte, 2006 measures 0.4 inch (10.3 mm) SL, the smallest 0.3 inch (7.9 mm) SL, making it the smallest known vertebrate species. The silver goes to the second described species of the genus *P. micromehethes*, whose largest female is a whopping 0.44 inch (11.4 mm) SL, about twice as long as a grain of long-grain rice.

Danionella translucida Roberts 1986, a minute representative of the *Danio* lineage from Borneo that measures just under half an inch (12.0 mm) SL, takes the bronze. However, representatives of the genus *Boraras* certainly qualify for honorable mention in this contest. The largest known wild-caught specimens of *Boraras maculates* measure almost an inch (2.0 cm) SL, but under the more benign conditions of captivity it can grow to a whopping 1.25 inches (3.2 cm) SL! The smallest is the aptly named *Boraras micros*, with a maximum recorded size in nature of about .5 inch (1.3 cm) SL (see photos, page 63).

The downside of such remarkable miniaturization is a short life span. It is unlikely that any of these miniature fishes live longer than two years in nature, and their life span in captivity is not much longer. Unless one is specifically watching for them, fish this small are quite easily overlooked. Fisheries biologists, frequently the first researchers to survey tropical river systems, are particular offenders on this score, and have a tendency to lump

Boraras urophthalmoides occurs in large schools of very tiny individuals. Predators find them less easy to snap up when the minute jewels enjoy the protection of plants.

Smaller than small: Female *Boraras micros* (above) and a pair of White Clouds, *Tanichthys albonubes* (below)

any fish less than an inch (2.5 cm) SL under the catch-all term of "unidentified fry." As the freshwater fishes of southeast Asia are far from completely known, the discovery of additional *Boraras* species in the future will come as no great surprise.

Peat swamp species

All *Boraras* species described to date—and 29 of the 49 species of miniature fishes native to south and southeast Asia (Kottelat and Vidthayanon, 1993; Kottelat, Britz, Tan, and Witte, 2006)—are inhabitants of peat swamps. This is anything but coincidental. These are quintessential blackwater habitats, characterized by ultra-soft (total and carbonate hardness values of 17.1 ppm/< 1 dH) and highly acidic (pH 3.5–5.0) conditions.

In addition to being acutely deficient in the calcium necessary for bone and scale formation, such waters are characterized by extremely low biological productivity because they lack the dissolved carbonates necessary to support vigorous phytoplankton growth. When food is in short supply and the building blocks essential for skeletal development are even harder to come by, natural selection strongly favors reduced body size.

Blackwater habitats are not the only habitats that support miniature fishes. Three species of minute cyprinids are endemic to the hard, alkaline waters of Burma's Lake Inle, and miniature fishes are also known from both brackish waters and the marine realm. This suggests that other factors can drive the evolution of small body size in fishes. However, as the same association of miniaturization with blackwater conditions is evident in Africa and South America, it is certainly reasonable to conclude that this phenomenon is frequently an adaptive response to these extreme and far from hospitable environments.

Boraras species for the aquarium

Having defined the group and placed it in its evolutionary context, the time has come to introduce its members. The doyen of the genus, with regard to both priority of description and debut as an aquarium fish, is *Boraras maculatus* (Duncker, 1904), which was first imported to Germany in 1905. Native to the Mekong River drainage in Thailand, Laos, Cambodia, and Vietnam, this widely distributed species ranges from the Isthmus of Kra in extreme southern Thailand through Malaya and to the Indonesian island of Sumatra. The Dwarf Rasbora, as it is commonly known, almost certainly owes its early appearance in the aquarium literature and persistence in the trade to the fact that it is also native to the island of Singapore, historically the first major focus of tropical fish exportation from southeast Asia. It is also readily accessible to shippers in Bangkok.

The photos on page 61 depict male and female *B. maculatus*. Males are slightly smaller and significantly slimmer than females. They also have a slightly larger and more clearly defined black shoulder spot and more red in the unpaired fins. A reddish amber base coloration characterizes the dominant male or males in a group. In

P.V. LOISELLE

some of the earlier aquarium literature, this species was confused with the much larger Clown Rasbora, *Rasbora kalochroma* (Bleeker, 1851). The conflation of these two very different fishes apparently happened because both species feature bold black spots on a clear beige background and red markings in the unpaired fins. Given that ichthyologists as familiar with the fishes of the region as Weber and de Beaufort (1916) expressed the view that *B. maculatus* were actually juvenile *R. kalochroma*, a certain amount of early confusion over the proper name of the Dwarf Rasbora is easy to understand.

Boraras uropthalmoides (Kottelat, 1991) was the next species of the genus to join the ranks of ornamental fishes. It made its aquaristic debut in 1913, and was subsequently described by Ernst Ahl (1922) as *Rasbora uropthalma*. During the course of research on the taxonomy of southeast Asian rasboras, Kottelat found that the type series of Ahl's *R. uropthalma* did not consist of specimens of the species initially imported in 1913 but rather of a dwarf barb species. As this left the fish formerly known to the hobby as *R. uropthalma* without a scientific name, he proposed calling it *Rasbora uropthalmoides*, literally "like *uropthalmus* in appearance." *Boraras uropthalmoides* is the most widely distributed of the eyestrain rasboras.

This species is well endowed with common names. Least Rasbora, while not particularly flattering and also used for another species, is at least descriptive. This species is not known to exceed 0.6 inch (1.6 cm) SL in the wild, and grows no larger than 0.86 inch (2.2 cm) SL under aquarium conditions. Why it has been saddled with the names Sparrow Rasbora and Spice Rasbora, only the Asian exporters on whose price lists it is so designated can say.

I am personally partial to the name Exclamation Point Rasbora, which very accurately describes the most obvious element of its color pattern: a black mid-lateral stripe that tapers toward the rear and terminates in a well-defined, round black spot on the base of the caudal fin. As can be seen in the photo on page 58, this dark band is bordered by a metallic stripe of roughly equal width. The color of this stripe varies from one population to the next. The most commonly encountered color is gold, but populations sporting metallic orange or green stripes are also known. Females are somewhat larger than males and have notably fuller, silvery white abdomens.

Boraras brigittae was originally thought to be a subspecies from Borneo of *B. uropthalmoides* on the strength of a superficially similar pattern of black pigmentation, and it was so described by the German aquarist Dieter Vogt in 1978. It has since been recognized as a valid species, replacing its Indo-Chinese congener in the rivers of southern Kalimantan, the Indonesian portion of the island of Borneo. It has been referred to as the Mosquito Rasbora, Blood Rasbora, and Chili Rasbora.

The first name clearly refers to its diminutive adult size. The largest known wild specimens measure 0.70 inch (1.8 cm) SL, with aquarium specimens reaching about 1.06 inches (2.7 cm) SL. The other two names are clearly inspired by the intense red coloration that suffuses the body and the unpaired fins of socially dominant and courting males (see page 58). As it shares this feature with the next species to be considered, I suggest that both this species and *B. merah* should collectively be called Blood Rasboras, while the evocative Chili Rasbora should be reserved for *B. brigittae*. This is arguably

Dwarf Rasbora, *Boraras maculatus*, male

Dwarf Rasbora, *Boraras maculatus*, female

P.V. LOISELLE

Phoenix Rasbora, *Boraras merah*, male

Phoenix Rasbora, *Boraras merah*, female

the most beautiful and certainly the most easily sexed of the eyestrain rasboras. Females are somewhat larger and fuller-bodied than males and show only a trace of salmon-orange in their unpaired fins (photo, p. 58).

The fourth species of the genus, *Boraras merah* Kottelat, 1991, is native to western and southern Kalimantan. It has the same intense red coloration as *B. brigittae*—indeed, *merah* is the Malay word for red—but instead of *B. brigittae*'s black lateral band it has a series of elongate black spots along the mid-lateral line (top photo above). This species has been marketed under the names Phoenix Rasbora and Strawberry Rasbora. I find the former a singularly descriptive moniker in view of the fiery intensity of the coloration of dominant males.

The Phoenix Rasbora is a bit smaller than the Chili Rasbora, attaining 0.67 inch (1.7 cm) SL in the wild and 0.86 inch (2.2 cm) SL in captivity. It is also easily sexed. Like the Chili Rasbora, females lack the intense red coloration of their consorts (above, bottom photo). As the two Blood Rasboras were initially conflated by exporters, a situation that persists to this day, it is unclear exactly when *B. merah* was first imported, but it was certainly available through commercial channels in the mid-1980s.

Miniature fish Olympian

Boraras micros Kottelat and Vidthayanon, 1993 is another laterally spotted species. It fully merits is specific name—*mikrós* is the Greek word for small. The largest known specimen in the type series measures about half an inch (1.3 cm) SL, which qualifies this species for an honorable mention in the Miniature Fish Olympics. Fish I have had for six months grew quite quickly to 0.63 inch (1.6 cm) SL, but even with generous feeding, I have seen no indication of further growth.

The common name Least Rasbora is, on the face of it, far more descriptive of *B. micros* than it is of *B. uropthalmoides*. This species is native to the Mekong River basin in Laos and northern Thailand. It is unclear when it made its debut as an aquarium fish. As it shares the spotted pattern (see photos, page 63) of the Dwarf Rasbora, it is quite possible that prior to its recognition as a valid species, *B. micros* was exported from Bangkok as *B. maculatus*.

Boraras naevus Conway and Kottelat, 2011 is the most recently described eyestrain rasbora. The type series was collected from a peat swamp associated with the eastward-flowing Tapi River in peninsular Thailand. In accordance with its species name, *naevus* (birthmark or mole), this is another laterally spotted *Boraras* species. At first glance it might be confused with *B. maculatus*, but it differs most obviously from that species in the sexually dimorphic character of its lateral spotting. In *B. maculatus*, the shoulder spot is approximately the same size in both sexes; in *B. naevus*, the male's is much larger than the female's (photos, page 64). This species is also exported from Bangkok and is usually sold as the Strawberry Rasbora.

Although they have a reputation for fragility, the aquarium husbandry of *Boraras* species poses few difficulties if due consideration is given to their diminutive size. That they will only prosper in extremely soft, acid water is a misconception. I have kept five of the six *Boraras* species without problems in Rahway, New Jersey municipal water, which comes out of the tap with a pH of 7.4, a total hardness of 232.7 ppm (13 dH) and a carbonate hardness that ranges from 3 dH to 7 dH.

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While at least one species, *B. brigittae*, has bred successfully in water of pH 7.2–7.4 and a total hardness of 125.3 ppm (7 dH) (Hellweg, 2010), I suspect that the heavy losses many importers have experienced in the past have arisen from the failure of exporters to slowly acclimate fishes collected from a blackwater habitat to less extreme water conditions. I will concede that when kept in softer, slightly acidic water, the colors of these fish are more intense, and it would not come as a surprise to discover that they produce more fry when they are bred under such conditions; sperm motility and the permeability of the egg membrane are both influenced by water chemistry. However, it isn't necessary to invest in a reverse osmosis unit to keep and enjoy these diminutive jewels.

Soft water, clean water

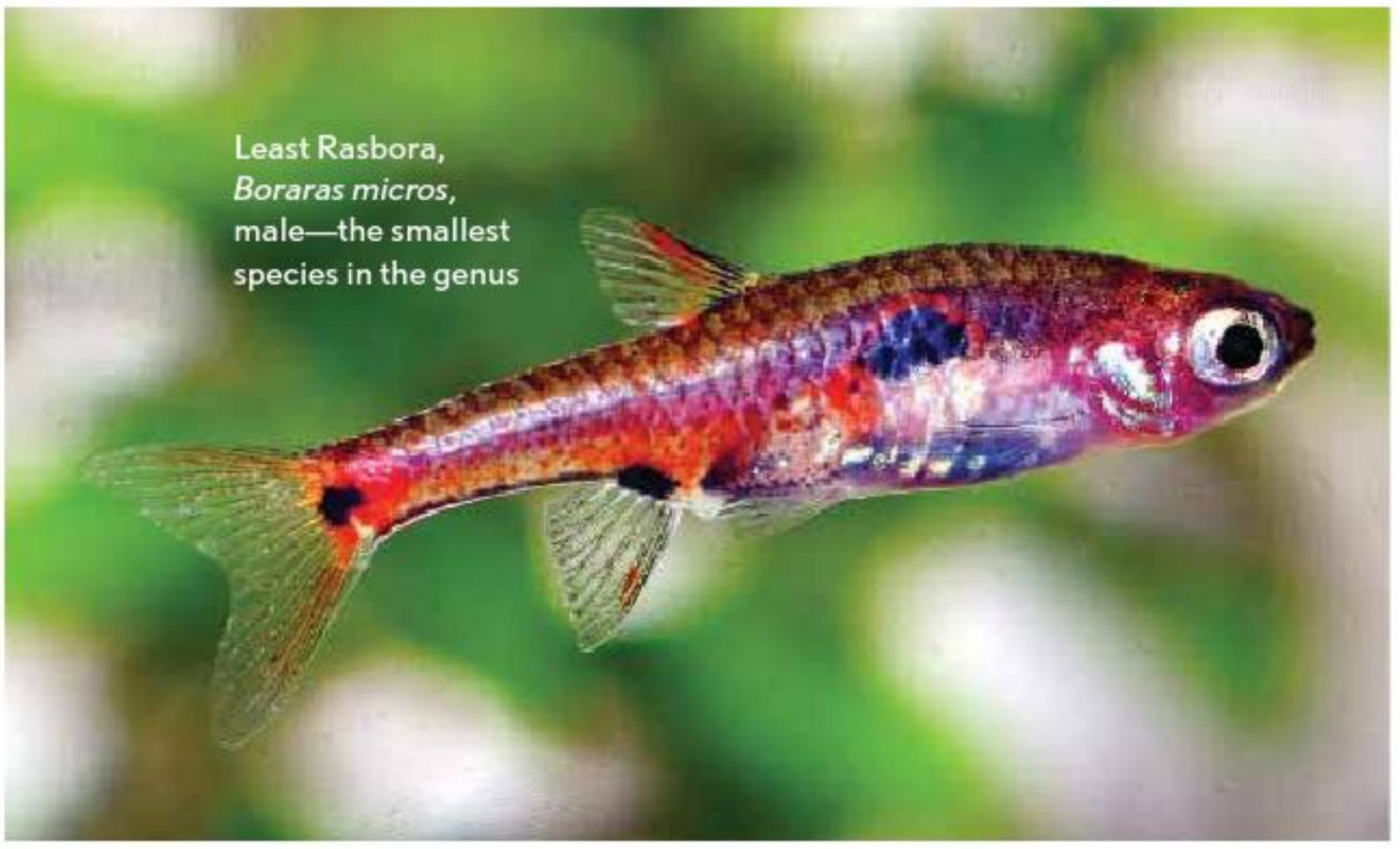
While soft, acid water is not absolutely essential to successfully maintain eyestrain rasboras, careful attention to other aspects of water chemistry is. These fishes are extremely intolerant of dissolved metabolites. A fully matured biological filter is critical for their successful maintenance. Nor do these fish appreciate elevated nitrate levels. Nitrate buildup is easily prevented by either a program of small, frequent water changes or the use of a chemically active filter medium such as Poly-Filter®™.

Some degree of water motion in their tank is appreciated, although the species vary in their response to a current. I find that *B. maculatus* and, to a lesser extent, *B. micros* and *B. naevus* actively seek out the return from the filter of an Eclipse 7 system, while *B. brigittae*, *B. merah*, and *B. uropthalmoides* swim preferentially nearer the bottom in areas of calmer water. To satisfy all the fishes' preferences, I plug the filter on their tank into an appliance timer set to generate two six-hour periods of pronounced current and two periods of calm water daily. Water temperatures of 70–74°F (21–23°C) suffice for normal maintenance, and the temperature is raised to 78–80°F (24–26°C) for breeding.

Filtration devices can pose a threat to these tiny fishes, which will readily slip between the slots in a standard water overflow or the strainer that caps a siphon tube. Before adding any of these species to a system, be sure that all such hazards are shielded with filtration foam or nylon mesh. They are also active swimmers and will jump from an uncovered tank.

Success with *Boraras* also depends critically on both how their tank is furnished and the choice of their tankmates. In nature, these fishes live in close association with submerged vegetation. This affords them shelter from hungry mouths as well as important feeding grounds and spawning sites. *Boraras* are micropredators, and a significant part of their diet consists of tiny prey items picked from the leaves and stems of aquatic plants.

Such tiny fishes must feed constantly to maintain body condition and do poorly in captivity unless afforded the opportunity to do so—one or two feedings a day do not suffice to keep them in good health. A planted tank is thus necessary, not only to keep these fish at their most colorful but to ensure that they are properly fed



Least Rasbora, *Boraras micros*, male—the smallest species in the genus

Least Rasbora, *Boraras micros*, female

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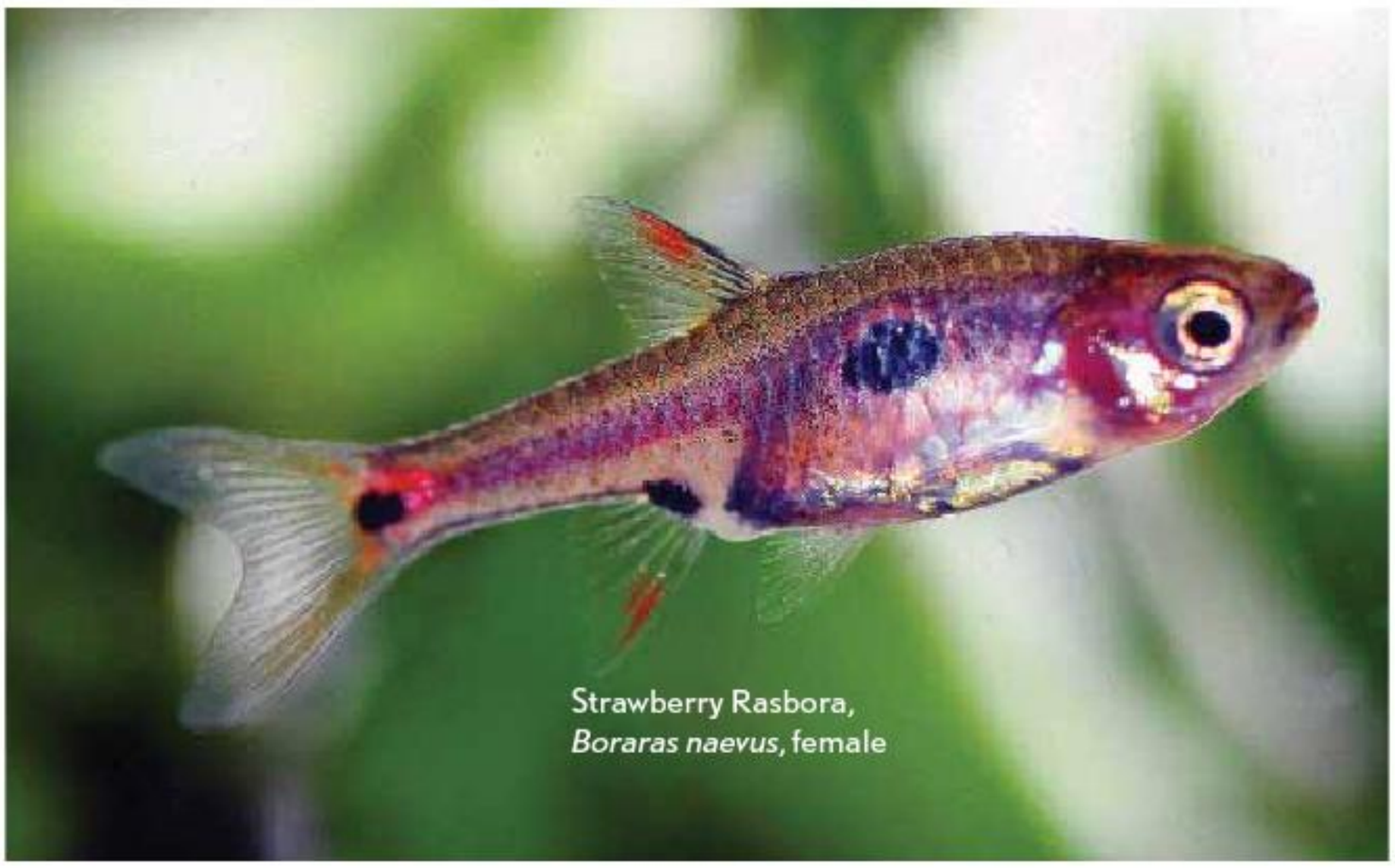
and healthy. That said, eyestrain rasboras are not overly demanding about the aquascaping. They will do as well in a 5-gallon tank containing a large clump of Java Moss and a layer of floating fern as they will in an elaborately aquascaped Leiden or Amano-style aquarium.

Strawberry Rasbora, *Boraras naevus*, male



Strawberry Rasbora, *Boraras naevus*, female

Boraras are intensely social fish. In nature, the lower one is on the food chain, the greater the safety in numbers, and fishes as small as eyestrain rasboras are barely one step above zooplankton. That said, they do not form coherent schools such as one sees in many *Danio* species, but live in loose groups or shoals. Half a dozen individuals represents the bare minimum number needed to elicit normal social behavior, and a group of 8 to 12 is far closer to ideal. These are natural candidates for a single-species tank. A dozen Dwarf or Chili Rasboras in a nicely planted 5-gallon tank make a stunning display, and spawning behavior—although not necessarily breeding success—is virtually assured given such an arrangement.

Choosing tankmates

It is possible to keep *Boraras* with other fishes if, when selecting potential tankmates, due consideration is given to how small they are. White Clouds, *Tanichthys albonubes*, are conventionally considered to be small fish, but as the photo on page 60 shows, they are giants compared to *B. micros*. When housed with companions that are boisterous or much larger, eyestrain rasboras spend their time in hiding. They cannot compete effectively with such tankmates at feeding time. Too inhibited by the presence of larger fish to forage effectively among the plants for the microscopic food items that comprise a significant part of their diet, they invariably go into decline and die.

While there are some obvious advantages to a regionally eclectic approach to stocking a community tank, there are even greater benefits to adopting a more biogeographically rigorous focus when selecting companions for these minuscule rasboras. Many of the fishes with which *Boraras* share their habitat have also undergone miniaturization, and having co-evolved with them are unlikely to be perceived as a threat. Other *Boraras* species are an obvious choice. As mentioned above, I have groups of *B. maculatus*, *B. merah*, and *B. micros* living amicably together. There tends to be a general scrum at feeding time, but apart from this, the three species keep to themselves.

The diminutive Axelrod's Rasbora, *Sundadanio axelrodi*, is another co-occurring cyprinid that can be expected to live harmoniously with *Boraras* species. Thailand is home to two tiny ricefish, the Mekong Ricefish, *Oryzias mekongensis*, and the Dwarf Medaka, *O. minutulus*, that can also be counted on to co-exist peacefully with eyestrain rasboras. Small loaches, like the diminutive Devil Loach (*Barbucca diabolicus*) or the Banded Dwarf Loach (*Yunnanilus cruciatus*), and dwarf labyrinth fishes, such as the sparkling gouramis—the Dwarf Croaking Gourami (*Trichopsis pumilus*), the Threestripe Gouramia (*T. schalleri*), and the licorice gouramis of the genus *Parosphronemus*—are also realistic candidates for residence in a *Boraras* tank.

While aquarists who do not wish to limit themselves

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to southeast Asian species need to proceed a bit more cautiously, other regions are also home to suitable tankmates for *Boraras*. As already noted, pairing *B. micros* and White Clouds worked well for me and I have been able to introduce a pair of wild-caught Honey Gouramis (*Colisa sota*) to my *Boraras* community without difficulty. White Clouds are native to southern China, Honey Gouramis to northeastern India. My attempt to house *Boraras* with the Celestial Pearl Danio (*Danio margaritatus*) was not a success—small size notwithstanding, the danios were simply too boisterous for the eyestrain rasboras. So although a friend houses *B. brigittae* with the diminutive Goldring Danio (*Danio tinwini*) from Burma without difficulty, I am reluctant to repeat the experiment with other representatives of the danio lineage.

I would also discourage attempts to house *Boraras* with even the smallest Asian barbs, although I would chance cohabitation with much smaller West African representatives of this group, such as *Barbus jae*, *B. barajae*, *B. sylvaticus*, and *Barboides gracilis*. Other potential West African tankmates are the Clown Killifish, *Pseudepiplatys annulatus*, and the lampeyes of the genera *Micropanchax* and *Poropanchax*. Tiny armored catfishes like *Corydoras hastatus* or *C. habrosus* are unlikely to cause these fish any difficulty.

However, adding dwarf characins such as *Hyphessobrycon amandae*, the Ember Tetra, to an aquarium housing *Boraras* should be treated as an experiment that must be conducted with extreme vigilance. Characins, regardless of size, are well equipped with teeth, and few species are disinclined to use them when interacting with tankmates. The tiny pencilfishes of the genus *Poeciliobrycon* are the safest South American companions for *Boraras*.

Dwarf shrimps in the *Caridina* and *Neocaridina* genera, popularly known as cherry, crystal, and bee shrimps, are appropriate tankmates for eyestrain rasboras and will help clean up stray bits of food that reach the bottom.

Their small size notwithstanding, *Boraras* are very easily fed. Flake foods ground to an appropriate size between thumb and forefinger are eagerly taken, as are live foods of appropriate size, such as *Artemia* nauplii, *Cyclops*, and newborn *Daphnia*. Ocean Nutrition's prepared frozen brine shrimp nauplii are eagerly taken and represent a convenient and nutritious alternative to hatching *Artemia* from cysts. Frozen foods of appropriate size are also devoured with gusto. *Boraras* relish frozen bloodworms, although I find it necessary to chop them finely prior to thawing to assure that the fishes can swallow them without difficulty. They are also very partial to dry and frozen CYCLOP-EEZE©, a product marketed by Argent Laboratories. These Arctic crustaceans are rich in the precursor substances fish require to synthesize yellow and red pigments. Regular offerings of CYCLOP-EEZE© have a dramatic effect upon the intensity of these fishes' red and orange coloration. If at all possible, *Boraras* should be given several small meals daily. If this is not

possible, the opportunities for foraging offered by a well-planted tank assume particular importance.

Breeding challenges

Breeding these fishes is definitely a challenge. It is not that they are reluctant to spawn in captivity. If a group comprising both sexes is housed in a single-species tank and fed well, spawning follows more or less automatically. However, this is no guarantee of success, for while these fish will spawn in water up to 268.5 ppm (15 dH) carbonate hardness, the eggs require considerably softer water to develop successfully. The upper limit falls somewhere between 89.5 and 125.3 ppm (5–7 dH). Additionally, like other miniature fishes, female *Boraras* mature small batches of eggs every few days and spawning activity tends to be more or less continuous.

Unlike true *Rasbora* species, which are group spawners that broadcast large numbers of eggs at a time, *Boraras* spawn as pairs and deposit their eggs a few at a time in the leaves of aquatic plants. Clutches thus are not large to begin with, and while eyestrain rasboras are not as given to snacking on their own eggs as some other cyprinids, they will opportunistically consume newly hatched fry. The usual way to minimize such losses is to condition the two sexes separately for a week, reunite them in the breeding tank for a day or two, then remove them before they have had sufficient time to eat their newly hatched progeny.

The use of a spawning grate with meshes large enough to permit eggs to pass but too fine to allow the breeders to follow is also recommended (Jocher, 1972a, b). If this approach is adopted, one has somewhat more leeway in removing the spent breeders. Given the small size of these fishes, the easiest way to manage this is to hang a relatively coarse-meshed nursery/isolation trap in a 2.5-gallon (9.5-L) tank. If a larger tank is chosen, several such traps can be installed and a well-conditioned pair placed in each. The tank needs no furnishings apart from a heater, a well-matured sponge filter, and a large clump of Java Moss. Such a bare-bones setup makes it much easier to spot newly hatched fry on the walls and bare bottom of the tank. Once the first fry are noticed, the breeders can be returned to their habitual lodgings. It is a good idea to leave the traps with their clumps of Java Moss in place a few days after removing the breeders to be certain that all the eggs deposited therein have hatched. Such an approach assures a larger hatch of fry while eliminating the risk of egg-eating by individuals not actually engaged in spawning that is inherent when working with more than a single pair of fish. However, even if these procedures are followed, *Boraras* are notably less prolific under aquarium conditions than their larger cousins are.

The fry should be offered infusoria and commercial

liquid food as soon as they begin to swim freely. The latter should be offered sparingly. Overfeeding with these products can lead to water fouling and subsequent loss of the fry. Within a week of attaining mobility, they will have grown large enough to take brine shrimp nauplii and frozen or dry *Cyclops*. At this point, it is a good idea to add a few ramshorn or pond snails to the tank to clean up any uneaten food. As fry are sensitive to water quality, it is prudent to make small partial water changes (up to 20 percent of the tank's volume) every few days for the first month of their life. By this time, the first traces of their adult color pattern should make their appearance, and the periods between water changes can be stretched to 7–10 days.

With regular feeding, the fry will begin to look like miniature versions of their parents at six to eight weeks post-hatching and can be expected to attain sexual maturity at six to eight months of age. Bear in mind that these are not long-lived fishes. If the intention is to maintain these species on a long-term basis, it is best to begin breeding them as soon as they have reached sexual maturity.

Colorful, peaceful, and easily maintained, the eye-strain rasboras are ideal residents for a small aquarium and add a touch of elegance to larger tanks. They truly prove that good things may indeed come in very small packages!

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Rare New Plants from Borneo:

Bucephalandra

Recently a small genus of unusual aquatic plants has made its debut on the aquarium scene in Asia. Its name is *Bucephalandra*. Still unknown to most aquarists, it is already a bit of legend among rare plant enthusiasts. • *by Flair Wang in collaboration with Crimson Taiwan*

The plants can easily be attached to wood for a decorative effect.

Bucephalandra is the scientific name of a small genus of semi-aquatic plants in the huge aroid (*Arum*) family (Araceae), which also contains other, better-known genera such as *Anubias* and *Cryptocoryne*. The genus name derives from the Greek word for "bull-head" and refers to the horn-shaped anthers of the flowers.

The thick, dark leaves of these plants are a striking feature. The leaves of many forms exhibit undulate margins, making them particularly attractive. The leaves also bear tiny, pearl-like grains that cause the plants to glitter in the light; in some forms the foliage has a bluish sheen. No wonder, then, that these plants have rapidly attracted a circle of fans, especially in Asia.

Rock-dwellers

The genus *Bucephalandra* is endemic to the island of Borneo. As far as is known to date, these plants are found mainly in the south of the island (in the Indonesian province of Kalimantan), as well as in smaller numbers in Sarawak (Malaysia). Large parts of the north of the island either have been deforested to make way for the palm-oil industry or are difficult to access, making it hard to find still-intact *Bucephalandra* habitats there.

The members of this genus are rheophytes—plants that grow in running water. They grow on rocks along the margins of small, shaded rainforest rivers and streams, and can live underwater for a certain amount of time. It is relatively easy to acclimate them to aquarium conditions, where they usually do well.

In Asia, *Bucephalandra* species are also known as Chili Anubias, because their dark green, wavy leaves resemble those of the related genus *Cryptocoryne* (aka Chili Grass) and they grow on stones like the universally popular *Anubias* species. But the unique pale flowers readily distinguish them from other genera.

Bucephalandra require very high humidity to grow emersed. In their natural habitat these plants are often found together with mosses on rocks along the edge of the water. Sometimes they form thick carpets on rocks, including those in the middle of rivers. The plants cling tightly to the rocks with their powerful roots and can withstand even the strong current that occurs during the rainy season, when the water rises and inundates the habitat.

Bucephalandra species normally flower emersed, but occasionally the unusual funnel-like inflorescences can be seen in specimens growing underwater. Like *Cryptocoryne*, *Bucephalandra* produces a spathe; it flowers for around

F. WANG; OPPOSITE PAGE, TOP: M. LO; BOTTOM: Z. HANG

Bucephalandra species growing along a small stream in the shady rainforest of Borneo.

Below: The little plants grow in thick carpets on the rocky terrain (Bukit Kelam, near Sintang).

Left: At flowering time the plant develops a spathe that opens for three to five days, revealing the flowers inside.

Right: Spathe of a *Bucephalandra* species from Sekadau, shortly before opening.

three to five days and then forms fruits, as long as there is successful fertilization by insects. The leaves formed above and below water differ noticeably.

Numerous undescribed species

The genus *Bucephalandra* was described back in the 1960s, but has been given little scientific attention since. At present only four species are described: *Bucephalandra gigantea*, *B. motleyana*, *B. catherinae*, and *B. magnifolia*, which represent the four most common leaf forms within the genus: the large-leaved, those with thick, oval leaves, those with narrow leaves with wavy margins, and those having oval leaves with straight edges.

It is now more than questionable whether this classification will prove correct on closer scientific examination. We know of more than 100 different forms from different locations, discovered by hobbyists and professional collectors all over Borneo. Presumably many of these forms are undescribed species, so rather than rush to determine the taxonomy of any plant collected, it is usual to name the form in question after the place where it was found or some special characteristic. For example, the probably as-yet-undescribed species *Bucephalandra* sp. "Sintang" is named for its collecting site near the village of Sintang, while *Bucephalandra* sp. "Pearl Grey" owes its name to its unusual leaf color.

Left: Submersed form of a *Bucephalandra* species from Malinau. The smaller underwater leaves can be seen at the front, the old leaves of the emersed form at the back.

Below: Shrimps such as this "Black Bee" are good "algae police" that can be kept with *Bucephalandra*.

TOP LEFT, M.-L.: TOP RIGHT, Z. HANG; BOTTOM: F. WANG

During the rainy season the plants develop submerse foliage.

Unfortunately, some plants have been given different names by different collectors, which makes correct identification even harder. In the absence of detailed scientific study, we have no certainty whether or not any of the plants sold under the above-mentioned trade names belong to any of the described species. On the other hand, some of the externally distinct forms may belong to the same species.

Cultivation

Bucephalandra species can be cultivated both above (emersed) and under (submersed) water. In emersed culture they can be grown as epiphytes attached to wood or rocks and cultivated where there is a very high level of humidity—in a paludarium, for example. While *Cryptocoryne* grown emersed requires a substrate such as beech (*Fagus sylvatica*) leaf mold in which to root, *Bucephalandra* will happily grow without one. Cultivation in glass jars, which is commonplace among *Cryptocoryne* enthusiasts, is possible as long as high humidity is maintained.

The majority of aquarists will, however, prefer to concentrate on submersed culture in the aquarium. Impatient plant enthusiasts must be warned right away: *Bucephalandra* grow incredibly slowly—even more slowly than *Cryptocoryne* and *Anubias*! The plants are usually collected from the wild in their emersed form, and when

Below: Note the pearl-like structures on the upper sides of the leaves of this *Bucephalandra* sp. "Kapit 4".

Right: Some forms, such as this *Bucephalandra* sp. "Red Vein", have reddish flower stems, while others, such as "Dark Grey", even produce reddish leaf shoots that later turn green.

TOP: M. LO; BOTTOM: F. WANG

Various wild forms of *Bucephalandra* with their trade names

Bucephalandra sp. "Sintang"

Bucephalandra sp. "Fine Edge"

Bucephalandra sp. "Copper Gold Leaf"

Bucephalandra sp. "Sanggau"

Bucephalandra sp. "Sri Aman"

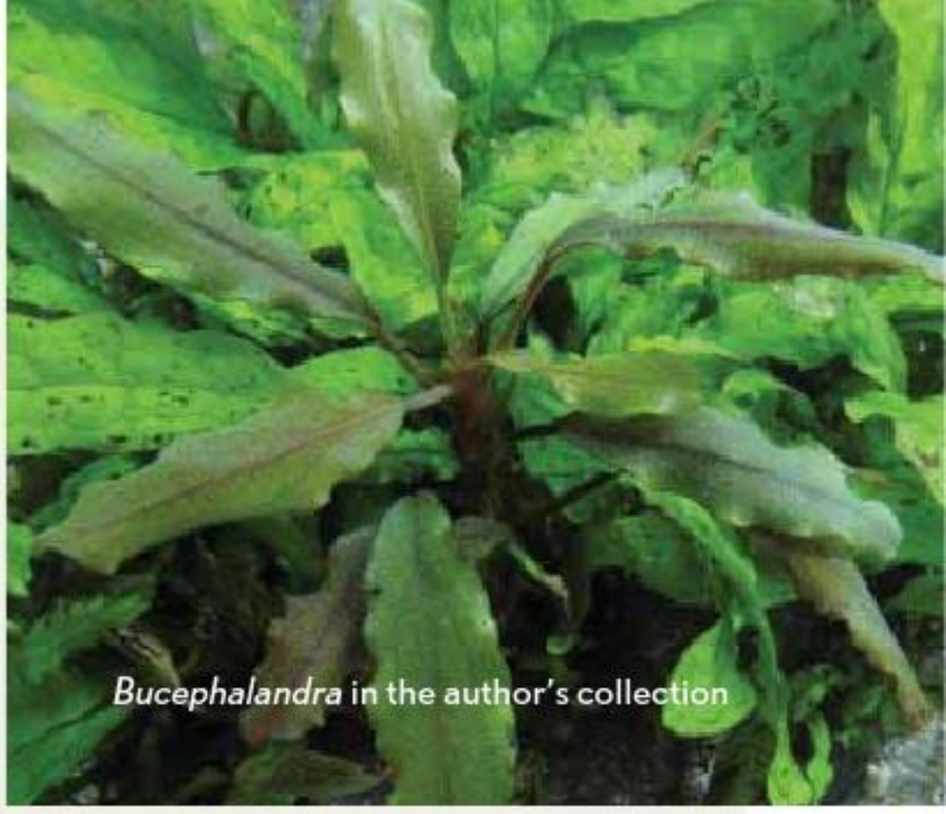
Bucephalandra sp. "Simunjam"

Bucephalandra sp. "Black Carpet"

Bucephalandra sp. "Batang Ai"

Bucephalandra sp. "Padawan"

Bucephalandra sp. "Dark Grey"



Bucephalandra in the author's collection

A Fan's Notes

Plants that grow in streams and flowing water are described as rheophytes, which means that they are adapted to live in fast-moving water, and *Buchephalandra* fits this description perfectly.

When I first cultured *Bucephalandra*, I believed that water flow could be a requirement for good healthy growth, but I have since grown the plant with Java Fern in a bowl of still water, where it looks just as beautiful as it does in a traditional planted aquarium. If provided with a high energy environment, *Bucephalandra* plants do benefit from increased water movement, but water flow is less critical when they are grown in a moderately lit aquarium.

Bucephalandra may be an exotic freshwater plant, but its needs in planted aquariums are not unusual. Like other epiphytes, it should be grown on some kind of hardscape, either rock or wood, so that its roots can get plenty of aeration. Its lighting needs are not out of the ordinary: it tolerates low to high light well, although it should be placed in an area of higher water flow in high energy aquariums.

The only parameter that *Bucephalandra* may be picky about is water temperature; since it comes from flowing streams in Borneo that are often shadowed by a forest canopy, the water should be a typical tropical aquarium temperature, not much higher than about 77°F (25°C). The only instance of a *Bucephalandra* failure I have experienced was when the leaves melted away like a *Cryptocoryne* following an unexpected spike in temperature.

Perhaps the only real challenge to keeping *Bucephalandra* plants is getting some of your own. *Bucephalandra* has not yet entered the inventories of mainstream aquatic plant suppliers, at least not in the Americas or Europe, and the best way to track it down is to connect with progressive plant collectors.

Most species in this genus grow very slowly, so your first starter plants won't be cheap—but if you are looking for something new and unusual, a nice clump of *Bucephalandra* would make a fine trophy plant quite unlike anything else currently available to freshwater aquarium gardeners.

—Jake Adams

INTERNET

http://www.aquaticplantenthusiasts.com/plants/4760-bucephalandra-cf-gloriously-endemic-plants.html

subsequently cultivated submersed they can take a very long time to adjust and develop their underwater foliage. But, like *Anubias*, these plants don't mind living underwater all year 'round. The submersed forms are noticeably smaller than the emersed forms.

In accordance with their natural habitat, *Bucephalandra* grow best in soft, slightly acid water. Fertilization with CO_2 and other nutrients via the water is beneficial and will accelerate growth. The plants can be attached with fishing line to small pieces of lava rock or bogwood and placed at more elevated spots in the aquarium if desired. It is also possible to plant them in the substrate in the foreground, but make sure the roots aren't buried too deep or they might rot.

Because *Bucephalandra* are adapted to life in heavily shaded rainforest streams, they need only a little light. They won't tolerate strong light or persistent temperatures over 82.5°F (28°C). Good filtration of the water and a certain amount of current, together with regular water changes to avoid too strong a nitrate concentration, are very important factors.

Bucephalandra are eminently suitable little aquarium plants for anyone who is keen on the black- and clear-water fishes of Southeast Asia and decorates his or her aquarium as described above.

Along with *Cryptocoryne* and other species with a low light requirement from soft, slightly acid water, they can also be combined with numerous small fishes and shrimps from the rainforest biotopes of Southeast Asia. (See *Brilliant Things in Tiny Packages*, page 56.) *Bucephalandra* will thrive even in moderately hard water, although this will slow growth even more. Because of their small size they are very suitable for nano aquariums.

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OPPOSITE PAGE: F. WANG; THIS PAGE: JAKE ADAMS

Channa pulchra: the Rainbow Snakehead

There was great excitement when the Rainbow Snakehead, *Channa pulchra*, arrived in the trade. It is a gorgeous species that appears to be an acceptable size even when full grown—12 inches maximum. Some even call it a dwarf snakehead. Due to the challenges of keeping an unusual species, there has been a lot of competition to keep these fishes correctly, and, of course, to breed them. • *by Nora Brede and Markus Kleinbölting*

December 2007 saw the publication of the original scientific descriptions of two recently discovered snakehead species, *Channa ornatipinnis* and *Channa pulchra*. The two are similar in external appearance, but *C. ornatipinnis* has larger black spots on the operculum. According to Dr. Ralf Britz (2008), both species originate from Myanmar. *Channa ornatipinnis* was collected in Waloun Chaung in the north of the state of Rakhine, *C. pulchra* in Kyeintali Chaung in southern Rakhine. As far as is known, both live in mountain streams.

Aggression

As so often happens, the web forums were soon full of the details of keeping them—based on hearsay, interpretation of Britz's paper, and first observations. According to these rumors *Channa pulchra* required cool water, a tank with lots of hiding places, and plenty of current. Almost everyone keeping these fishes discovered right from the start that battles within the group quickly resulted in the deaths of some individuals, and it was assumed that these expensive fishes would have to be kept separately.

We, too, experienced these squabbles and lost a small specimen in the beginning. We, too, raised and lowered the temperature, increased and reduced the current, and kept rearranging the

N. BREDE

Below: The male *Channa pulchra* has a broader and beefier head than the female. In our specimens the dorsal fin has a large orange component. Contrary to the observations of other owners, in our pair there is no difference in the amount of white in the pectoral fins.

Above: *Channa pulchra* has a large amount of orange in the body coloration. Although it wasn't stated in the original description, the number of black spots on the dorsal fin is variable and appears to alter as the fish grows.

Left: *Channa ornatipinnis* has black spots on the operculum and flanks.

aquarium decor. Eventually we came to the following conclusion: given a temperature of 73.5–77°F (23–25°C), current produced by a standard-sized airlift, and unaltered aquarium décor, the quarrels stopped as soon as each fish had established a small territory that it was able to defend.

Initially we maintained eight specimens in an 80-gallon (300-L) aquarium (40

Below: The female *Channa pulchra* looks slimmer than the male and more blue.

TOP AND BOTTOM: N. BREDE; MIDDLE: H.-G. EVERS

Left: The parents are attentive in their brood care and always keep their young in sight. The bright spot on the head of the youngster disappears in the course of development.

x 24 x 20 inches/100 × 60 × 50 cm) decorated with large water-worn stones, mangrove wood, and tubes of cork bark. We repeatedly observed that the smaller specimens, in particular, rested almost goby-like on surfaces or in caves, using their pectoral fins as props. Larger individuals swam in the water column in the centers of their little territories and displayed to rivals with inflated throat sacs and extended gill covers. By this stage we couldn't see any more injuries—not even a frayed tail to suggest that *C. pulchra* was excessively aggressive.

Bubble-nest breeders

By now a number of other people keeping *C. pulchra* had bred and reared the species. While it had initially been suggested that the Rainbow Snakehead might be the first cave breeder in the genus, it soon turned out that almost every well-matched pair not only constructed a bubble nest, but also regularly raised large numbers of fry—except in our tank.

Then we moved, and in our new space the *Channa pulchra* were given an 85-gallon (320-L) aquarium (80 x 16 x 16 inches/200 x 40 x 40 cm). One fish had died during the move, so six now shared the space. While we were busy setting up and decorating all our other aquariums, a pair formed and bred for the first time. One day we looked in the aquarium and found another adult dead and around 30 young, already .31–.39 inch (8–10 mm) long, swimming around in a corner of the tank.

While the female remained amongst the fry, the male guarded the outer perimeter of the extensive territory

This specimen has been exposed to constant territorial struggles. The dark stripe extending along the flank from the operculum indicates that the fish is stressed. Resting in an elevated spot is very typical behavior.

TOP: H.-G. EVERS; BOTTOM: N. BREDE

they had established. The two remaining adults were crammed together in the last 8 inches (20 cm) at the other end of the 80-inch (2-m) aquarium and showed clear signs of parental aggression. After we moved these two fishes to another aquarium, we sat and watched the attentive brood care of the *C. pulchra* fry. It appeared that the parents never attacked the little snakeheads.

Most of the fry were dark in color, apart from a small, round, light spot on the forehead. As they developed the youngsters became increasingly lighter on the back until the black-brown pattern was restricted to the ventral surface, separated by a golden flank stripe from the brownish color of the dorsum. At this stage, when they were around 1.5 inches (3.5-4 cm) long, the species-typical black spots on the flanks appeared, the throat began to turn metallic blue, and the first orange spot developed on the upper part of the caudal peduncle.

It is difficult to determine the sexes in adult specimens, a problem known from other snakehead species. Essentially, the male looks beefier and has a broader head, and in our male the rays of all the unpaired fins were orange, whereas the female's were white to bluish.

A cluster of foam bubbles in a dark corner of the aquarium that was sheltered from the current indicated a new breeding attempt by the pair. After we added a number of *Cryptocoryne* plants to the tank, we repeatedly found pieces of leaf in the chosen corner. We kept seeing eggs, newly hatched larvae, and free-swimming fry. The failure of any to survive was probably due to the continued presence of the older youngsters in the aquarium—the parent fishes apparently didn't prevent them from eating the new broods.

Because our pair showed no signs of stopping spawning at the prevailing temperature of 75°F (24°C), we decided to drop the temperature in the coming weeks, as we felt that the continuous breeding might harm the health of the female. The young *C. pulchra* were moved to a separate aquarium so that we could provide sufficient food and a continued higher temperature in order to rear them successfully. They grew steadily and rapidly compared to other snakehead species.

No special requirements

The reason we haven't discussed water parameters and aquarium décor here is that these fishes appear relatively indifferent to these aspects of husbandry. Both the super-hard water of Switzerland and soft reverse-osmosis water with a conductivity of around 100 µS/cm appear acceptable, although our fishes first started breeding in the soft water that we have used exclusively since we moved.

Because our aquariums are fitted with energy-saving lighting, after two moves in the space of a year we didn't have many plants left. Surface vegetation doesn't last long with this type of lighting, either, so tubes of cork bark offer an interesting alternative.

At around 10 inches (25 cm) *Channa pulchra* can generally be maintained successfully in a medium-sized aquarium. They will eat practically any type of food offered, including pellets, edible mussels, squid, and mosquito larvae. They also like insects and shrimps. However,

A female *Channa pulchra* with her shoal of fry, around three weeks old (breeder: B. Schmitt, Schwarzenbek). She guards the central part of the breeding territory while the male defends the outer perimeter. When the adults meet they perform a threat display, ignoring the free-swimming young.

H.-G. EVERS

it is important not to overfeed this species (or any other snakehead). *C. pulchra* will almost always eat anything in any amount they are given, and hence are inclined to lay down fat deposits. Not only can this lead to a plump appearance, but it can also cause the sex organs to be converted to fat-storage units.

Luckily, however, this greed means that even the smallest fry will accept protein-rich dry rations and thus can be grown on without problems. And the fact that *Channa pulchra* is relatively easy to breed is good news for all would-be *Channa* keepers as well as for wild *C. pulchra*, as it means that there is no need to take excessive numbers of the species from the wild and that the price of these wonderful, beautiful snakeheads should remain affordable.

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Right: These fishes like to hide in tubes of cork bark, which float at the surface, making it relatively easy for the snakeheads to obtain the air they need to breathe.

Below: Caves of all types make good hiding places, especially for smaller and weaker individuals.

N. BREDE

Male *Ancistrus* sp. "Rio Paraguay"

The female lacks the head tentacles typical in the adult male.

Ancistrus sp. "Rio Paraguay"

A small, spotted catfish from Paraguay

The majority of species in the very popular catfish genus *Ancistrus* are plain to look at, with a predominantly gray or brown base color and lighter contrasting spots. Only a few species deviate from this rather unexciting coloration, and one of them is the little *Ancistrus* sp. "Rio Paraguay" with its pattern of red-brown spots.

• *article and images by Wolfgang Kochsiek*

According to Ingo Seidel (2008), the exact provenance of *Ancistrus* sp. "Rio Paraguay" is unknown, but the species supposedly occurs in the Rio Paraguay system. Staeck has caught a specimen on the Bolivian side. Both sexes exhibit round and oval red-brown spots (about 3 mm in diameter) on a dark background, with the spotting distributed all over the body (including the underside) and on all the paired and unpaired fins. *Ancistrus* sp. "Rio Paraguay" is smaller than L 110 and L 157 and has a much denser spot pattern.

According to the few details to be found in the literature and on the Internet, adult specimens measure up to 4.75 inches (12 cm) in length. But that refers to the specimens originally imported. My *Ancistrus* sp. "Rio Paraguay" are now 18 months old and measure only around 3 inches (7–8 cm).

Males have the snout tentacles typical of the genus; these are not often branched, but are well developed in this species. Females sometimes have a row of short, unbranched tentacles along the edge of the snout.

Problem-free maintenance

A pair of *Ancistrus* sp. "Rio Paraguay" can be maintained successfully and bred in an aquarium 24 inches (60 cm) long or bigger. The substrate should be fine-grained (2–3 mm) gravel with no sharp edges, and the tank should be decorated with rockwork, bogwood, and a number of plants. Clay pipes and/or bamboo tubes are recommended as shelter and breeding caves. This rather undemanding catfish species can be kept in medium-hard to hard water, but soft water is better for breeding. With this wide spectrum of acceptable hardness, a temperature range of 73.5–80.5°F (23–27°C), and a pH of 6–8, this species has proved very tolerant.

Below, left: Eggs of *Ancistrus* sp. "Rio Paraguay" three days after spawning.

Right: The eggs on the morning of the fourth day after spawning. The eyes can be easily seen.

Top left: At one day old, *Ancistrus* sp. "Rio Paraguay" measures about .25 inch (7 mm).

Top right: At three days, the fish is around .39 inch (10 mm) long and the yolk sac is almost exhausted.

Right: Ten-day-old *Ancistrus* sp. "Rio Paraguay".

To maintain water quality I use an air-powered sponge filter and change 30 to 40 percent of the tank volume every two weeks, using a mix of reverse-osmosis water and tap water to refill. A small group of wild guppies act as companion fishes.

These fish will happily eat food tablets, frozen foods such as bloodworms, mosquito larvae, *Artemia*, *Cyclops*, and some vegetables, including cucumber and zucchini.

Unpigmented larvae

Provided suitable spawning caves are available, breeding will take place without any major problems. My pair spawn regularly in clay pipes (0.75–1 inch/20–25 mm) in diameter, closed off at the rear end, in water with a conductivity of 300–400 µS/cm. A clutch consists of between 20 and 35 yellow eggs with a diameter of around 3 mm (some report as many as 50 eggs). The clutch is often found in front of the spawning cave, and in such cases it is advisable to hatch the eggs in a separate small tank with an airstone.

At 80.5°F (27°C) the eggs hatch after five to six days. The newly hatched larvae are around .24–.28 inch (6–7 mm) long and unpigmented, and have a medium-sized yolk sac that is consumed over the following four days. Two to three days after hatching, the young are already .39 inch (10 mm) long and begin to develop the first signs of pigmentation. After two more days they are all fully colored, .43 inch (11 mm long), and swimming freely.

From then on they must be fed heavily. For the first few days the young catfishes should be fed three times daily with freshly hatched *Artemia* nauplii and food tablets. Later on the menu can be expanded to include frozen foods, such as bosminids and *Cyclops*.

According to Seidel & Evers (2005), in some broods around 20 percent of the young remain completely unpigmented for several days, while their siblings are fully colored right from the start. Within a few days, however, all the little catfishes look the same and can no longer be distinguished from one another. This phenomenon hasn't occurred in any of my broods to date.

If you perform a 50 percent water change every two days, the fry will grow well, but nowhere near as rapidly as the fry of other catfish species. The growth rate of *Ancistrus* sp. "Rio Paraguay" also varies considerably between broods. So far, I haven't experienced the high mortality rate described in the rather sparse literature on this species.

The red-brown spot pattern becomes apparent when the fry are about four weeks old and around 0.75 inch (22 mm) long. At five and a half weeks (see photo) they measure just over an inch (28 mm). I stopped measuring the young regularly at the age of 11 weeks, when they were about 1.75 inches (45 mm) long.

I can heartily recommend *Ancistrus* sp. "Rio Paraguay" to everyone who is interested in loricariid catfishes. The species is very attractive, easy to keep, and easy to breed and rear, and requires relatively little space. Unfortunately these fishes aren't always easy to obtain, but your dealer may be able to get them for you. Sometimes you can find them advertised online or for sale at fish shows and auctions.

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Seidel, I. 2008. *Back to Nature Guide to L-Catfishes*. Fohrman Aquaristik, Jonsered, Sweden.

At five weeks, this fish is just over an inch (28 mm) long and the spot pattern is well developed.

AQUARIUM

CALENDAR

compiled by Mary E. Sweeney

JULY

11–15 **Convention**, American Cichlid Association, hosted by Circle City Aquarium Club, Indianapolis, IN
www.cichlid.org

SEPTEMBER

15 **Auction**, Sarnia Aquarium Society
Sarnia, ON, Canada
www.sarniaaquariumsociety.com

15 **Fall Auction**, Colorado Aquarium Society, Arvada, CO
www.coloradoaquarium.org

15–16 **Convention**, Aquarium Club of Lancaster County, Lancaster, PA
www.aclcpa.org

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

30 **Fall Show and Auction**, London Aquaria Society
London, ON, Canada
www.londonaquariasociety.com

OCTOBER

4–7 **Show and Auction**, Saskatoon Aquarium Society, Saskatoon, SK, Canada
www.saskatoonaquarium.com

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

21 **Giant Fall Auction**, Regina Aquarium Society
Regina, SK, Canada
www.reginaaquariumsociety.ca

NOVEMBER

1–4 **Convention**, Aquatic Gardeners Association, hosted by Missouri Aquarium Society
St. Louis, MO
www.aquatic-gardeners.org

3 **Annual Meeting**, Potomac Valley Aquarium Society, Fairfax, VA
www.pvas.com

16–18 **Extravaganza!** Ohio Cichlid Association
Strongsville, OH
Ohiocichlidassoc@aol.com

JANUARY

19 **Annual Winter Swap Meet**, Grand Valley Aquarium Club, Grand Rapids, MI
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A surface skimmer for duckweed

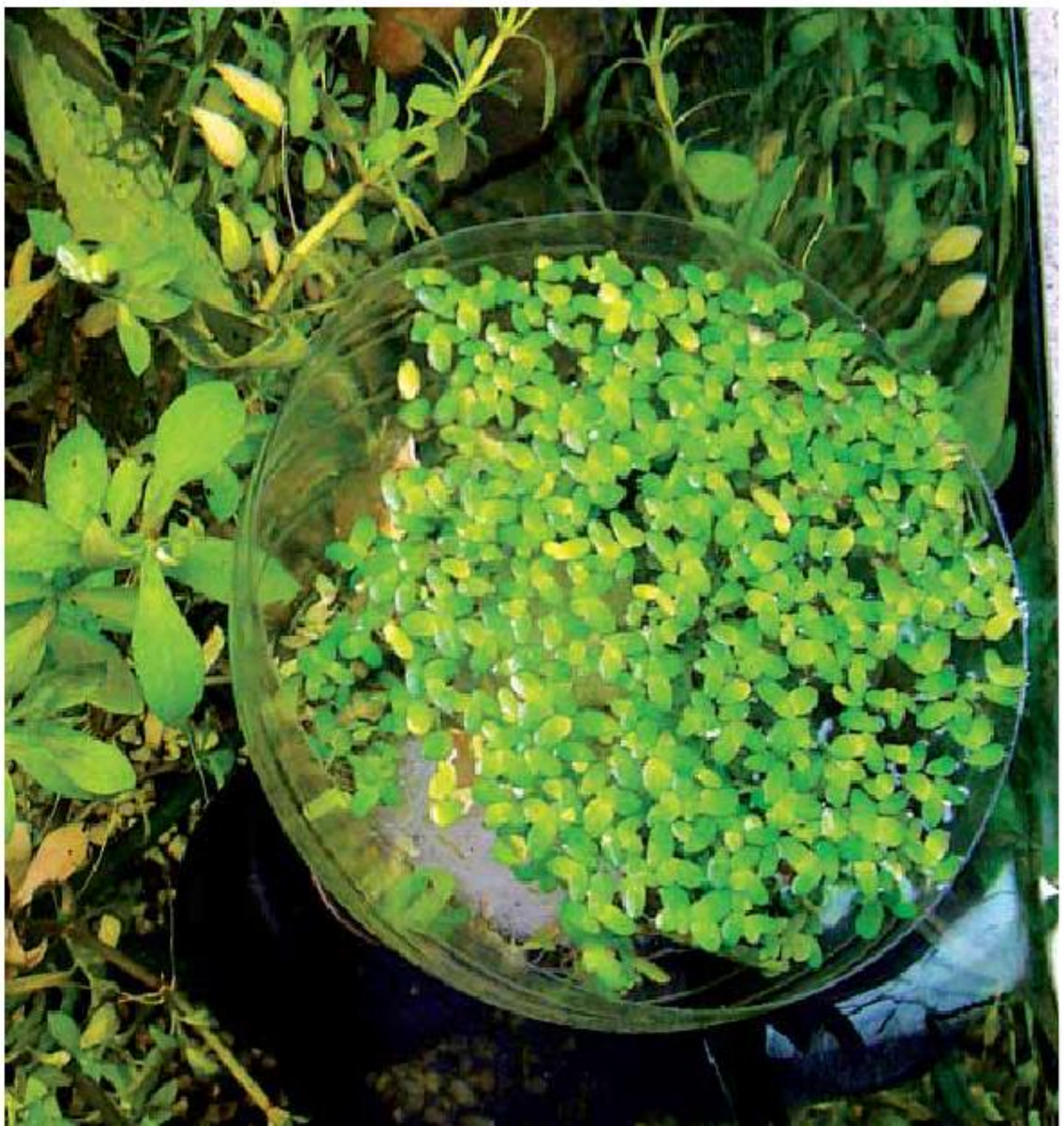
by Cord Hildebrand and Maike Wilstermann-Hildebrand • Like Columbus's egg, anything is easy once you know how to do it. (When a group of critics derided the triumphant explorer, saying his discovery of the New World was no great feat, Columbus challenged them to make an egg stand on end. When all had given up, Columbus tapped the end of the egg on the table, and there it stood. "It's the simplest thing in the world to do," he said, "once someone shows you how.") Not everyone is able to come up with bright ideas of their own, and it doesn't hurt to recognize somebody else's creativity and use it for your own purposes.

In order to keep aquascapes that include *Hemianthus*, *Riccia*, and similar plants neat and tidy, the plants must be trimmed regularly. "Cut, cut, cut!" is the rule if you want to achieve a good result. The process is akin to mowing the lawn. At the end you are left with shortened stems and a mass of fine trimmings floating around the tank. Then comes the tedious job of fishing them all out. A clever solution to this problem has been devised by Ghazanfar Ghori (2011), who automated the tidying up of the aquarium after trimming and described his "Do-it-yourself surface skimmer" in *The Aquatic Gardener*. Now, we are no aquascapers, and we are unfamiliar with such problems. But we do have a lot of duckweed (*Lemna* sp.)!

Ghori's principle is simple: The surface water is sucked into a funnel with the aid of a pump. Everything floating on or just beneath the surface of the water is carried in, too. To construct your own surface skimmer, all you need is a small water pump, a plastic bottle, and a piece of filter fleece or foam—and maybe a bit of silicone sealant or an "adapter" made out of a piece of pipe or hose.

Cut the bottom of the bottle off. The cut edge should be as smooth as possible and horizontal. The neck part of the bottle (the funnel) is connected to the pump inlet. The joint can be sealed with silicone sealant. If the pump's inlet doesn't match the diameter of the bottle neck, it may be necessary to use a washer or packing piece or to file away the nozzle. Place the filter fleece or aquarium foam in the funnel. Position the completed surface skimmer in the aquarium so that the funnel is just beneath the surface. When the pump is switched on, water flows into the funnel and the bits of plant collect on the filter material. If the pump begins to suck in air, it should be positioned somewhat further beneath the surface so that the water can run in fast enough.

Starting a session of duckweed eradication.



Better than a net

In order to avoid problems with positioning the device, the bottle's neck shouldn't have a significantly larger diameter than that of the pump's inlet. If the funnel presses against the glass and hence assumes an angle, water won't be sucked in all around the rim and the duckweed will accumulate around the outer edge. It can be beneficial to use flat-sided bottles, which are less likely to be pushed out of shape if pressed against the aquarium glass. Bubbles rising from the pump outlet, and in a shallow aquarium the outflow itself, can cause the water to flow away from the funnel. This can be prevented by extending the pump outlet with a piece of tube.

The method is a lot more thorough than working with a net. No duckweed

ALL: M. WILSTERMANN-HILDEBRAND

Everything that could possibly go wrong. The funnel is at an angle and water is running over only part of its rim. The pump is sucking in air and the rising bubbles are driving the duckweed away. The leaves of the *Vallisneria* are preventing the duckweed from floating with the current.

is sucked underwater by eddies to become trapped among the plants, so there is no resurfacing of particles from the thicket of plants after a water change. In addition, even very small pieces of duckweed are removed from the aquarium.

Plants or other décor objects that extend up to the surface can impede the water flow, so they should be removed or pushed underwater so no duckweed remains stuck to them. One thing to know about: the guppy problem. These fishes absolutely must see what is going on in a funnel. Consequently, you have to sort out the fishes from the duckweed. We feed our duckweed to herbivorous apple snails (*Pomacea canaliculata* and *Marisa cornuarietis*) and then simply catch the guppies out of the snail tank after the duckweed has been eaten.

This practical surface skimmer can easily be cobbled together in a few minutes from basic materials. It greatly simplifies the removal of duckweed or clippings from aquascaping and is significantly more thorough than even the finest net. Which begs the question, why we didn't think of the idea ourselves?

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Ghori, G. 2011. DIY surface skimmer on the cheap! *The Aquatic Gardener* 24 (1): 42–3.

Below, left: Two models with different pumps. Right: Too short a funnel combined with a powerful pump won't function effectively. The water is pumped out faster than it can run in and a lot of air is sucked in. Tall, square bottles often work best.

❶ *GYMNOCHANDA VERAE* ❷ *PARANANOCHROMIS AXELRODI* ❸ *AMBASSIS AGRAMMUS*
❹ *MUGILOGOBIU* SP. "TOWUTI" ❺ *ACHEILOGNATHUS TONKINENSIS* ❻ *PSEUDOMUGIL CF. PASKAI*

Male *Gymnochanda verae*

Gymnochanda verae, Rose Flame Glassfish

1 The small genus of scaleless glassfishes, *Gymnochanda*, has recently gained a new member, a very unusual species from the Indonesian island of Belitung.

Males of this species have blood-red fins and the rays of the first dorsal fin are connected by a membrane. In related species known in the aquarium hobby, *G. filamentosus* and *G. limi*, the rays are separate and much longer.

As with the other three members of the genus, only the males exhibit bright coloration; females are transparent and colorless. The species is named in honor of Vera Kasim, the wife of fish collector Gunawan Kasim, who was the first to catch the species on Belitung and introduce it to his customers in Singapore.

According to information from the exporter of the species, Patrick Yap of Aquaculture Technologies in Singapore, *Gymnochanda verae* has so far been found only in the area around Gantung in the east of the island. Apparently it occurs in large numbers during the breeding season, from June to August. Outside this period it isn't worth it for collectors to make the trip.

The species has already been exported several times to the Unites States and countries in the Middle East, and a few times to Europe. Imazo, a company in Sweden, is a customer of Aquaculture Technologies and imported the fish in the autumn of 2011; it was probably the first firm in Europe to do so. The scientific description appeared shortly afterward, so a scientific name was available almost immediately. All we need now is a few specimens to breed, but we will have to wait at least until summer 2012 for that.

—Hans-Georg Evers

REFERENCES

Tan, H.H. and K.K.P. Lim. 2011. A new species of glass-perch from Belitung Island, Indonesia (Teleostei: Ambassidae: *Gymnochanda*). *Zootaxa* 3085: 55–62.

Parananochromis axelrodi

2 The majority of the small cichlid species of the genus *Parananochromis* Greenwood, 1987 are not often seen in our aquariums, and up until now *Parananochromis axelrodi* Lamboj & Stiassny, 2003 had not been imported alive for the hobby. All the more reason to celebrate the fact that a pair of this species has finally reached Europe, so that at least we now know what these cichlids look like when they are alive.

Parananochromis axelrodi may not be the most brightly colored of cichlids, but its pastel shades make it quite a pretty fish; *Parananochromis* aren't all that colorful anyway. The species is fairly high-backed for the genus and hence rather atypical in appearance. Its distribution region lies in the area around the town of Makokou in northeastern Gabon, where it is found in the drainage of the River Ivindo.

As yet nothing is known regarding the biology of the species, but it can at least be assumed that it is a pair-forming cave-breeder. These fishes require soft and slightly acid to neutral water. The temperature shouldn't be too high—71.5–77°F (22–25°C) is recommended. Such relatively low temperatures are also advisable for the majority of fishes from the central and eastern regions of Gabon. Males measure about 3.125 inches (8 cm) in length, while females are a little smaller; these fishes are fully adult and sexually mature at this size. These cichlids are quite shy and are rarely seen at the front of the aquarium. There seem to be no problems with feeding them as long as live or deep-frozen foods are offered. They are very reluctant to take flake food.

My pair appear to be harmonized, as they can usually be seen together, though I haven't as yet seen any display or spawning behavior. I hope that *Parananochromis axelrodi* will breed successfully, and if they do

M. HAKANSSON

Male *Parananochromis axelrodi*

Female *Parananochromis axelrodi*

it will certainly be a worthy topic for a detailed article.

—Anton Lamboj

REFERENCES

Lamboj, A. 2004. *Die Cichliden des westlichen Afrikas*. Schmettkamp Verlag, Bornheim, Germany.

Ambassis agrammus, Sailfin Glass Perchlet

3 | A number of specimens of the Sailfin Glass Perchlet, *Ambassis agrammus* Günther, 1867 have recently been imported from Indonesia. The species is not very widespread in the wild, and there are just a few populations in the northern part of Australia and the southern part of New Guinea. These areas were linked during the ice age, and only when the sea level rose again after the ice thawed did the Arafura Sea, which separates Australia and New Guinea, come into existence.

Ambassis agrammus occurs in freshwater habitats and attains a length of some 2.375–2.75 inches (6–7 cm). In the aquarium these fishes like to move around in a group in open water or hide among dense stands

The Sailfin Glass Perchlet, *Ambassis agrammus*

TOP: A. LAMBOJ; BOTTOM: M. TAXACHER

of plants. They sometimes form large shoals in waters with weak current and dense marginal vegetation, which are their natural habitats.

Ambassis agrammus can be kept in soft to moderately hard water and is uncomplicated in its maintenance needs. However, breeding Glass Perchlets isn't exactly easy. The fry are extremely small, move very little, and require very fine live foods during their first days. We are currently working hard to breed these attractive fishes so as to establish this rarely imported species in the aquarium hobby.

—Michael Taxacher & Johannes Graf

REFERENCES

Allen, G.R. 1991. *Field guide to the freshwater fishes of New Guinea*. Publication no. 9 of the Christensen Research Institute, Madang, Papua New Guinea.

Mugilogobius sp. "Towuti", Unknown Towuti Goby

4 Just when we thought that all the gobies from Lake Towuti had been identified, yet another new one turned up in this huge lake in the heart of Sulawesi!

During a trip to the rocky coast of Lake Towuti at Tominanga, one of the fishermen accompanying us caught a number of gobies for me, as he knew that I was very interested in these fishes. Among the exciting catch there were two pitch-black fishes with huge pectoral fins. They were around 2 inches (5 cm) long and quite simply captivated me. The fisherman said they were rare and difficult to catch, so they had never been exported. "Great," thought I, and delved into my memory for information on the species known from the lake. Apart from *Mugilogobius rexi*, the Lemon Goby, and *Mugilogobius latifrons* (both dwarf gobies and both known in the aquarium hobby), the only described species from Lake Towuti is *Mugilogobius lepidotus*. Study of the genus revision by Helen Larson (2001) quickly made it clear that the fishes couldn't be that species. Pending clarification of their status I will call them *Mugilogobius* sp. "Towuti" and hope that someone—perhaps one of our readers—can help identify them.

Both are males, almost black, and have a slight reddish sheen to the fins. (I wonder what the females look like?) They generally keep out of each other's way, but if they do meet they spread their fins and display vigorously. If these rather quarrelsome little fellows are kept in a small aquarium without enough hiding places, the dominant individual may attack and injure the other. This makes the species the most territorial dwarf goby from the lake that I have come across to date.

—Hans-Georg Evers

REFERENCES

Larson, H.K. 2001. A revision of the gobiid fish genus *Mugilogobius* (Teleostei: Gobioidei), and its systematic placement. *Rec West Austral Mus* Suppl. No. 62: 1–233.

Acheilognathus tonkinensis, Chinese Bitterling

5 Bitterlings are interesting, likable fishes, more often kept in ponds than aquariums. Those that are native to European waters lay their eggs in freshwater mussels in order to provide their young with a protected nursery, but they aren't really suitable for the average aquarium because they require very low water temperatures at some times of the year. So it is good that there is also a whole set of subtropical species, of which one in particular, the Chinese Bitterling (*Achei-*

Mugilogobius sp. "Towuti"

Displaying male *Acheilognathus tonkinensis*

lognathus tonkinensis), is imported now and then. It too spawns in mussels, and does well in an unheated aquarium kept at room temperature year-round.

These bitterlings grow to 2.75 inches (7 cm) long and are relatively peaceful, so they can be kept in a group of six to ten individuals in a tank at least 32 inches (80 cm) long. The males are resplendent in the loveliest of metallic shades, especially when stimulated by large water changes. They will eat all the usual foods from frozen to flake. As far as I know, nobody has attempted to breed these fishes yet. I wonder if our native freshwater mussels would suit them?

—Hans-Georg Evers

Pseudomugil cf. paskai, Paska's "Red Neon" Blue-Eye

6 | Fans of small fishes have reason to celebrate. In the fall of 2011, Aquarium Dietzenbach imported a new blue-eye for the first time, and the species will certainly cause the heart of many an aquarist to skip a beat. The first photos appeared with the label *Pseudomugil* sp. "Red Neon", a name used by exporters in Thailand and Indonesia.

As far as I can tell, these fishes, which in all probability are tank-bred, are being distributed via a middleman in Java (Indonesia). Their natural distribution is unknown, but it may well be the southern part of the Indonesian province of West Papua, as the males are highly reminiscent of *Pseudomugil paskai*, a species from southern New Guinea, in terms of both their body form and their finnage, which sports numerous small spots. But there are also major differences, such as the splendid orange base color of the body and fins and the neon-blue dorsum.

Pending further information, I suggest the name *Pseudomugil cf. paskai*. These fishes are barely 1.25 inches (3 cm) long and real little bundles of energy that swim around just below the water's surface all day long, displaying, courting, and probably also spawning.

Male *Pseudomugil cf. paskai*

Both Aquarium Dietzenbach and I already have our first fry, so we hope that these fishes will soon be available at lower prices. These little fishes aren't particularly delicate, just a bit shy. They will eat not only *Artemia* nauplii but also small dried and frozen foods.

—Hans-Georg Evers

LEFT: H.-G. EVERS; TOP: F. WANG; RIGHT: H. NIGL

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Dry Wash Aquarium Society, Phoenix
www.DryWashAquarium.org

Arizona Aquatic Plant Enthusiasts (AAPE)
Tuscon & Phoenix
www.azaquaticplants.com/index.php

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www.SacramentoAquariumSociety.org

San Francisco Aquarium Society
San Francisco
www.SFAquarium.org

Silicon Valley Aquarium Society
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www.SiliconValleyAquariumSociety.com

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www.ColoradoAquarium.org

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www.GHASCT.org

Northeast Livebearer Association
Bristol
www.nela.northeastcouncil.org

Norwalk Aquarium Society
South Norwalk
www.NorwalkAS.org

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Greater Washington Aquatic Plant Association
www.GWAPA.org

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Gold Coast Aquarium Society of South Florida, Cooper City
www.GCAquarium.org

Tampa Bay Aquarium Society, Tampa
www.TBAS1.com

GEORGIA

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Atlanta
www.AtlantaAquarium.com

HAWAII

Honolulu Aquarium Society, Honolulu
www.HonoluluAquariumSociety.org

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Central Illinois Tropical Aquarium Club (CITAC)
Bloomington
www.citac-il.org

Federation of American Aquarium Societies
Champaign
www.FAAS.info

Greater Chicago Cichlid Association
Brookfield
www.GCCA.net

Green Water Aquarist Society, Alsip
www.GWASOC.org

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Circle City Aquarium Club
Indianapolis
www.CircleCityAqClub.org

Michiana Aquarium Society, South Bend
www.MichianaAquariumSociety.org

IOWA

Eastern Iowa Aquarium Association
Cedar Rapids
www.FinFlap.com

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www.selas.us

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www.BostonAquariumSociety.org

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Jersey Shore Aquarium Society
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Allegheny River Valley Aquarium Society
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www.orgsites.com/ny/ARVAS

Brooklyn Aquarium Society, Brooklyn
www.BASNY.org

Danbury Area Aquarium Society (DAAS)
Carmel
www.northeastcouncil.org/daas

Central New York Aquarium Society
Syracuse
www.CNYAS.org

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Rochester
www.ggw.org/GVPAKE

Greater City Aquarium Society, Flushing
www.GreaterCity.org

Long Island Aquarium Society
Stony Brook
www.LIASOnline.org

Nassau County Aquarium Society
Rockville Center
www.NCASweb.org

Niagara Frontier Koi & Pond Club
North Tonawanda
www.NFKPC.org

Tropical Fish Club of Erie County
Hamburg
www.Tropical-Fish-Club-of-Erie-County.com

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North Carolina Aquarium Society
Raleigh
www.NCAquariums.com/society

Raleigh Aquarium Society, Raleigh
www.RaleighAquariumSociety.org

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American Cichlid Association, Hamilton
www.cichlid.org

Cleveland Aquarium Society, Cleveland
www.ClevelandAquariumSociety.org

Columbus Area Fish Enthusiasts
Plain City
www.ColumbusFishClub.org

Greater Akron Aquarium Society, Akron
www.GAAS-FISH.net

Great Lakes Cichlid Society, Euclid
www.GreatLakesCichlidSociety.net

Medina County Aquarium Society
Medina
www.geocities.com/MCASfish/index

Ohio Cichlid Association, Brunswick
www.OhioCichlid.com

Stark County Aqua Life Enthusiasts Society, Canton
www.ClubScales.com

Youngstown Area Tropical Fish Society
Youngstown
www.YATFS.com

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Greater Portland Aquarium Society
Clackamas
www.GPAS.org

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Aquarium Club of Lancaster County
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Houston Aquarium Society, Houston
www.HoustonAquariumSociety.org

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Tropical Fish Club of Burlington
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www.tfcb.org/

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Central Virginia Aquarium Society
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www.thePSAS.org

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home.vicnet.net.au/~cichlid

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www.cichlidae.be/

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London, ON
ww.londonaquariasociety.com

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www.theMontrealAquariumSociety.com

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www.HDAS.ca

Durham Region Aquarium Society
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www.DRAS.ca

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www.aquahoito.info/cichlids/index.html

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Frankfurt am Main
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Discus Club Singapore
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Anabantoid Association of Great Britain
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www.AAGB.org

Bristol Aquarists' Society, Bristol
www.bristol-aquarists.org.uk

The Federation of British Aquatic Societies, Sussex
www.FBAS.co.uk

Greater Manchester Cichlid Society
www.nekrosoft.co.uk/GMCS

Middlesex & Surrey Border Section, British Koi Keepers Society
www.MSBsection.co.uk

The Calypso Fish and Aquaria Club
London
www.calypso.org.uk

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Licorice Gouramis: *Parosphromenus deissneri*, top and center. *Parosphromenus quindecim*, bottom. From *AMAZONAS*, September/October 2012, featuring *Dario dario*, Nano Freshwater Tanks, and Assassin Snails.

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