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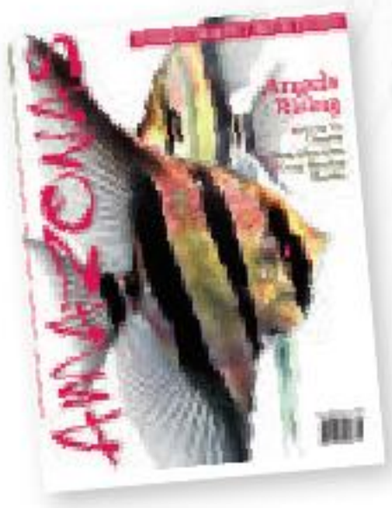
COVER:
Pterophyllum altum: Wild pair from the Rio Atabapo.
Photos: B. Kahl



AMAZONAS founding editor Hans-Georg Evers

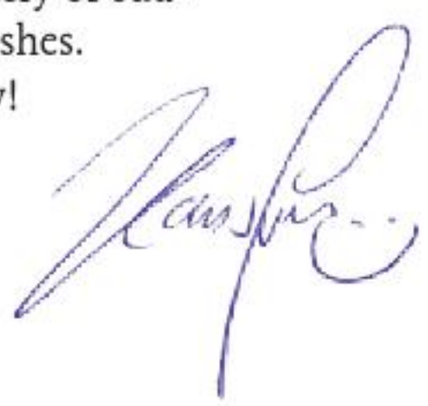
Dear Reader,

It has actually taken a lot of work to reach a point where we could present a classic genus to a public that is interested in more than just colorful pictures accompanied by the same old stale verbiage. Unfortunately, many classic aquarium fishes suffer from being considered "common" beginners' fishes and, hence, beneath the interest of advanced aquarists. But the freshwater angelfishes in the genus *Pterophyllum* are quite a special genus of cichlids. With just three recognized species, the group is easy to summarize, but also includes both easy-to-keep "bread and butter" fishes, with numerous exotic strains and cultivated forms, and rare wild forms that are often very difficult and time-consuming to keep and breed.

We want to use this issue to spread the word among aquarists who have been working extensively with angelfishes for many years and know what they are doing. That may sound highly contradictory, but it won't deter us from our goal of introducing these majestic fishes to our readers. We have deliberately placed the emphasis on the wild forms, in order to increase awareness of these beautiful fishes. In the past there have been real battles of opinion in certain circles, especially regarding the majestic Altum. So don't be surprised if some statements in the individual articles appear somewhat contradictory. One thing is crystal clear, however. Angels are gorgeous fishes for beginners and experts alike. I am quite sure that after reading our cover feature you will pay more attention the next time you find yourself standing in front of a tank of angelfishes.

We also have a couple of real stunners in this issue. The very attractive Paska's Blue-Eye has been tracked down and is being bred—and a new star in the mini-fish heavens has found its way into the aquarium. We take you with us for a look inside the fishrooms of Walter Hilgner, a truly passionate breeder of many desirable fish species and a former hobbyist who admits to losing the battle with one of his aquarium "addictions." And readers of our English edition will find an enlightening piece by Ian Fuller on the mystery of sudden death and the treatment of other maladies peculiar to Corydoradinae catfishes.

I wish you happy reading and continued enjoyment of the aquarium hobby!



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• *by Dr. Mark Sabaj Pérez—Special Report to* AMAZONAS

Damming the Río Xingu: field update

With the specter of an ecosystem-killing hydroelectric dam project moving ahead in Brazil, the eyes of many concerned observers, especially those interested in the fate of native fish species, are on the Lower Xingu River.

For two weeks, from October 3–17, I joined Brazilian colleagues on a fishing expedition to the Lower Xingu near Altamira, Brazil. (I am Collection Manager of Fishes at the Academy of Natural Sciences in Philadelphia.) During this time of year, the Xingu is at its lowest seasonal point, and many species of fish become crowded together, making them easier to find and catch.

The collecting group included Dr. Leandro Sousa, a professor at the Universidade Federal do Pará, Altamira campus, who is part of a team of Brazilian scientists conducting aquatic surveys of the Lower Xingu in the stretches that will be affected by the construction of the Belo Monte Dam. Dr. Mariangeles Arce, an expert on the molecular evolution of thorny catfishes (Doradidae), is also on the team; she recently completed her doctoral degree at the Pontifícia Universidade Católica do Río Grande do Sul in Porto Alegre, Brazil.

Expedition team (left to right): Edson, Zezinho, Dani, Dr. Mariangeles Arce, Dr. Mark Sabaj Pérez, Dr. Leandro Sousa.

Damming and diversion of the Río Xingu, below, will displace tens of thousands of indigenous people in the heart of the Amazon basin and threaten native stocks of fishes caught for food and export to aquarists.

Scobinancistrus aureatus, described by Burgess in 1994 from the Lower Xingu. Known as the Sunshine Pleco or Goldie Pleco, it is one of the species threatened with extinction by the Belo Monte project.

The expedition consisted of four separate trips. The first was a day trip by car to a tributary of the Río Penatecaua, a small, isolated tributary of the Amazon about 50 miles (80 km) west-southwest of Altamira on Route 230. The second was another day trip, this time by boat (*voadeira* in Portuguese), to a shoal made up of sand, gravel, and platelike conglomerates and a rocky outcrop in the Río Xingu about 9 miles (15 km) upstream from Altamira.

The third and fourth trips were also by voadeira. On the third we ventured upstream on the Xingu to its major left-bank tributary, the Río Iriri, and then proceeded about 9 miles (15 km) up the Iriri to a large waterfall, Cachoeira Grande. The fourth trip took us downstream of Altamira, into the large, bell-shaped curve in the Lower Xingu called Volta Grande (Big Bend) and as far as Cachoeira do Jericoá, about 34 miles (55 km) east-southeast of Altamira, where the Xingu suddenly drops through a series of powerful waterfalls. We also made a stop at the Río Bacajá, a small right-bank tributary of the Xingu. Two of the most skilled and respected pleco fishermen in Altamira, Dani and Edson, as well as our skipper, Zezinho, and our cook, Rai, accompanied us on the last two trips.

The expedition netted and preserved about 2,500 specimens, including tissue samples of about 350 individuals for molecular analysis, from a total of 11 sites. The pleco hunting was extremely good, with about 25 species recorded, most caught by Dani and Edson. Highlights included two species of *Scobinancistrus* (*S. aureatus* and *S. paRíolispos*), three species of *Baryancistrus* (*B. chrysolomus*, *B. niveatus*, and *B. xanthellus*), the rare *Leporacanthicus heterodon*, two species of *Hypancistrus*, *H. zebra* and one undescribed (L174), two or three *Spectracanthicus*, including one undescribed (L020), and a beautiful specimen of an undescribed *Pseudacanthicus* (L025).

The specimens were divided between and vouchered at the Academy of Natural Sciences of Philadelphia and Instituto Nacional de Pesquisas da Amazônia in Manaus, capital of the Brazilian state of Amazonas. The purposes of the expedition were 1) to collect additional specimens and tissue samples of undescribed species under study by Mark, Leandro, Mariangeles, and colleagues; 2) to take photographs of live fishes, their habitats, and the conditions of the river; 3) to test logistics and collecting gear for future expeditions to the Lower Xingu; and 4) to contribute to baseline estimates of fish diversity in vaRíous stretches of the Lower Xingu pRíor to its modification by the Belo Monte Dam complex. The expedition was funded in part by a generous donation from Julian Dignall and PlanetCatfish.

Dam construction in progress

Construction on the Belo Monte Dam complex appears to be progressing swiftly, despite legal challenges and the protests of indigenous tribes whose lands and livelihoods are threatened.

We did not visit the construction site, but caught a glimpse of the temporary low dam of rocks, sand, and mud being built across the entire channel in the upstream portion of Volta Grande (a site known as Pimental). Here the river channel is divided into a number of streams by islands and small shoals. The low dam has been creeping across the Xingu all year, and now only the largest section of the river, along the western bank, remains unimpeded. Leandro said that early in the construction, the Xingu overpowered the low dam in what was locally regarded as a big victory for nature. But since then, the dam builders have been the victors. From time to time, groups of indigenous peoples gather at the construction site to protest the dam. Their protests are largely peaceful and largely ignored.

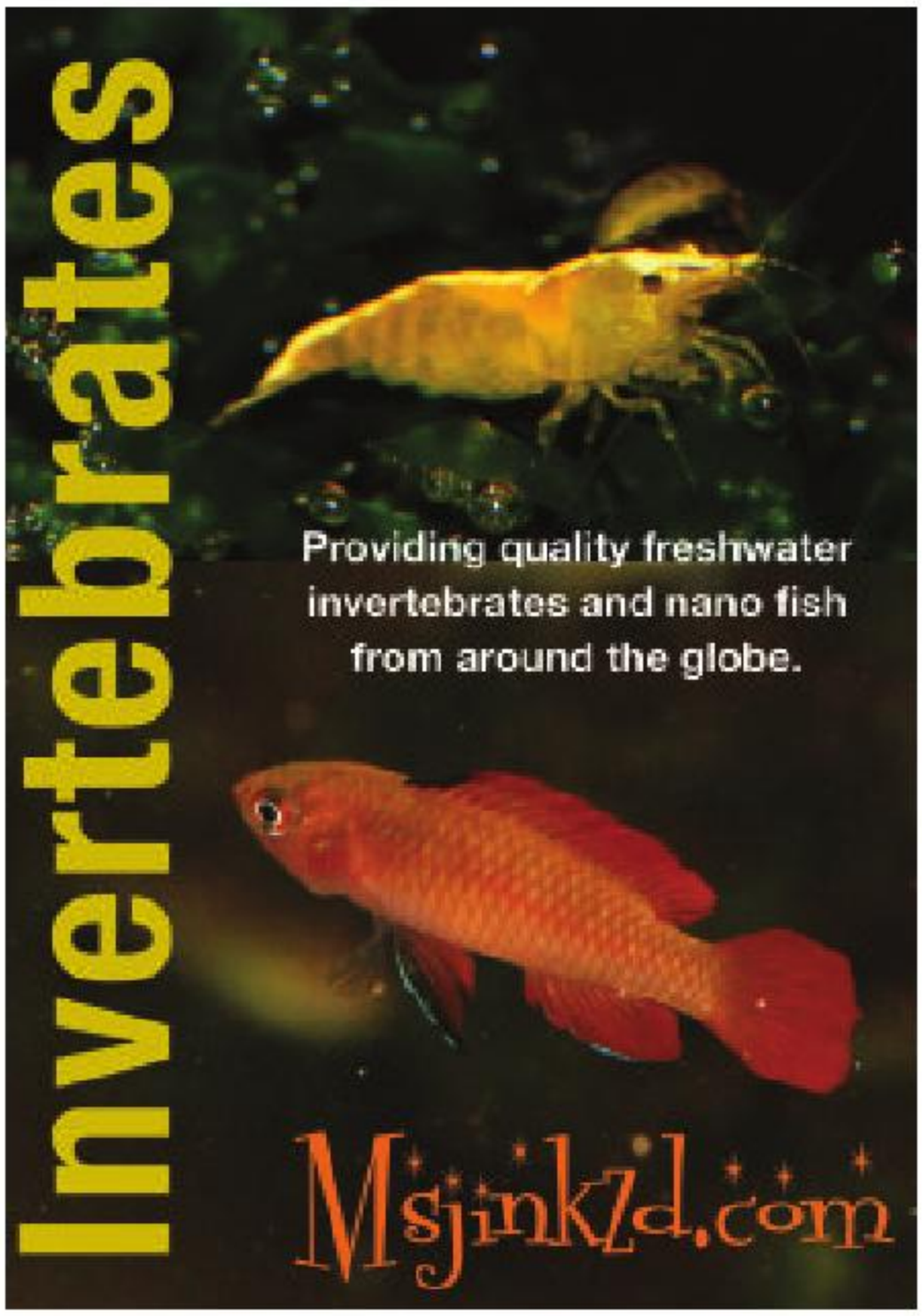
Top: Xingu version of *Peckoltia sabaji*, a species described by Armbruster in 2003 based on Essequibo specimens.

Bottom: New species of *Hypancistrus* (L174) to be described by Leandro Sousa, found along rocky ledges over 52 feet (16 m) deep. Deep water habitat may become scarce for such species after water is diverted from Volta Grande.

Toward the end of our expedition, the rainy season began and the Xingu started to rise. Presumably, construction of the dam will be suspended, given the increased flow of the river. Once the river subsides again next year, the low dam (assuming it remains intact) will not take long to complete. Eventually, a more permanent dam will be built at Pimental, impounding the Lower Xingu to form the Calha do Xingu Reservoir, which will extend upstream to about half the distance between Altamira and the mouth of the Río Iriri. From the reservoir, the Xingu's water will be diverted through two large canals being dug toward Belo Monte near the downstream limit of Volta Grande.

Some have estimated that more earth is being displaced for these diversion canals than was removed during the construction of the Panama Canal. The portion of Volta Grande that is not inundated by the reservoir will be effectively "short-circuited" by the canals. No one knows exactly how much water will be diverted through the canals to generate electricity via Belo Monte. Therefore, no one knows exactly how much water will remain to fill the complex labyrinth of narrow channels that make up the downstream portion of Volta Grande.

Experts estimate that Volta Grande will retain only one-third of the water it normally contains at flood level. In the low-water season, many of the shallow channels could become isolated and go completely dry, resulting in heavy losses for resident fishes and other aquatic organisms. One thing is for sure: much of the Belo Monte Dam complex will be completed soon...perhaps by the end of the next dry season.



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A new mailed catfish of the *Corydoras aeneus* group

by Erik Schiller • In September 2009 my friend Ingo Seidel told me that he had obtained a new mailed catfish with attractive yellow fins, which was slightly reminiscent of *Corydoras zygatus*. The good news was that the collecting locality for this "new species" was known. Jens Gottwald had caught the fishes at the Río Aripuaná in Brazil. This fish has received the code number CW 68 on Ian Fuller's *CorydorasWorld* site.

Above: Male *Corydoras* sp. CW 68

Corydoras zygatus, the Blackband Cory, comes from Peru, from the Río Huallaga system in the Río Santiago. However, locations are also known from the Río Pindo in Ecuador. Because the distances between these locations in Peru, Ecuador, and Brazil (Río Aripuaná) are extremely large, I originally called this new mailed catfish from the Río Aripuaná *Corydoras* sp. "Río Aripuaná". But because the species has now been classified as CW 68, this code number should be used instead.

Corydoras sp. CW 7 is another similar species. The precise location for this species is not known, but it is a bycatch with *Corydoras zygatus*. So these catfishes definitely don't come from Brazil!

Naturally, I was very interested, but my space is limited, with 25 aquariums. So for the time being, Ingo kept the small group of specimens. But because he had also acquired a large number of other new catfishes, there was no question of breeding the *Corydoras* from the Río Aripuaná right away. Two years passed before I picked up three *Corydoras* from Ingo in September 2011. Unfortunately, there was no longer any sign of the yellow fins, but in both sexes the dark stripe above the midline was readily visible. I received a trio of one female and two males—a good starting point for successful breeding.

I. SEIDEL

Spawning at low pressure

The *Corydoras* sp. CW 68 were given a 60-L (15-gallon) aquarium with fine sand and a large piece of bogwood as shelter. After good feeding with live food, the female rapidly developed eggs. These catfish were extremely retiring in their habits. I only rarely saw them at feeding time. That changed a little when I introduced eight *Nannostomus beckfordi*.

While many mailed catfishes change color during courtship and the spawning process, with the coloration of male specimens becoming bolder and that of females a little paler, this pattern is completely reversed in *Corydoras* sp. CW 68. After several water changes with cooler water, the base color of the males lightened up. The catfish were iridescent greenish below

Above: When they are about six weeks old and .75 inch (2 cm) long, a bluish iridescent spot appears on the young fishes' sides.

Below: The females of CW 68, with their plump body form, are particularly reminiscent of *Corydoras zygatus* from Peru.

I. SEIDEL

the midline. Under lateral lighting this makes a nice color combination with the post-occipital scute, which changes color to yellowish. The dark stripe becomes even more prominent in females. Excited swimming around in the evening during a period of falling barometric pressure made me hopeful. But early the next day, all the fish were once again resting quietly beneath the bogwood. After feeding them with live *Artemia* I went to work. Great was my jubilation when I came back to my fish room and saw that the corners of the aquarium were full of eggs. After collecting and transferring them to a separate container I counted around 80 eggs.

Problem-free rearing

The first larvae hatched after five days at 23°C (73°F). All the fertilized eggs (around 90 percent) hatched into catfish larvae. Another four days later the fry were managing freshly hatched *Artemia* nauplii without problems. Just a day after they started feeding the fry began to show color. A dark band developed, starting in the head region and running to the pectoral fin insertion. As a result the head appeared to be separated from the rest of the body.

After around five more days, several dark dots appeared along the back. After 14 days the head region, set off by the black band, looked more yellowish and created a contrast with the rest of the finely dotted body. There were four large, dark dots along the line of the dorsum, and a further row of smaller dots marked the midline, below which occasional additional dots could be seen. The size of the little catfishes was now around .5 inch (1.3 cm).

After a further 10 days, when the fish were almost five weeks old, the transparent base color was replaced by a yellowish shade. At this age the catfish averaged about .7 inch (1.8 cm) long. At a length of around .75 inch (2 cm) a dark, bluish, iridescent spot developed beneath the dorsal fin. This spot grew longer with increasing age. In this way the broad, dark band typical of *Corydoras* sp. CW 68 developed. And the yellowish-looking post-occipital scute also became apparent at this time.

Next time, I caught the Golden Pencilfish out of the tank and added an airstone to circulate the water vigorously in one corner of the aquarium. Two days later I was able to watch the *Corydoras* trio spawning. The eggs were distributed at random around the aquarium. Each time four to eight eggs were transported by the female in her pelvic-fin pouch and attached to a substrate. A day later the eggs looked milky. Again, there were around 80 of them.

Even though *Corydoras* sp. CW 68 isn't a miracle of color, it is still a further new species that we haven't ever been able to keep in our aquariums before.

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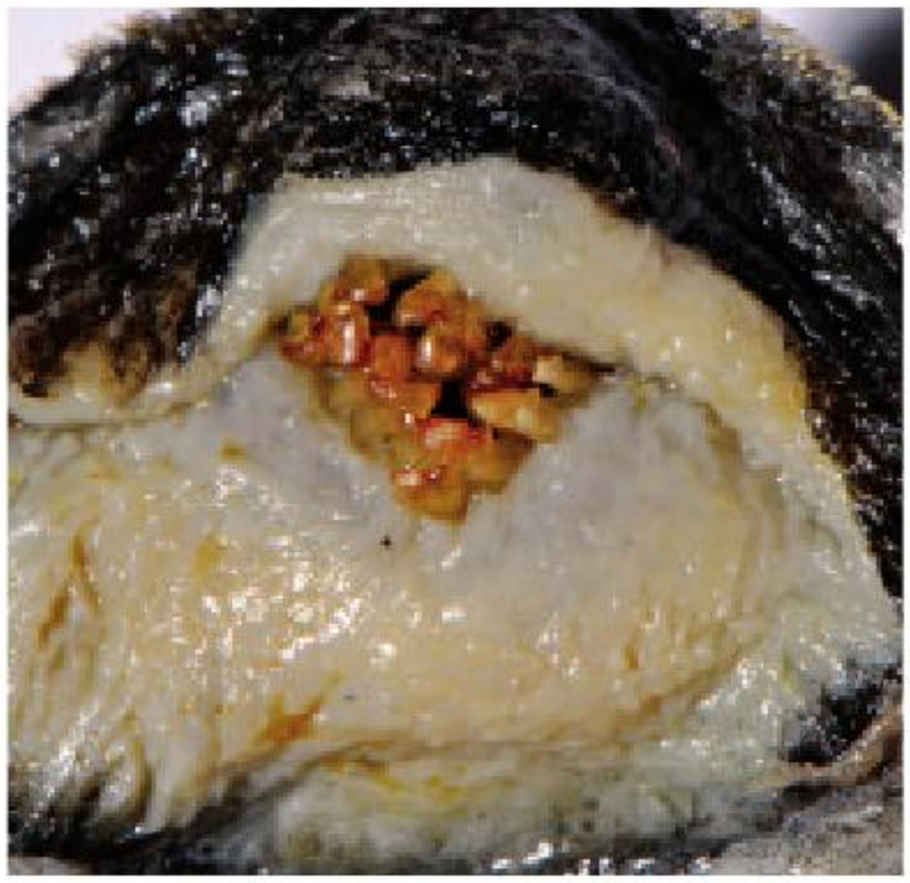
Above: Preserved specimen of *Peckoltia otali* from the Maroni River.

Right: Preserved specimen of *Panaqolus koko* from the Maroni.

Four new loricariid catfishes described from the Guiana Shield

article and images by Ingo Seidel • With the aid of a new molecular biological technique known as DNA barcoding, ichthyologists Fisch-Muller, Montoya-Burgos, Le Bail, and Covain have sought to clarify the phylogenetic relationships of a number of ancistrines of the *Panaque* assemblage from the Guiana Shield. In so doing they simultaneously described four loricariid catfish species so far unknown in the aquarium hobby and undertook a redescription of *Hemiancistrus medians*, the type species of its genus.

As an important byproduct of their research results, Fisch-Muller, Montoya-Burgos, Le Bail, and Covain (2012) undertook the long overdue validation of the genus *Panaqolus*, which for years has been regarded as a synonym of *Panaque* by leading ichthyologists (e.g. Armbruster 2004). It seems, however, that despite their very similar dentition, there are no close phylogenetic links between the two



Left: View of the unusual dentition of *Panaqolus koko*.

Right: View of the dentition and papillae of *Hemiancistrus medians*.

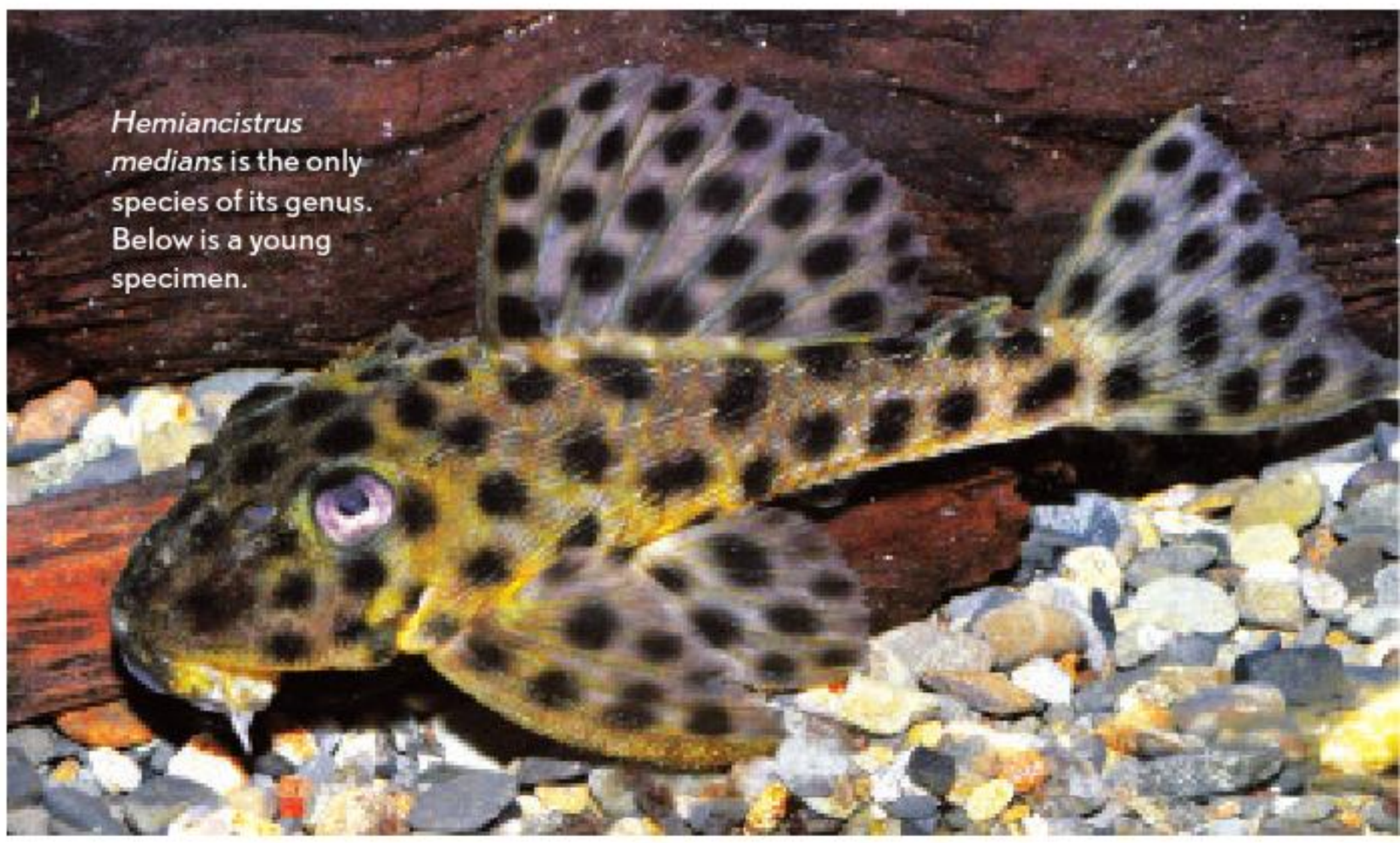
genera; instead, *Panaqolus* is thought to be very closely related to the genus *Peckoltia*, whose members are very similar in appearance and size.

New *Peckoltia* species

A total of three species of the genus *Peckoltia* and one *Panaqolus* species were newly described from French Guiana and Surinam. The new *Peckoltia simulata* from the River Oyapock, which forms the border between French Guiana and Brazil, is very similar to *Peckoltia oligospila* (also known as L 006) from the Brazilian federal state of Pará. The species is apparently not identical with the similar *Peckoltia* species L 055, which has purportedly been imported in the past from that river and has dark cross-bands on the caudal fin (which is dark-spotted in *P. simulata* and *P. oligospila*).

I am unaware of there being any specimens of this species in the aquarium hobby to date, and the same applies to the species *Peckoltia capitulata*, which is native to the River Approuage. Unfortunately, for this reason I am unable to provide pictures of these species here. So far both *Peckoltia* species are known only from specimens with a maximum total length of some 3–4 inches (8–10 cm), but that may not be the absolute eventual size of these species. *Peckoltia capitulata* possesses a somewhat more elongate body than *P. simulata* and likewise exhibits black spots, but these are absent on the head region and elsewhere widen into broad crossbands.

By chance I obtained a number of specimens of the other two new species, *Peckoltia otali* and *Panaqolus koko*, from my friend Jens Gottwald, who had preserved them for scientific purposes during a collecting expedition by Panta Rhei GmbH from Hannover. Both species occur together in the Maroni, the river that forms the border between French Guyana and Surinam. So I am now in the fortunate position of being able to illustrate at least these two species here.



Hemiancistrus medians is the only species of its genus. Below is a young specimen.

Peckoltia otali is another 3–3.5-inch (8–9-cm) long brown *Peckoltia* species with black spots connecting to form irregular bands. It is one of the smaller *Peckoltia* species in which males are very heavily bristled, and may be fairly closely related to two species well known in the aquarium hobby, namely L 038 and L 080. Hence it is not surprising that during the bar-coding, Fisch-Muller et al. established striking differences between this and the other two new *Peckoltia* species, which they classified as genetically fairly close to *P. oligospila*.

The species *Panaqolus koko* is likely to be the subject of future major discussion among ichthyologists, as it is a very unusual fish. When I examined this species in detail before the publication of its description, I classified it as a member of an undetermined genus, as the combination of body form, odontode (dermal tooth) growth, and dentition distinguished it from all other genera known to me to date.

I found its assignment to the genus *Panaqolus* very surprising, as all other members of the genus that I am aware of possess a broader body form and spatulate teeth with a single cusp. Only *Panaqolus maccus* purportedly (according to Schaefer & Stewart 1993) exhibits a certain variability in dentition when young, with a possible second cusp.

The new *Panaqolus koko* is uniform black-brown in color, with an unusually pointed head and slender form. All the specimens I have examined are thought to be half-grown and already have unusually striking odontodes such as I have never previously seen in any other *Panaqolus* species at this age. And while the teeth were spatulate overall, they were unusually large and possessed a second large lateral cusp. The species may attain a total length of around 4.3–4.7 inches (11–12 cm).

Is *Hemiancistrus* monotypic?

Ichthyologists have hitherto avoided differentiating the catch-all genus *Hemiancistrus* from *Peckoltia*; in the past it has been a depository mainly for assorted black-spotted armored catfishes that don't fit well in other genera. But Fisch-Muller et al. have established that *Hemiancistrus medians*, type species of the genus *Hemiancistrus*, is not closely related to *Peckoltia* and *Panaqolus*.

The authors believe the genus *Hemiancistrus* should be regarded as monotypic, as the other species currently assigned to this genus are probably not closely related to the type species.

Hemiancistrus medians is a very unusual loricariid, which may now also have been imported alive to Europe, probably for the first time, by Panta Rhei GmbH. This armored catfish, which grows to around 9.8 inches (25 cm) long, is most closely reminiscent of the members of the genus *Baryancistrus*, but has unusually large eyes, heavily ridged scutes on the sides of the body, and truly extraordinary papillae in the mouth cavity. The smaller specimens have noticeably fewer, but extremely large black spots on the body, and these become smaller and more numerous with increasing age. These black spots look very attractive on the yellowish-brown background.

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article and images by Hans-Georg Evers

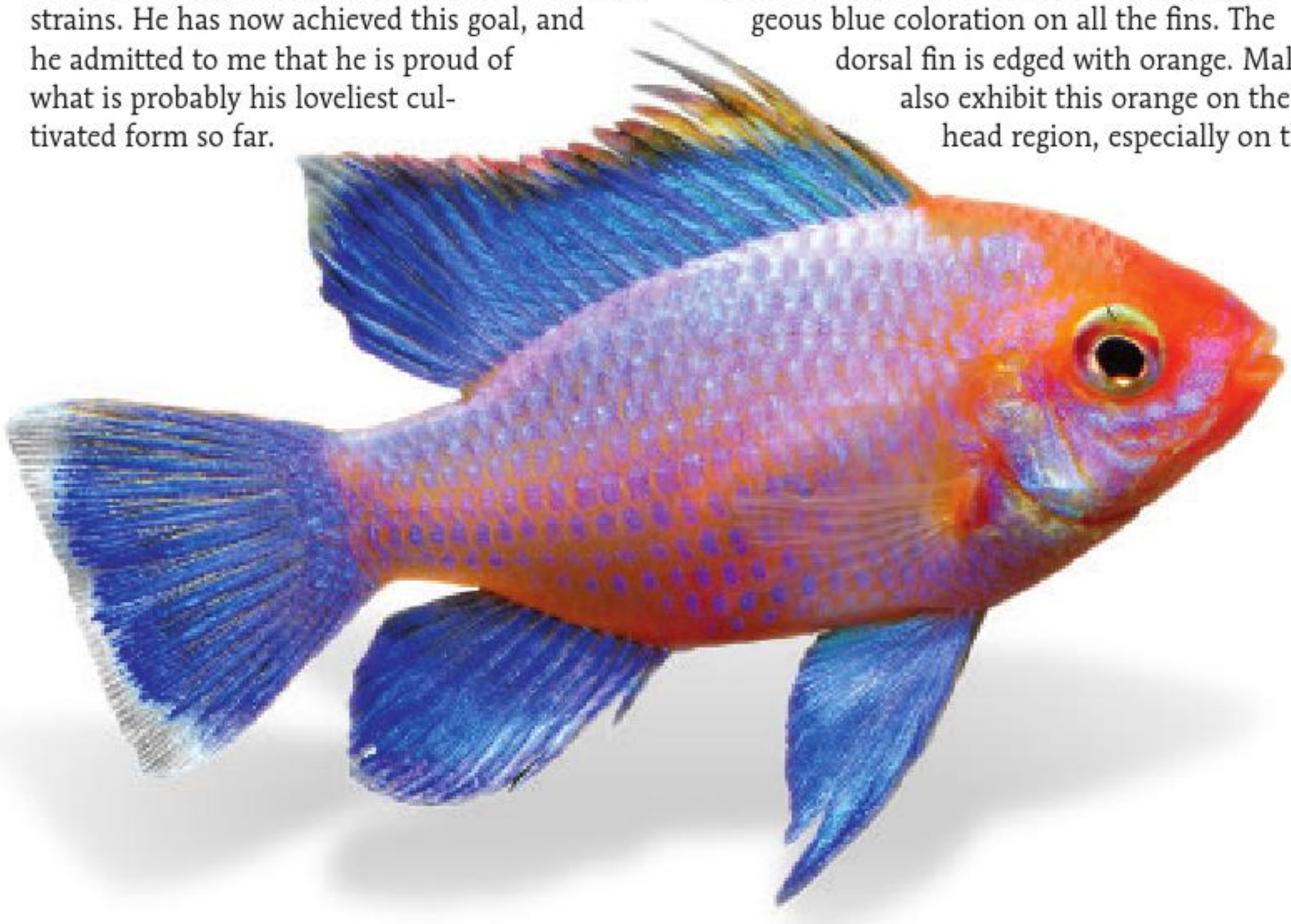
New Rams

Above: The "Super Neon Blue Gold" ram's behavior is similar to that of the wild form. The light falling from above accentuates the orange body color of the male in the middle.

Right: Lovely male of the new "Super Neon Blue Gold", bred by Peter Günnel.

The breeding skill of the well-known breeder Peter Günnel, Sr., has recently produced a number of very attractive new cultivated forms of the popular Butterfly Dwarf Cichlid *Mikrogeophagus ramirezi*. It seems he has gotten hooked on rams, with the goal of breeding new, stable forms from the "Electric Blue" cultivated form by in-crossing particularly high-backed German strains. He has now achieved this goal, and he admitted to me that he is proud of what is probably his loveliest cultivated form so far.

The "Super Neon Blue Gold" has been in the trade for some months now. I obtained a number of specimens of this lovely cultivated form, whose body base color is a brilliant orange-gold, from Peter via the firm Von Wussow Importe (Pinneberg). Adult males exhibit a powerful body form with iridescent turquoise-blue dots on the sides of the body and a gorgeous blue coloration on all the fins. The dorsal fin is edged with orange. Males also exhibit this orange on the head region, especially on the



"Wow!"

AMAZONAS
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The females, too, are a brilliant blue.

Male of the new "Perlmutt" cultivated form.

Females of the "Perlmutt" cultivated form positively shimmer.

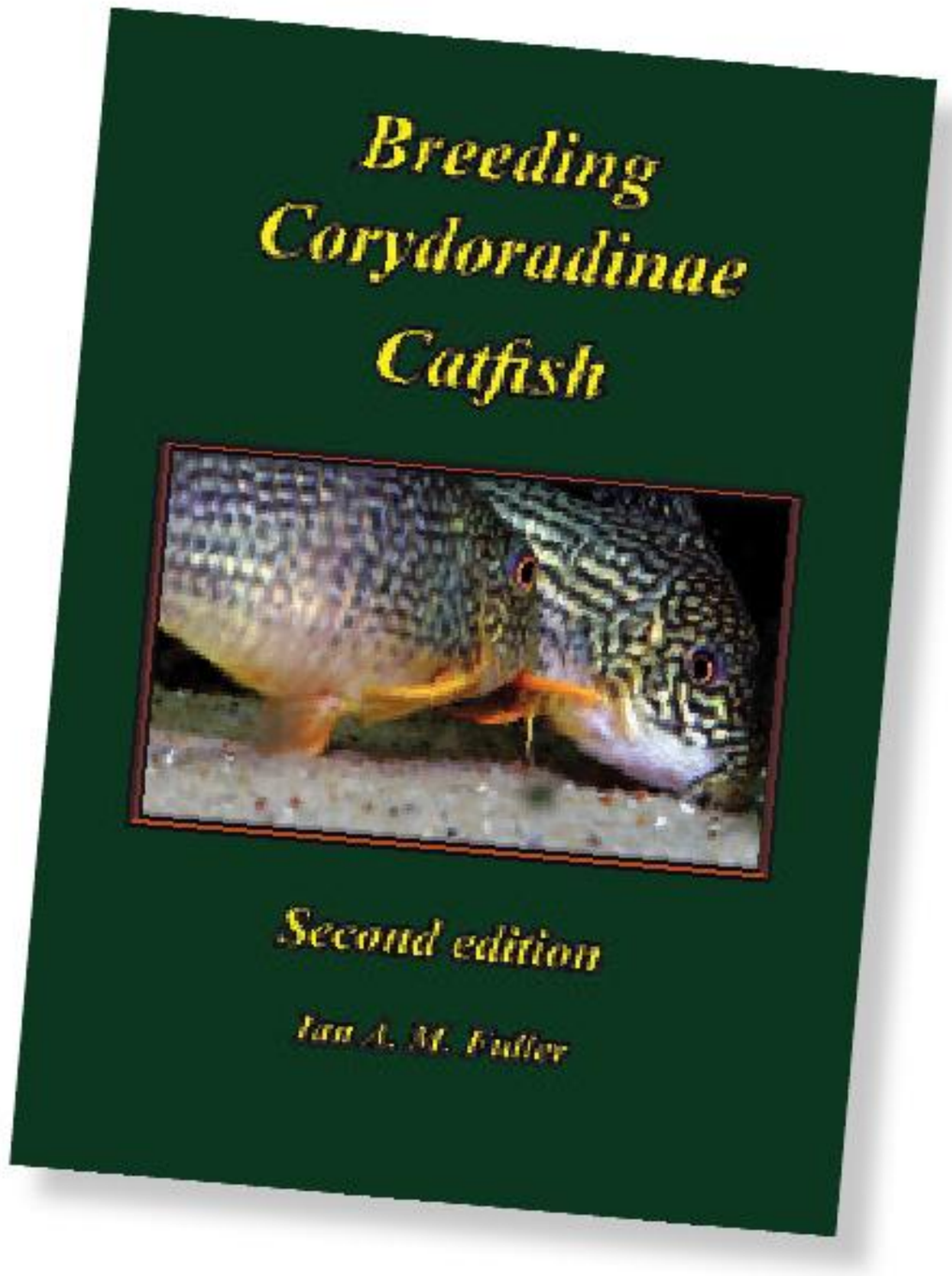
DANIEL CASTRANOVA (© NIH/NICHD)

forehead. Even the females of this lovely cultivated form are a brilliant light blue, but they don't exhibit the orange quite as strongly.

A second new form, also bred by Peter Günnel, is called *Mikrogeophagus ramirezi* "Perlmutt". Particularly in females, the mother-of-pearl effect is accentuated by a large number of highly reflective metallic scales.

We now have two more very attractive cultivated forms of the Butterfly Dwarf Cichlid to admire.

Who knows what the future holds next for rams?



Breeding Corydoradinae Catfish (Second Edition)
by Ian Fuller
Ian Fuller Enterprises • ISBN 978-0-9540872-3-4
Available from www.corydorasworld.com

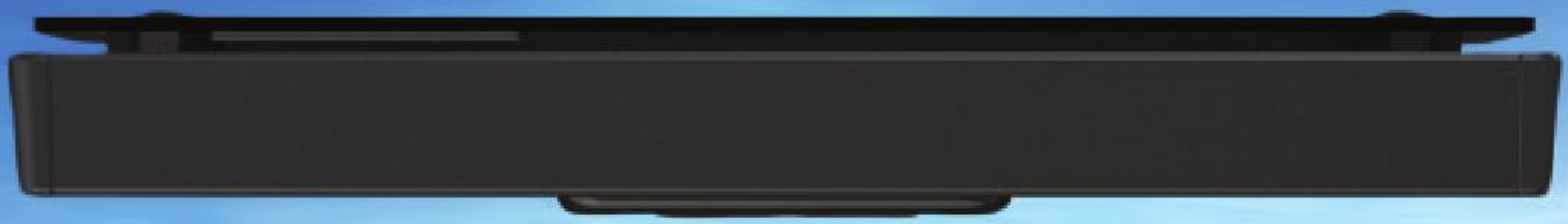
Book review • *by Hans-Georg Evers*

Ian Fuller, an expert on mailed catfishes whose fame extends far beyond his native England, has brought out an updated, greatly expanded and comprehensive edition of his 2001 book on breeding Corydoradine catfishes, which has long been out of print. The new self-published work can be ordered on the author's website. Fuller has obtained help from a number of other breeders, and the new book details breeding success and fry development in more than 150 species.

After an introductory section encompassing more than 30 pages on his breeding set-up, with numerous detailed photos, tables, and loads of information on methods of breeding mailed catfishes, we come to the 330-page heart of the book, the "spawning logs," where at least two pages are devoted to discussing each species using a clear and readable style.

In *Breeding Corydoradinae Catfish*, Ian Fuller has published a wealth of information on the reproductive biology of one of the most popular of all catfish families. It is a reference volume that should be of interest to every expert aquarist, not just fans of corys and their kin. Trends come and go in the aquarium hobby, but Ian Fuller has dedicated his life to the study of mailed catfishes. This big new book will be welcomed by many aquarists.

H.-G. EVERS



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Pterophyllum sp. 1 from the Río Nanay in Peru. The reddish brown spots on the flanks are typical. This species is also erroneously known as the "Peruvian Altum" because of its mouth form and body height.

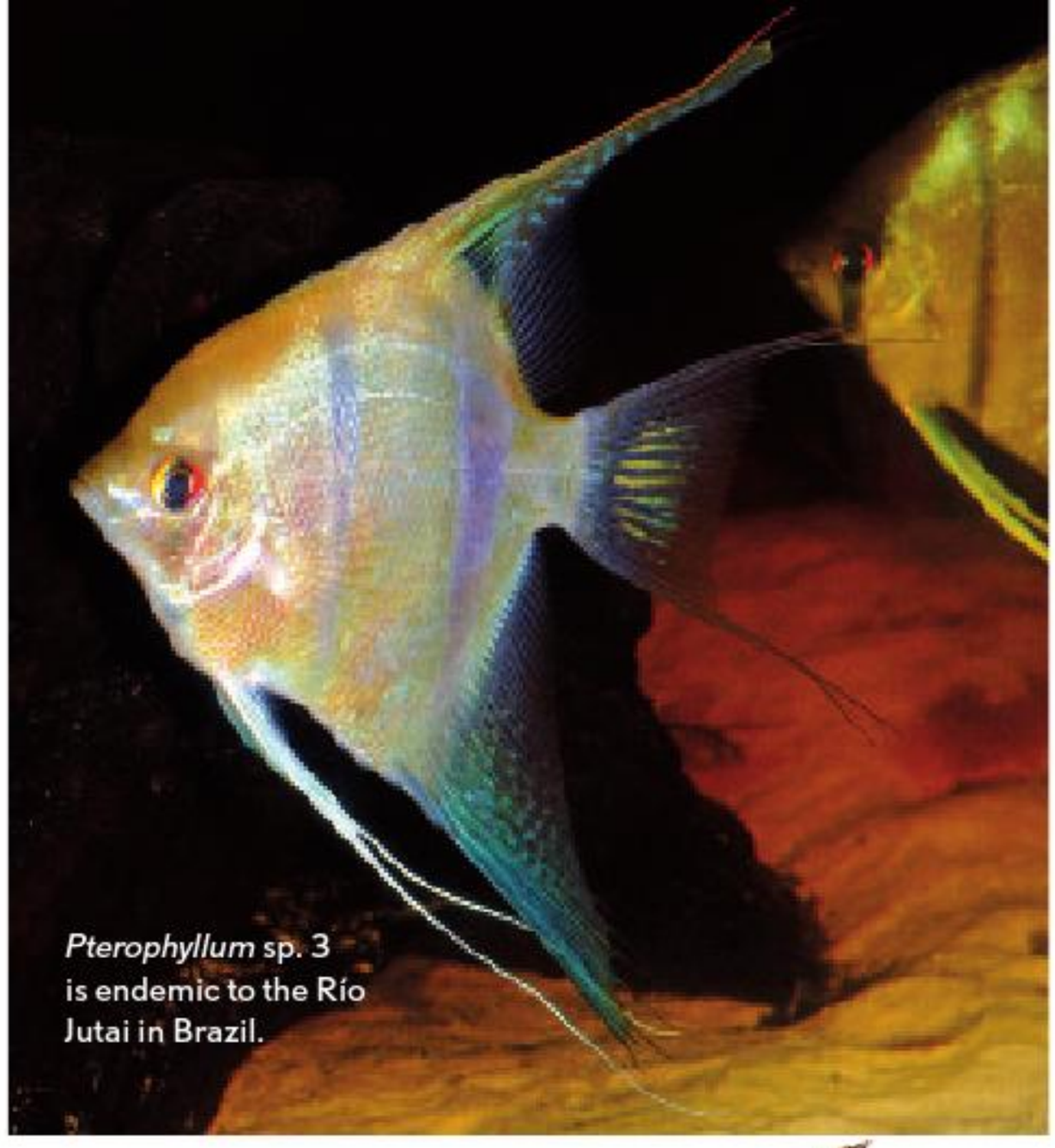
The latest on *Pterophyllum*: species and forms of angelfishes

by Heiko Bleher • For years there has been disagreement regarding the names of the various angelfishes we keep and the species to which they belong. Heiko Bleher shares his personal experiences and discusses the forms he has collected during his travels and imported for the aquarium hobby.

I first made the acquaintance of an angelfish in the early 1950s, in my mother's fish and plant hothouse in Frankfurt on Main, where, as a little lad, I had to keep out of the way of her free-roaming 6.5-foot (2-m) caiman. The daughter of Adolf Kiel, the "Father of Water Plants," my mother had inherited his passion for adventure and collecting wild things, something she passed on to me. It was also she who told me about the nomenclatural confusion attaching to the angelfish: in 1758, Carl von Linné, the father of the binomial scientific nomenclature of all species, assigned a number of fish species to the genus *Zeus*.

It was Schultze who first described the species *Zeus scalaris* in a work by Hinrich Lichtenstein (1823), from

N. KHARDINA



Pterophyllum sp. 3 is endemic to the Río Jutai in Brazil.

Pterophyllum sp. 5, from the Río Apaporis in Colombia.

a specimen from the Amazon River, purportedly from Barra, the mouth area of the Río Negro.

Nomenclatural confusion

But eight years later, Cuvier reassigned the angelfish to the marine genus *Platax* and called it *Platax ? scalaris* from "Bresil" (Cuvier & Valenciennes 1831). Next, Jakob Heckel erected the genus *Pterophyllum* (**meaning "leaflike fins"**) in 1840 and assigned the species the new name of *Pterophyllum scalaris*.

Then, François de Castelnau, a French naturalist, described another angelfish, which he collected from "Pará, Bresil" during his Amazon expedition (1842–1847), as *Plataxoides dumerilii* Castelnau, in 1855, although Heckel had established *Pterophyllum* as the name of the genus some 15 years before.

The confusion did not stop, as additional angelfishes were collected in the lower course of the Atabapo, an extreme blackwater tributary of the Río Guviare, which empties into the upper Orinoco. The Atabapo forms the border between Colombia and Venezuela for almost its entire length. In 1903 one of the best-known ichthyologists, Jacques Pellegrin, described the angelfishes caught there as a subspecies of *Pterophyllum scalare* and called them *Pterophyllum scalare altum*. The name related to the unusually high body form and size. To the present day this is the largest angelfish, the most majestic, elegant, and extraordinary of them all.

My mother told me that the most recently described angelfish, *Pterophyllum eimekei* Ahl, 1928, may be the smallest, and supposedly originates from the Río Negro. But later on, just like *P. dumerilii*, it was regarded as a synonym of *P. scalare*. However, in my opinion, *P. eimekei* is definitely a valid species.

Despite all the scientific attention, it wasn't until 1907 that an importation of live specimens from the lower Amazon region

I discovered this eight-banded species, *Pterophyllum* sp. 4, in the Brazilian Río Demini, a tributary of the middle Río Negro.

Pterophyllum sp. 2 from the drainage of Lago Paricatuba, lower Purus basin, in Brazil. Note the thread-like extensions to the anal fin.

Right: The striking coloration at the base of the dorsal fin is species-typical for *Pterophyllum* sp. 3 from the Río Jutai.

TOP LEFT: N. KHARDINA; OTHERS: H. BLEHER

Pterophyllum altum from the Río Ventuari in Venezuela, a tributary of the upper Orinoco.

Pterophyllum altum from the Río Atabapo, upper Orinoco basin, the type locality of the species.

Right: *Pterophyllum* sp. 6 lives in Lago Aiapuá, lower Purus basin, Brazil.

reached Germany. The first successful breeding took place in 1911, although the breakthrough in the breeding of the angelfish, then known as the "king of aquarium fishes," didn't take place until the 1920s. The first imports to the United States date to about 1915, with two unmated fish reportedly selling for $75, a princely sum at the time and roughly equivalent to almost $2,000 in current terms. Prices began to drop in the early 1920s when breeders in the both Germany and the U.S. found success.

New species descriptions

Between 1953 and 1955, my three siblings and I traveled with Mother through what was then the most impenetrable jungle on Earth, covering a distance of more than 1,550 miles (2500 km) under the greatest of hardships, in order to collect almost countless plants and fishes. For months on end we lived among natives, and I got to see my first wild angelfishes. Nowadays there is nothing but soybean plantations in the area—not a single virgin tree remains.

Ten years later I financed my studies in ichthyology at the University of South Florida by working at one of the largest aquarium-fish farms in the world. Because the people at Gulf Fish Farm were familiar with the work of my mother and the pioneering work of my grandfather, I was asked to set up a unit for propagating aquarium plants and breeding fishes. Two buildings were made available to me. Orders, particularly for angelfishes, poured in. After some deliberation, a number of alterations, and the establishing of large ponds for the breeding of *Cyclops* and *Daphnia*, I was producing more than 10,000 angels a week, and within a month they attained a body diameter of around 1.5 inches (35–40 mm), a saleable size.

Ross Socolof, the owner, was the person who introduced me to the Altum Angelfish, but it was another five years before I saw these incredibly beautiful angelfishes, whose fins can grow up to 17 inches (45 cm) high, and catch some small specimens. Starting in 1970 I imported and sold this species worldwide and made *Pterophyllum altum* accessible to the aquarium hobby, zoos, and enthusiasts.

In 1963, ichthyologist Jean-Pierre Gosse described *Pterophyllum leopoldi* from the Río Solimões. However, this angelfish also occurs in the Río Negro, and in 1965 I recorded it in the Manacapuru region, where I also collected the Red-Back Angelfish and the discus that later became known as the Royal Blue. In those days, most aquarists weren't so interested in wild-caught angels; tank-breds predominated. In ad-

TOP: AQUAPRESS/H.-J. MAYLAND; OTHERS: H. BLEHER

dition, it turned out that the Red-Back Angel hardly ever displays its bright red color under less than optimal maintenance, and usually looks rather like *Pterophyllum eimekei*.

My Manacapuru-Amazon adventure was the first of over 400 collecting trips I have made to the Amazon region, where I have always kept an eye out for angelfishes. As recently as December 2011 I recorded a variant in a lagoa a long way from the Río Yavari (which forms the boundary between Peru and Brazil).

Forms and species

Here I will list the forms of angelfishes that I have recorded over the course of many years. They include what are possibly new species, and they are certainly distinguishable from one another on the basis of external appearance.

***Pterophyllum* sp. 1:** This angelfish is found only in the Río Nanay drainage and is clearly recognizable by the black spot situated dorsally below the start of the long dorsal rays and extending vertically on the dorsum. In no other angel is this so distinctly expressed. In addition, this form is almost always characterized by its rust-brown spots, sometimes distributed all over the body; the slightly upturned mouth (which leads to its sometimes being confused with *P. altum* and known as the Peruvian Altum in the aquarium hobby); and the five or six reddish stripes on the dorsal and caudal fins.

***Pterophyllum* sp. 2:** So far, I have been able to find this angelfish only in the Lago Paricatuba drainage in the lower Purus basin. It is distinguished from all others by the veil-like prolongation of the anal fin (this is undoubtedly a good place to look for the origins of all veil-finned angels). It always has seven stripes on the dorsal fin and seven running irregularly across the caudal fin. As in the majority of angelfishes, the stripes on the anal fin are rarely expressed.

***Pterophyllum* sp. 3:** I first found this splendid angelfish many years ago (1997) in the Río Jutai (Amazonas State), and only there. It is readily recognizable by the two striking black spots (sometimes merging into one) on the

Above: *Pterophyllum altum* from the Río Inirida in Colombia.

Below: This *Pterophyllum scalare* from the Río Negro is often sold as tank-bred *P. altum* in the aquarium hobby.

H. BLEHER

base of the dorsal fin. These spots are almost always surrounded by bright blue. This angel always has a red eye and the mouth is turned slightly upward. There are six or seven stripes visible on the dorsal fin, while those on the caudal fin are only rarely apparent.

***Pterophyllum* sp. 4:** To date I have caught this form only once, and that was in the Río Demini drainage (a tributary of the Río Negro). It is the only angel I have found so far that exhibits eight striking bands.

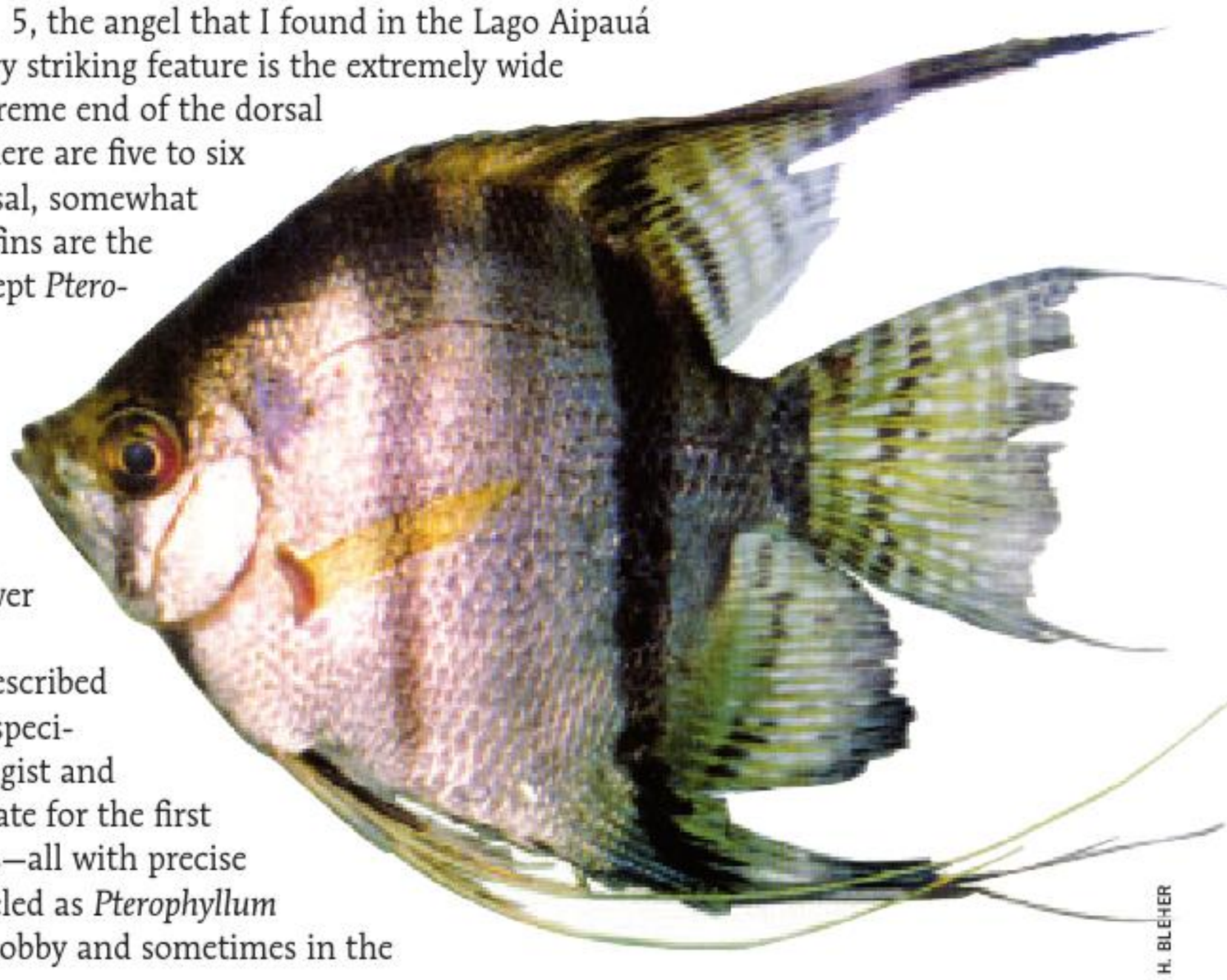
Pterophyllum sp. 5: This angel, which I found in the ichthyologically unexplored Río Apaporis (Colombia), is distinguished from all other angelfishes by its small number of dorsal-fin rays. Other differences include its large, silvery scales, the striking, large humeral spot immediately behind the eye, and the very irregular eight or nine stripes, often more like spots, on the dorsal fin. By contrast, the caudal fin has only three to four broad reddish stripes.

***Pterophyllum* sp. 6:** Like *Pterophyllum* sp. 5, the angel that I found in the Lago Aipauá (Río Purus basin) has larger scales. But a very striking feature is the extremely wide posterior black band extending from the extreme end of the dorsal to the last ray of the anal fin. In addition, there are five to six broad black stripes clearly visible on the dorsal, somewhat less striking on the caudal fin. The pectoral fins are the longest I have ever seen in any angelfish except *Pterophyllum altum*.

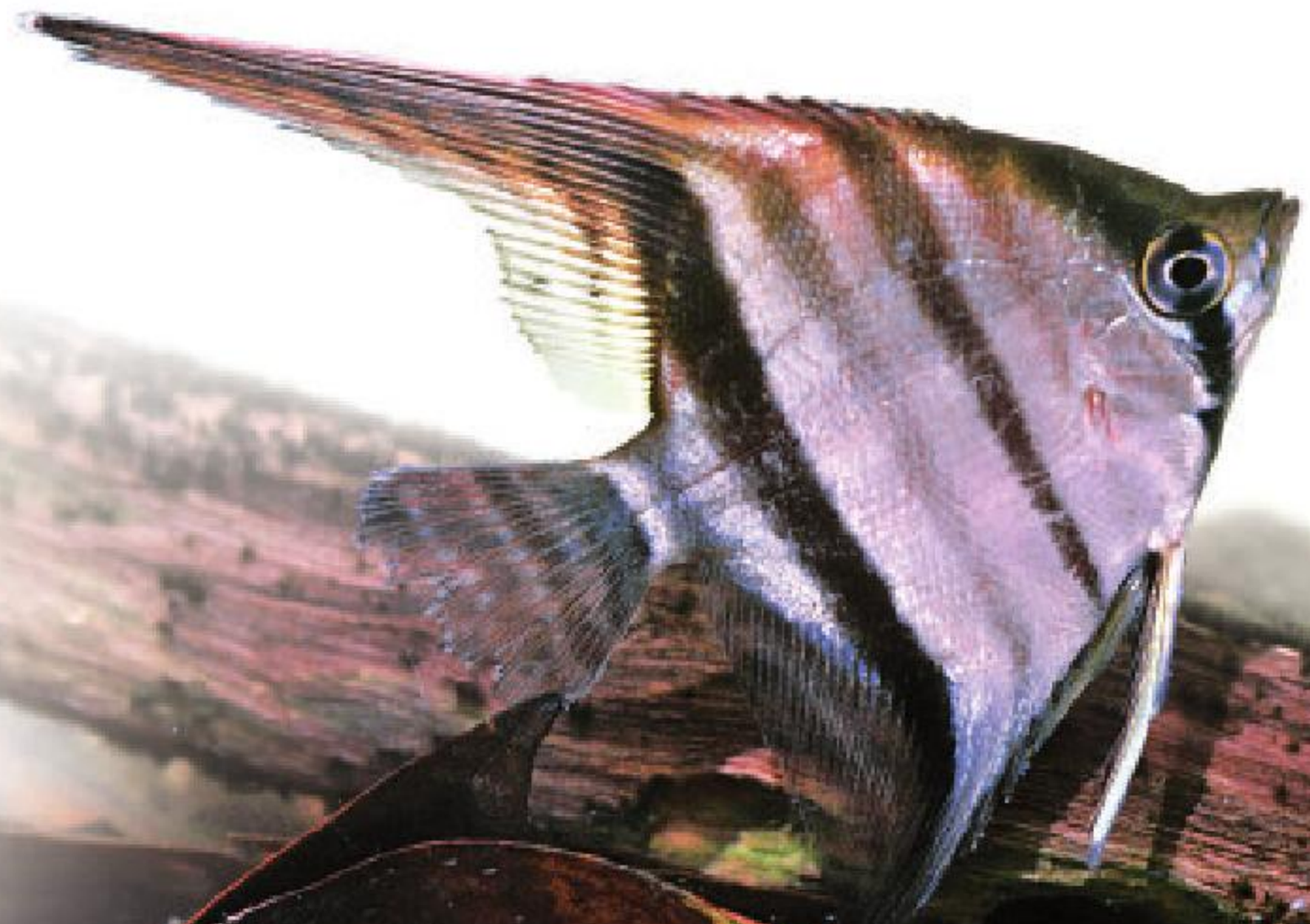
***Pterophyllum altum*:** This species was described by Pellegrin in 1903. Natasha Khardina and I have examined the specimens in the Paris Museum (the jar apparently hadn't been opened since 1903). The three specimens originated from the lower Atabapo, Río Orinoco, Venezuela.

***Pterophyllum scalare*:** This species was described by Schultze in 1823 on the basis of a single specimen collected by M.H.C. Lichtenstein, zoologist and first director of the Berlin Zoo. Here I illustrate for the first time the variants that I assign to this species—all with precise collection site data. This species is often labeled as *Pterophyllum altum* (Río Negro Altum) in the aquarium hobby and sometimes in the

Pterophyllum scalare from French Guiana, possibly a distinct species?



Pterophyllum scalare from the Río Negro in Brazil.



TOP: AQUAPRESS/PLANQUETTE; BOTTOM: H. BLEHER; OPPOSITE PAGE, BOTTOM RIGHT: N. KHARDINA; OTHERS: H. BLEHER

The Red-Shoulder Angelfish from the Río Arapiuns, a tributary of the lower Tapajós, is classified as *Pterophyllum* cf. *eimekei*.

Pterophyllum cf. *eimekei* from the Río Javari, Peru.

Pterophyllum cf. *eimekei* from Lago de Serpa in Brazil. The markings of this fish match the description in the work by Ahl (1928).

The Red-Back Angelfish from Lago Manacapuru in Brazil is likewise to be assigned to *Pterophyllum* cf. *eimekei*.

Freshly caught *Pterophyllum leopoldi* from the Río Negro, Brazil.

scientific literature. Most, if not all, of the so-called *P. altum* cultivated forms can be traced back to this scalare variant. Perhaps the real *P. altum* from the Río Atabapo is being bred for the first time as I write these words. The fishes I have seen worldwide to date under the name *P. altum* are not the same as the majestic fishes that I was the first to import.

Pterophyllum eimekei: This angel was described by Ahl in 1928. It was described from the lower Río Negro and later declared a synonym of *P. scalare*. I am, however, of the opinion that this, the smallest of all the angelfishes, should be regarded as a valid species. Because this is not the place to make the case for taxonomic changes (that should be reserved for a scientific publication), the form is presented here under the designation *Pterophyllum* cf. *eimekei*.

Pterophyllum cf. *eimekei* from the Río Cuiuini, often called the Santa Isabel Angelfish in the aquarium hobby, is notable for its red fins.

I am sure that it has the largest distribution in the middle and lower Amazon basin. All the so-called Red-Shoulder and Red-Back Angelfishes from the Manacapuru, Cuiuni (aka Santa Isabel), and Tapajós should also be assigned to this form.

Pterophyllum leopoldi: This angel was described by Gosse in 1963. The type locality is "Furo du village de Cuia, left bank of Ro Solimões, ca. 90 km upstreams [sic] of the Manacapuru, Brazil," but I have also recorded it elsewhere in the Solimões and Río Negro. This angelfish, which doesn't grow all that large, is immediately recognizable by its downturned mouth and broad, dark shoulder spot.

I hope that I have managed to give a good summary and inspired further clarification of the different variants, species, and forms.

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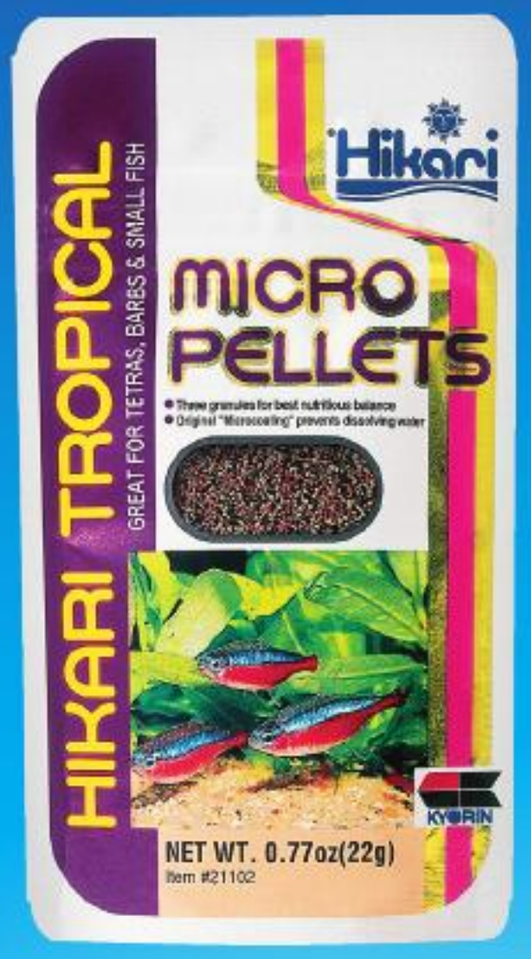

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A life with angels

This specimen of the Blue Angel demonstrates very nicely that it is probably a back-cross with a White Pearl Angel, as evidenced by the change in the scales on the flanks.

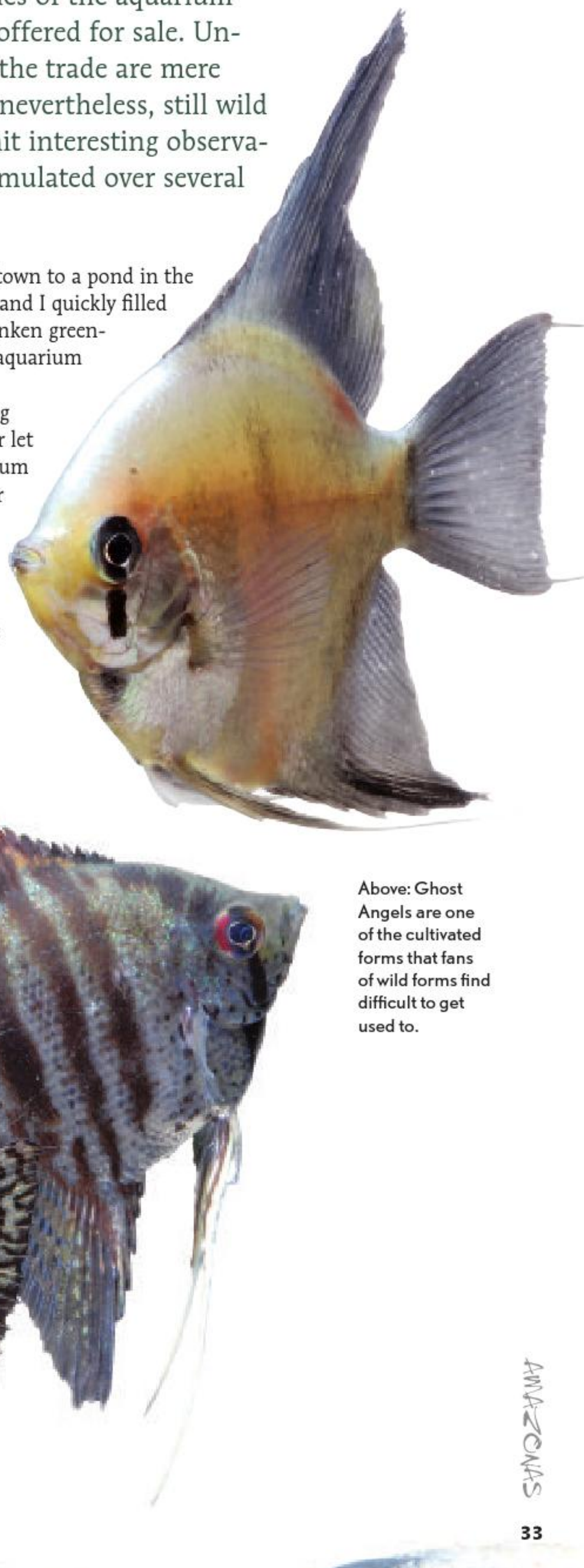
A sight that has fascinated me all my life. My living-room tank is home to a group of *Pterophyllum* cf. *altum* from the Orinoco.

by Bernd Schmitt • Angelfishes are among the classics of the aquarium hobby, and a wide variety of cultivated forms are offered for sale. Unfortunately, many of the specimens being sold in the trade are mere shadows of the angelfishes of the past. There are, nevertheless, still wild strains that not only look attractive but also permit interesting observations. Bernd Schmitt relates his experiences, accumulated over several decades of maintaining angelfishes.

As a 10-year-old boy, I made two pilgrimages every week from our town to a pond in the next village. The pond contained bright-red water fleas (*Daphnia*), and I quickly filled my little bucket with them. My curiosity was often aroused by a sunken greenhouse visible behind some bushes near the road, where, I learned, aquarium fishes were being bred.

When I first descended the steps into this bubbling and gurgling paradise, my life changed, and the aquarium hobby's pull has never let me go. At the rear of the greenhouse stood what was a huge aquarium in those days, with a stout steel frame. In this tank there was a pair of angelfishes, surrounded by a shoal of .75-inch (2-cm) fry. The aquarium I had then was too small to keep these splendid fishes, but that changed later on, and there have been only a few interruptions in my involvement with these fishes.

Back then there were differing opinions regarding the scientific names of these fishes, and that is still the case—probably because



Above: Ghost Angels are one of the cultivated forms that fans of wild forms find difficult to get used to.

Zebra Angels, one of the most popular cultivated forms, are bred in large numbers by professional breeders.

H.-G. EVERS

Above, left to right:

Over the generations, this strain of what used to be the Golden Angel has developed into more of a "Silver Angel" through lack of selection for color.

I have been breeding this Blue Angel for a long time.

A splendid Koi Angel male, bred by the Wilhelm family.

Short and splayed ventral fins, short dorsal fins, and poor growth are, unfortunately, all too common. Poor-quality specimens like this one reduce the majestic angelfish to an almost circular form and shouldn't be allowed into circulation.

Right: True Black Angels are rarely seen nowadays, but the "Half-Black" cultivated form is very popular.

of their vast distribution region. The discovery of more new local forms, coupled with a lack of any serious systematic study of this wealth of species (and not only in *Pterophyllum*), results in a rough but by no means definitive picture, so I will largely refrain from systematic arguments—they would be beyond the scope of this article and would contribute nothing new.

When I was a young boy, it was enough to know that my angelfishes sailed through life with the scientific name *Pterophyllum scalare*. I was also immensely proud of being able to pronounce the name correctly (TAIR-oh-FY-lum skuh-LAR-ee). Even the discovery that there was another, smaller species, *Pterophyllum eimekei*, didn't particularly bother me; very soon it was thought these two forms couldn't be separated. They were merrily crossed with each other, even in the absence of imports.

Veiltail, Smoke, and Ghost

As it turns out, angels have a high potential for changes in finnage and coloration. The first Veiltail Angels, which came from a breeder in Gera (Thüringen), have probably passed into oblivion today—heaven be praised! Veiltail Angels brought their breeders a good price, since nobody cared about things like deformity in those days. Black Angels followed, but these soon showed not inconsiderable signs of degeneration. And the same was true of a series of black versions of other species. In *Hoplosternum*, for instance, black specimens were regularly blind. It was also not uncommon for pure black specimens to be infertile.

Crosses between the Black Angel and the original form produced Smoke Angels. People repeatedly resorted to these Smoke Angels in order to avoid deformed specimens or completely unviable embryos.

During a trip with Dr. Hans-Joachim Franke to what was then Czechoslovakia, at the end of the 1960s, we discovered the Marbled Angel at a friend's house. Jochen brought some back, as he made his living from breeding fishes, and they sold well. I didn't get involved—I didn't think these cultivated forms could ever compare with the wild forms.

Soon thereafter, Franke crossed the Marbled Angel into the Black Angel, so as to revitalize the Black strain in this way. That is the reason why, when you breed with Black Angels nowadays, there are always Golden Angels among the offspring. They probably all go back to this strain. In those days, homozygous strains—that is, fishes that breed true—were regarded as an expensive luxury, but that was the only way to obtain 100 percent black individuals.

But the development of cultivated forms continued unabated. The potential was far from exhausted: Ghost Angels, Zebra Angels, Half-Moon Angels, White Angels (so-called "White Pearl"), Blue Angels (apparently a back-cross with White Pearl, as they sometimes exhibited the same changes in scalation), and Red Angels. The Red Angels came about through intensive breeding work by Frank Wilhelm in Kamsdorf (Thüringen), who used long-term selective breeding to produce Koi Angels and "Red Devils" from the Marbled Angel. He even obtained pure red specimens, although he was only partially successful in fixing the red color on the belly region of the fishes.

Below: On the rear half of the body, this form still has the "Smoke" component, a formerly popular cultivated form.

Mass production

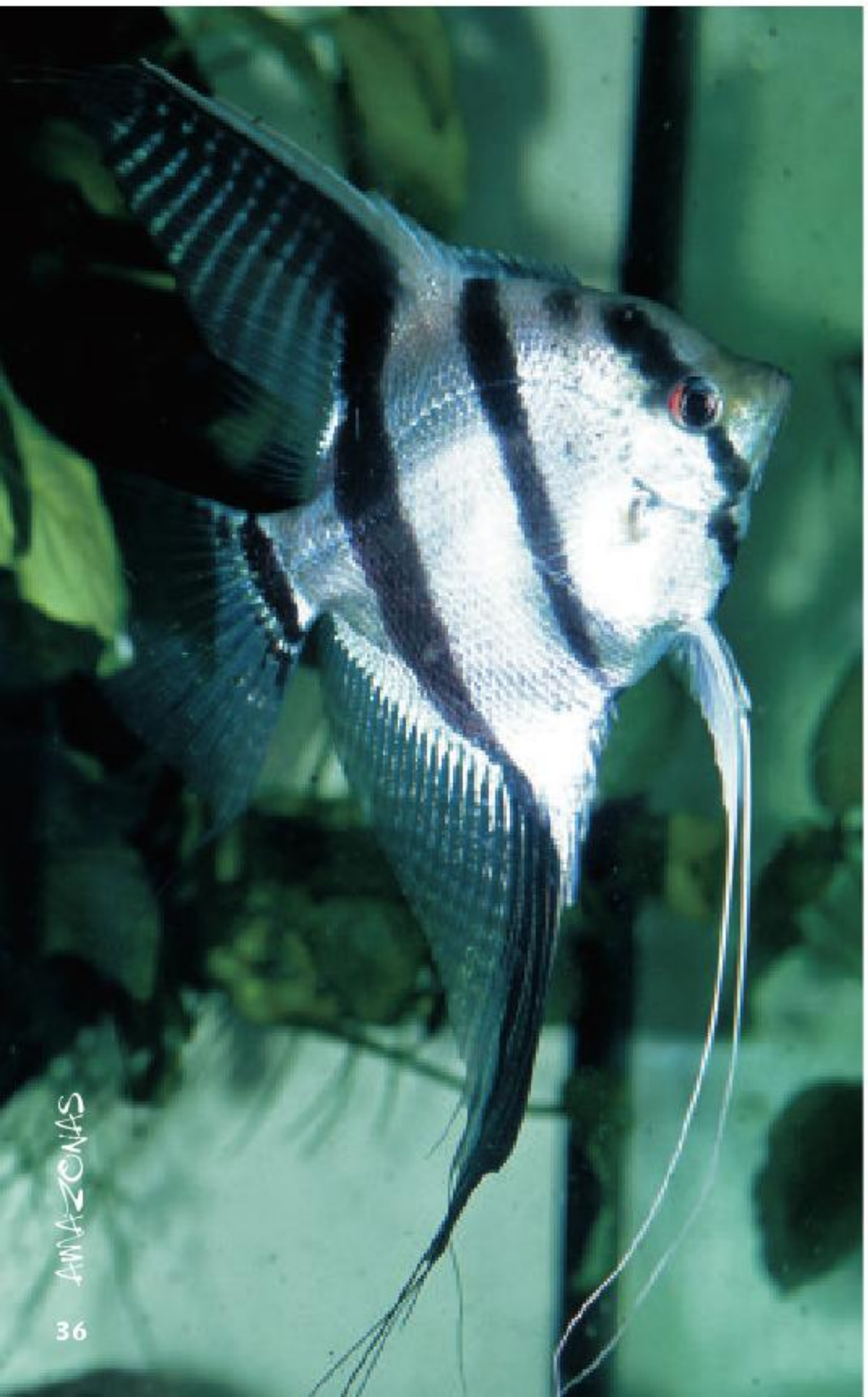
Ever since people started keeping fishes for aesthetic reasons, they have disagreed about what makes an attractive cultivated form. A "Red Devil" can be a real sight for sore eyes, but "can" is the operative word. Many of the fishes sold as angels in the pet trade today have had their wings severely clipped. Their form is only vaguely reminiscent of the unique original fish. Dorsal and anal fins are mere stumps, the ventral fins often often twisted like corkscrews. The colors and markings of these fishes are faded and washed out.

The cause of this is usually rearing under cramped conditions and/or an unbalanced diet. Infrequent or insufficient water changing is usually involved as well. This type of "mass production" never produces optimal specimens. Many other fish species likewise fail to thrive under such inadequate rearing conditions, a few as badly as angels. It also takes several genera-

H.-G. EVERS

tions to produce good fishes from such degenerate stock. Deformity of the ventral fins almost always indicates artificial rearing and the use of Trypaflavine (Acriflavine). This fungicide, frequently used as a medication for certain diseases in our fishes, is a mitosis toxin—in other words, it prevents cell division and thus causes damage during development of the embryo. In addition, it is classed as a carcinogen because of this property and may not be used as a medication in the production of food fishes.

Above, left: Angels are bred in the thousands by large breeding enterprises like this one in Asia.



If angelfishes are to be reared artificially—and a professional fish breeder quite simply has to do it that way—then methylene blue should be used. It is a relatively mild oxidant and causes no damage when used at light-blue levels.

Of course, the crowning achievement is to have angels practice brood care. But that doesn't always happen right from the start. The prerequisite is a fully compatible pair that has formed from a group. If the aquarium is large enough and well arranged, the rest of the group can generally remain in the tank. This will serve to stimulate the brood-care instinct of the pair. Naturally, such broods are blessed with far fewer fry, but the sight is more than adequate compensation.

Above, right: This Half-Black Angel (upper corner of tank) at a breeding farm in Singapore is diligently tending its young, despite the low water level, and attacked the approaching photographer. This demonstrates that the brood-care instinct is generally retained, even in professional hatcheries.

Peruvian Altums

Over the decades, numerous, mostly wild-caught populations have passed through my tanks. I have had some strange experiences with the so-called Peruvian Altum from the Río Nanay. They

Left: Old male Peruvian Altum. Unfortunately, the red-brown dots on the body have been obliterated by the camera flash.

TOP: H.-G. EVERS; BOTTOM: H.J. AUGUSTIN

Tank-bred offspring of my Red-Back Angels. These fish need lots of space, plenty of food, and good water if they are to grow into such splendid specimens.

Right: Red-Back Angels from the Manacapuru spawning on a suspended plastic tube.

Below: Group of "Red Devils", an intense red-orange cultivated form developed from the Koi Angel.

are named for their steep upper head profile, although they have nothing to do with the *Pterophyllum altum* found in Venezuela and Colombia. I selected a number of specimens from an import consignment and soon had young. Then suddenly, in the second brood, four youngsters turned up with a flesh-colored to reddish base color, interrupted only by a few rather small black markings. The eyes were dark, so they weren't albinos, but probably xanthic specimens. All four were females. They were hardly full-grown before the black speckles developed into very obvious tumors, and the fishes died within a short time. No other brood ever produced specimens like this.

MIDDLE: H.J. AUGUSTIN; OTHERS: H.-G. EVERS

Unfortunately, the tank-breds became increasingly more aggressive, and specimens acquired from aquarists who had obtained them from me as youngsters brought no improvement. When the male killed the female even in a 6.5-foot (2-m) aquarium, I finally decided to give up.

Red-Back Angels

I had high hopes of a new strain: Red-Back Angels from Manacapuru. It was incomprehensible that such a gorgeous fish could have remained unnoticed for so long by collectors so close to Manaus. The fish were not only gorgeous, but without doubt the most peaceful angels ever to swim in my tanks. I kept a group of 11 individuals in a 210-gallon (800-L) aquarium, with a few *Ancistrus* looking after the bottom region.

It happened that three pairs spawned simultaneously on plastic tubes suspended in the tank no more than a foot (30 cm) apart. All the pairs were shepherding their broods, and I even observed fry leaving their own parents and swapping broods.

I find it remarkable that these Manacapuru Angels apparently don't live to be as old as those from other strains. After just two or three years they already showed signs of aging, and the intervals between spawns became increasingly longer. Unfortunately this strain is also becoming less common. I had hoped that such splendid fish wouldn't disappear through crossing into the general mish-mash, but I am already seeing "Manacapuru Angels" that are no such thing on sale in many places. The reason is probably the lack of patience common in breeders; these fish aren't easy. They have a particular need for lots of rearing space, if you want to rear attractive, high-backed specimens.

Surinam Altums

Some years ago, a form of angelfish with red-brown spots arrived from Surinam. They were termed Surinam Altum "Red Spotted". These splendid angels with blue-violet fins had nothing to do with Altums, although growing juveniles looked very similar. But how did they get to Surinam? Arend van den Nieuwenhuizen told me that once upon a time, a consignment of fishes was left stranded in the capital, Paramaribo, after a plane from Manaus stopped off there. Out of pity for the fishes, the entire consignment was tipped into a lake near the airport, where there are now said to be Cardinal Tetras and angelfishes. Could the fish in my aquariums be those?

Wherever they came from, they are beautiful fish, although initially they presented huge problems. Individual wild specimens kept suffering dreadful breakouts on the head and below the dorsal fin. The best solution was to paint these areas with potassium permanganate, although the cure was only temporary. A number of juveniles from the first brood also died of this strange plague. But after that the disease appeared to have been conquered.

A number of other strains also offer a challenge. In the Río Negro region, in particular, there are a number of forms that may represent a link with *Pterophyllum altum*.

Altum Angels

Altum: the word sends many aquarists, especially angelfish fans, into raptures. When, some years ago, I saw a brood-caring pair of Altums at Dr. Norbert Menauer's in Soest (it was actually a trio—the pair tolerated the addition of a solitary individual), they attacked us through the glass, even though the young had long since abandoned their shoaling behavior. Naturally, we included

Left: This "Red Devil" bred by me exhibits a very large amount of red and meets the breeding standards originally set by the Wilhelm family. Even the belly region is reddish.

Opposite page: Despite my intensive efforts, my *Pterophyllum* cf. *altum*, bred by Dr. Norbert Menauer, have not yet shown any inclination to breed.

H.-G. EVERS

Breeding angelfishes

Angels are rather unreliable parents when it comes to brood care in the aquarium. Because the likelihood of good care of the clutch and fry depends on having a compatible pair, it is advisable to start with a group. This requires a large aquarium with plenty of suitable cover. Angels are very fond of spawning on vertical wood or leaves with a large surface area. They will also accept suspended plastic tubes or spawning cones like those used in discus breeding. Conveniently, you can easily influence the area where the fishes spawn. If the rest of the fishes can retire out of sight behind décor marking the territorial boundary, the male can assume the territorial defense and the female can care for the clutch. This division of labor immediately does away with one major cause of the eggs being eaten.

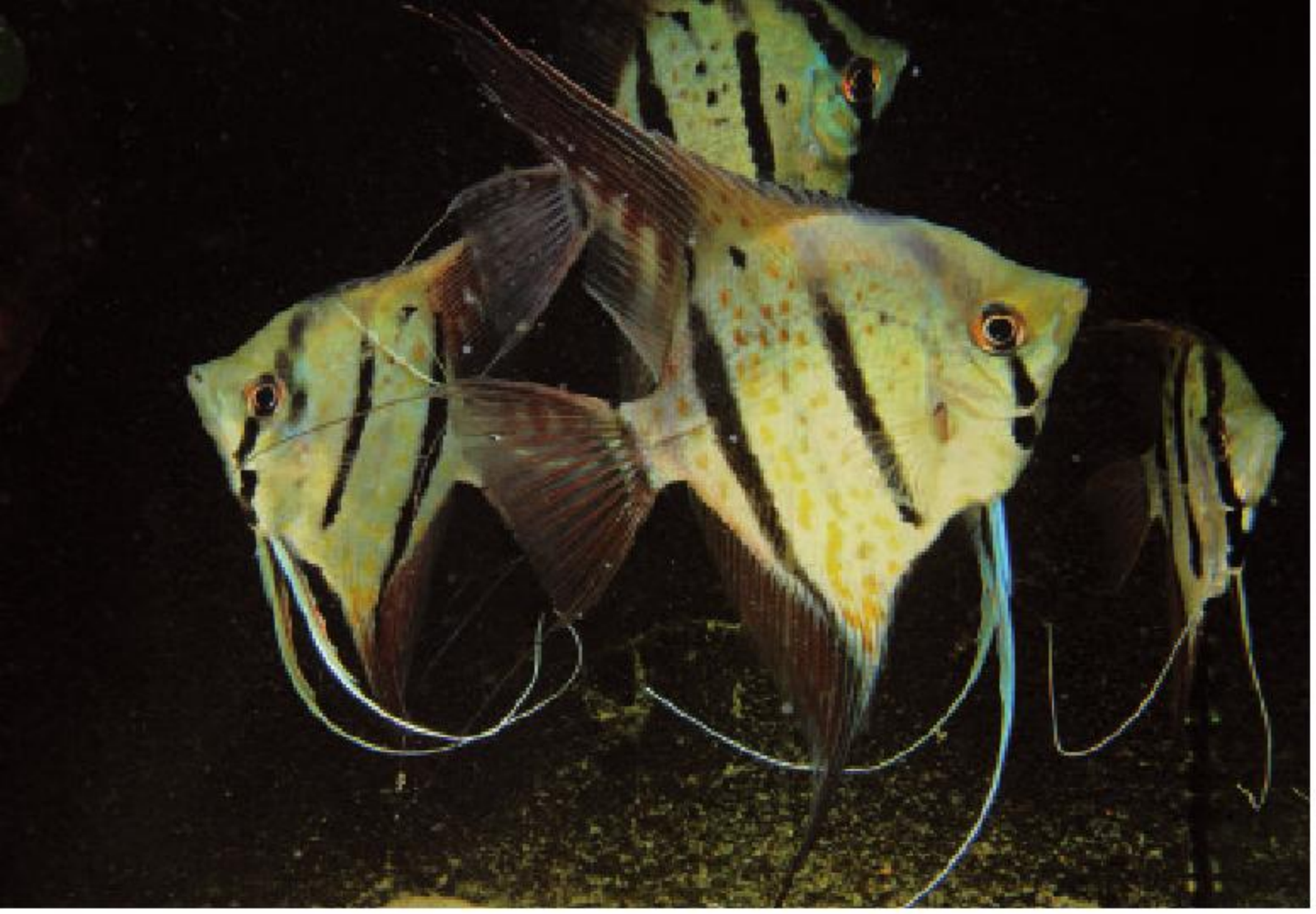
But even the largest aquarium has its limits, and even optimal arrangement of the décor doesn't help in the case of some angelfish strains. The aggression of the brooding pair necessitates the removal of the remaining members of the group. There are, of course, lots of other factors that can still spoil everything: for example, other fishes (such as catfishes) may eat the eggs during the night. A dim room light may help the parents to remain in control during the hours of darkness. But a sudden change in lighting or precipitate activity in front of the tank can disrupt things too.

The larvae, which hatch after two to three days (depending on the temperature), are attached in a concealed spot that has been thoroughly cleaned. Around the seventh day after spawning, the fry swim free. They are best fed with *Artemia* nauplii, initially with freshly hatched nauplii. Later the *Artemia* should be supplemented with cod-liver oil, salmon-oil capsules, or something similar. You can also alternate with *Cyclops* nauplii or other very fine pond foods. Beware of feeding too many *Cyclops* nauplii! At the high temperatures required (angelfishes should be kept and bred at 26–30°C), they metamorphose rather rapidly into *Cyclops*, and "stingers" can eliminate the entire brood. But anyone who has observed brooding angels isn't deterred by the effort he or she may have to invest.

Commercial breeders rarely rely on pairs brooding. They remove the clutch and transfer it to a small rearing tank with conditioned fresh water. A fairly regular stream of air bubbles not far from the clutch will ensure a good oxygen supply. Because of the lack of parental care, an anti-fungal has to be added. Methylene blue has proved effective. A stock solution is added drop by drop to the hatchery until the water is a light blue color. This doesn't have to be removed immediately after hatching; it is not a mitosis toxin like Trypaflavine, for example.

The aeration can, however, be reduced so that the larvae can develop in peace. Dead eggs should be removed, as they will only pollute the water. Gentle water changes can also be undertaken (using the drop method, as they will dilute the methylene blue). When feeding starts, it is important to do regular water changes. You should transfer the fry into large rearing aquariums if you want to raise big, beautiful angels.

H.-G. EVERS



The parents of this variant, which I have bred for several generations, came from Surinam. The precise origin of the species is a mystery.

Below: Sadly, this disease syndrome often occurs in offspring of the Surinam Angelfish.

some of the young in our luggage on the journey home. The wild-caught individuals supposedly originated from the Río Orinoco in Venezuela, from the area around Puerto Ayacucho. They were much more compact and beefier in their body form than the true *Pterophyllum altum* from the upper Orinoco drainage.

But despite intensive efforts and a 370-gallon (1,400-L) aquarium, I had no success, and neither did Dr. Menauer. It was all over by the day after the beginning of courtship and the cleaning of the chosen spawning site. However, the fish grew into splendid specimens. Food is provided in abundance in my tanks, as I still go "ponding" almost every day. Good feeding is indispensable for breeding condition and for the rearing of the young brood. *Cyclops*, *Daphnia*, *Moina*, glassworms, and mosquito larvae are on the menu—and not just as frozen food! Unfortunately, the excellent menu wasn't enough for my Altums. What was my mistake? Was it rare to succeed with young fish of the next generation, as with Heckel Discus? The only answer is to keep on trying!

H.-G. EVERS

Blackwater Altums

In the past year, I finally got to see the blackwater Altum underwater in the Río Atabapo and in the net. The fishes reared by Dr. Menauer probably originated from a population living in the Orinoco, probably at Puerto Ayacucho, where the Orinoco is a whitewater river. But that can be deceptive, as there are not only black-, white-, and clearwater rivers in South America, but also mixed-water zones, as is the case at Puerto Ayacucho. Some way to the south, two mighty blackwater rivers, the Sipapo and the Atabapo, empty into the upper Orinoco.

The fishes from the pure blackwater of the Atabapo (pH 4.5 at a conductivity of around 30 µS/cm in March 2011) are much more high-backed and filigreed than those from the Orinoco. Their beige-brown base color also differs from the blue-green of the Orinoco fishes. In the Atabapo fishes, red dots predominate on the head region, but the dots are blue in those from the Orinoco. Unfortunately, we weren't allowed to export the fishes from Venezuela. Imports from there are getting more and more scarce.

When these fishes do reach our shops, they are usually from Colombia. That is often a death sentence for Altums, as they are transported from the lowlands to Bogota, in the highlands. At this altitude, with unheated tanks, everything depends on how quickly the fishes are subsequently dispatched. The sensitive Altums are often chilled and the losses reach 100 percent. But healthy specimens may soon reach us again.

Because they are now being bred successfully in Germany, hopefully that will continue in the filial generations, so that these fishes can be permanently retained in our aquariums.

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COVER STORY

Pterophyllum altum:

the King of the Río Orinoco

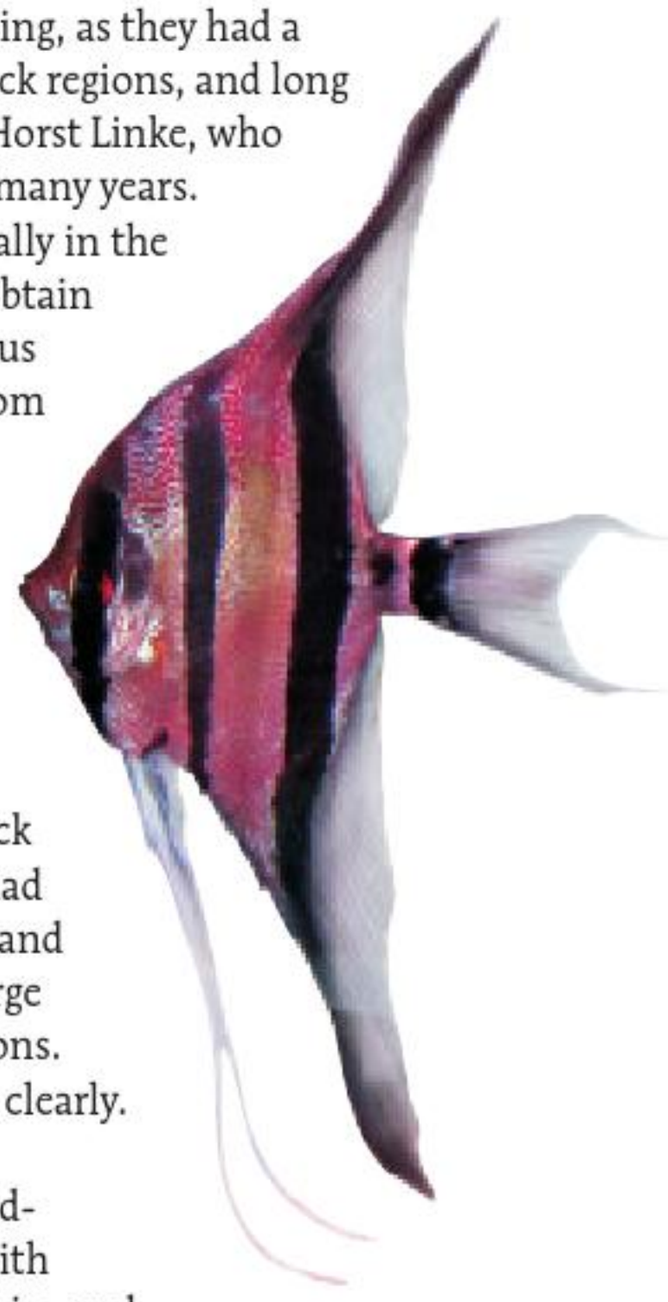
by Simon Forkel • For more than four years I have been intensively involved in the breeding of *Pterophyllum altum*, the Altum Angel. I began with captive-bred stock before I ventured to breed wild-caughts. Not only water and food quality, but also the conditions under which the fry are reared, are keys to successful breeding of this coveted species.

My first tank-bred *Pterophyllum altum* originated from Switzerland. They were bred by Adolf Siegrist, who had been breeding these majestic fish since 1993. I found these fish particularly pleasing, as they had a high body form, a lot of red on the head and back regions, and long fins. I subsequently obtained tank-breds from Horst Linke, who had reared very large numbers over a period of many years.

Since 1994 I have been working professionally in the aquarium hobby, and I have also been able to obtain wild-caught fish from my wholesalers. I was thus fortunate enough to obtain healthy imports from Colombia and Venezuela, which has become very difficult in recent years. According to the exporters, these fish originated from the Río Orinoco, the Río Inirida, and the Río Atabapo, the type locality of this species.

I noticed that *Pterophyllum altum* from the Río Orinoco exhibited a greater blue component, with red dots on the head and back regions; that specimens from the Río Inirida had more red spots on the head and back regions; and that those from the Río Atabapo had a very large amount of red all over the head and back regions. Two specimens demonstrated this particularly clearly. Luckily, they were a pair!

So I had sufficient broodstock to start breeding *Pterophyllum altum*. My first success was with 18-month-old specimens from the Siegrist strain, and shortly thereafter with fish of the Linke strain as well. Since then I have also crossed the two strains. I also persuaded a wild-caught male from the Río Atabapo to spawn with a female of the Siegrist strain. Recently I also managed to mate a female from the Río Orinoco with a male of the Linke strain. But crossing *Pterophyllum altum* with *P. scalare* was never part of my plan. My favorites are the wild-caughts from the Río Atabapo, as they exhibit a very large red component, and the wild-caughts from the Río Inrida.*



Group of tank-bred *Pterophyllum altum*, whose parents were wild-caughts from the Río Inirida—the so-called Siegrist strain.

Right: *P. altum* from the Río Atabapo at the around four years. This form exhibits a lot of red on the back.

B. KAHL; INSET: S. FORKEL

Spawning at low pressure

When an 18-month-old pair formed from a group of tank-breds of the Siegrist strain, I placed them in a tank measuring 48 x 24 x 24 inches (120

Wild-caught pair from the Río Atabapo.

Below: *Pterophyllum altum* can be kept with discus, which have similar requirements.

x 60 x 60 cm) (114 gallons/430 L). However, these fishes aren't full-grown until they are 36 months old. In my experience, breeding pairs, especially the females, don't grow as fast, as they need all their energy for spawning.

These fishes spawn up to eight times at intervals of a certain number of weeks in a single spawning phase from October to July. Then there is usually a pause. If all goes well, the pair begin spawning again in October. Naturally, it is very unusual for them to spawn so often, but we are, after all, dealing with tank-breds. In wild-caught fishes the main spawning time is usually in the period from April to June and then again in October and November.

Good water quality is essential in order to induce a breeding pair to spawn. A varied diet of frozen food is also important—above all glassworms, *Artemia*, bloodworms, and krill.

I adjust the water parameters in the breeding tank to a conductivity of 100–150 µS/cm and a pH of 5.5–6.0. A few days later, the angels usually rigorously clean the spawning cone, and with a little luck and patience they will start spawning at a temperature of 82°F (28°C). A low-pressure weather system can also stimulate the fishes to spawn.

After the eggs are laid, I move the cone with the spawn to a separate 16-gallon (60-L) tank with the same water parameters as the breeding tank. The rearing tank must be matured for a long time. This is achieved with an internal filter with two foam cartridges; the bottom

Left: Captive-bred pair of the Siegrist strain spawning.

Right: Larvae attached to the spawning cone shortly after hatching.

Below: A wild-caught pair of *P. altum* from the Río Atabapo. With age, these fish usually exhibit a thickening above the kink in the snout.

OPPOSITE PAGE AND BOTTOM RIGHT: B. KAHL; TOP: S. FORKEL

Above: The young are fed four to five times per day to guarantee optimal growth.

Captive-bred pair of *Pterophyllum altum* of the so-called Siegrist strain from the Río Inirida.

is covered with a .75-inch (2-cm) layer of quartz sand. The benefit of this is that on hatching, the larvae don't fall straight onto the bottom glass, which could be coated with bacterial slime that might have a negative effect on the development of the larvae. I practice artificial rearing. This has the advantage that I never have problems with gill-worms or flagellates.

Even if the clutch looks good and contains 600–800 eggs, it remains to be seen how the eggs will develop and how many larvae actually hatch after 60 hours at 86°F (30°C). Initially I had a lot of problems with this. Naturally, there should also be an airstone about 2 inches (5 cm) from the cone, to supply the larvae with the necessary oxygen and provide water movement.

Rearing in deep tanks

If the brood develops well, around 500 larvae hatch and swim free after eight days. I feed the fry freshly hatched *Artemia* nauplii four times a day. In addition I change around 20 percent of the water every day in order to remove uneaten food, as this rapidly pollutes the water.

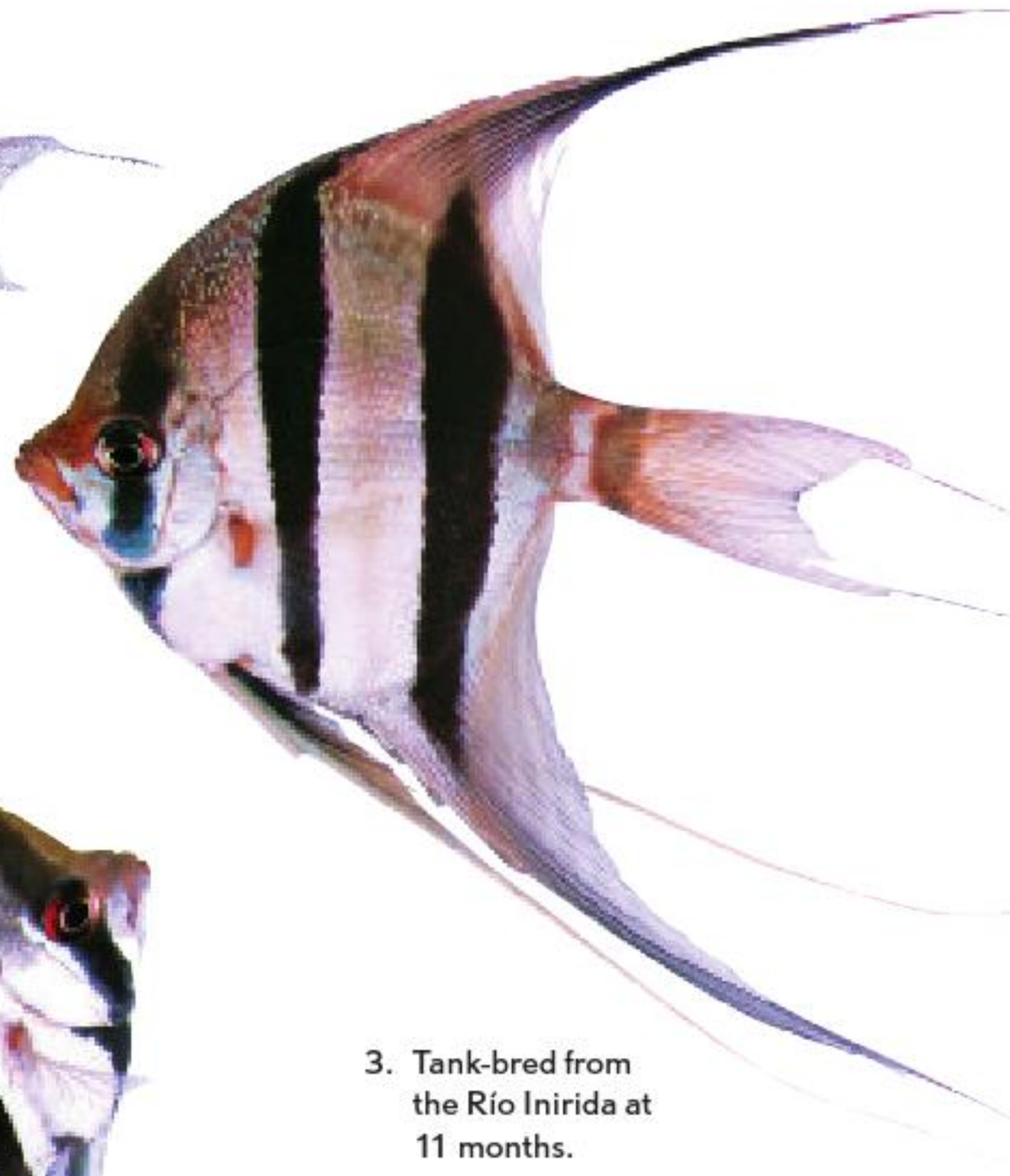
After around three weeks I transfer the young Altum Angels to larger tanks, about 100 youngsters to 114 gallons (430 L) or 200 fry to 190 gallons (720 L). This is necessary for the young angels to grow and develop long fins. It is inevitable that some poorly developed youngsters have to be culled. Only thus can I rear high quality fishes.

A twice-weekly 50 percent water change

B. KAHL

1. Juvenile wild-caught from the Atabapo at 8 weeks.

2. Tank-bred from the Río Inirida at 14 weeks.



3. Tank-bred from the Río Inirida at 11 months.

One of my parent fishes from the Río Inirida.

is necessary to keep the nutrient levels low. From the fourth week on I also feed frozen *Cyclops*, which they eat greedily after a brief hesitation. From the fifth week on I offer frozen *Artemia* several times a day, and from the sixth week I feed frozen glassworms as well. I continue thus until the tenth week, when the youngsters have usually reached a saleable size of 3–4 inches (8–10 cm) across.

The youngsters are kept in tap water with a pH of 7.5, a carbonate hardness of 4°KH, and an electrical conductivity of 280 µS/cm at a temperature of 82°F (28°C). A tank depth of 24–28 inches (60–70 cm) is necessary in order to ensure optimal growth with beautiful long fins, and, of course, regular water changes and several feeds per day. In this way the young Altum Angels can attain a height of 8 inches (20 cm) within six months and a good 12 inches (30 cm) after 12 months. A full-grown specimen can achieve a height of 16 inches (40 cm) after 36 months!

I have also induced wild-caught *Pterophyllum altum* from the Río Inirida and the Río Atabapo to spawn. This happened at water parameters similar to those used for the tank-breds of the Siegrist strain. Egg development has proved very problematical with the wild fishes. I succeeded only at the third spawning, by optimizing the water quality even further. I was then able to rear large numbers. The wild fishes have by now spawned frequently and the results keep getting better. Breeding these fish requires a lot of time and patience.

I hope that this article and its accompanying photos will encourage all aquarium-fish enthusiasts to keep these magnificent ornamental fishes. The fact that tank-breds are already available makes rearing and maintenance easier than it is with wild-caught stocks.

Additional photos and videos can be found on my website at www.skalarezucht.de.

*** Editorial note:** *Individuals of the forms named sometimes differ considerably from each other, as well as from those that originate from the actual habitat of* Pterophyllum altum*—the clear-flowing waters of the upper Río Orinoco, for example the Río Inirida, the Río Atabapo, and the Río Ventuari (see article on page 22). So for this article, we have chosen only photos that, according to the author, show specimens that demonstrably originate from the Río Inirida or the Río Atabapo.*

S. FORKEL

Angelfish: Genetic Transparency Changes Everything

article and images by Matt Pedersen, with additional images by Mellow Aquatics and Raiko Slavkov • Aquarists who know me would argue that I am a *marine* fish breeder. I made a name for myself as the first and only person to breed the "impossible to keep alive" Harlequin Filefish (*Oxymonacanthus longirostris*). Only the folks who know me *really well* understand that I don't discriminate on the basis of salt content! My recent fishroom expansion finally gave me the space to seek out one of my next challenges in fresh water.

An F2 "50% Manacapuru" Silver (wild-type) angelfish. This is genetically a blank canvas (+/+) in the designer-breeder's mind. However, it is the second generation (F2) grandchild of a wild outcross. Its grandparents were a Platinum Veil (g/g - V/+ - pb/pb) and a wild Manacapuru Angelfish. Given the genetics of its grandparents and parents, this outwardly wild-type fish could carry hidden recessive genes (Gold and Philippine Blue).

I am in love with the Altum Angelfish (*Pterophyllum altum*), and I am no stranger to the difficulty this species represents (insert expletives here). I always tell marine breeders, "Start with something easy and similar to your end goal." In doing so, you make the beginner mistakes early on, leaving you prepared to later handle the complexities of something more sensitive or challenging. I had never bred the ubiquitous Freshwater Angelfish (*P. scalare*), so it made sense to learn with the classic angelfish before tackling the Altum.

However, while getting my feet wet with angelfishes, I was quickly sidetracked by the intriguing world of angelfish genetics. This forever altered my viewpoint on the breeding of "designer fish" in the face of an ongoing need to consider the conservation implications of what we do as fish breeders.

A revelation

The free and open discussion of angelfish genetics among breeders provided an excellent model to bring back to the saltwater side of the breeding world, where the fledgling "designer clownfish" craze had me questioning whether there was a future for the original wild form of something like the Common Ocellaris Clownfish (*Amphiprion ocellaris*). Five years ago, I bemoaned the "guppification" of clownfishes, insisting that designer forms could push wild forms out of the aquarium world. Through my work with the Lightning Maroon Clownfish (a mutation discovered twice on the reefs of Fisherman's Island, Papua New Guinea) and my surprise exposure to the fascinating world of angelfish

MATT PEDERSEN

genetics, I've definitely softened my rhetoric. Hybridizing between species is still a tremendous conservation issue simply because hybrids can't be undone, and they can wreak havoc if inadvertently introduced into a species preservation–oriented breeding program. Loss of distinction between geographic races is equally concerning, particularly because history tells us that some races wind up being unique species after closer examination. However, designer breeding—that is, working with genetic mutations within a species—can prove to be at least tolerable in the conservation mindset, so long as the genetics are known and the path back to the wild form and geographic provenance isn't lost.

I need only point out that the standard wild-type, or Silver, angelfish is still around, though perhaps it's not as popular as something like a Platinum, Pinoy, or Koi these days. Nevertheless, the unadulterated wild-type angelfish remains a tool of breeders looking to strip particular genetics out of a complex domestic form. Given a robust genetic understanding, angelfish breeders seek out high quality wild stock to outcross with domestic breeding lines, as this can often impart desirable traits such as fin length and conformity, repairing the degradation caused by generations of inbreeding. The value of wild forms has led some breeders to specialize in preserving these unique geographic populations. Such commendable efforts preserve the raw materials of breeding, helping to ensure that these variations will remain available to breeders and hobbyists in the future.

By virtue of its genetic usefulness, the wild-type, or Silver, angelfish will persist. Whether today's domesticated angelfishes represent a single species or not is open to debate, so the conservation merits of designer angelfish breeding are certainly questionable.

From wild-type (opposite page) to insanely WILD: a selection of classic and ultra-modern designer angelfishes offered by Mellow Aquatics.

Top row, left to right: Gold (g/g), Gold Marble Pearlscale (Gm/g - p/p), Crowned Koi (Gm/Gm - S/S)

Bottom row: Gold Marble Platinum with Crown (Gm/g - pb/pb), Blue Pinoy Zebra Lace Veil (D/+ - Z/+ - V/+ - pb/pb), Mellow All Orange Koi (Gm/Gm - S/S).

Despite this preservation shortfall in domesticated angelfishes, one thing has become clear: in a world where the community ethic has embraced the open-sourcing of genetic knowledge, any angelfish breeder with the genetic raw materials can recreate and refine the desired genetic result.

Angelfish genetics: a history of standardization

In no small part, the late Dr. Joanne Norton is credited with laying the foundation for most of the current understanding of angelfish genetics. From 1982 to 1994, Norton published no fewer than 18 articles in *Freshwater and Marine Aquarium* (*FAMA*) covering her extensive personal work divining the genetic basis for the myriad of forms being produced around the world. It is fair to say that Dr. Norton demonstrated how an aquarist can single-handedly change the aquarium hobby and industry, and, without a doubt, the tradition of genetic transparency was indoctrinated through Dr. Norton's visionary contributions.

The Angelfish Society (www.theangelfishsociety.org, TAS) was founded in 2000 and incorporated in 2003 as a not-for-profit organization. While the Society provides and performs many functions, it also perpetuates the tradition of Dr. Norton's work. The current website includes a repository of the 18 seminal works she published in *FAMA*, but takes it a step further with the phenotypes library that's readily available online (http://www.theangelfishsociety.org/phenotype_library_2007/NewIndex.html). This phenotype library covers all the known genetics as uncovered by Dr. Norton in the 1980s and '90s, and was last fully updated in 2007.

This genetic canon is generally well regarded as a definitive starting point, although observable traits may be the result of multiple genes or what breeder Frank O'Neill routinely refers to as "genetic modifiers." Then there are occasional mysteries that stand in stark contrast to the assumed-proven genetics. Current TAS president Tamar Stephens points out, "The genes that we have listed [in our phenotype library] are all genes that follow Mendelian genetics. With multigenic traits, multiple genes contribute to the overall effect, making the results unpredictable." That unpredictability may be the reason why many traits have yet to reveal their genetic secrets.

The Angelfish Society has taken on the role of the

Classic Forms

Top row, left to right: Halfblack Veil Angelfish (V/+ - h/h), Black Angelfish (D/g) (a.k.a. Hybrid Black), Koi Veil Angelfish (Gm/g - S/S - V/+)

Philippine Blue Influences

Bottom row, left to right: Pinoy Veil WiFi (Widefin) Ghost Angelfish (D/+ - S/+ - V/+ - pb/pb), Blue Marble Angelfish (M/+ - pb/pb)

MATT PEDERSEN; BLACK ANGELFISH: MELLOW AQUATICS

official organization to standardize the names, symbols, and formatting used for angelfish genes, and in doing so basically implies unofficial common names used for phenotypes. Many breeders do abide by these names. However, Stephens points out that TAS doesn't "try to establish standard naming for common names...if someone wants to sell me a Gm/Gm–S/S, I know what I am getting genetically, whether it is called a 'koi,' a 'panda koi,' a 'pumpkin' angelfish, or whatever one can dream up."

It is only community acceptance, and use of the proposed standards, that validates TAS as an authority. To maintain credibility, TAS employs a rigorous, science-based methodology when considering the canonization of new genetics. This requirement has meant that at least one new genetic mutation obtained community acceptance a few years ago, yet is not currently recognized in TAS standards. This disparity between communal belief and the official record has caused some to question the legitimacy of TAS.

Accepting and standardizing genetic discoveries

The mutation in question is the phenomenal "Philippine Blue" gene, which some believe originated in Asian fish farms. From there, the gene was ultimately investigated, popularized, and named by Ken Kennedy in the Philippines. In 2009, seeing a lack of recognition for this mutation by TAS, members of the angelfish breeding community moved forward with creating their own "standards" following the TAS model (see http://www.angelfishusa.net/Philippine_Blue.pdf). It could be argued that this was necessary to facilitate discussion and allow progress within the breeding community.

Stephens provides insight into the current Philippine Blue conundrum: "I realize that not having the new phenotypes on [the TAS] website has made us look bad. I think people got excited about creating beautiful angelfishes with the blue effects caused by this gene, and I think that is wonderful. Unfortunately, without the offspring counts, we would be doing pseudoscience, not real science. Some of our members are now doing offspring counts, and we anticipate having that data soon."

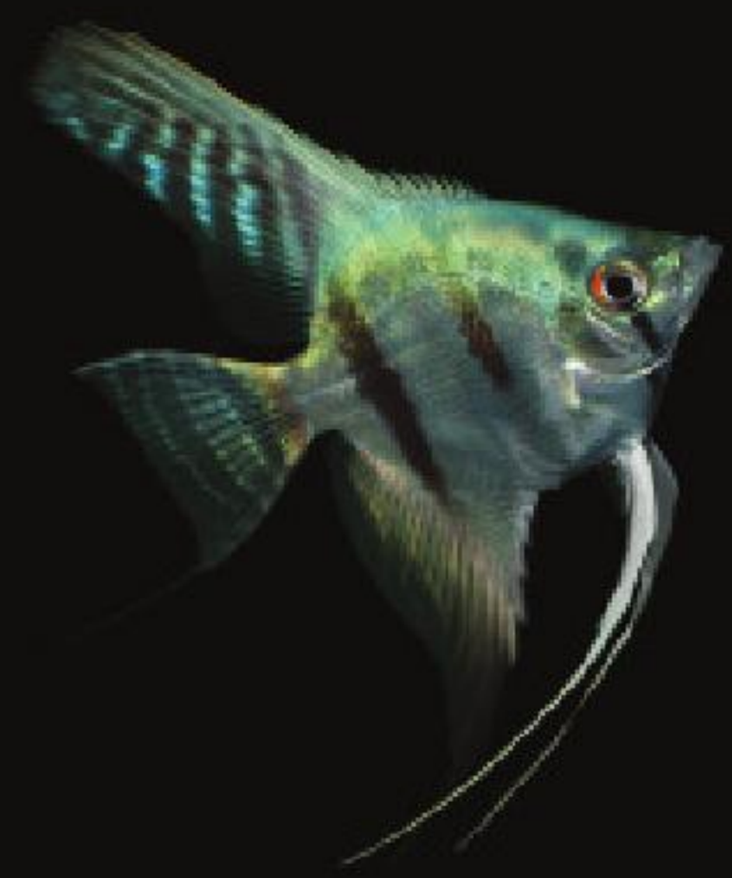
Philippine Blue Influences

Top: Blue Silver Angelfish (pb/pb)

Bottom, left:
Platinum (front) and Platinum Marble Veil (back) - (g/g - pb/pb) and (M/g - V/+ - pb/pb). The black marble pattern on the back fish is obscured by the fish in the foreground.

Bottom, center:
50% Manacapuru Ghost Veil Angelfish with either one or two blue alleles (S/+- V/+ - pb/pb?), showing the combtail trait as well. With Platinum Veil X wild Manacapuru grandparents, this fish also has the potential for a hidden gold gene. Test matings could expose the presence or absence of gold and determine the number of blue alleles present.

Bottom, right:
F2 50% Manacapuru Ghost Angelfish with single Philippine Blue allele and hidden recessive pearlscale allele (S/+ - p/+ - pb/+)

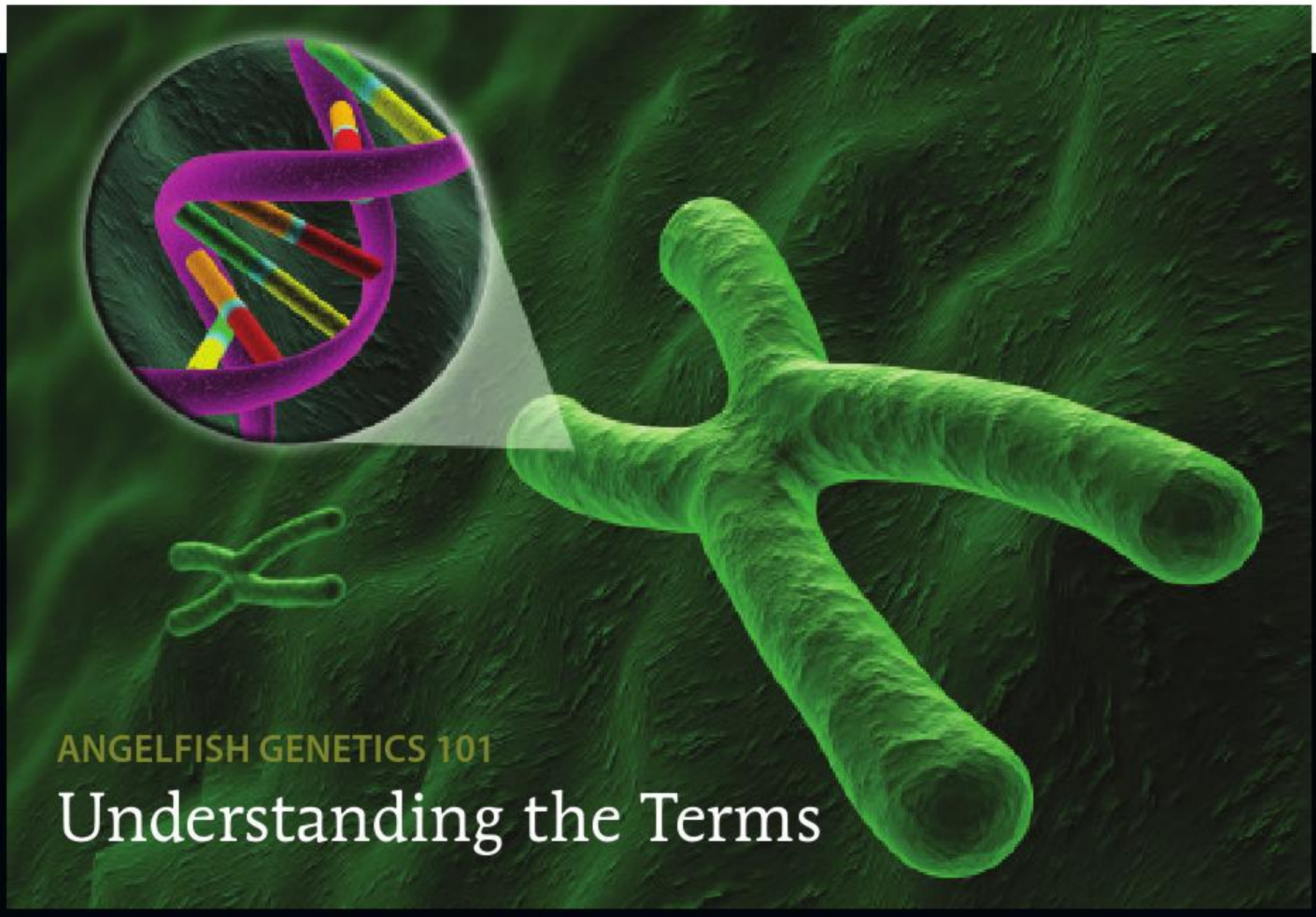


MATT PEDERSEN

Stephens really hits home the importance of performing sound science and utilizing hard data when discussing the communally held notion that the Philippine Blue gene is a recessive mutation. "Although most people believe it to be recessive, I also have information that leads me to believe it is probably partially dominant, meaning it expresses to some extent in single dose, then more fully in double dose," says Stephens. Lee Gordon might concur, observing that "one dose has been shown to cause a range of phenotypic effects."

Many breeders don't share these sentiments and feel that TAS's position is a political one. Consider the viewpoint of Rob Wilden, who wrote, "I would say that there is no doubt that [Philippine Blue] is a recessive gene mutation at a new locus. Far more work has been done on this by many breeders throughout the world, and the supporting evidence is far stronger than for many of the genes that Norton identified."

Angelfish breeder John Melograna also believes that the Philippine Blue gene is recessive, but cites confusion caused by variable expression ranging from blue to green. Melograna suggests that multiple factors could be in play, including genetic modifiers, interactions with other known and unknown genes, or maybe even a second new



ANGELFISH GENETICS 101

Understanding the Terms

A working mastery of genetics allows the angelfish breeder to turn the wild-type angelfish into a painter's canvas, selecting the mates with the appropriate genetics to create, or recreate, any particular designer form he/she chooses. Don't be put off by the technical information presented. To be blunt, the basic rules of poker are probably more complicated than this. (Also, to be honest, one can be a master breeder knowing what outcomes to expect when crossing different strains or color forms and not using the genetic jargon, but most elite breeders use the following terms.)

To date, the understood genetics of angelfishes follow some pretty basic rules, using the following jargon and functionality. The Angelfish Society created a genetic shorthand (based on scientific standards) for use in discussions, which we've leveraged here.

We must remember **genotype**, referring to the genetic code of an individual fish, and **phenotype**, referring to the outward, visibly discernible results of the genotype.

A **locus** is the place in the DNA or gene sequence for a particular gene, and the plural of locus is **loci**. At each locus, there is one **gene** or **allele** (a copy of the gene) inherited from each parent.

In freshwater angelfishes, at least eight unique loci are identified and named, and the pairing of alleles at each locus is of particular interest. Most known loci only have two types of alleles, the default **"wild" type** or a **mutated form**.

A good example is the albino locus—here a parent fish

allele at the same locus. The data that TAS and Stephens crave drives the science that could address these questions.

For the moment, the disconnect between the community-formed governing body and breeders at large remains, with most breeders working under the assumption that the Philippine Blue allele is recessive, at a new locus, and using the abbreviation "pb" when discussing it.

Frontiers of designer breeding

Of course, there is no shortage of new discoveries in the angelfish world, and breeders around the globe are only scratching the genetic surface, with the Internet allowing collaboration like never before. Traits like "Glitter" (seen in wild fishes and domesticated lines) keep breeders scratching their heads. The same could be said for two fin traits, the long-standing "Combtail" trait that most breeders believe only shows up in veil but not standard finned fish, and the newer "Widefin" variation, which may turn out to be rather complex genetically. Breeders have used selective breeding to push the expression of genetics as well, which is why, today, we can see "high coverage" or even "full coverage" Koi Angelfish, in which the typical white base coloration with orange or red crown and black marbling has been replaced by fish showing only black marbling with an orange to red base coloration covering areas that formerly would have been white.

Along the lines of traits that are being refined, we now have a very interesting trait, dubbed "Snakeskin",

can only have wild type alleles or albino alleles. These two alleles result in offspring with three possible combinations: wild/wild, wild/albino, or albino/albino. Other loci have a myriad of allele options. The Zebra/Stripeless locus is one example. A fish will only have two alleles for this locus, but the breeder has the choice of the wild-type allele, the Stripeless allele, and the Zebra allele; three options to fill only two spots, resulting in six possible combinations (wild/wild, wild/Stripeless, wild/Zebra, Stripeless/Stripeless, Zebra/Zebra, and Stripeless/Zebra).

All of this is further clarified by the various forms of genetic expression, and this, combined with the understanding of angelfish genetic loci, allows breeders to represent the known genetics of their angelfish in a standardized format using letters and punctuation. The wild-type allele is represented by a +. There are three basic forms of expression: **Recessive**, **Dominant**, and **Partially Dominant**.

Recessive mutations require two copies of the allele to affect the phenotype or appearance of a fish, and are represented with lowercase letters. Thus, (a/a) = a **homozygous** pairing (both alleles are the same) = an outwardly albino fish.

If the genetics are (a/+), this is a **heterozygous** pairing (mixed alleles) and in this case, the fish would carry a hidden albino gene that should not affect the outward appearance of the fish.

Dominant traits require only one copy of the allele to fully change the phenotype, and the phenotype will look the same regardless of whether there are one or two copies of the allele present. Dominant alleles are represented with capital letters. Zebra is a dominant mutation; be it (Z/+) or (Z/Z), the fish will outwardly appear "Zebra".

Partially dominant mutations express differently, changing the phenotype with only a single copy of the allele, but changing it again when there are two copies present. The aforementioned Stripeless allele, when in a heterozygous state (S/+), creates an angelfish with broken or absent bars called a "Ghost". However, if the angelfish winds up with two stripeless alleles (S/S), the phenotype is altered again, resulting in a fish with translucent gill covers and a complete absence of any striping; this fish is known as a "Blushing" or "Blusher".

This all comes to a head when you start mixing things together. Different alleles on the same locus produce still different phenotypes such as the Clown Angelfish, having one each of the Stripeless and Zebra alleles (Z/S). Then, add in multiple mutations on multiple loci, and you further digress from the standard wild form.

For example, you could have an albino Veil Clown Angelfish (a/a – V/+ – Z/S) or a Smokey Leopard Pearlscale Blue Angelfish (Z/+ - Sm/+ - p/p - pb/pb). Make it even more complex when you consider **epistasis**, where the alleles at one locus can hide/alter/nullify the effects of other alleles on other loci, often shorthanded as **genetic modifiers**.

In perhaps the ultimate display of genetic prowess, **genetic calculators** can now allow you to "test" the pairing of two known genotypes to determine what you'll get. Small scale commercial breeders can use genetics to customize pairing to provide a diverse range of offspring from a single pair of fish, saving on space allocated to broodstock: case in point, I have one pair of fish that, due to their disparate genetics, can yield exactly 48 unique genetic combinations in their offspring as determined by an online genetics calculator!

A solid understanding of the genetics at play can even help the detective fish breeder to implement test matings whose progeny can reveal parental genetics that were otherwise obscured.

Rearing conditions and environment can have significant impacts on the expression of these alleles, a classic example being the generally recessive halfblack trait, which at times seems to develop only if low light conditions are provided. In truth, selective breeding and genetics that we don't completely understand create a vast diversity of potential forms within a seemingly small, restrictive framework of known genes. Ultimately, genetics is only the starting point; knowledge of genetics won't substitute for good husbandry and breeding choices in the quest to produce top quality angelfish.

Some of the latest examples of cutting-edge selective angelfish breeding focus on enhancing the expression of existing traits. High-Coverage Koi Angelfish (Gm/g - S/S) like the young one shown at right took decades to develop.

Snakeskin is an emerging trait whose genetics are not yet understood. Shown below in the first row are two views of Carol Francis's female Platinum Snakeskin (g/g - pb/pb), the original fish used to start her Snakeskin breeding lines.

At bottom, two views of a young Blue Smokey Leopard Snakeskin Angelfish (Z/+ - Sm/+ - pb/pb) from Francis's breeding are just starting to show the unique iridescent snakeskin patterning. Some of Francis's best broodstock now exhibit this net-like patterning over their entire bodies.

Angelfish GENETICS BREAKDOWN

Canonized Loci

Albino Locus—*Alleles include*:
wild type (+)
albino (a) recessive

Dark Locus—*Alleles include cascading dominance of*:
Dark (D)
Marble (M)
Gold Marble (Gm)
wild type (+)
Gold (g) recessive

Halfblack Locus—*Alleles include*:
wild type (+)
halfblack (h) recessive

Pearlscale Locus—*Alleles include*:
wild type (+)
pearlscale (p) recessive

Smokey Locus—*Alleles include*:
Smokey (Sm) partially dominant
wild type (+)

Streaked Locus—*Alleles include*:
Streaked (St) dominant
wild type (+)

Veiled Locus—*Alleles include*:
Veiled (V) partially dominant
wild type (+)

Zebra/Stripeless Locus—*Alleles include*:
Zebra (Z) dominant
Stripeless (S) partially dominant
wild type (+);

Community Accepted Loci

Philippine Blue Locus—*Alleles include* wild type (+); Philippine blue (pb) recessive?

Emerging / Suspected Mutations / Requiring Investigation

Combtail—may be recessive, purported only visible on veil and superveil angelfishes, but possibly in standard fin fish as well.

Eye Color—in the past suggested linked to sex, may sometimes be influenced by other genetics; indeterminate.

Widefin—a very obvious trait that may express on a continuum; genetics indeterminate.

Threadfin—multiple extensions on dorsal, anal, and caudal fins; genetics indeterminate.

Snakeskin—a subtle trait at this time; genetics indeterminate.

Glitter—genetics indeterminate, seen in both wild and captive lines; may interact with or be related to Snakeskin.

Bulgarian Green—thought recessive at new locus, (bg) being used in discussions; genetics under investigation.

Lost Mutations genetic traits assumed extinct, but could re-emerge or be rediscovered.

Naja Gold—recessive

Hong Kong Gold—recessive

MATT PEDERSEN

F2, 50% Manacapuru Angelfish with their first spawn. The female is a Blue Ghost (S/+ - p/+ - pb/pb); the male Ghost (front) has either one or two pb genes as well.

Slavkov's Bulgarian Green Gene
Bulgarian Seal Point Pearlscale at left (D/Gm - S/+ - p/p - bg/bg), and Bulgarian Seal Point (D/Gm - S/+ - bg/bg)

which was initially brought to the breeding community by Hawaiian breeder Neil Oyama. What's exciting is the notion that this could be the genesis of body patterning akin to what can be seen now in discus. Carol Francis's pursuit of the expansion of this Snakeskin trait has many breeders curious—the trait certainly seems to be hereditable. There is also a growing suspicion that Glitter and Snakeskin have some sort of genetic relationship, although Francis dismisses this notion.

The next big gene?

Perhaps the most interesting new development is the emergence of what some are calling a new mutation, currently termed the Bulgarian Green (bg) gene. This potentially unique mutation was discovered by Raiko and Ilia Slavkov, proprietors of Malavi in Bulgaria, in a phenotype that has been dubbed the Bulgarian Seal Point. Many questions have arisen. Is it really something new? Is Bulgarian Green recessive? Is it on a new locus? Or is it a new allele on the highly complex Dark locus?

Raiko is convinced that what they've found is a previously undiscovered recessive gene, exposed through 10 years of inbreeding with Dark Gold Marble (D/Gm) and Hybrid Dark (D/g) lineages. Assuming that our current understanding of the Dark locus and Gold Marble allele is correct, the Slavkovs performed a test cross of a Blushing Bulgarian Seal Point to a wild-type angelfish. The results revealed offspring that had either the Dark allele or the Gold Marble allele, both of which are thought to occupy the Dark locus. Since the Silver angelfish would have neither, the conclusion is that the Blushing Bulgarian Seal Point parent is contributing either a Dark allele or a Gold Marble allele to the offspring of this test cross. Raiko explains, "It is not possible to have a third gene in this locus." In other words, the allele that drives the Bulgarian Seal Point cannot be on the Dark locus.

Raiko states that "the crosses I've made showed that Bulgarian Green is a new recessive gene in a new locus. The effect is that the new gene hides the black color in the body area (stripes, spots, or completely black body) [in] the phenotypes we know. The black color in the area of the fins does not change."

It has taken a couple of years of breeding, with the capacity of a hatchery, for Raiko to come to these conclusions. It will take hard data provided to the Angelfish Society for the Bulgarian Green gene to be added to the genetic canon. Even if the Slavkovs don't furnish such data, someone else might. There is a possibility that Bulgarian Green will be the next big gene making

COURTESTY RAIKO SLAVKOV/MALAVI

its way into the tanks of angelfish breeders; the Slavkovs report that they are selling their angelfish "on the local market," so there is "no risk of losing the gene."

A new mutation like Bulgarian Green always starts as a mystery. It is the diligent breeder or amateur scientist who may be able to figure it out and further our understanding of designer angelfishes.

The benefits of genetic transparency

In my opinion, the standardization and open nature of angelfish genetics has leveled the playing field. Since anyone can truly remake a Koi or Platinum angelfish, the emphasis in breeding shifts toward producing a better Koi or a better Platinum, or focusing on conservation-oriented breeding to maintain domestic populations of various geographic races, or challenging sister species like *Pterophyllum altum*. In other words, breeders are forced to compete on the quality of their fishes, and that is a winning scenario for everyone. Knowing the genetics, breeders working with a particular phenotype can easily plan outcrosses back to wild fishes to strengthen their lines. This seems to result in improved conformation and has intrinsic benefits for overall genetic fitness. With the right selection of offspring, most phenotypes can be recreated in only one or two generations of sibling crosses. Of course, there are plenty of low-quality, mass-produced angelfishes out there, but for the discerning retailer and the demanding enthusiast, finding a truly stunning fish isn't that hard. Genetic transparency within the angelfish breeding community has raised the bar for everyone.

Matt Pedersen *is a 30-year veteran aquarist, 2009 MASNA Aquarist of the Year, and accomplished marine fish breeder. He is an associate publisher for Reef to Rainforest Media and a senior editor for* AMAZONAS *and* CORAL *magazines.*

Special thanks are extended to Carol Francis (Angels by Baskington), Raiko Slavkov (Malavi, Bulgaria), John Melograna (Mellow Aquatics), Frank O'Neill (Indianwood Angelfish), Lee Gordon (Angelmania), Tamar Stephens (The Angelfish Society), Ted Santos (House of Orange), David Labell (Angelfish USA), Steve Rybicki (Angels Plus), and Rob Wilden (The Aquatic Habitat, UK) for their collaboration and contributions to this article.

LINKS

TAS Repository of Dr. Norton's original articles: http://www.theangelfishsociety.org/articles/norton/index.html

TAS 2007 Phenotypes Library: http://www.theangelfishsociety.org/phenotype_library_2007/NewIndex.html

Superior Angels Genetics Calculator: http://superiorangels.com/angelfishgeneticscalculator

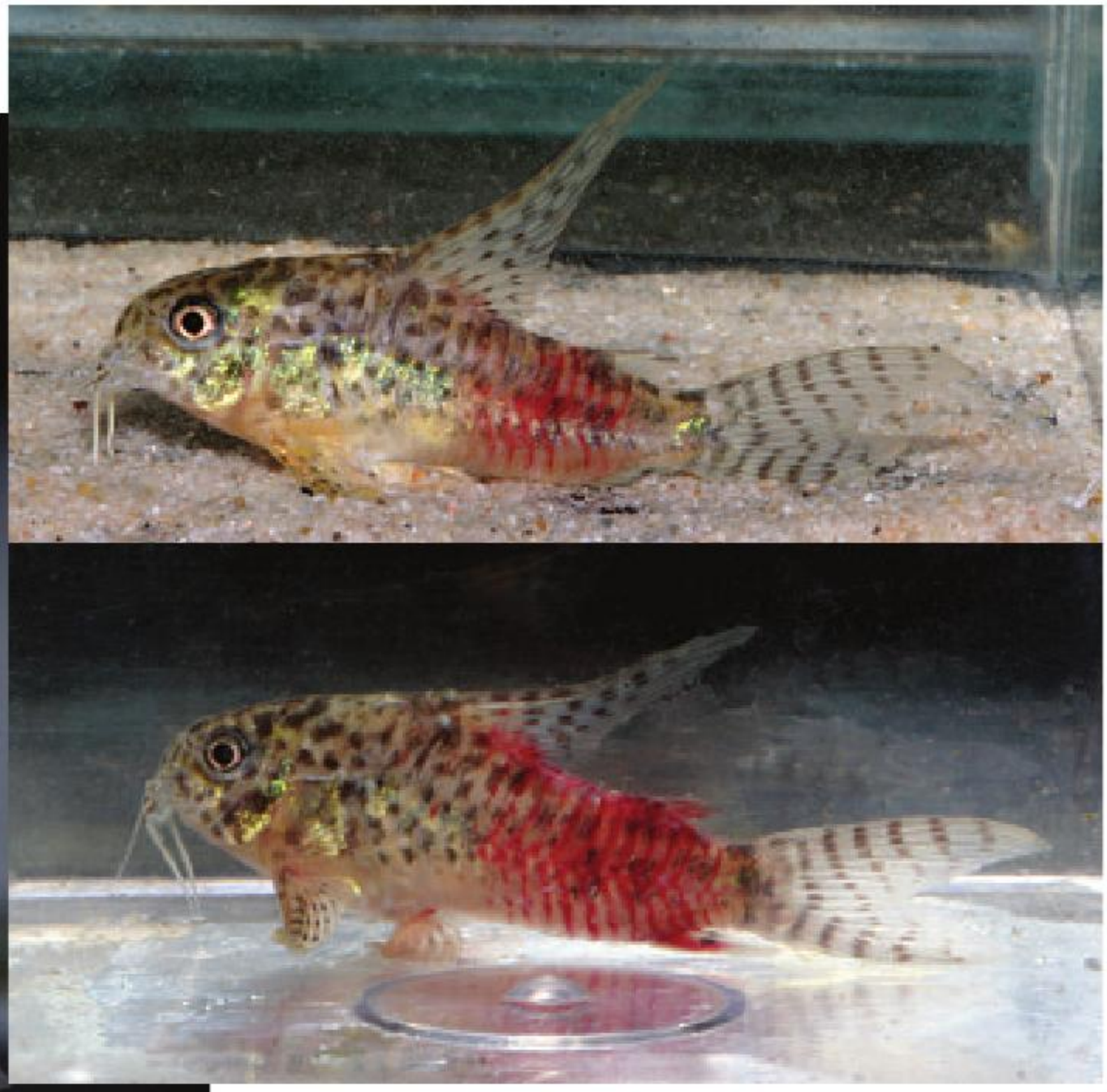
Finarama's Genetics Section: http://www.finarama.com/genetics/

Raiko Slavkov's test mating that disproved the "Dark Locus" theory for the Bulgarian Green allele: http://angelfish.net/VBulletin/showpost.php?p=266304&postcount=231

Common health problems
in Corydoradine catfishes

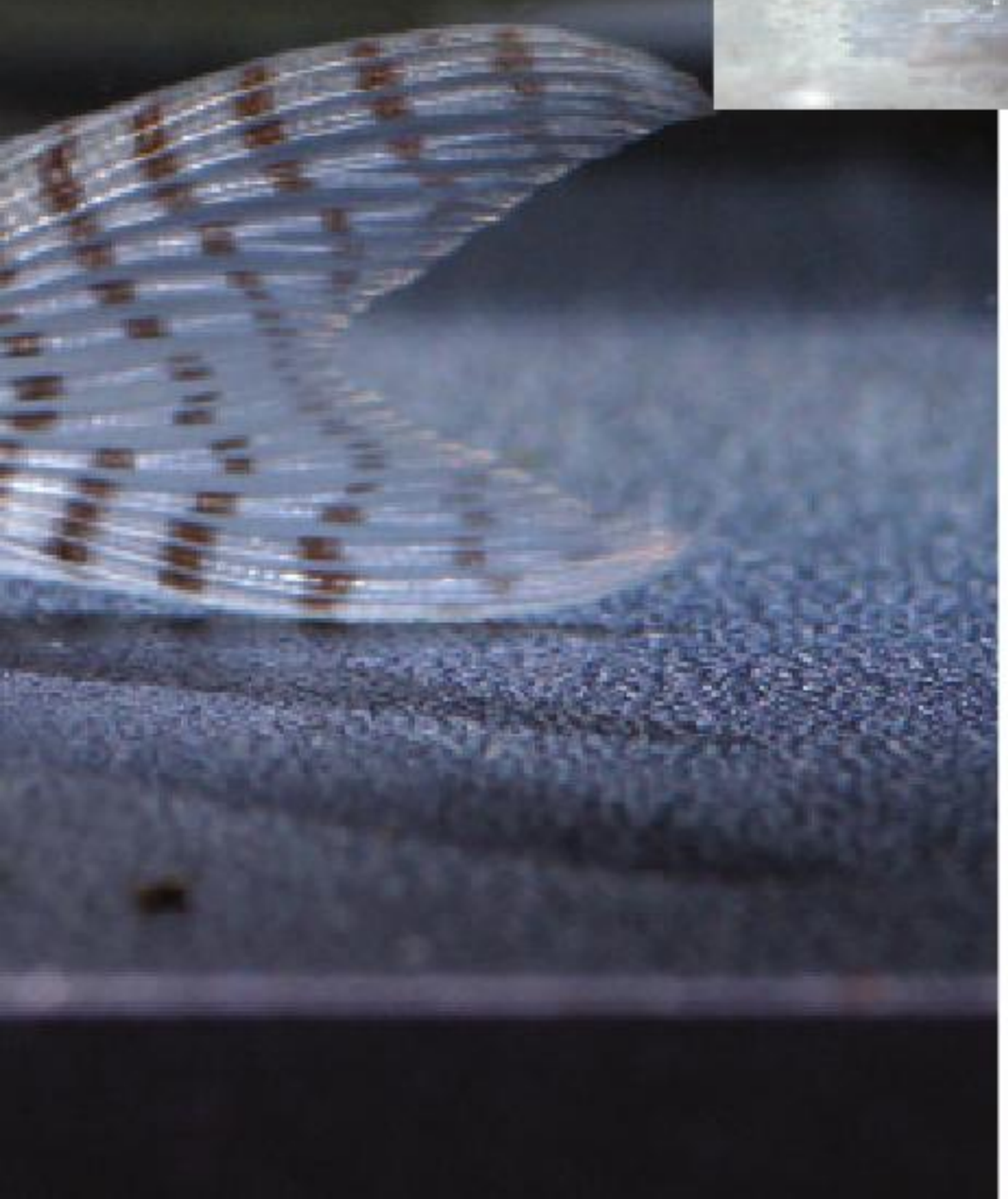
The *Corydoras* sp. C007 "Missiones" pictured at right with red blotches, after successful treatment.

article and images by Ian Fuller • How many of you have purchased a group of new, long-sought-after corys, only to find that they have all died in the bag on the way home? I can assure you it is an unforgettable experience.



Top right: *C.* sp. C007 "Missiones" showing the red blotches within two hours of the appearance of small red spots. Once this condition takes hold it spreads rapidly, and the whole body of the fish turns red.

Bottom right: *C.* sp. C007 "Missiones". After another hour the red area has doubled in size; at this point the fish has only a slim chance of survival.



This scenario has been known for quite a long time, and I first became aware of the problem more than 20 years ago after losing a group of newly purchased *Corydoras trilineatus* (Three-Lined Cory). All of them were dead when I got home. At the time I just thought that the fishes I had purchased were of poor quality, even though they had actually looked very good in the shop. I subsequently contacted the store and the owner offered to replace them, so I returned, taking the fishes with me. We were both at a loss as to what had happened—the rest of the stock in the shop looked in perfect condition.

The replacement fish were duly packed and the bag placed on the counter while we talked about other fishy things. Suddenly, the shop owner saw one of the fish roll over in the bag, followed quickly by a second. We immediately opened the bag and instinctively put all the fishes in a container of fresh, clean water from their original

stock tank. Within a few minutes they were all looking just fine, showing no sign of any further problems. All made the trip home without any recurrence of the problem.

Self-poisoning

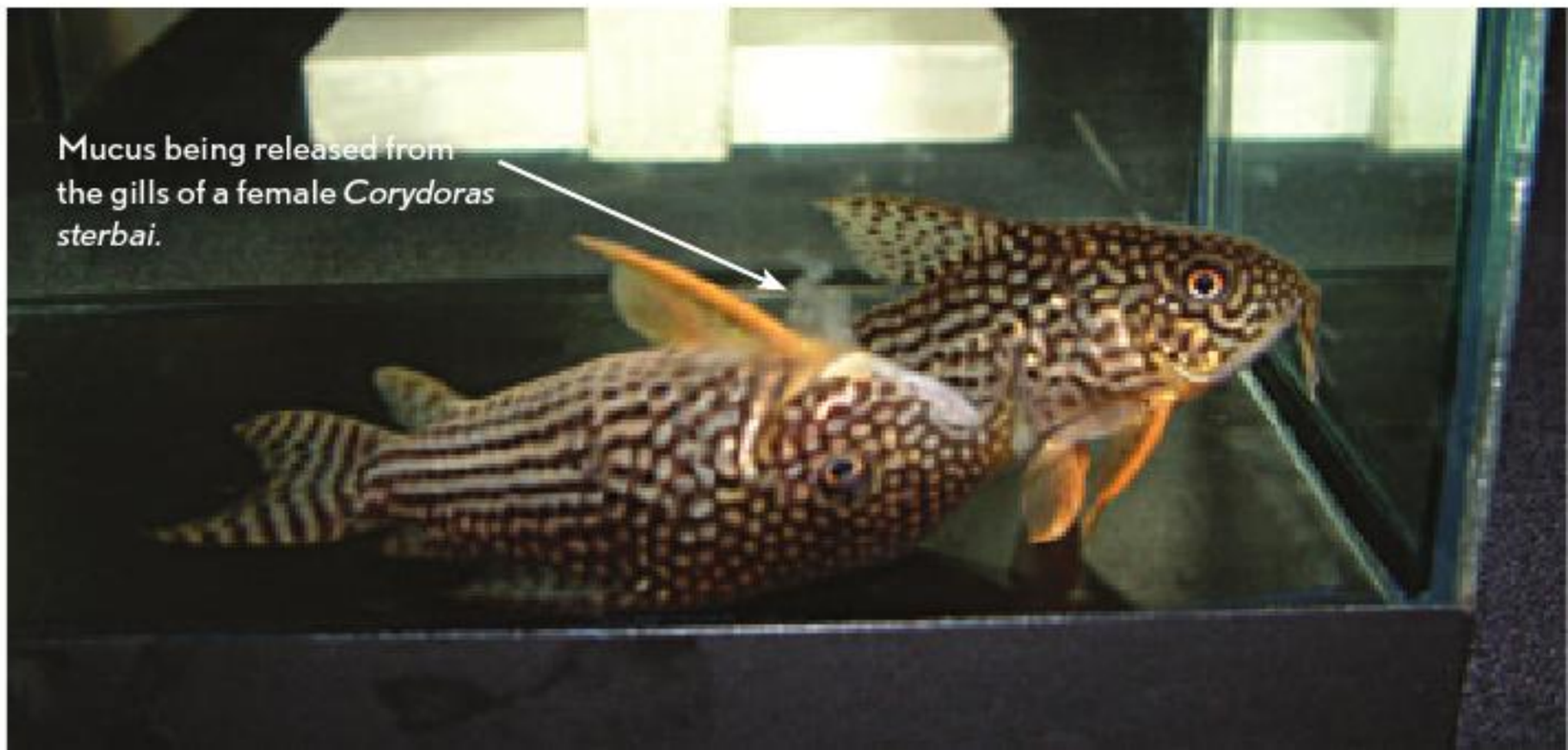
So why does this happen? Well, from my observations over the years I have discovered that many, if not all, catfishes of the subfamily Corydoradinae (*Aspidoras*, *Brochis*, *Corydoras*, and *Scleromystax*) release toxins when under extreme stress. At first it was not known from where or how the toxins were released. It was only several years after my original encounter with the problem that I first noticed a mucus-like substance being exuded by a *Corydoras* under stress—in this case, from under the base of the left-hand gill plate. The fish releasing the mucus was the female of a pair of *Corydoras sterbai* (Sterba's Cory) that were being exhibited at the Catfish Study Group Open Show in Wigan, England, in 2002. I immediately took a photo (reproduced at left), and this is the only photographic record of this phenomenon that I am aware of. In this particular case, the water in the show tank was replaced, and the fish quickly made a full recovery and went on to win its class.

The strength of the substance seems to vary according to the species, with *Corydoras trilineatus* apparently being the most toxic. The term "poor travelers" was frequently applied to several species before the phenomenon now known as self-poisoning was understood.

I believe this behavior to be a natural defensive mechanism that is probably present in many other genera of fishes, and not just the Corydoradinae. I suspect it is primarily a defense against predation, with the toxin being released when the fish is grabbed by a larger predator, an attempt to cause the latter to release its grip and affording the prey a chance to escape.

How does this theory translate into hobby terms? The aquarist represents the predator, catching the cory in a net and putting it into a bag or small container. The fish is, of course, put under stress and instinctively releases its toxic fluid. Here we deviate from the predator/prey situation because, although the cory has been released from the net, it is still under stress and in a state of shock; in the wild it could simply swim away in the copious toxin-free water of its native river, but in a plastic bag or show tank it cannot escape from the poisonous fluid it has released. As a result, in a very short space of time the fish starts to be affected by the poison that has now fully dispersed into the water. The cory appears to stop breathing, and the fish is dead within a few minutes.

This problem can and does happen whenever we transport corys, be they new fishes from a shop, a group of young you are taking to a friend or a shop to sell, or even specimen fishes you wish to exhibit at a show. The first indication of the existence of a problem is small bubbles forming at the edge of the water's surface in the bag or other container; the fishes may be breathing rapidly, although usually the opposite is the case—their breathing slows down or even stops altogether.



Mucus being released from the gills of a female *Corydoras sterbai*.

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Avoiding trouble

As long as you follow a few basic procedures, it is quite a simple matter to avoid losing corys through self-poisoning. Before catching your fishes, take enough water for transportation from their tank and put it into the bag or container to be used. Then fill another, larger container with water from the cory tank, catch the fishes, and put them into this second container. Next, disturb them several times over the next few minutes—this can be done simply by chasing them with a small net, enough to make them skittish but not enough to cause them to panic and try to jump out. This should create enough stress to cause them to release their toxins. The fishes should then be removed from the second, larger container and placed in the smaller transportation container; you can then discard the water from the second container. You will probably notice that this waste water has a slightly pungent smell.

A further tip (and one that might elicit a comment or two from the animal rights fraternity) is that when buying corys, you should try to ensure that they are stressed enough by the person catching them to make them release their toxins before they are put into a bag or other transport container. Sometimes the inexperienced shop assistant is the best person to catch your new corys, mainly because he or she will tend to chase them around a little more than an experienced person.

I know I am repeating myself, but it is important to spot the first signs of a potential problem, which is small bubbles forming around the edge of the water surface; the water may also start to take on a yellowish tinge and begin to go cloudy. Quick action is required: you must re-bag the fish in new, clean water. Most, if not all, aquatic shops will gladly re-bag fish if you think there is a problem, and you could even ask for some extra water in an empty container (taken from the tank before the fishes are caught) and spare bags, in case re-packing is required halfway home.

The species I have found to be most susceptible to self-poisoning are *C. adolfoi*, *C. arcuatus*, *C. melini*, *C. metae*, *C. panda*, *C. rabauti*, *C. sterbai*, and *C. trilineatus*. However, care should be taken with all *Corydoras* species.

Red Blotch Disease

Another phenomenon that appears to be prevalent only in armored catfishes, and particularly in corydoradine species, is commonly known as "Red Blotch Disease." Very little is known about its cause, although it is almost certainly related to water quality. This condition, too, can manifest in the confines of a transportation bag, especially if the water put into the bag is of poor quality or comes from a source other than the tank in which the fishes were kept.

The first signs to appear are small red spots on the body scutes; these are actually small skin hemorrhages that are showing through from beneath the scutes. These

can, and will, rapidly expand to form large red patches (see the photos at the beginning of this article), and if the condition is not treated quickly the fish will die.

The condition is not infectious or contagious, and tankmates will develop it only as a result of the prevailing water conditions that affected the first (probably the weakest) fish.

If treated as soon as it appears this condition can be halted. First, completely change the water. If the problem occurs in the transportation bag, it may be too late to do anything, but if it is spotted partway through a journey, even changing some of the water for non-carbonated bottled drinking water will give the fish a fighting chance. If you first notice an affected fish in an aquarium, the remedy would be a very large water change—at least 60 percent.

The next step is to check for anything that could have caused pollution, such as a blocked or clogged filter or an unnoticed dead fish, which was the cause of the worst outbreak I have ever seen. This took place in a 24-gallon (90-L) community stock tank; a pair of *Ancistrus tamboensis* wedged themselves into a small ceramic pipe, could not get out again, and died. Because they looked like they were in a mating embrace, I did not realize they were stuck or that they had died. The ensuing pollution caused a very rapid decline in water quality, and about half of the corys in the tank developed red blotches and died.

I immediately did a large water change of around 80 percent (19 gallons/72 L). Once the tank had been refilled it was treated with a full dose of Melafix from API. This botanical product is intended for the treatment of open wounds and abrasions, as well as fin and tail rot, and is the only medication I know that helps with Red Blotch Disease. At first Melafix causes coarse foaming (large bubbles) at the surface—the addition of two airstones will create good water movement and help to keep the surface moving. This is essential to ensure maximum oxygenation, especially if the problem has arisen in a mixed community tank that has surface-dwelling species. After 24 hours the foaming will have completely ceased. At this point I changed another 30 percent of the water and added another half dose of Melafix. All the affected fishes were totally clear of the red blotch condition after 48 hours. The photo on page 60 shows the previously pictured fish with red blotches, after successful treatment.

Parasites

Apart from the conditions discussed above, the main ailments that seriously affect corydoradine catfishes are parasites. Flukes and intestinal worms occur most often, and as a general precaution all newly imported wild fishes should be treated to prevent future problems. If left to their own devices, some parasites will become established in an aquarium, though it may be several months after

their introduction before they become a real problem.

A typical sign of external parasites (such as flukes) in corydoradine catfishes is flicking and/or rubbing against solid objects, similar to the response to Ich (White Spot, or Ichthyophthiriasis). Inflamed gills and rapid breathing can also indicate that gill flukes are present. There are numerous commercial treatments on the market designed to eradicate these pests, and your aquarium dealer can advise you. There are also several DIY treatments, including potassium permanganate, which can be administered in a hospital or quarantine tank. The recommended dose is 10 ml/L. The purple color is a little off-putting, but the treatment is very effective. Biological filters are badly affected by potassium permanganate, however, so it is advisable to remove them during treatment. Salt (sodium chloride, NaCl) also works well against flukes, but rather than using a low dose over an extended period in the community tank, as is often recommended (which means repeated water changes to remove it after treatment), I much prefer to give the fishes a short-duration dip in a small hospital tank with a concentrated solution of 30 g/L. The dip should last for up to 15 minutes, or be terminated if the fishes appear to be in distress.

Indications that intestinal worms are present vary depending on the parasite species, and there may be no signs at all. The usual sign of *Camallanus* (a genus of parasitic nematode worms) is red, thread-like worms protruding from the anus. With other species it may be demonstrable that a fish has a worm infection only on dissection. Symptoms indicating the possible presence of worms are weight loss or abdominal swelling due to intestinal blockage, and the latter will almost certainly result in the death of the fish.

There are several commercial worm treatments on the aquatic market, most of them derived from treatments used for worms in mammals. Levamisole is a prime ingredient in pig and sheep wormers; it is very effective and a main ingredient in many commercial branded treatments. *Camallanus* worms can be eliminated using fenbendazole, levamisole, and praziquantel, available as branded treatments. Your aquarium dealer or veterinarian can advise you if necessary.

Because internal parasites are so difficult to detect, you can never be sure the fish you have just purchased is not harboring such "passengers." My advice is always to treat newly imported fishes, especially wild specimens, as a preventative measure during the quarantine period.

Don't panic!

Although all this may sound alarming, corydoradine catfishes are generally less disease-prone than a lot of aquarium fishes, and many aquarists never experience any health problems with them at all. However, prevention is invariably better than cure, so the sensible fishkeeper will always try to be aware of what may go wrong so he can avoid problems or nip them in the proverbial bud.

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article and images by Walter Hilgner • Many aquarists dream of turning their hobbies into careers, and many have fallen on their faces trying. Here Walter Hilgner, one of those who have succeeded, explains how he got there and how he breeds a number of species.

Serious Fishrooms

Breeding aquarium fishes for the wholesale trade

Part of the rearing unit at Aquarium Dietzenbach. On the right are large breeding tanks for cichlids and *Synodontis*, on the left the rearing unit for rainbowfishes, *Sturisoma*, and others.

I started out in the aquarium hobby as a boy at the beginning of the 1970s, with *Melanochromis auratus*, *Pseudotropheus johannii* (still known as *Pseudotropheus daviesi* in those days), *Pelvicachromis pulcher* (Kribs), and *Steatocranus casuarius* (Blockheads). Three aquariums became six, then ten, then more and more. There are no rehab clinics for this type of addiction.

In 1984 I reached my goal at last. My business was registered and my garage and cellar were stuffed full of aquariums (total volume: 4,000 gallons/15,000 L). As my water was hard and alkaline (general hardness 21°dGH, pH 8.5), I bred mainly East African cichlids, which I sold to aquarists and aquarium dealers, so I had constant contact with people who shared my interest. But times change! Today's aquarists prefer large markets and avoid cellar dealers, so I had to start selling my tank-bred fishes to the wholesale trade.

The move to the wholesale trade

Aquarium Dietzenbach, in the Rhein-Main area of Germany, wanted to establish their own fish-breeding unit. After two minutes of none-too-delicate haggling with the owner, Herbert Nigl, it was all settled, and I moved in as a tenant (such things are possible when you're hooked on breeding). I brought my own stock and tank-breds to the new premises and expanded my range considerably. In addition to rare livebearers, *Synodontis*,

Sturisoma, gobies, killifishes, and other newly imported fishes, I was able to obtain practically anything and set up to breed it—paradise indeed.

But what is the point of breeding aquarium fishes in the wholesale trade? Uninteresting species aren't bred in Asia for economic reasons. In the case of cichlids, some dealers sell only the attractive males. How can anyone become fascinated by our lovely hobby if he or she misses out on observing courtship and brood care? I believe it is important for the hobby to offer a large variety of species and not just the usual "bread and butter." If rare aquarium fishes can be bred in adequate numbers in captivity, it is possible to dispense with collecting in the wild.

It rapidly became clear to me how small my home aquarium setup had been. The scale on which I now operated was a lot more demanding. Jobs such as breeding live foods, reinvigorating breeding strains at the right time, recognizing diseases early on, and keeping filters functional took more time as the size of the breeding unit and the number of fish species increased.

The aquarium fishes from the East African lakes are very robust, not very susceptible to disease, and easy to breed. Problems can arise with more disease-prone species. The constant arrival of new fishes is accompanied by a fresh supply of pathogens. It is very difficult to perfectly isolate the breeding and rearing areas from the newly imported fishes. Water maintenance, varied feeding, and regular monitoring of water parameters are essential.

Food must also be provided for the numerous different fish species. *Artemia* is easy. My hatching containers hold up to 5.25 gallons (20 L) of water, so there are always sufficient brine shrimp available. Plankton is a more difficult affair. The cultures must be constantly tended in order to be able to feed rotifers regularly. I feed them with condensed milk. I monitor the population density of the unicellular organisms daily with the microscope. Powdered and flake foods and various sizes of granulate are used in accordance with the species and size of the fishes.

Here are some of the species I breed and their peculiarities:

Above: This incubator unit in the laboratory is used to hatch the eggs of species that don't practice brood care. The eggs are placed in the tubes, and water is circulated via a UV unit to keep them in constant motion. Hatched larvae rise to the top and are washed into the rearing tanks, where they stay until their yolk sacs are exhausted.

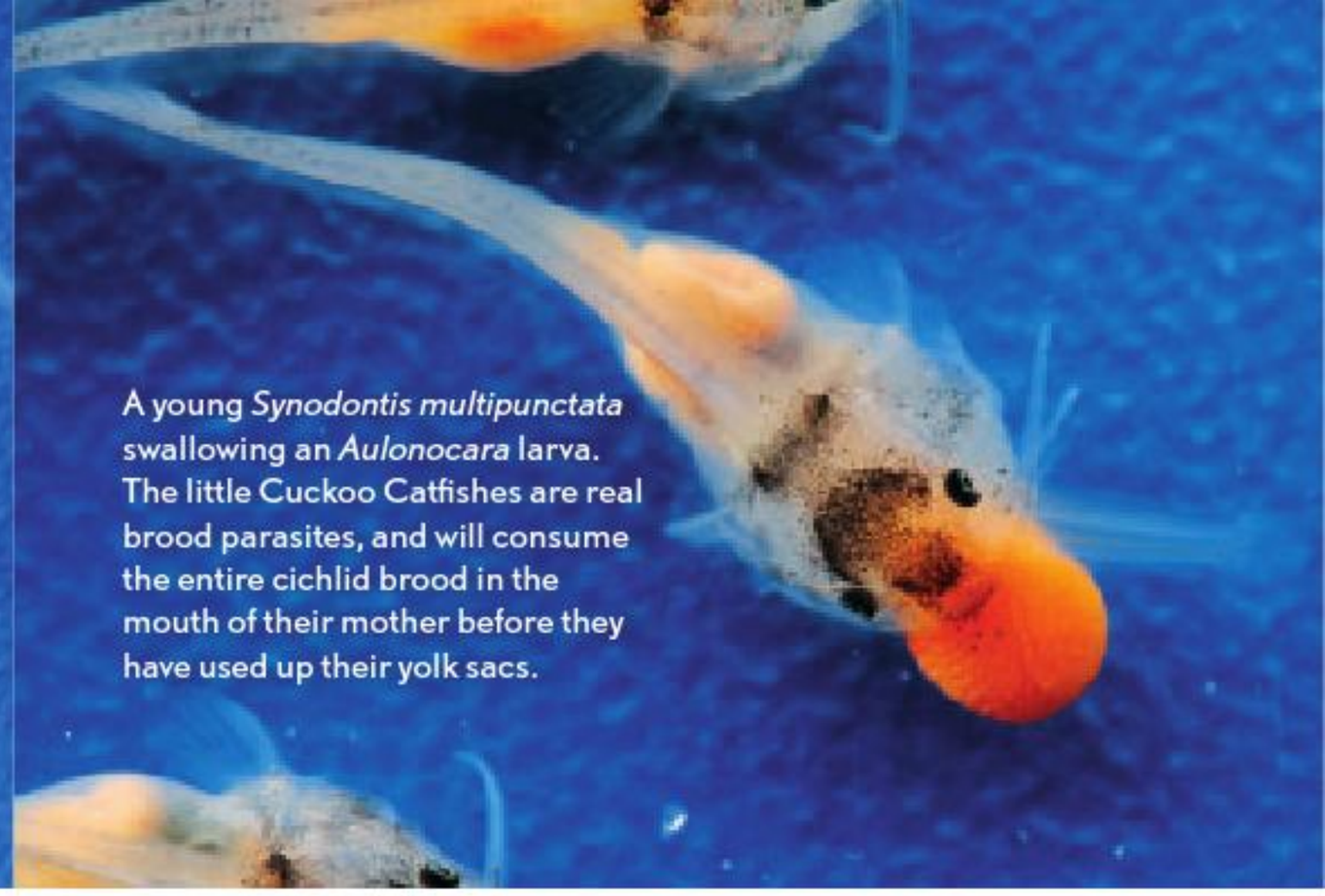
Right: This block of small aquariums is used for breeding Lake Tanganyika cichlids. The fishes are kept in pairs.

Synodontis and *Aulonocara*

For organizational reasons, our aquarium units are numbered. Our Unit 5A, consisting of 90 large and 115 small tanks with centralized particulate and nitrate filtration, houses predominantly East African cichlids, *Synodontis*, and *Sturisoma*.

When breeding *Synodontis lucipinnis* (often incorrectly known as *Synodontis petricola* "Dwarf" (*S. petricola* grows larger and has large spots on the head, while *S. lucipinnis* has smaller spots) and *S. polli*, we use two-part, closed-ended plastic pipes with a diameter of 6 inches (15 cm) as breeding caves. In the upper half there is an

A female *Aulonocara jacobfreibergi* has spat out her brood during transfer. Along with her own young there are a number of much larger Cuckoo Catfish fry.



A young *Synodontis multipunctata* swallowing an *Aulonocara* larva. The little Cuckoo Catfishes are real brood parasites, and will consume the entire cichlid brood in the mouth of their mother before they have used up their yolk sacs.

opening 1.5 inches (4 cm) across. Because these catfishes are fond of eating their own eggs, the lower half of the pipe is removable and separated from the upper by a piece of mesh. The strongest male occupies the breeding cave and the females constantly try to follow the displaying male into the opening in the pipe.

As early as the second day, there are eggs in the lower half. The spawn is removed and placed in a rearing tank. The larvae hatch after just 24 hours. As soon as the yolk sacs are exhausted I feed them with *Artemia* nauplii. The young fishes change color several times before they are full grown.

The unique mode of reproduction in *Synodontis multipunctata* makes this upside-down catfish extremely interesting and has earned it the trade name of "Cuckoo Catfish", as it insinuates its eggs into the clutches of spawning mouthbrooders. The eggs are around 1 mm across and orange-yellow in color. The larvae develop more rapidly than those of the mouthbrooders, whose eggs and larvae serve the little catfish as food. Artificial hatching of *Synodontis multipunctata* appears to be impossible because of their mode of feeding during their first days of life. We breed the Cuckoo Catfish together with the Malawi Butterfly, *Aulonocara jacobfreibergi*, and species of the genus *Protomelas*. After around 14 days the female releases up to 15 little catfishes from her mouth instead of her own brood. To our annoyance, the mouthbrooders stop spawning after a while and a new breeding group has to be put together.

The little *Synodontis multipunctata* are feeding machines. By the age of three weeks the little "parasites" attain a length of .75 inch (2 cm). Within two months they are already 2 inches (5 cm) long.

The mouthbrooding *Aulonocara* and *Protomelas* are maintained in groups of four or five males and around 20 females. A cultivated form known in the trade as *Aulonocara jacobfreibergi* "Eureka", in which the red color is

The *Synodontis* egg traps described in the text.

The Cuckoo Catfish, *Synodontis multipunctata*, spawns in the same pit as mouthbrooding cichlids, so the eggs find their way into the female cichlid's mouth, where they are brooded to term.

Above: The little *Synodontis multipunctata* grow on very quickly.

Right, top: *Synodontis lucipinnis* (False Cuckoo Catfish), better known as *Synodontis petricola* "Dwarf", is bred in large numbers using the egg traps.

Right: A young *Synodontis polli* bred at our facility.

Below: A breeding pair of *Aulonocara jacobfreibergi* "Eureka". We keep a large group of these mouthbrooders together with *Synodontis multipunctata*, the Cuckoo Catfish, which insinuates its eggs into the clutches of the cichlids.

particularly well expressed, is widespread in the aquarium hobby. Even the albino form exhibits a lot of red. The sky-blue dorsal fin contrasts attractively with the red.

Like the majority of Lake Malawi cichlids, *Aulonocara jacobfreibergi* is a mouthbrooder. The development time from spawning to leaving the mouth is three weeks. Larvae that are released too early are placed in an incubator, in which they are kept constantly in motion. Depending on the size of the female, 20–50 fry per brood can be expected.

Neolamprologus spp.

Our Unit 5B consists of 48 small aquariums housing shell-dwelling cichlids and other pair-forming cichlids.

Neolamprologus leleupi displays marked intraspecific aggression. Trying to make a random pair usually ends in the death of the female. It is wise to raise a group of around 12 individuals together and feed them heavily with a varied diet. When a female has filled with eggs and is seen quivering in front of a large male, I put them both in a separate breeding tank. As a rule the pair spawn on the ceiling of a cave (for example, a coconut shell) during the next few days.

The larvae hatch on the third day and swim free after another 12 days. They are fed several times daily with *Artemia* nauplii. To achieve the ideal coloration, they should receive this food until they are .75 inch (2 cm)long.

Pairs of shell-dwelling cichlids, like the attractive *Neolamprologus calliurus*, are placed in small aquariums to breed.

To create breeding pairs of the shell-dwelling cichlid *Neolamprologus brevis*, I select a large and a small individual from a group of fish of the same age and place them in a separate aquarium. Typically the pair hit it off right away and occupy the snail shells provided without problems. It is advisable to use the shells of French edible snails (escargots). The female always swims in first, then the male follows. The belly of the female becomes marbled yellow prior to spawning.

It is difficult to establish the precise moment of spawning. The mother fish rarely leaves the shell. To see the developmental stage of the eggs you can carefully hold the shell up to the light, first making sure it is full of water. You will see either the eggs attached to the shell wall or the free-swimming fry.

Rearing to saleable size takes place in Units 1 and 2, each containing 60 aquariums with a volume of 80 gallons (300 L) apiece.

Pseudomugil gertrudae

My breeding stock of Spotted Blue-Eyes, *Pseudomugil gertrudae*, are the local variant Aru II, from the Indonesian Aru Islands south of New Guinea. In April 2009 we obtained 30 specimens about 1.25 inches (3 cm) long. They were fed with *Artemia* nauplii and *Cyclops*.

I began the first breeding attempts after three weeks, placing a wool spawning mop in the aquarium and weighing it down with a stone. After eight days I removed the mop. On examining the strands I discovered shiny eggs, 1 mm across, everywhere. The next day I discovered the first 3-mm-long youngster. More little *P. gertrudae* appeared every day. The hatch didn't end after eight days, as expected, but continued for a few days longer. With this peaceful aquarium fish, the difference in size resulting from the different hatching times doesn't matter. I feed the fry

We use these clay pipes for breeding small cave-spawners that practice brood care. See opposite page, bottom.

Neolamprologus pulcher "Daffodil" is one of the Lake Tanganyika cichlids that we breed regularly. The photo shows a pair with tiny fry.

with infusorians and *Artemia* nauplii.

After two months some of the young have attained a size of .75 inch (2 cm) and the males are already developing their splendid finnage.

Fundulopanchax gardneri

I keep the sexes of our *Fundulopanchax gardneri* separated. There are four adjacent, shallow aquariums, one for males and three others holding 10 to 12 females apiece. The fishes are fed heavily for two weeks in order to condition them for breeding. Thereafter I fill the aquariums occupied by the females with a layer of boiled peat granules, 1.25–1.5 (3–4 cm) thick, and add the males. They are fed with live glassworms so that no leftover food can accumulate in the spawning substrate.

Ten days after the start of the breeding attempt I

The Peacock Gudgeon, *Tateurndina ocellicauda*, is bred regularly.

Above: *Pseudomugil gertrudae*, the Spotted Blue-Eye from the Aru Islands south of Papua New Guinea, is bred in large numbers.

Left: For breeding killifishes, rainbowfishes, and blue-eyes we use spawning mops made of artificial wool, which are transferred to the rearing unit when sufficient eggs have been laid.

remove the peat, put it in a fine-meshed net, and squeeze out the water with my hands. I then put the still slightly damp peat into a plastic bag and store it at around 77°F (25°C), affixing a label detailing the contents and the date of removal. After three weeks have elapsed the peat is placed in a rearing tank filled with aquarium water. After just an hour the first fry swim free. During their first days of life they are fed with infusorians and *Artemia* nauplii. Once they are .75 inch (2 cm) long, they can eat coarser frozen foods as well. Frequent feeding will ensure continuous growth.

The aquarists of tomorrow

During seminars to educate staff in the pet trade, and based on comments made by groups of visitors, we have noticed that the breeding of ornamental fishes and reptiles helps create increased interest. That led us to the idea of inviting school classes to our facility. We divide

Top: We also breed rare livebearers. Here a female *Micropoecilia picta* (Swamp Guppy) is seen giving birth.

Middle: Classic barbs like these *Puntius nigrofasciatus* (Black Ruby Barb) are part of our permanent stock and are bred in large numbers.

Bottom: *Sturisoma festivum* (Long-Fin Royal Farlowella) has been bred successfully for years. The species is rarely imported now, so we rely on captive-bred stock.

the children into two groups and show them our reptile and ornamental fish breeding units alternately.

Wool mops full of *Melanotaenia* eggs, freshly removed *Synodontis* spawn, a *Neolamprologus leleupi* male aggressively defending his breeding cave against a person's finger—all these things are fascinating, even to the non-aquarist. In our reptile unit the children can hold snakes, look at the eggs of reptiles, and admire numerous color variants of geckos. The object is to show the youngsters that there are interesting things other than TVs and computers. In this way we hope to gain young people for our hobby, so that it doesn't go the same way as stamp-collecting.

For years now we have been demonstrating that the indoor breeding of ornamental fishes for the wholesale trade is economically viable in a "developed" country, despite the challenges and potential losses to disease. It can be done—but only by motivated personnel who carry out their work with passion and discipline and don't put down their tools on the dot of 5:00.

Selling our own tank-breds and hearing the praise of retailers are our reward. By breeding our own stock we are making a contribution to preserving variety in the aquarium hobby and educating more people. The aquarists of the future shouldn't have to watch fishes swimming across the screen on YouTube; they should be able to observe the real thing in the aquarium.

With flashes of brilliant color,

A new blue-eye is here!

We had searched in vain for *Pseudomugil paskai* during a trip to the south of the Indonesian province of West Papua. But the description of the putative locality in the drainage of the inaccessible Kopi River was enough for our guide back then, and he tracked down a species new to the aquarium hobby. Could this be the real blue-eye species *Pseudomugil paskai*? • *article and images by Hans-Georg Evers*

Only a few months after our return from New Guinea, photos of a little fish appeared under the name *Pseudomugil* sp. "Red Neon", initially in Thailand. These strikingly attractive fish were very expensive and in the beginning, there were probably only males for sale. There were all sorts of exciting stories about their origin, and they were even said to be a cultivated form created by humans. Slowly but surely, it became clear that the fish came from an intermediary dealer in Jakarta, and before long the first females arrived as well.

I obtained my specimens from my friend Jeffrey Christian at Maju Aquarium in Cibinong, on Java. He had acquired them from Aquarium Dietzenbach, whose proprietor was resolutely keeping their provenance to himself. But species such as *Melanotaenia ogilbyi* and *Pseudomugil pellucidus* also suddenly turned up on his list. This was a clear indication that the fisherman that Jeffrey, our friend Mikael Hakånson, and I had instructed in Timika during the tour we made together had collected the species we had discovered, as well as a new blue-eye in the drainage of the Kopi River, and sold them to Jeffrey's competitor. Fishing in that area, which was close to a large gold mine, was forbidden to Europeans, but as a local this fisherman could do as he pleased there. Strangely, he didn't offer the fish to Jeffrey but to his competitor. Unfortunately, this type of thing is quite normal in Indonesia; loyalty seems to counts for nothing, at least when rare fishes are involved.

Male *Pseudomugil* cf. *paskai* "Red Neon" in typical coloration.

Miracles of color

Hardly had I introduced my first 20 individuals into a planted aquarium with a bottom area measuring 20 inches square (50 x 50 cm) than the party began. The brilliant coloration of the males came as a real surprise. They swim close to the water's surface and their backs gleam neon blue as they reflect the light falling on them. The body and the fins are colored deep orange. The

tips of the caudal fin are white, while those of the pectoral fins are white or orange, depending on the individual. The unpaired fins of males are sprinkled with little black dots.

The females are rather plain in appearance, with a bit of orange at the bases of the fins, some neon blue on the back, and brilliant blue eyes. The previously familiar illustrations of *Pseudomugil paskai* are highly reminiscent of the new fish, but those in Allen et al. (2000 and 2008) show more faintly colored fish. Are we dealing with a new species or merely a new color form of *Pseudomugil paskai*? Until the matter is eventually resolved, I suggest the name *Pseudomugil* cf. *paskai* "Red Neon", so as to include the name used in the trade.

When two males meet, the owner of the territory demonstrates his claim by spreading his fins. These males' pectoral fins are tipped with white. The photos on the next two pages show the progession of behaviors during this encounter.

Colorful dancers

If the males are in territorial mood, which they tend to be after water changes or a change of tank, when they encounter one another they spread all their fins and dance around the aquarium in parallel position. This display establishes the order of rank within a group, and the winners take possession of the best spawning

Females are less splendidly colored and have shorter fins. The eyes are still a glorious blue.

Above, left to right: If the opponent doesn't swim away, but spreads his fins, then the dance begins. Here a large old male is challenging a young tank-bred male with orange-tipped pectoral fins. The older these fishes get, the longer the first rays of the first dorsal fin grow.

Adversaries typically carry the dorsal and ventral fins stiffly extended. Initially they remain at a short distance; as hostilities progress they come closer together and use laterally directed movements to send little waves of water toward each other.

These two are near the end of their battle. They have come very close together and the younger fish (foreground) is about to give up. It is unclear why, but all disputes end in this way and the loser is not harmed.

territories. Females swimming into these little territories are not courted by dancing, but approached from the front with gentle head nodding. If the female doesn't swim away, the courting male turns next to her, quivering briefly. They swim beside each other in the direction of a spawning substrate—in my tanks this is a mop or a clump of Java Moss. This spawning procedure can be seen every day; the entire group is constantly ready to spawn if well fed. I collect the eggs regularly and incubate them in a bowl in shallow water. The eggs are around the same size as those of other small blue-eyes, such as *Pseudomugil gertrudae*—about 1.2 mm in diameter.

Not at all difficult

Unfortunately, not all the eggs developed in my tap water, which had a temperature of 77–80°F (25–27°C), a pH of 7.5, and an electrical conductivity of around 350 µS/cm. I assume that the species actually inhabits the swamps in the drainage of the Kopi, and thus lives in very soft black water with a low bacteria count. In the case of eggs transferred to 100 percent reverse-osmosis water, the larvae hatch after 10 to 12 days without problems. If I hatch them in bowls filled with tap water, I have to help at hatching time (Evers, 2011).

I feed the adults daily with *Artemia* nauplii, live or frozen *Cyclops* and water fleas, and very occasionally with very high-protein granulate. The frequent feeding of such granulate and *Artemia* nauplii isn't healthy for the fish. Like other small species of blue-eyes, the females, in particular, become misshapen and fat if their diet is too rich. Their bellies become distended and they must be put on a strict diet or you will lose them. Feeding them entirely on pond

foods appears to be just the ticket, and leads to healthy, very agile fish that spawn readily.

Rearing the hatchlings is easy. In the first few days they will eat rotifers and *Paramecium* spp., and also take very finely powdered flake food from the water's surface. After a few days they can manage freshly hatched *Artemia* nauplii. I have achieved the most rapid growth with sieved *Cyclops* and *Diaptomus* (copepod) nauplii, which are taken very readily. However, it goes without saying that there should be no stingers among the *Cyclops* to endanger the entire brood. If the eggs are collected regularly—I get up to 15 a day from my group of wild-caught fishes, but usually fewer, as they are probably also egg-robbers—you will soon have a considerable number of youngsters swimming around.

I have now put together a large group of young fish, which have already started spawning at the age of four months. Other aquarists have accumulated an impressive number of young as well, so these splendid little fellows are safely established in the aquarium hobby and no further imports will be required. I wish these orange and blue flashes a successful aquarium career. They are extremely colorful, not the least bit shy, and not difficult to keep and breed. What more could we ask for?

Bottom, left to right: Freshly hatched fry remain near the water's surface and immediately begin to feed. They have bright blue eyes from the start.

This juvenile is around three weeks old and grew up in the adults' tank. It was the only survivor: apparently any smaller siblings that followed were eaten. In larger aquariums, however, it should be possible to rear lots of young without any major intervention.

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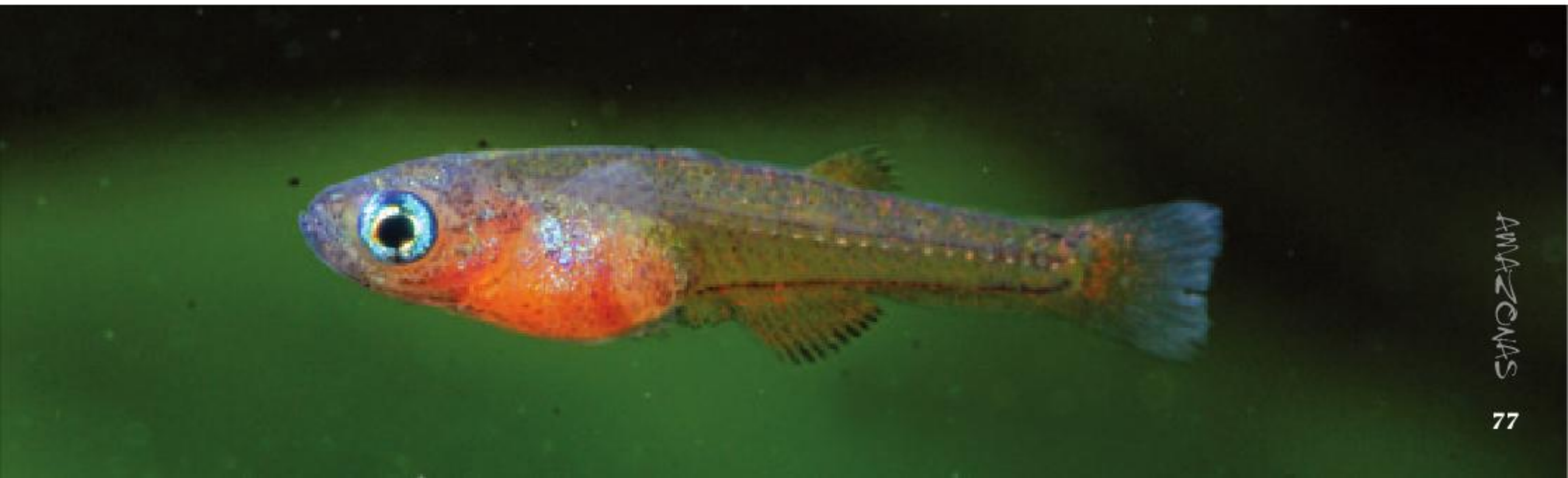


Chilatherina sentaniensis male, top, in full color appears to almost glow red from within. Females exhibit red only on the rear half of the body.

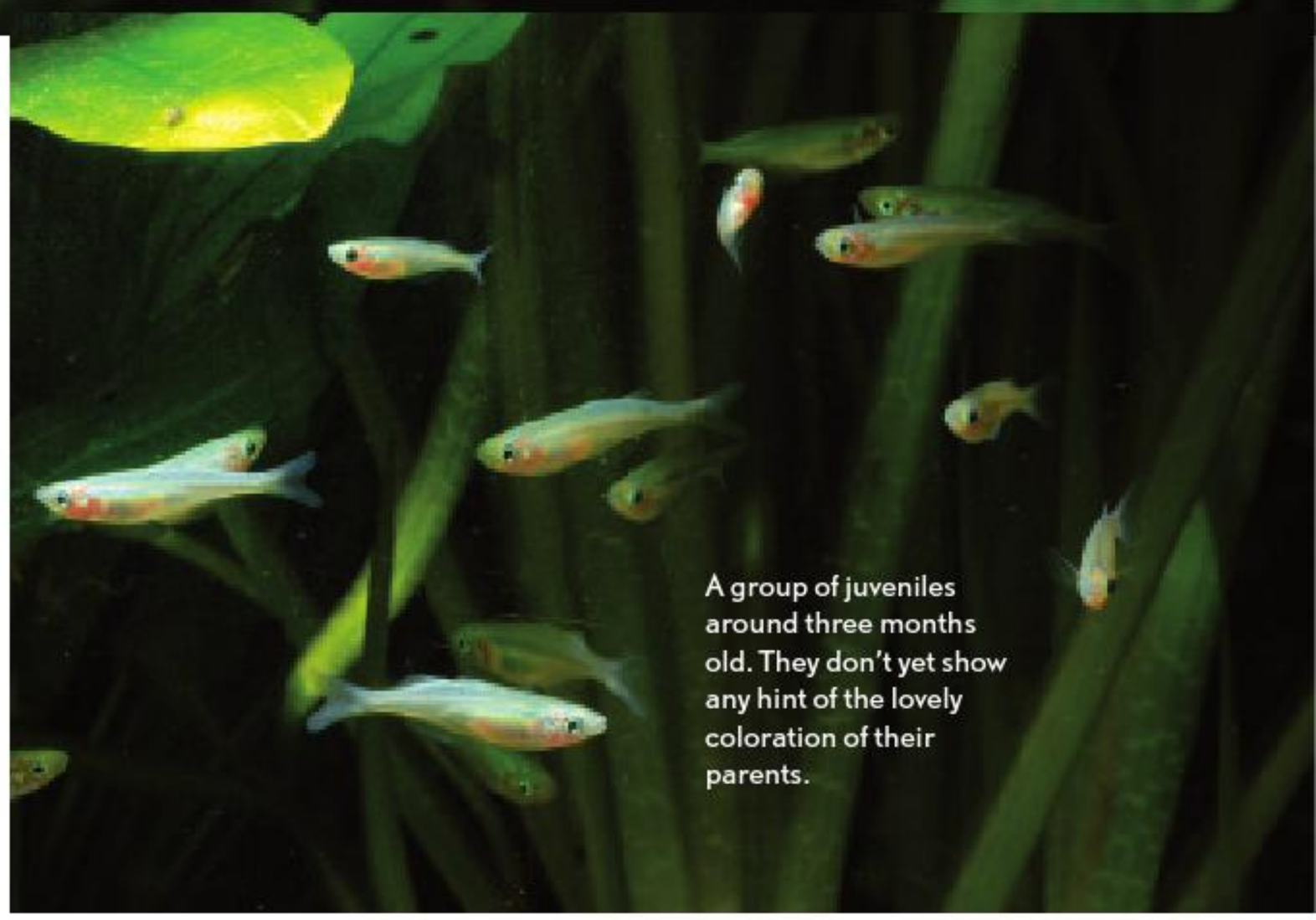
Chilatherina sentaniensis: Long sought, finally found

by Thomas Hörning • I had always wanted to keep *Chilatherina sentaniensis*. This beautiful red rainbowfish was originally described as *Rhombatractus sentaniensis* by Weber in 1908 and assigned to the genus *Chilatherina* by Regan in 1914. In the 1990s small numbers were imported frequently, but they were often confused with *Chilatherina fasciata* from Lake Sentani.

In June 2011, at the annual general meeting of the IRG (Internationale Gesellschaft für Regenbogenfische/International Rainbowfish Association), one of our Czech members was selling *Chilatherina sentaniensis* in the auction. No sooner had I entered the room than I acquired two bags of them. The fishes were already a good size, and thoughts of breeding them had my eyes gleaming. The three days of the meeting flew by and we set off for home, accompanied by my friend Heinrich and his wife, who planned to travel on to the Baltic next day. Once we were back home, though, there were long faces after we unpacked the fish. Almost all of them had pop-eye.

Chilatherina sentaniensis are very agile swimmers that make frequent jerky movements.

The species is peaceful. If two males meet they display briefly to one another, but there is no serious conflict.



A group of juveniles around three months old. They don't yet show any hint of the lovely coloration of their parents.

The next morning, though, we were greeted with a surprise. We saw gorgeous fish radiating bright red all over their bodies, with a hint of pink and bold black edgings to the fins. There was no longer any trace of pop-eye! Had it been the long period of transportation or the pure oxygen I had put in the bags at the meeting? We had no idea—the main thing was, they were healthy now. We both sat in front of the tank and celebrated like small children, despite our several decades together in the aquarium hobby.

But were these fish really *Chilatherina sentaniensis*? In the past there had probably been confusion with *Chilatherina fasciata* from Lake Sentani (described in a report by Johannes Graf in the IRG journal in January 2010). So my neighbor Hans-Georg Evers took a few photos, one of which we sent to Graf for identification. He confirmed that we had the real thing. Now I was confident and content.

After several days of optimal maintenance with lots of pond food, the first woolen spawning mop was suspended in the tank. Eight to ten days later around 70–80 fry hatched. I was happy—the population was secured.

The water parameters in the breeding tank were around 12°dGH, pH 7.3–7.5, temperature 77°F (25°C). For the first few days the fry were fed with a protein-rich powdered food and pond water, as it was impossible to sieve out foods as fine as the fry required. After around five to seven days, we began to feed them freshly hatched *Artemia* nauplii, followed by sieved water fleas and *Cyclops* (fresh-caught), chopped frozen food, and now and then granulate as well.

I normally use rather large tanks for rearing right from the start. Only thus do the young grow to an impressive size fairly quickly. In this case it was a 50-plus-gallon (200-L) tank. The largest young were 1.5–2 inches (4–5 cm) long after four months. At this size some of them were starting to show a hint of pink or red on the body, especially after a water change. I was already dreaming of maintaining and observing a large shoal of these fish in my 238-gallon (900-L) aquarium.

For the benefit of fans of sedately swimming fishes, it should be mentioned that *Chilatherina* generally swim around anything but sedately, and, indeed, sometimes rather chaotically. This could be termed an "unrounded" mode of swimming. By contrast, my *Melanotaenia herbertaxelrodi* and *M. trifasciata* now and then appear somewhat drowsy. Be that as it may, I can recommend these fish. The special thing for me is the overall red coloration, rarely seen in rainbowfishes.

Channa sp. "Fire & Ice"

From Thailand New Snakeheads

by Dominik Niemeier and Pascal Antler • Many aquarists grow especially fond of certain fish groups as time goes on. In recent years we've seen the birth of a new group of fish fanatics, people dedicated to very strange fishes that used to be regarded as monsters—the snakeheads of the genus *Channa*. With interest in this genus increasing, a number of new forms and species, including the three discussed in this article, are now being imported.

In February 2009 it was rumored that a particularly colorful snakehead had arrived—our telephones hardly stopped ringing. The locality for this new species was the Chatuchak Market in Bangkok, near which *AMAZONAS* editor Hans-Georg Evers was staying at the time. He didn't miss the chance to take a closer look and discovered a snakehead that appeared to remain small and looked similar to *Channa gachua*, but was markedly more splendid in its coloration.

The bright red pigment beneath the eye in this snakehead, plus the ice-blue fin-rays, induced Evers and his colleagues, Kamphol Udomrhitthiruj and Neil Woodward, to devise the first common name for this fish: *Channa* sp. "Fire & Ice". The name caught on and is now accepted in the *Channa* world. The fishes were found together with a batch of loaches (*Schistura balteata* "Sumo II") in the market, and the location for the latter was given as the Ataran River on the border between Myanmar and Thailand.

Hans-Georg Evers brought three specimens back to Germany and a consignment of four individuals was dispatched to Pascal Antler. It wasn't long before the first photos of this new form were published. Evers's specimens exhibited extreme aggression when kept together in the same aquarium, and had to be separated. Precise water parameters from the collecting locality were unavailable and so at first it was a matter of guesswork based on the climatic conditions and geographical location of the site.

H.-G. EVERS

Pair of *Channa* sp. "Fire & Ice" (male, upper right)

When the young swim free, their parents care for them devotedly.

Channa sp. "Fire & Ice"

The territorial behavior of the *Channa* was already familiar from other importations of subtropical snakeheads. Hence initial attempts to keep *Channa* sp. "Fire & Ice" together were made only under close observation and monitoring, and sometimes the fish were separated very early on, as naturally we didn't want to run any risks. The sexes of the individuals were relatively easy to determine on the basis of experiences with other *Channa* species.

Based on the geographical data, we kept our snakeheads under subtropical conditions at a temperature between 64 and 72°F (18 and 22°C). They didn't tolerate a cold phase at lower temperatures very well. Although in some areas where snakeheads occur there are cold periods with a water temperature of less than 64°F (18°C), to date there is no snakehead species known in which such a cold phase has proved necessary. Quite the opposite—as in the wild, only the strongest and healthiest individuals survive such extreme situations.

Like the majority of snakeheads, these wild-caught fish weren't fussy about feeding. Insects and their larvae were taken very quickly and it soon became obvious that this *Channa*, like the majority of *Channa* species from subtropical regions, was inclined to obesity. We felt it was advisable to feed them sparingly once a week. *Channa* spp. are not specialized piscivores. Insects, worms, and crustaceans are probably their main prey.

The four *Channa* sp. "Fire & Ice" purchased at the Chatuchak Market on a Sunday were dispatched the following Tuesday and eventually arrived in Pascal Antler's aquarium on Thursday. Unfortunately—and this point should be mentioned in any article on snakeheads—one of the four specimens managed to depart from the uncovered aquarium during the first night, and perished. A second individual was suffering under a massive worm burden and couldn't be saved despite the use of medication.

The remaining individuals appeared to have settled very well in the aquarium and initially tolerated one another very well, but, as is usual with snakeheads, there were quarrels after a while. The fish battled so fiercely that they had to be separated. After they had been segregated for six months a final attempt was made to house them together in a 40-gallon (153-L) aquarium.

The fish proved to be readily maintainable at a temperature between 68 and 73°F (20–23°C) and the aggression among them gave way to permanent courtship, during which the male seemed to intensify his colors and repeatedly approached the (significantly larger) females in order to display his full beauty.

TOP: D. NIEMEIER; BOTTOM: P. ANTLER

Male *Channa* sp. "Fire & Ice" with full throat sac. When mouthbrooding, these fish are very susceptible to disturbance and sometimes eat their eggs.

It wasn't long before the females were carrying the first broods in their mouths, but unlike other *Channa* they proved to be rather susceptible to disturbance. The first six broods were swallowed or spat out. Only when the fish were left in peace due to the absence of their owner did they rear young for the first time. The male now hid in a floating tube of cork, while the females monitored their surroundings with increased watchfulness. The parents also behaved differently from other *Channa* during the rearing of the young. The fry were often moved around and concealed behind décor items. The growth rate of the young was also noticeably slower than in other *Channa*, and after a year the offspring had attained a size of just 2.5–3 inches (6–7 cm).

Channa sp. "Redfin"

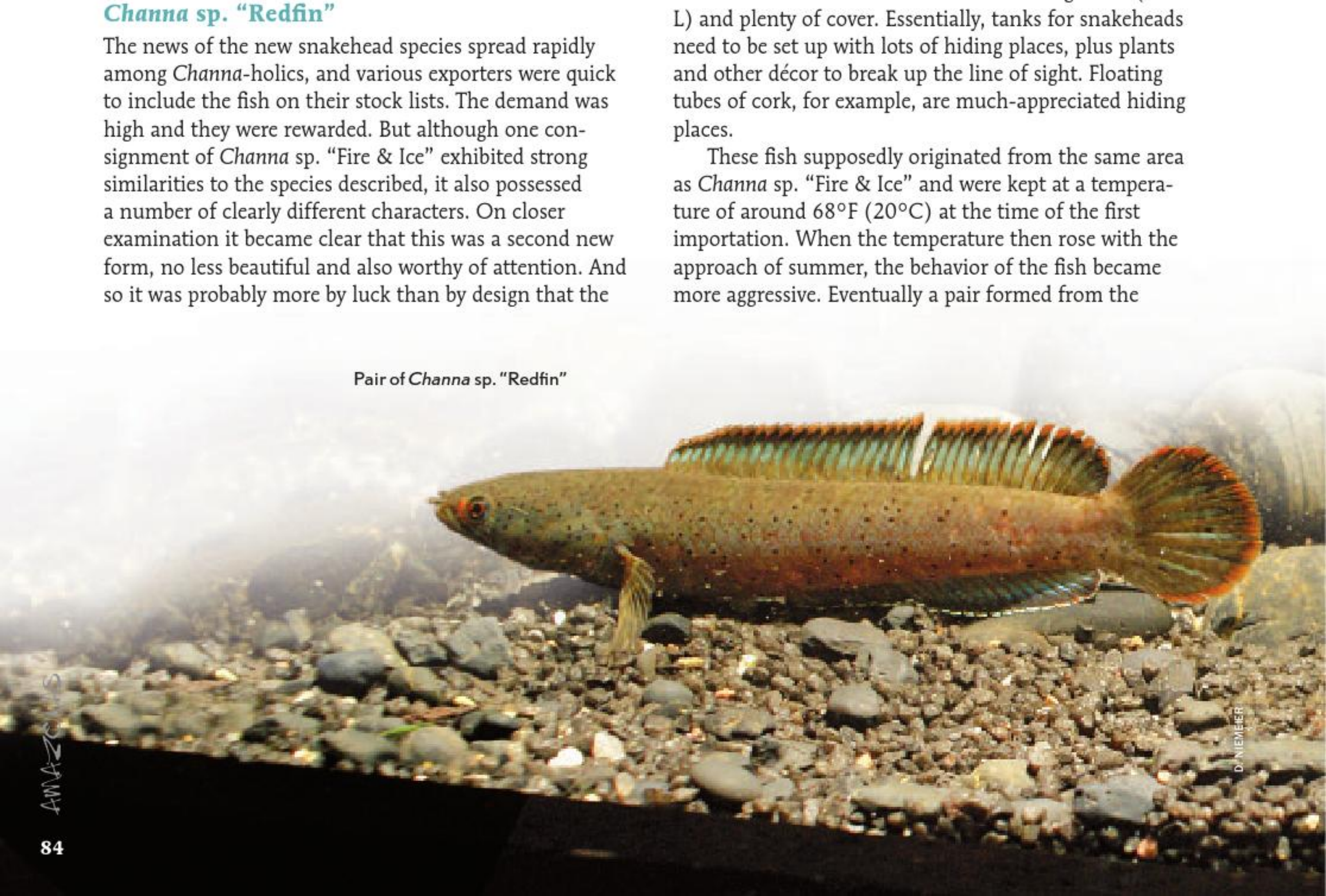
The news of the new snakehead species spread rapidly among *Channa*-holics, and various exporters were quick to include the fish on their stock lists. The demand was high and they were rewarded. But although one consignment of *Channa* sp. "Fire & Ice" exhibited strong similarities to the species described, it also possessed a number of clearly different characters. On closer examination it became clear that this was a second new form, no less beautiful and also worthy of attention. And so it was probably more by luck than by design that the first imports of a new form, now traded under the name *Channa* sp. "Redfin", came about.

Channa sp. "Redfin" is similar in stature to *Channa gachua*. In stress coloration these fish exhibit numerous small black dots that aren't otherwise visible. The coloration of the male is spectacular. The body base color is dark, almost black, in stark contrast to the ice-blue finrays and fire engine–red fin edgings.

In *Channa* sp. "Redfin", too, there were initially problems with aggression in the wild-caught fish, though not as markedly as in *Channa* sp. "Fire & Ice". The maintenance of six individuals in a 40-gallon (100 x 60 x 40 cm) aquarium continued without problems until mating. And even thereafter the fish could be kept without problem in a tank with a volume of around 50 gallons (200 L) and plenty of cover. Essentially, tanks for snakeheads need to be set up with lots of hiding places, plus plants and other décor to break up the line of sight. Floating tubes of cork, for example, are much-appreciated hiding places.

These fish supposedly originated from the same area as *Channa* sp. "Fire & Ice" and were kept at a temperature of around 68°F (20°C) at the time of the first importation. When the temperature then rose with the approach of summer, the behavior of the fish became more aggressive. Eventually a pair formed from the

Pair of *Channa* sp. "Redfin"



D. NIEMEIER

The aquarium for *Channa* sp. "Redfin" provides a wealth of hiding places.

remaining individuals, and they were transferred to a separate 40-gallon (153-L) tank. Excitingly, after a few days the fish exhibited more intense coloration and the male was observed to keep disappearing into a pottery cave. Fry around 6–8 mm (1/4 inch) long could be seen in the cave in the beam of a flashlight. They left the cave after a week, rose to the water's surface, and swam around between their parents.

The interesting thing about the young is that they have no longitudinal stripes on the body as most other *Channa* do. The young are canary yellow, already almost golden in color. They were provided with "feeder eggs" by the mother. Even so, we initially fed live *Artemia* nauplii twice a day as well. The brood was very small with only around 20 fry, but that can be attributed to the youth of the parents. The young were tolerated by the parents to a size of about 1/4 to 1/2 inch (3–4 cm). For a long time there were no further breeding attempts. It turns out that it is absolutely essential to have a suitable cave in the aquarium. The male conceals the larvae, as yet unable to swim, in this cave until they have exhausted their yolk sacs. Thereafter the fry leave the cave of their own accord, and only then is the female allowed to come near the brood and feed them with feeder eggs. The further rear-

Above: The young of *Channa* sp. "Redfin" are golden yellow during their first weeks of life. At this time the parents exhibit a particularly attractive coloration.

Far right: The sight of brooding snakeheads surrounded by their offspring is a special treat for any aquarist.

Channa sp. "Flameback" is another very attractive species from the *C. gachua* or *C. limbata* group.

ing of the young is uncomplicated, as they can manage *Artemia* nauplii immediately.

Channa sp. "Flameback"

Channa sp. "Redfin" and Channa sp. "Fire & Ice" appear under various names in the trade: "Dwarf Redfin", "Ice & Fire", "Firefin", "Red Chin", "Crimson Snakehead", "Black Spotted Snakehead", and *Channa* sp. "Red" and *Channa gachua* "Red". At the end of 2011 two more names appeared: *Channa* sp. "Laos Fireback" and *Channa* sp. "Flameback". Not much is known about the precise locality, but it is supposedly not in Laos, but an area in northern Thailand on the border with Laos.

These fish are very probably a form related to *Channa gachua* or *C. limbata*, and one that can grow relatively large. The first imported specimens were all around 6 to 9 inches (15–25 cm) long and apparently not yet full-grown. In this case we are dealing with a tropical rather than a subtropical species. Temperatures of 73 to 86°F (23–30°C) over the course of the year are recommended. As with the other species discussed, there were problems with the aggressiveness of the first wild-caught specimens, even in large aquariums.

However, these battles ceased after pair formation and we were very quickly able to pick out a pair which were peaceful and harmonious from then on, constantly seeking body contact with each other. After just a few weeks the first dummy spawning runs could be seen, and after a few failed attempts at mouthbrooding, the first successful breeding soon followed. Like all *Channa gachua*–like forms these fish are paternal mouthbrooders. The females again produce feeder eggs in this species, so rearing the fry is very straightforward.

In the near future we will probably encounter even more new snakeheads from the region (in fact, while writing this article I read about *Channa* sp. "White Fin", probably a member of the *Channa stewarti* complex), and it will be interesting and exciting to see what surprises are in store for us.

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❶ *TAREBIA LINEATA* ❷ *SCLEROPAGES INSCRIPTUS* ❸ *SCHISTURA SPILOTA*
❹ *HYPOPTOPOMA* SP. ❺ *SINELEOTRIS SACCHARAE* ❻ *BIOTODOMA WAVRINI*

Banded Melania Snail, *Tarebia lineata*

Tarebia lineata, Banded Melania Snail

1 Some months ago, Aquarium Dietzenbach in Germany imported a little snail species from Indonesia that has almost never been seen before.

Tarebia lineata is an attractive yellow-brown turret snail with fine black-brown lines. The shell is about an inch (2.5 cm) high and .4 inch (1 cm) across. In the wild it is often covered in black deposits. The coils are slightly convex, but have nodules immediately beneath the seam, making the transition from coil to coil very clear. The sole of the foot is white to pink in color. The snail is pigmented gray on its head and body. The species belongs to the livebearing and parthenogenetic snails and hence should breed easily in the aquarium. Common in Asian rivers and ponds, it is sometimes regarded as a form of *Tarebia granifera*, the Quilted Melania Snail. That isn't of primary importance to the aquarist, whose main interest is in having another attractive invertebrate to watch in the aquarium.

—Maike Wilstermann-Hildebrand

Scleropages inscriptus, Inscribed Arowana

2 The arawana from Myanmar introduced in *AMAZONAS* Vol. 1, No. 2 has now been described. Ichthyologist Tyson R. Roberts described *Scleropages inscriptus* from the Tenasserim basin. This river, which empties into the Indian Ocean, is home to many fish species that have been described in recent years or are still awaiting description.

Interestingly, Roberts doesn't accept the species of the *S. formosus* complex described a few years ago. Only *S. formosus*, and now also *S. inscriptus*, a species clearly distinguishable on the basis of meristic and color characters, are placed together in the subgenus *Delsmania* and thus treated as separate from the Australian species *S. leichhardti* and *S. jardinii*. From an aquarium-hobby viewpoint, *Scleropages inscriptus* hasn't yet appeared in numbers worth mentioning. That may soon change, at least in Asia.

—Hans-G. Evers

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Schistura spilota, Spotted Hillstream Loach

3 *Schistura spilota* is proof that large hillstream loaches are not that unusual. *S. spilota* can be 2 inches (5 cm) bigger than *Schistura* sp. "Arunachal

H.-G. EVERS

The Inscribed Arowana,
Scleropages inscriptus

Pradesh", which grows to almost 4 inches (10 cm), according to the exporter, and which Hans-Georg Evers has described as unusually large. We caught specimens measuring 4.7 inches (12 cm) in crystal-clear streams and found individuals almost 5.9 inches (15 cm) long in the basket traps of native fishermen, for whom hillstream loaches are prized food fishes.

Schistura spilota may have been found west of the Tenasserim Mountains, but it belongs to the fish fauna of Siam, as it occurs in the headwaters of the Mae Nam Klong system, which empties into the Gulf of Thailand. It is not uncommon in suitable biotopes. It lives in natural pools and waterfalls in streams and small rivers where the water is cool (average 75°F/24°C), oxygen-rich, and moderately hard (conductivity 180 µS/cm).

The aquarist may be nervous about this loach's size, but bear in mind that most loaches grow slowly in the aquarium, one reason why the sizes attainable by hillstream loach species are rarely (or never) documented. This is in stark contrast to the mouthbrooding fightingfishes of the genus *Betta*, which can grow into real Goliaths in the aquarium, even though they are rarely found at such sizes in the wild.

—Jens Kühne

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Kottelat, M. 1990. ***Indochinese nemacheilines: A revision of nemacheiline loaches (Pisces: Cypriniformes) of Thailand, Burma, Laos, Cambodia and southern Vietnam.*** **Verlag Dr. Friedrich Pfeil, Munich, Germany.**

Spotted Hillstream Loach,
Schistura spilota

TOP: K. UDOMRHITTHIRUJ; BOTTOM: J. KÜHNE

Hypoptopoma sp. "Iquitos"

Hypoptopoma sp. "Iquitos"

4 | An armored catfish that I recently received from our correspondent in Iquitos, Martin Mortenthaler, via the firm EFS (Sonneberg), is probably a new species of the genus *Hypoptopoma* (subfamily Hypoptopomatinae). This large-growing species doesn't appear in the most recent revision of the genus by Aquino & Schaefer (2010). Martin obtained the fish from a fisherman who had purportedly caught them in the vicinity of Iquitos.

The overall size of the fish is striking. My largest specimen measures 5 inches (12.7 cm) TL, which is larger than all the other species I have kept to date. The black patterning on the dorsal and caudal fins is likewise unusual for the genus *Hypoptopoma*. *Hypoptopoma* sp. "Iquitos", as I have provisionally named the species, also possesses the mucus typical of the genus. These fishes spend the entire day sitting on wood and only become active during the night. They then streak around the aquarium and nibble at the food tablets that I put in before lights out.

—Hans-Georg Evers

Male Chinese Sleeper Goby, *Sineleotris saccharae*

Sineleotris saccharae, Chinese Sleeper Goby

5 | For many long years, fishes from China were virtually impossible to obtain. But now, increasingly larger numbers of interesting fishes are arriving from the south of that vast country. The gobies and loaches are particularly fascinating to aquarists. An especially lovely species has been imported by Metop Aquarium (Czech Republic) from Aquaculture Technologies in Singapore, whose director, Patrick Yap, was interviewed in the November/December issue of *AMAZONAS*.

With a maximum of around 6 inches (15 cm) total length, *Sineleotris saccharae* is one of the medium-sized

H.-G. EVERS

REFERENCES

Aquino, A.E. and S.A. Schaefer. 2010. Systematics of the genus *Hypoptopoma* Günther, 1868 (Siluriformes, Loricariidae). *Bull Amer Mus Nat Hist* 336: 1–110.

members of the small family Odontobutidae, the freshwater sleeper gobies. The species was described from the New Territories of Honking, but these fishes are hardly ever found there now and our imports originate from less disturbed areas of the Chinese mainland.

The male in the photo is still relatively young. With age, these fishes are said to develop an impressively high forehead and become rather thuggish. My male was thuggish long before that, and it only took him a few hours to dispatch the less attractive female to fishy heaven. These fishes have proved to be sensitive to transportation and need time to regain their strength after shipping. So far there are no reports of the successful breeding of this attractive species.

—Hans-G. Evers

Biotodoma wavrini "Río Preto da Eva", Orinoco Eartheater

6 | Normally *Biotodoma wavrini*, the Orinoco Eartheater, is found in the drainage of the Orinoco in Colombia and Venezuela, as well as in the upper course of the Río Negro. However, it seems that a small enclave of *Biotodoma wavrini* has become established in the drainage of the Río Preto da Eva in Brazil, which lies hundreds of kilometers from the actual distribution region of this species.

In 2011 Aquarium Glaser imported a small group of the Río Preto da Eva population, and I acquired the entire batch. At the same time they were also selling *Biotodoma wavrini* of around the same size from the drainage of the Orinoco and imported from Colombia. A number of these fish also found a home in my aquarium cellar for the purpose of comparison.

Because the *Biotodoma* species can be classified, at least roughly, in the aquarium hobby on the basis of the shape and position of the lateral spot, I hoped to be able to detect at least marginal differences, but, unfortunately, I found no reliable criteria, and there were no obvious differences in the body form.

There are differences in the form of the fins: in adult specimens of the Río Preto da Eva population, the unpaired fins are noticeably longer and have more delicate filaments. Were I to add that the Río Preto da Eva fishes are significantly more attractive in color, I would get a few scornful looks, but although both populations have a white-wine base color, the flanks of the Río Preto da Eva fishes are overlain with soft blue-green shades and the soft-rayed parts of the unpaired fins are reddish.

I had secretly hoped that it would be possible to definitively distinguish the two populations, as their geographical separation is so great that it is hard to believe they are the same species. I am not aware of any molecular-biological or morphological studies on the two populations, so for the time being I am forced to assume that they are one and the same species.

—Thomas Weidner

T. WEIDNER

Orinoco Eartheater,
Biotodoma wavrini

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Greater Detroit Aquarium Society
Royal Oak
www.GreaterDetroitAquariumSociety.com

Grand Valley Aquarium Society
Grand Rapids
www.GrandValleyAquariumClub.org

Southwest Michigan Aquarium Society
Portage
www.SWMAS.org

MINNESOTA

Minnesota Aquarium Society
Roseville
www.aquarium.mn

MISSOURI

Missouri Aquarium Society, St. Louis
www.MissouriAquariumSociety.org

NEW HAMPSHIRE

New Hampshire Aquarium Society
Rollinsford
www.NHAquariumSociety.com

NEW JERSEY

Jersey Shore Aquarium Society
Freehold
www.JerseyShoreAS.org

North Jersey Aquarium Society, Nutley
www.NJAS.net

NEW YORK

Allegheny River Valley Aquarium Society
Olean
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

Genesee Valley Koi & Pond Club
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

NORTH CAROLINA

Raleigh Aquarium Society, Raleigh
www.RaleighAquariumSociety.org

OHIO

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

OREGON

Greater Portland Aquarium Society
Clackamas
www.GPAS.org

PENNSYLVANIA

Aquarium Club of Lancaster County
Lancaster
www.ACLCPA.com

Bucks County Aquarium Society
Chalfont
www.BCASOnline.com

Greater Pittsburgh Aquarium Society
Pittsburgh
www.GPASI.org

TEXAS

Houston Aquarium Society, Houston
www.HoustonAquariumSociety.org

VERMONT

Tropical Fish Club of Burlington
Burlington
www.tfcb.org/

VIRGINIA

Central Virginia Aquarium Society
Richmond
www.CVAS.forumotion.com

Potomac Valley Aquarium Society, Fairfax
www.PVAS.com

WASHINGTON

Greater Seattle Aquarium Society
Seattle
www.GSAS.org

Puget Sound Aquarium Society
Federal Way
www.thePSAS.org

WISCONSIN

Milwaukee Aquarium Society, Milwaukee
www.MilwaukeeAquariumSociety.com

Central Wisconsin Aquarium Society
Wausau
www.cwas.org

INTERNATIONAL AQUARIUM SOCIETIES

AUSTRALIA

New South Wales Cichlid Society
Moorebank, NSW
www.NSWCS.org.au

Victorian Cichlid Society Inc.
Mitcham, VIC
home.vicnet.net.au/~cichlid

Queensland Cichlid Group Inc.
Clayfield, QLD
www.qcichlid.org

BELGIUM

Belgian Cichlid Association
www.cichlidae.be

BERMUDA

Bermuda Fry-Angle Aquarium Society
www.fryangle.com

CANADA

The Canadian Association of Aquarium Clubs
Canada & New York State
www.caoac.ca

London Aquaria Society
London, ON
www.londonaquariasociety.com

Saskatoon Aquarium Society
Saskatoon, SK
www.SaskatoonAquarium.com

Montreal Aquarium Society, Montreal, QC
www.theMontrealAquariumSociety.com

Hamilton & District Aquarium Society
Hamilton, ON
www.HDAS.ca

Durham Region Aquarium Society
Oshawa, ON
www.DRAS.ca

Regina Aquarium Society
www.reginaaquariumsociety.ca

Association Regionale des Aquariophiles de Quebec, Ste-Foy, QC
www.ARAQ.org

Aquarium Society of Winnipeg
Winnipeg, MB
www.ASW.ca

FINLAND

Ciklidistit r.y. (Finnish Cichlid Association), Vantaa
www.aquahoito.info/cichlids/index.html

FRANCE

Association France Cichlid, Hoenheim
www.FranceCichlid.com

GERMANY

Deutsche Cichliden-Gesellschaft
(German Cichlid Society)
Frankfurt am Main
www.DCGonline.de

MALAYSIA

Malaysia Guppy Club
www.myguppy.net

SINGAPORE

Discus Club Singapore
www.DiscusClubSG.com

UNITED KINGDOM

Anabantoid Association of Great Britain
Doncaster
www.AAGB.org

BIDKA: The British and International Discus Keepers Association
www.BIDKA.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

Thanks to Ray "Kingfish" Lucas of Kingfish Services in Boston, NY, for his invaluable help in establishing this directory and the *AMAZONAS* Aquarium Calendar of Events. www.kingfishservices.net

GET LISTED! **Contact:** Mary Sweeney, Senior Editor: **mary.sweeney@reef2rainforest.com**

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