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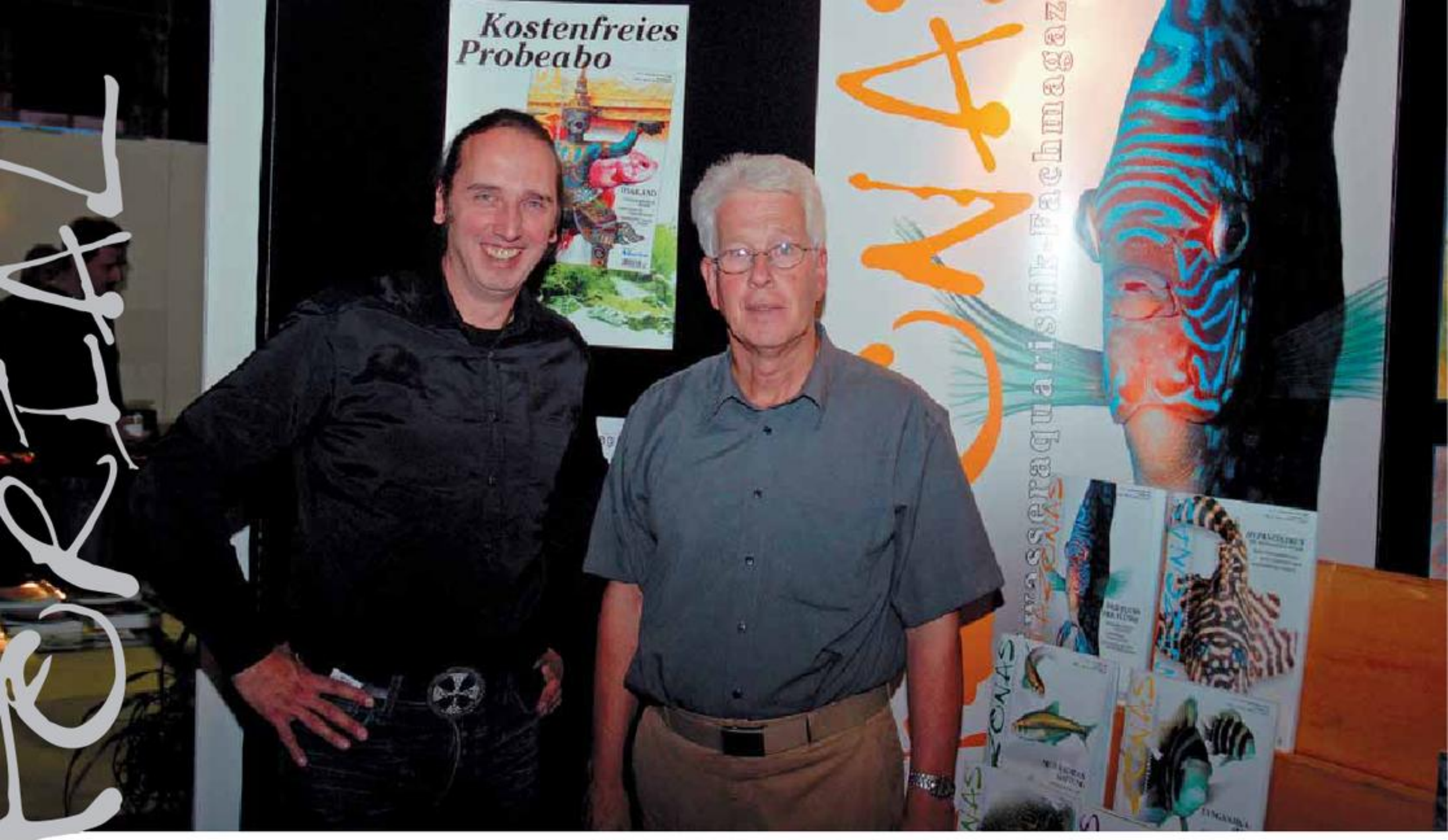
COVER STORY

FEATURE ARTICLES

DEPARTMENTS

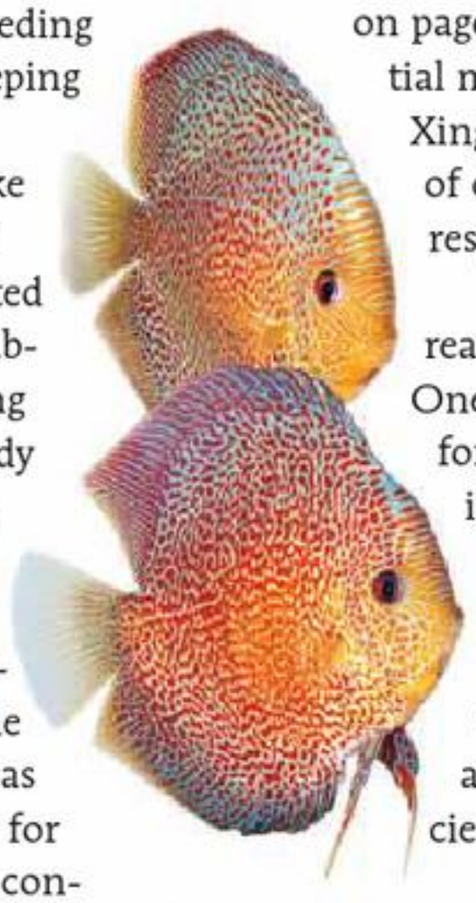


Hans-Georg Evers (left) and Horst Köhler at the Zierfische & Aquarium trade show in Duisburg.

Dear Reader,

Discus have their very own circle of fans—and a very big circle it is.

To outsiders (and I am one), it is sometimes difficult to understand the amount of fuss some enthusiasts make about their circular pets. Here in Germany, the devotees of wild forms, in particular, seem to like to emphasize the exclusivity and the difficulty of keeping their fishes, though fans of cultivated forms don't do so to such an extent. Some vehemently reject the often gaudily colored results of Asian breeding efforts, but others, often beginners at keeping discus, accept them enthusiastically.



So it took me quite some time to make sense of the confusing number of names for an incredibly large number of cultivated forms. Was it possible to tackle such a subject for "normal aquarists" without boring the discus-abstainers to death? You already know, gentle readers, that we sometimes encourage you to think outside the box. We have been able to obtain the services of a very experienced author for our leading article. The editor and publisher of the well-known *Diskus-Brief*, Horst Köhler, has been kind enough to attack the keyboard for us once again, and promptly became top contender for the title "author of longest article published in *AMAZONAS* to date." I believe that more information on the "most colorful discs in the world" has never before been published in an aquarium magazine.

I am also particularly pleased that we have been able to conduct an interview with Patrick Yap, a world-class rare fish-collector and exporter in Singapore. His enthusiasm is infectious, and we all have him to thank for making so many unusual and new Asian fishes available to us.

Brazil has recently been a source of both excitement and concern. In Aquatic Notebook, which starts on page 4, we offer an update on a drama and potential manmade disaster that is unfolding on the Rio Xingu. The Belo Monte dam project should be of concern to all thinking aquarists and all who respect the rights of indigenous peoples.

On several happier notes, there is plenty of reading matter for fans of new and rare species. One, in fact, happens to be a fish I personally was fortunate enough to find and collect in Sulawesi in 2010. It is a very likeable ricefish with a highly unusual mode of reproduction that I am still observing in my own home aquaria. Now some scientists have finally dared to describe it and name it after me: *Oryzias eversi*. I am highly honored and hope this curious species someday makes it into the aquarium hobby.

Happy reading!

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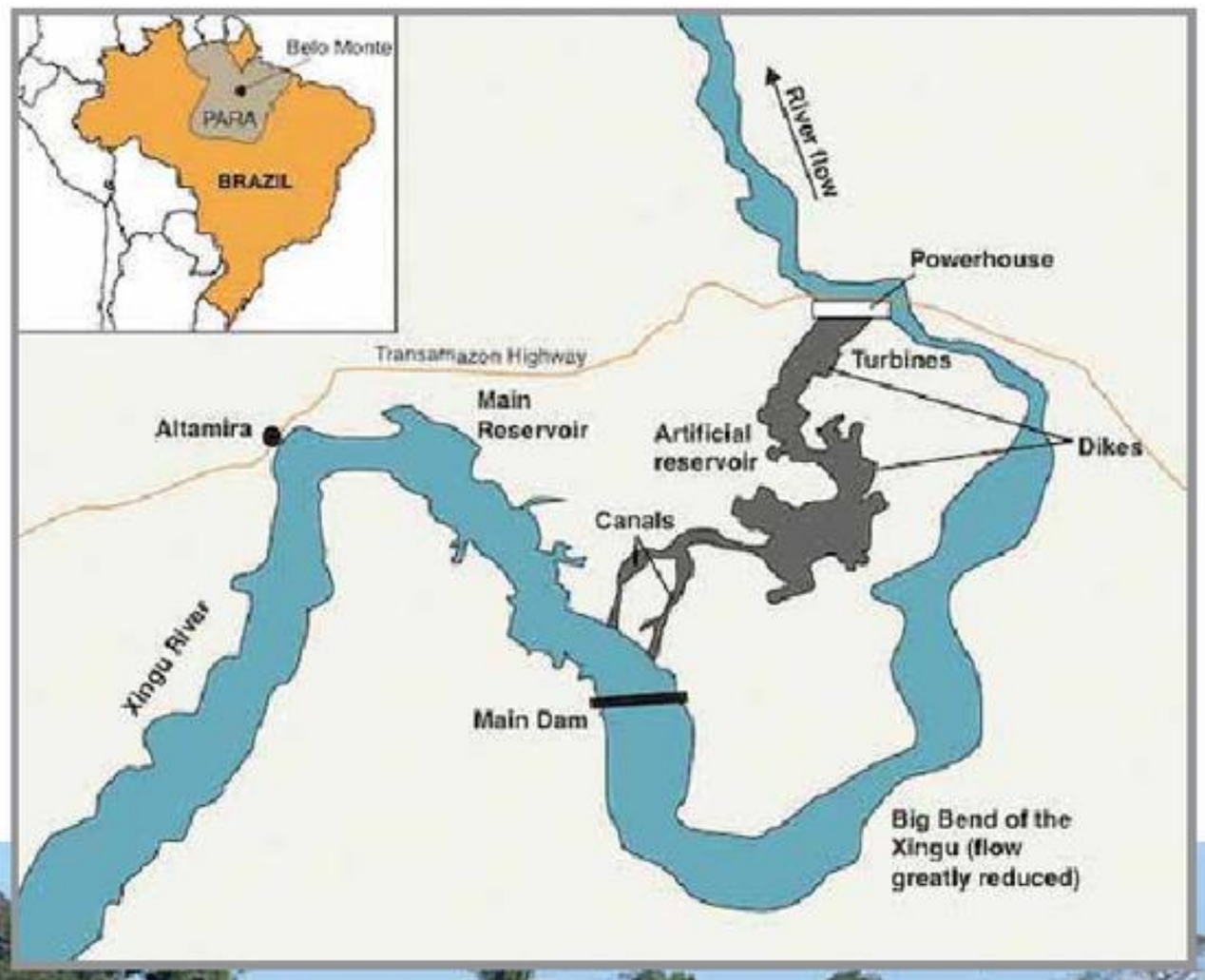
• *by Louise Watson, AMAZONAS Staff Report*

Belo Monte: Protests mount against "Monster Dam" on Brazil's Rio Xingu

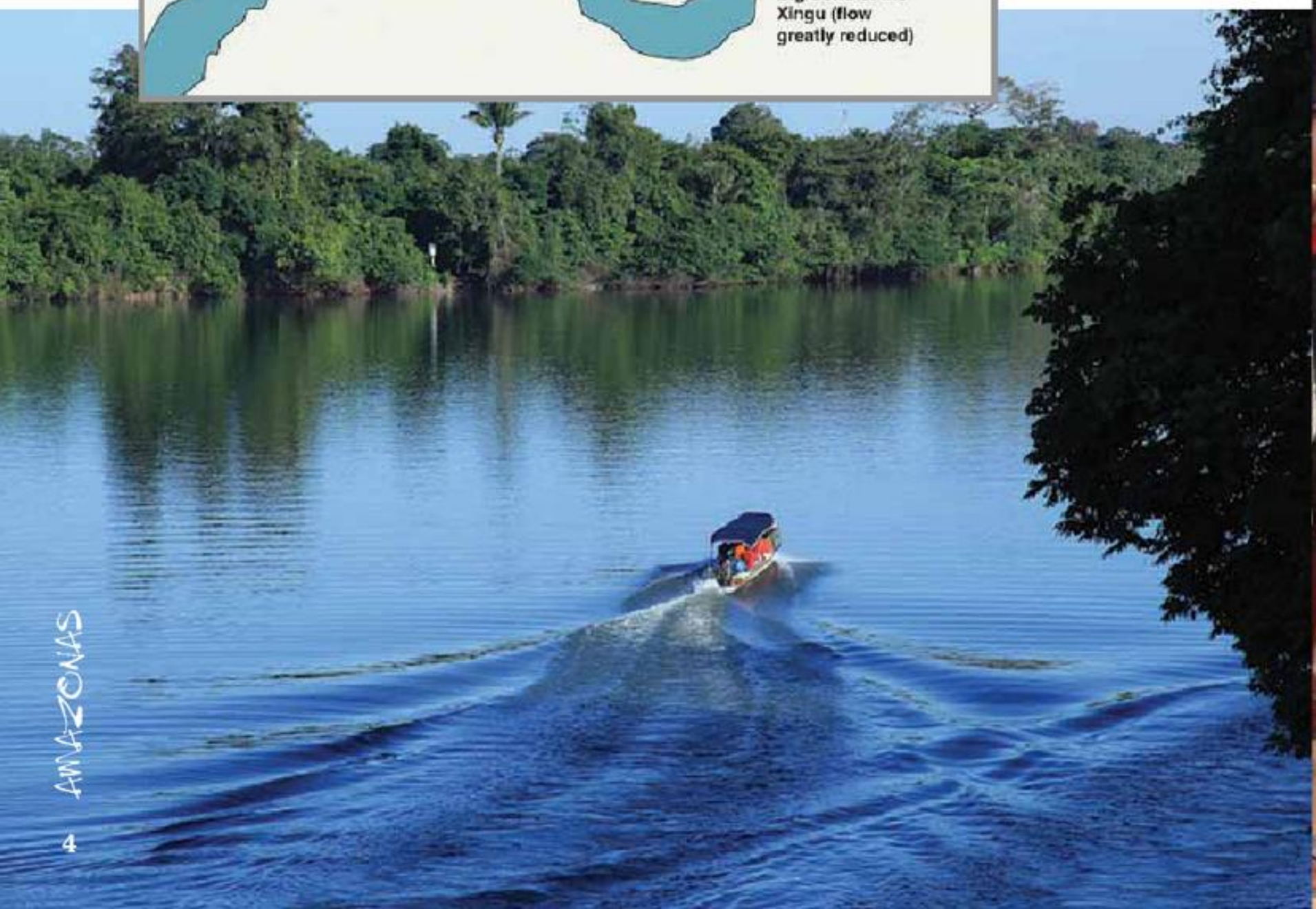
Biologists and human rights observers are calling it an epic disaster in the making, a massive river-damming complex in the heart of the Amazon basin that threatens tens of thousands of native rainforest dwellers and the fish populations that sustain them and enrich the aquarium world.

Belo Monte, the third largest hydroelectric project in the world, is part of the Brazilian government's plan to power a growing economy and reduce dependence on fossil fuels, but opponents say that there are far more environmentally sound ways to save and generate electricity and that the damage—including the release of huge amounts of methane, a gas 25 times as potent as carbon dioxide—would far outweigh the benefits.

According to Amazon Watch, an NGO founded "to protect the rainforest and advance the rights of the indigenous peoples of the Amazon Basin," 80 percent of the water in the Xingu River, a major tributary of the Amazon, will be diverted



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



Left: Construction has begun with the opening of new roads through the virgin forests.

Below: Indigenous warriors protest the invasion of their lands.

into two giant canals, each one-third of a mile wide, the creation of which would excavate more earth than was moved to build the Panama Canal. The dam would flood 258 square miles (670 km^2), over half of which is rainforest, and displace as many as 40,000 people, according to some estimates.

An independent panel of experts made up of scientists from Brazilian research institutions came to the conclusion that the dam project would cause a permanent drought in the area, with the following consequences:

• Fish stocks, which are especially rich and diverse in the Xingu, would be decimated. (Inhabitants of the region get 70 percent of their protein from fish.) The

ornamental fish trade, an important source of income for poor fisher families, would be crippled. The tribes whose ancestral lands, homes, and ways of life are threatened include the Kayapó, Arara, Juruna, Araweté, Xikrin, Asurini and Parakanã Indians.

• The reduction in the river's flow would restrict or prohibit navigation, preventing trade and access to medical care. Below the dam, agriculture would suffer from lack of water; upstream, wells would be contaminated by the rise in the water table and water-borne diseases would proliferate.

• The promise of construction and support jobs would entice up to 100,000 people into the unspoiled region via a network of new roads. These newcomers would compete for about 40,000 jobs and place an untenable burden on already frail physical and social infrastructures. Many of these immigrants are expected to settle in the rainforest and take up illegal logging and ranching.

There is more to the Belo Monte project than meets the eye: Additional upstream dams would be required in order to guarantee year-round power output, because water flow in the Xingu is subject to wide seasonal variations. And 30 percent of the power that would be generated has already been sold to the huge Eletrobras electric utility company, which will resell it to mining operations and other unsustainable and power-intensive industries.

A number of NGOs opposing the dam, including International Rivers, Xingu Vivo, and Amazon Watch, have been joined in their fight by celebrities—including James Cameron, director of the film *Avatar*, and actress Sigourney Weaver, who starred in the movie. Videos featuring both can be seen on the Amazon Watch website.

Construction of access roads to the site began in March 2011, but those opposed to the dam complex have been cheered in recent weeks as high-level forces have been attempting to halt construction via legal means. Federal judge Souza Prudente, whom many hailed as courageous for championing the rights of indigenous peoples, ordered work to stop in August 2012. The order was overturned within days by the Supreme Federal Court of Brazil. It was the latest in a series of conflicting rulings, and more are expected as worldwide opposition to the plan grows. (The Federal Public Prosecutors' Office filed an appeal on September 3).

Prudente said, "The court's decision highlights the urgent need for the Brazilian government and Congress to respect the federal constitution and international agreements on prior consultations with indigenous peoples regarding projects that put their livelihoods and territories at risk. Human rights and environmental protection cannot be subordinated to narrow business interests."

An incomplete environmental impact assessment, the failure to inform and consult with the people who would be affected, and a judge's ruling that the project could go ahead without these essential components have angered many, and a number of protests have been staged, including a three-week occupation of the site this June.

ON THE INTERNET:

International Rivers: http://www.internationalrivers.org

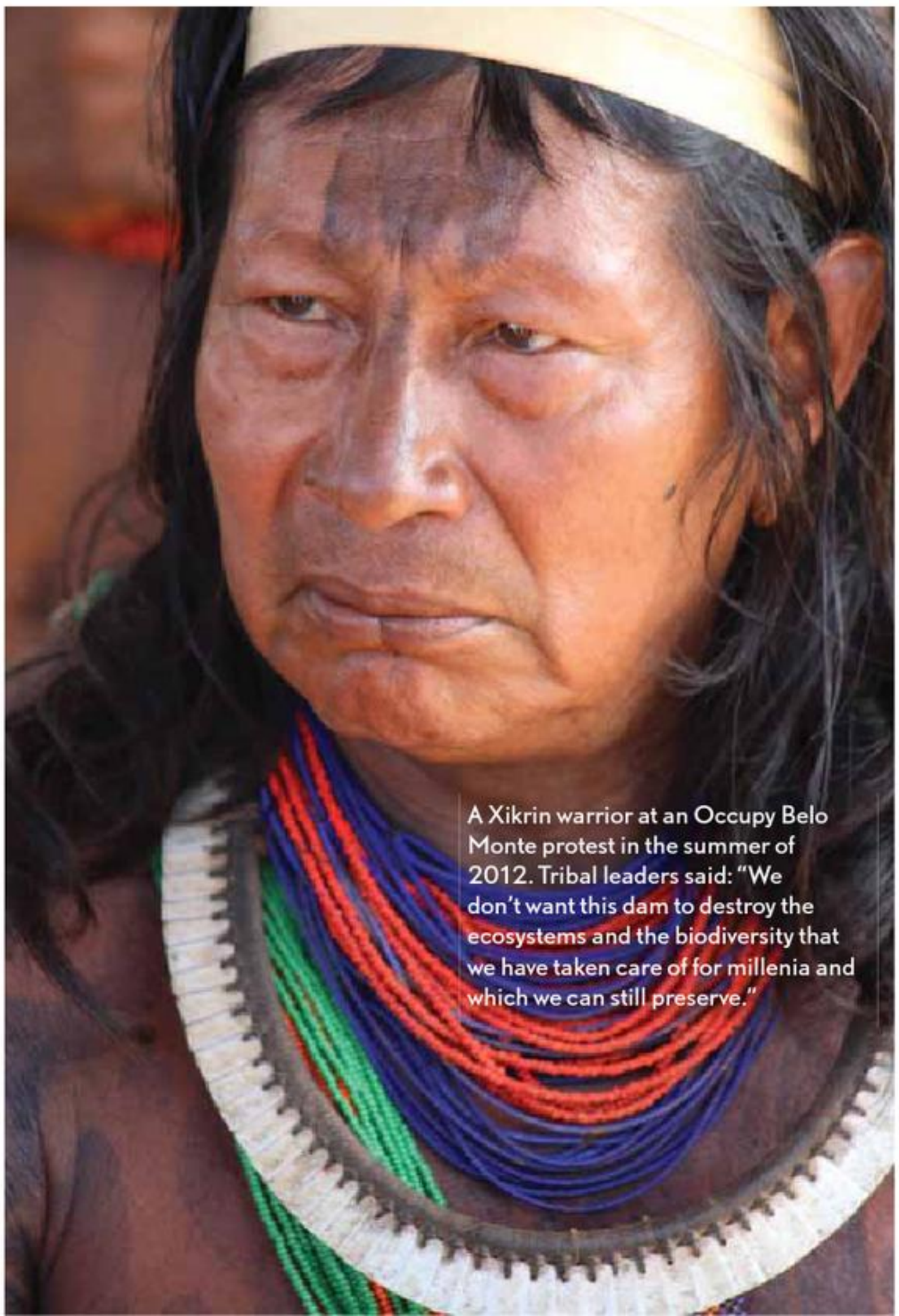
Amazon Watch: http://amazonwatch.org/work/belo-monte-dam

James Cameron, *A Message from Pandora*: http://amazonwatch.org/news/2011/0907-message-from-pandora

Sigourney Weaver, *Defending the Rivers of the Amazon*: http://amazonwatch.org/news/2010/0830-defending-the-rivers-of-the-amazon-sigourney

Survival International: http://www.survivalinternational.org/about/belo-monte-dam

Xingu Vivo (Portuguese only): http://www.xinguvivo.org.br/



A Xikrin warrior at an Occupy Belo Monte protest in the summer of 2012. Tribal leaders said: "We don't want this dam to destroy the ecosystems and the biodiversity that we have taken care of for millenia and which we can still preserve."

RAFAEL SALAZAR/WWW.AMAZONWATCH.ORG

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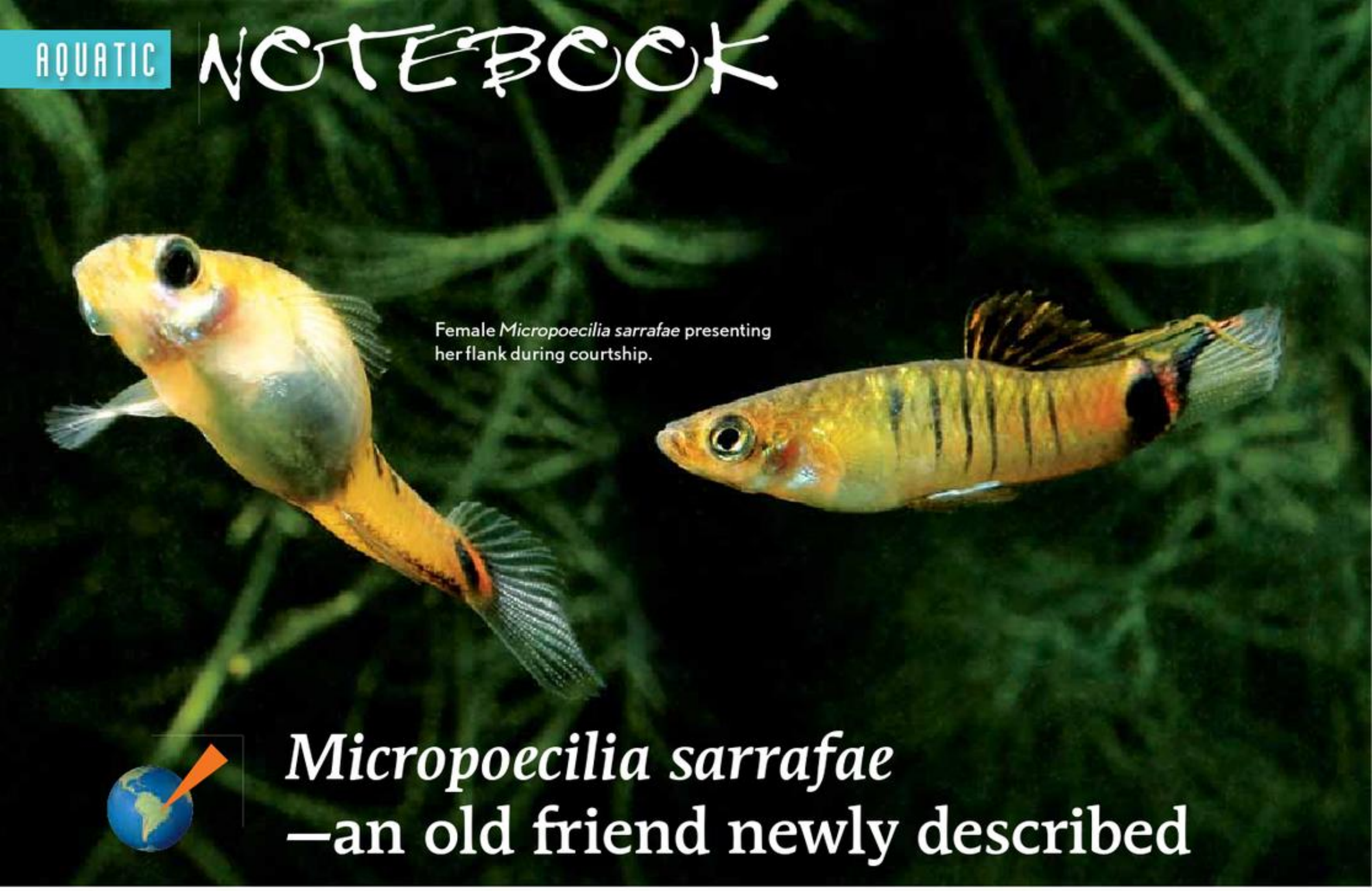

Female *Micropoecilia sarrafae* presenting her flank during courtship.

Micropoecilia sarrafae —an old friend newly described

by Elke Weiand and Dirk Stojek • Recent years have seen the arrival in the trade of not only the red cultivated form of the Swamp or Painted Guppy (*Micropoecilia picta*) and the color forms of the Twospot Livebearer (*M. parae*), but also a number of other interesting *Micropoecilia* species, including Branner's Livebearer (*M. branneri*) and *M. minima*. Yet another species—*Micropoecilia sarrafae*—has also been sold under these names. This fish wasn't scientifically described until 2010, although it did turn up earlier in the aquarium hobby under other names.

In spring 2010, I (EW) obtained some fishes purported to be *Micropoecilia minima* from an aquarist friend. I had been keeping this species since 2005 and was particularly interested in the new fishes when I heard about their different appearance. Unfortunately, I was able to obtain only four females and no males, but one thing was clear the moment I saw them in the bag: they certainly weren't *Micropoecilia minima*.

The fishes looked rather like females of *Micropoecilia branneri*, a pair of which I had gotten in 2009. And on the basis of photos, Dirk Stojek agreed. He had obtained a number of imported specimens that looked very much like mine. However, we noticed that, unlike the *Micropoecilia branneri* from the previous year, these new ones had dark spots on the flanks and the ring around the caudal-peduncle spot was orange-yellow rather than light yellow. They were, in fact, a species that had been described as *Poecilia sarrafae* that same year by Bragança & Costa, and which is here termed *Micropoecilia sarrafae*.

Risk of degeneration

My four females settled in quickly, and soon the first fry were swimming around in the tank without being hunted significantly by the adults. Unfortunately, the aquarium was sited in a less than ideal spot, and I was too busy to keep a close eye on it. So by the time I noticed that the females were infested with *Camallanus* worms, it was too late. Although I treated them immediately, this didn't help much; all but one of the fishes died, and the survivor was badly damaged.

Luckily, I was able to obtain a small group of F_1 tank-breds of both sexes from the same source. This time the fishes were carefully wormed and remained in superb condition. The group were housed in a standard 24-inch (60-cm) aquarium filled with tap water (general hardness 12°dGH, carbonate hardness 9°KH, and pH 7). They ate, displayed, and mated, but no fry resulted. In addition, the number of fishes gradually decreased for no obvious reason until just a pair were left. I moved the

D. STOJEK

Pair of Branner's Livebearer, *Micropoecilia branneri*.

survivors to the 10-inch (25-cm) tank on my desk, and one day at feeding time I found three little pairs of eyes staring curiously at me.

The little "mini fishes" grew on slowly but steadily, and a few more appeared now and then; eventually, the group numbered 10 again. I then split them between two aquariums, and after a rather long pause there were fry in both tanks.

While on the one hand this was reason for celebration, on the other I was a little worried: The tank-breds were considerably smaller than the wild-caught fishes from spring 2010. Even the F_1 failed to grow anywhere near as big as the wild fishes, and the F_2 were smaller still. Unfortunately, I still don't know the reason for this dwarfing. The causes of the maintenance problems and the birth of non-viable fry that a number of authors have repeatedly reported remain a matter for speculation.

One possibility is that essential components are missing from the fishes' diet. In an article on what was then thought to be *Micropoecilia branneri*, Flöthmann (2001) reported that he added vitamins to the food and thereby achieved good results. I am currently experimenting with suitable additives used in commercial fish breeding.

Undesirable sex ratio

In summer 2009, I (DS) ordered three pairs of *Micropoecilia sarrafae* (then identified as *M. branneri*). On unpacking the fishes I suffered my first setback, realizing that they were all females. So I ordered four males in addition. By the time the males arrived the females had settled in very well. But despite gentle adjustment from the transportation water to the tank water, three of the four males died a day later. I was unable to identify any reason for their demise, but at least I had one more male now.

The fishes occupied a 16-gallon (60-L) tank. A smaller tank seemed less suitable because of their apparently unlimited need to be on the move. Males tend to vigorously chase one another and the females around the tank. I never noticed any injuries resulting, but I was worried that subordinate individuals might be harmed by long-term stress.

The water was used untreated from the tap and had a pH of around 7.5, a carbonate hardness of about 3°dKH, and a total hardness of some 20°dGH. The tank was heated only by the room temperature and by warmth from the aquariums below it. In this way I maintained a temperature between 77 and 86°F (25–30°C) over the course of the year. This species shouldn't be maintained below 75°F (24°C) in the long term.

Because of the mainly negative maintenance experiences of other aquarists, I initially sought to follow the recommendations of Bork (1998), who felt that too rich a diet might be responsible for the problems in long-term maintenance. I fed *Paramecium* (from a culture) every two days, and on the intervening days I used pond foods,

Male *Micropoecilia minima*.

E. WEIAND

Above: Male *Micropoecilia sarrafae* showing the species-typical shoulder spot. Below: Female *Micropoecilia minima* can be easily recognized by the pattern of spots on the side.

Artemia nauplii, and vegetable dry foods, in alternation. I was simultaneously using the same diet to maintain a number of *Micropoecilia minima*. While I could detect no benefits or disadvantages in the case of the *M. sarrafae*, a loss of condition was apparent in the *M. minima*.

Generally speaking, livebearing toothcarps have the habit of eating themselves full almost to bursting whenever food is available. Because of that, limited feeding is definitely recommended.

Infections and parasites

Meanwhile, odd fry kept on turning up. I planted part of the tank densely in order to provide shelter for the newborn young. They were sometimes rather disoriented immediately after birth, and I saw them being pursued and eaten. The fry grew on fairly well up to a length of .38 inch (1 cm), but thereafter their growth slowed obviously. Some of the young developed swollen bellies. If water changes weren't frequent enough they reacted with clamped fins. All in all, the situation was less than satisfactory.

In the winter of 2009/2010 I adopted the methods of Flöthmann (2001) and began to enrich the food with a vitamin preparation. Specifically, I added a few drops of Emulvit to live *Artemia* nauplii two to three times per week and left it to take effect for a few minutes before feeding. After a while I had the feeling I was achieving a positive effect. The young weren't growing significantly faster, but they appeared to be properly formed. By May 2010 I had a population of some 40 individuals, and in June I discovered the first fry of the F_2 generation.

But then it all fell apart at once. From August on, I lost the entire population in the space of two months. I spent a

MICROPOECILIA SPECIES

Until recently, only five *Micropoecilia* species were known: *Micropoecilia branneri*, *M. picta*, *M. parae*, *M. bifurca*, and *M. melazona*.

Micropoecilia branneri (Eigenmann, 1894) is a pretty little livebearer that has been repeatedly imported at intervals, though it has proved impossible to establish the species in the aquarium in the long run. In 1989, Hieronimus described the striking courtship display of *M. branneri*, and over the course of the years there have been frequent articles about this rare toothcarp in aquarium-hobby magazines. The description of *Micropoecilia minima* (Costa & Sarraf, 1997) added a further species, one that is very similar to *M. branneri*.

In spring 2010, the first doubts crept in regarding the identity of some of the fishes that I had obtained as *Micropoecilia minima*. Were they *M. branneri* or another species? Following Meyer, I initially termed the fishes *M.* cf. *branneri*. Hieronimus (2010) likewise suggested that two different species were being identified as *M. branneri*. In December 2010 Bragança & Costa described a new species from the Parnaíba and Mearim drainages in Brazil. This description of *Poecilia* (= *Micropoecilia*) *sarrafae* solved the puzzle of *M.* cf. *branneri*.

Micropoecilia branneri, *M. minima*, and *M. sarrafae* all look very similar at first glance. They are distinguished from the other *Micropoecilia* species by the black caudal-peduncle spot, plus a number of pale gray stripes on the flank and a prolonged dorsal fin in males. While *Micropoecilia branneri* and *M. sarrafae* exhibit a yellowish base color on the body, in *M. minima* this is more of a silver gray. The females of *M. minima* have several dark spots on the flank; these are also seen in both sexes of *M. sarrafae*, but are completely absent in *M. branneri*. The shoulder spot on the upper half of the body in *M. sarrafae* is particularly characteristic of the species. Females of *M. branneri* have a yellow, and those of *M. sarrafae* an orange-yellow, ring around the black caudal-peduncle spot, while *M. minima* lacks such a ring entirely.

E. WEIAND

Micropoecilia sarrafae females also exhibit a shoulder spot and the species-typical stripe pattern.

long time searching for reasons for this die-off, and finally identified the addition of some *Xiphophorus* as the trigger. Because of problems in another tank (small skin eruptions on the body), I had moved the apparently healthy specimens in order to save them.

In addition, during the preparation of this article, Elke spotted a fish with *Camallanus* worms while she was going through my photos. I cannot say whether the *Micropoecilia sarrafae* were already infested before the introduction of the *Xiphophorus* or whether the latter were the carriers. Parasites of this kind are often very difficult to spot in this species, as they can't be seen hanging in a bunch from the anus as they can in other fishes. Because of the rapid movement of the fishes and the small size of the worms, it is at best possible to spot the occasional worm in a living fish, and then with difficulty. And it is usually a very long time before an infestation is indicated by noticeable emaciation.

Because of this painful experience, I recommend always using a species tank. This makes it easier to monitor the population, as well as to apply treatment if required. Experiments with tankmates are best undertaken using spare tank-breds.

All good things come in threes

The three species *Micropoecilia branneri*, *M. minima*, and *M. sarrafae* not only look very similar, but their behavior, too, is practically identical. The courtship display described by Hieronimus (1989) can be observed in all three species (albeit sometimes in altered form). The same applies to the defensive behavior in females described by Flöthmann (2001). This behavior wasn't initially observed in *M. minima* and *M. sarrafae*, probably because of the restricted conditions

Right, top: Displaying *M. sarrafae* males.

Bottom: Young *Micropoecilia sarrafae* already exhibit the typical shoulder spot.

TOP AND BOTTOM: E. WEIAND; MIDDLE: D. STOJEK

in the aquarium. But we can now assume that, as in *Micropoecilia picta*, population density has an influence on courtship behavior.

During our research we came to the conclusion, based on the photos illustrating their articles, that many authors had probably maintained *Micropoecilia sarrafae* and not, as they had assumed, *M. branneri*. Only the fishes described by Hieronimus (1989) and those which I (EW) maintained for a short time in 2009 can be unequivocally assigned to *M. branneri*.

The literature also mentions two additional species belonging to this group, namely *Micropoecilia heteristia*, described by Regan in 1909, which is regarded as a synonym of *M. branneri*, and the fishes discussed as *Micropoecilia* sp. "Piavi" by Stallknecht (2000). The fishes shown by Stallknecht may likewise be *M. sarrafae*, but could also be another species. There is still a lot of work for the scientists to do in the field of these little poeciliids. But who knows how long they will continue to exist in their native lands—in this case, Brazil?

Unfortunately, these little livebearers are imported rarely, often with inadequate locality data. This makes precise identification at the species level practically impossible for the layman. The enthusiast can but try to establish these rare fishes in the hobby. Contrary to the popular view that all livebearers will breed like rabbits entirely of their own accord, the long-term retention of these species is not that easy. Maybe someone will recognize the need to establish these fishes the next time they are imported and try to breed them.

Editorial note: *According to Eschmeyer et al. (www.calacademy.org)*, Micropoecilia *is currently regarded as a subgenus of* Poecilia. *On this occasion we don't agree with Eschmeyer and instead accept the classification used by the Deutsche Gesellschaft für Lebendgebärende Zahnkarpfen (DGLZ, German Livebearer Association) and other organizations that regard* Micropoecilia *as a separate genus.*

REFERENCES

Bork, D. and H.J. Mayland. 1998. *Seltene Schönheiten im Süßwasseraquarium*. Schmettkamp Verlag, Bornheim, Germany.

Bragança, P.H.N. and W.J.E.M. Costa. 2010. *Poecilia sarrafae*, a new poeciliid from the Parnaíba and Mearim river basins, northeastern Brazil (Cyprinodontiformes: Cyprinodontoidei). *Ichthyol Explor Freshwaters* 21 (4): 369–76.

Flöthmann, H. 2001. *Micropoecilia branneri*. *Aquaristik Fachmagazin* 160: 53.

Hieronimus, H. 1998. *Poecilia minima*, ein neuer Lebendgebärender. *DGLZ-Rundschau*: 7–9.

Hieronimus, H. 2010. *Micropoecilia*. DGLZ Rundschau Sonderheft 2/2010.

Kolodzey, R. 1995. Geheimnisumwittert: *Poecilia branneri*. *D Aqu Terr Z* (*DATZ*) 48 (8): 484–5.

Meyer, K.M., L. Wischnath, and W. Foerster. 1985. *Lebendgebärende Zierfische*. Mergus, Melle, Germany.

Stallknecht, H. 2000. *Lebendgebärende Zahnkarpfen*. Tetra, Melle, Germany.

Werner, U. 2007. Zwei Minikärpflinge aus Brasilien. *D Aqu Terr Z* (*DATZ*) 60 (9): 22.

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Sci Fi(sh)

Zebra Danio *gains elevated role in human health research at new U.S. facility*

Above: The new centralized Zebrafish facility at the National Institutes of Health campus in Bethesda, Maryland, has one of the world's largest populations of aquarium-bred *Danio rerio*.

The humble Zebrafish, *Danio rerio*, a classic first fish for neophyte freshwater aquarium keepers, is playing an enhanced role as a mainstay research species for some of the most sophisticated human health studies being conducted at the U.S. National Institutes of Health (NIH).

Designed to serve the needs of scientists at a number of NIH institutes, the new centralized Zebrafish facility in Bethesda, Maryland, boasts state of the art equipment and systems.

The Zebrafish, which shares many genes with humans, is highly valued as a model organism because of its rapid development from egg to fully functional animal, its prolific breeding habits, its ability to produce successive generations in short order, and the ease and affordability of its care.

Zebrafish are used worldwide in research involving vertebrate genetics and development, as well as testing of chemicals and potential new drugs. High-profile scientific research at the NIH focuses on embryonic development to provide better understanding of development aberrations in human children.

"Our institute supports research to ensure that human beings get the best start possible, so all people have the chance to reach their potential, regardless of disease or disability," said Alan E. Guttmacher, M.D., director of the NIH's Eunice Kennedy Shriver National

Right: Transparency of double pigment mutant named Casper (not yet available in the aquarium trade) makes most organs visible.

DANIEL CASTRANOVA (© NIH/NICHD)

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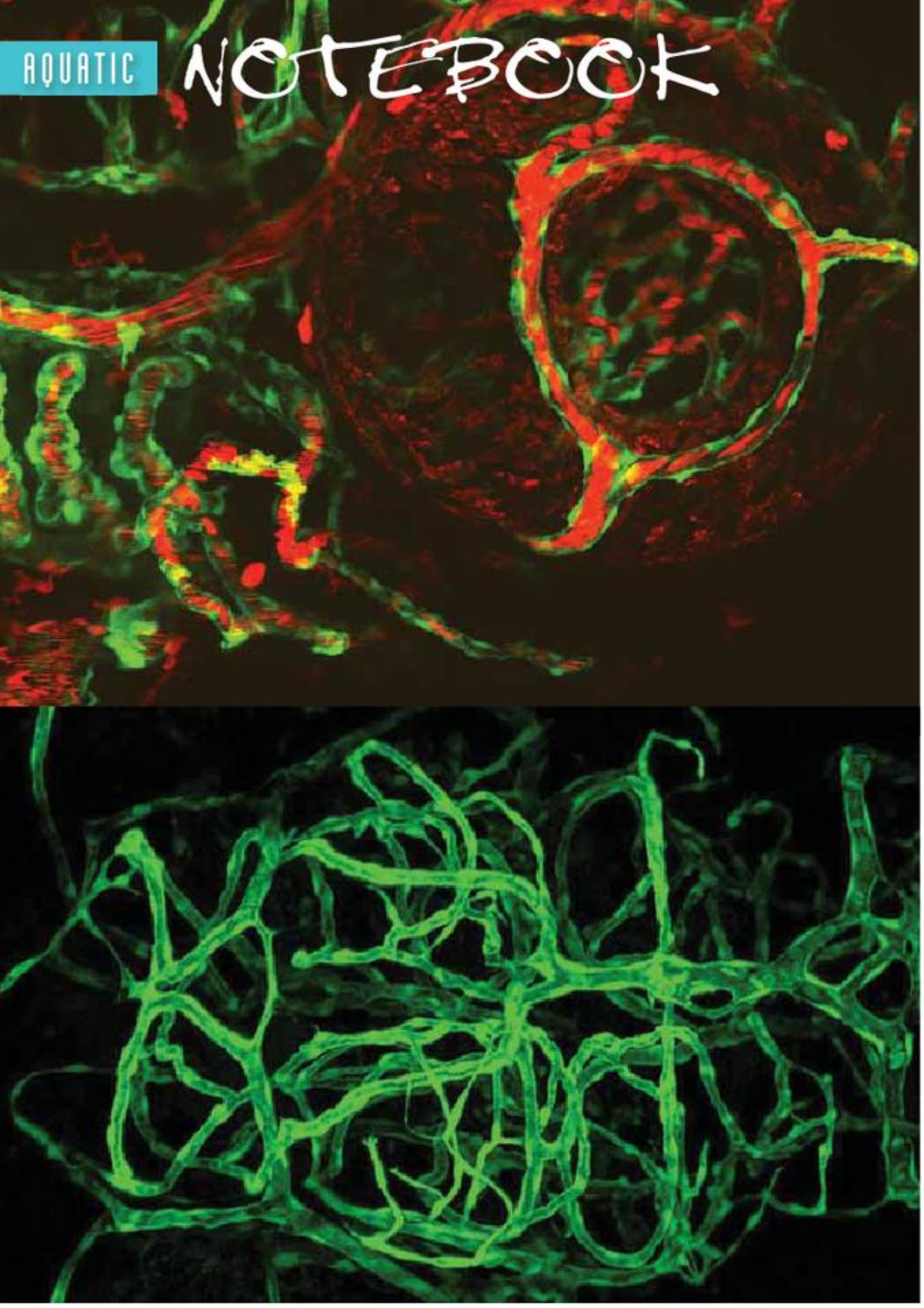


Top left: Microscopic view of eye, aortic arches, and heart of a live transgenic Zebrafish, 2.5 days post fertilization, with blood vessels labeled in green and blood cells labeled in red to study vascular development.

Bottom left: Microscopic dorsal (top) view of the head of a live transgenic Zebrafish, 3 days post fertilization. Blood vessels are labeled in green to study vascular development.

Institute of Child Health and Human Development (NICHD). "Many disorders and conditions arise early in embryonic life, when we can't directly observe them in humans. For this reason, we rely on animal models to stand in for humans to provide insight into the developmental process."

NIH Zebrafish facility

Many studies require large numbers of fish to test different compounds, to test varying doses of a compound, or to allow scientists to search for an uncommon genetic variation. The NIH facility is the largest in the world, with enough space for 19,000 tanks that can accommodate 100,000 fish. Zebrafish females can produce hundreds of eggs in a single mating.

"Answering the most important questions in science requires a facility of this size," Dr. Guttmacher said. The facility uses 25,000 gallons of water, about 40 percent of which circulates through the tanks at a given time. The remainder flows through a high-tech filtration system to remove wastes. The water temperature is maintained at 82°F (28°C) and the water chemistry is rigidly controlled. Before entering the tanks, the water is pumped past ultraviolet light to kill any bacteria or other organisms that have the potential to cause disease.

Custom-designed tanks are structured to be self-cleaning, with grated false bottoms that allow the easy collection of eggs. Ambient lighting closely mimics natural conditions by gradually changing in intensity at dawn and dusk transitions. The fish are fed a variety of foods, including a dry, prepared mix and live brine shrimp.

The facility is operated jointly by the NICHD and the NIH's National Human Genome Research Institute. A number of other NIH institutes also conduct research at the facility, including the National Cancer Institute, the National Heart, Lung and Blood Institute, the National Eye Institute, and the National Institute of Alcohol Abuse and Alcoholism.

The NIH also funds research studies employing Zebrafish at a number of research institutions around the country and in other parts of the world, explained Lorette Javois, Ph.D., of NICHD's Developmental Biology, Genetics, and Teratology Branch. Dr. Javois is co-chair of the Trans-NIH Zebrafish Initiative, which coordinates funding for research involving Zebrafish among the NIH institutes. It also serves as a resource for scientists doing research with Zebrafish.

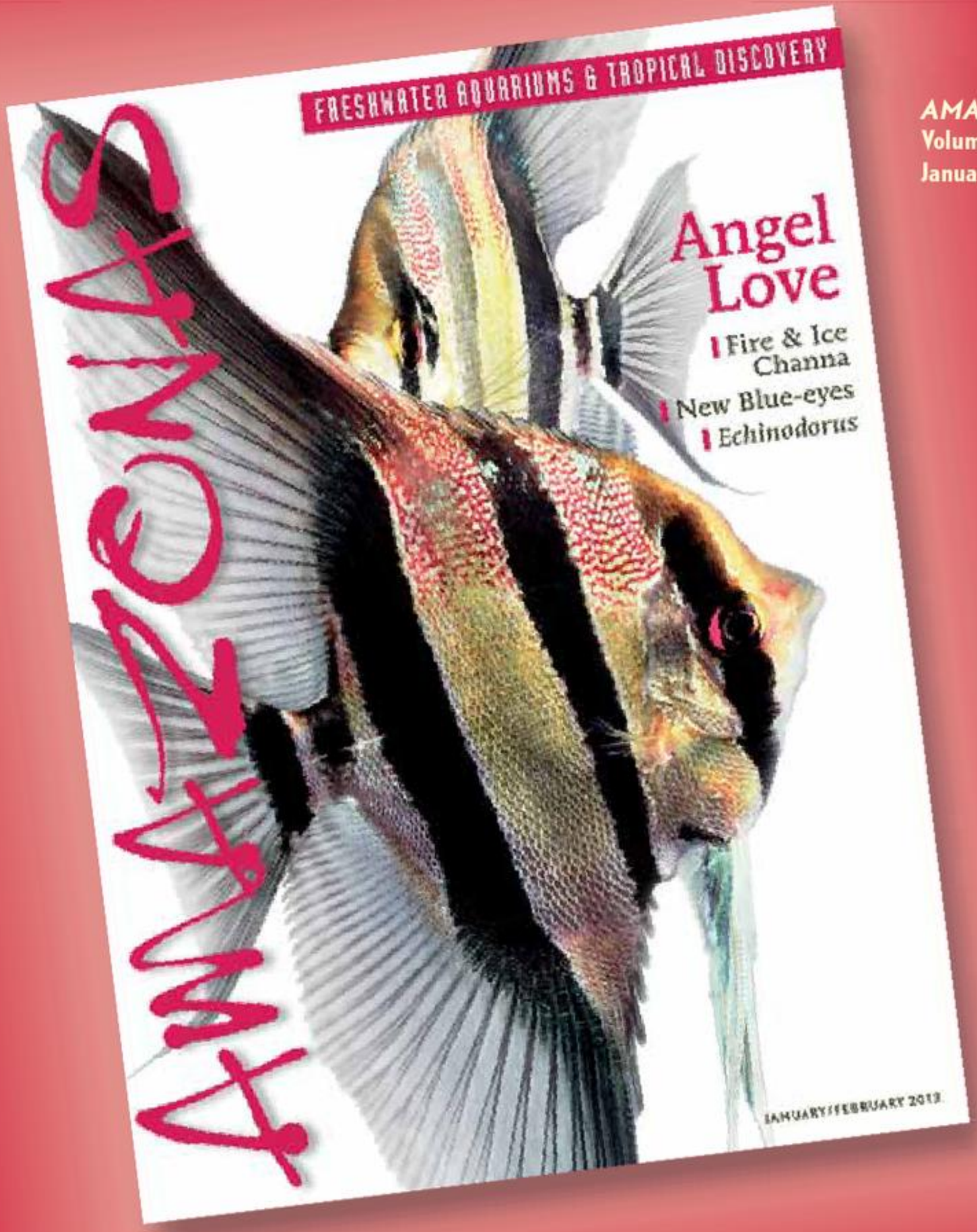
—from materials supplied by the National Institutes of Health

ON THE INTERNET:

A recent video about the new facility, *Zebrafish: A Key to Understanding Human Development*, and how it is playing a role in science can be found here: www.youtube.com/watch?v=l0BtcjgOay4&feature=plcp

DANIEL CASTRANOVA (© NIH/NICHD)

"Wow!"



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• *by Mary E. Sweeney*

New *Oryzias* species described

Above: Female *O. eversi* with developing eggs clearly demonstrates pelvic-fin brooding behavior.

Pelvic brooding is a rarely seen reproductive behavior in which a female fish carries her fertilized eggs externally, protectively clasped between her pelvic fins and held close to her belly. The small clutch of eggs, numbering perhaps 8 to 12, is carried until hatching, after which the female is soon ready to spawn again.

A new species of pelvic-brooding ricefish has just been described and is named in honor of *AMAZONAS* editor-in-chief and intrepid piscine explorer Hans-Georg Evers. *Oryzias eversi* was first discovered by Evers in a forest hill stream in Tana Toraja, on Sulawesi Island, Indonesia.

According to Evers, "This ricefish has a very unusual breeding behavior. I found this species in September 2010 and am still breeding them in my tanks. It's a very fascinating and amazing matter." The fish were caught using a snorkel and hand nets, and Evers photographed a male and a female immediately after collection in order to document their living colors. He also collected a number of the fish and brought them back to Germany so he could observe their breeding habits and behaviors in the aquarium.

These tiny gems differ from other Sulawesi ricefishes in the number of anal and dorsal fin rays, the number of scales in the lateral midline, the number of scale rows at the dorsal fin origin, the number of vertebrae, their small eyes, the male's blackish courtship coloration, and their pelvic brooding behavior. One other species in the genus, *Oryzias sarasinorum* (Sarasin's Buntingi), is known to be a pelvic brooder.

During development, and until they hatch, the female *Oryzias eversi* carries the eggs nestled between her pelvic fins, but they are still connected to her body by filaments protruding from her urogenital pore. In the handful of other pelvic brooders known, the female has a concave belly and enlarged pelvic fins to hold and protect the egg mass. This technique of caring for the eggs has been known in other Sulawesi lacustrine pelvic brooders, and now has been noted in river habitats, which represents a new evolutionary trajectory for Sulawesi ricefishes.

Authors of the paper describing the new

H.-G. EVERS

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AQUATIC NOTEBOOK

Male *O. eversi* in blackish breeding coloration.

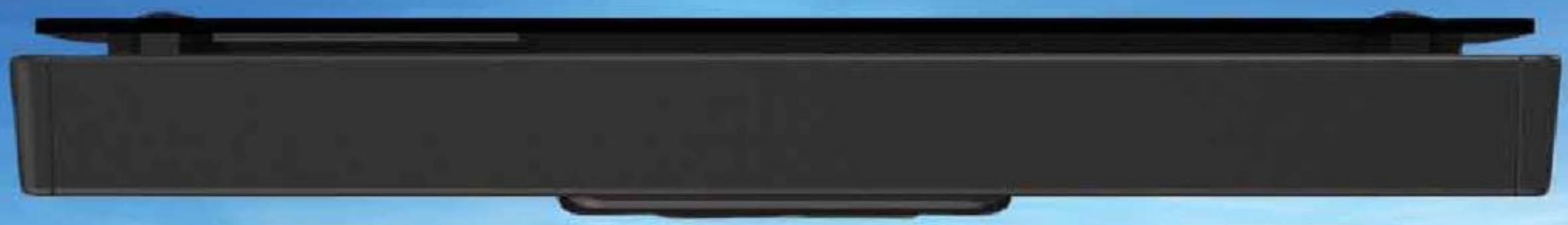
Male *O. eversi* in normal, non-breeding coloration.

species say this discovery helps to demonstrate the diversity of ricefish species in Sulawesi, an area of the world whose ichthyofauna has only been partially explored and still has the capacity to produce awe and wonder.

REFERENCES:

Herder, F., R.K. Hadiaty, and A.W. Nolte. 2012. Pelvic-Fin Brooding in a New Species of Riverine Ricefish Atherinomorpha: Beloniformes: (Adrianichthyidae) from Tana Toraja, Central Sulawesi, Indonesia. *Raffles B Zool* 60 (2): 467–76.

H.-G. EVERS



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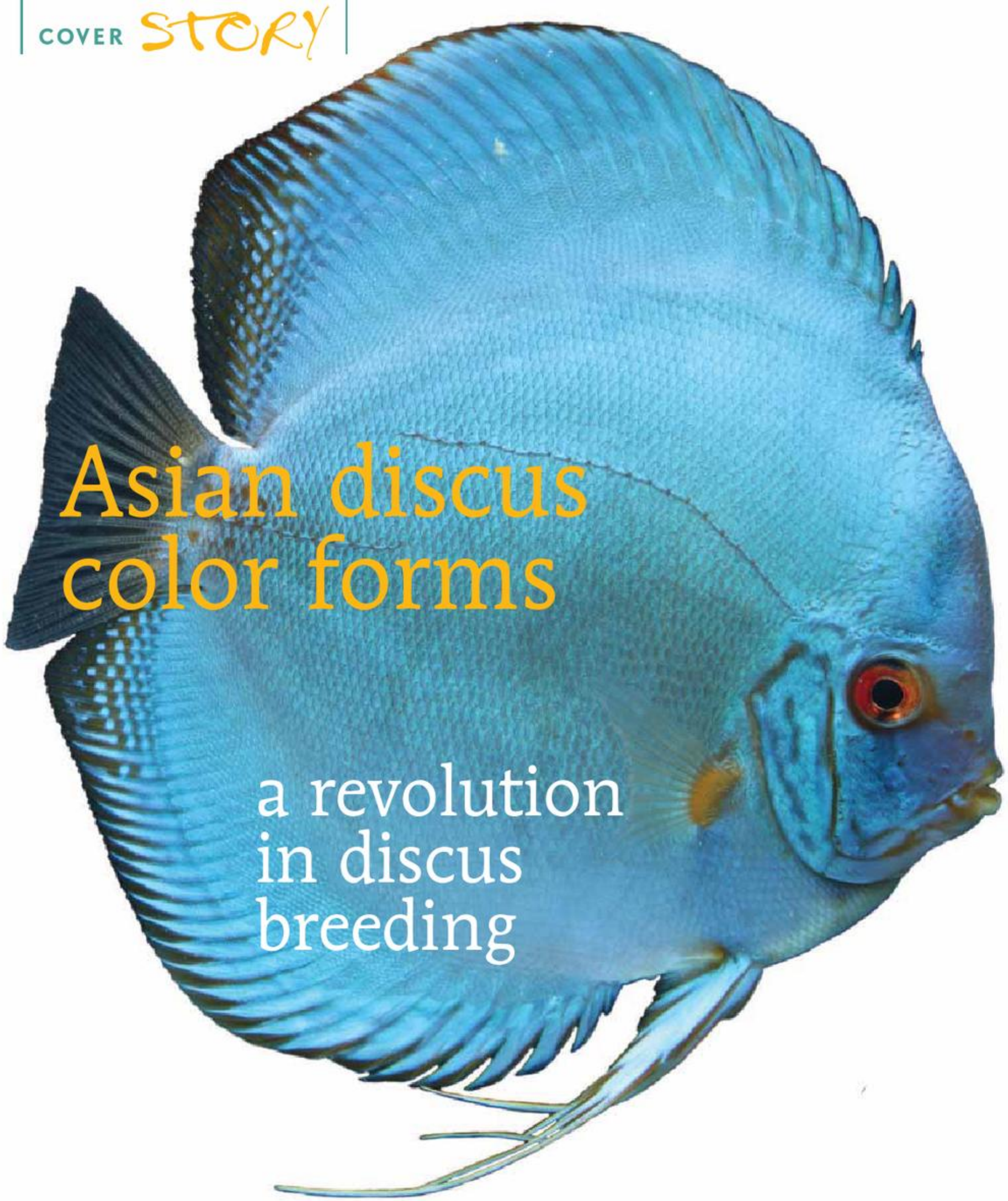

Asian discus color forms

a revolution in discus breeding

by Horst Köhler • *"Almost all discus from Asia are mixtures of different discus species, treated with hormones and pigments...Unattractive discus with black spots on the body and almost colorless discus with fantasy names are being put on the market. By contrast, I am trying to retain and improve the loveliest wild colors of imported fishes via line-breeding."* —Dr. Eduard Schmidt-Focke, discus breeder, in a 1993 letter to the author.

MATT BEAMAN

In the late 1980s and the early 1990s there was still heavy resistance to the invasion of discus from Southeast Asia and the Far East, whose unusual colors distinguished them from the German tank-breds and wild-caught forms from South America available at that time. The breeders who produced them were immediately accused of using illegal breeding methods—for example, irradiating their youngsters with UV and X-rays. There was never any concrete proof of that, but the commonplace use of methyltesterone was well known.

Dr. Schmidt-Focke (1913–1998), one of the best-known German discus breeders, was not the only one to warn aquarists against buying such "mongrels." Almost everyone who had a good reputation from the previous 15 years of the discus scene preferred to work with "conventional" German tank-breds or wild-caughts. Some dealers and aquarium stores that specialized in discus even distanced themselves publicly from "Asian fishes" by advertising with the slogan, "No Asian fishes here."

Opposite page, left: The Blue Diamond Discus, originally created by Lo Wing Yat of Hong Kong, took first place in the Solid Class at the North American Discus Association 2012 Show. This fish is owned by Tara Bennett.

But the resistance didn't last long. The colorful discus "made in the Far East" are now being bred in numbers in Germany, and I have the impression that these color sports are even more widespread in the aquariums of European fish enthusiasts than the typical German color variants, such as Turquoise and Solid and Brilliant Turquoise. The emphasis on wild-caught discus is likewise not as great as it was 10 or 15 years ago, although, thanks to the discovery of new collecting sites and better methods of capture, the fish imported nowadays are appreciably more colorful than those of the past.

Over a period of many years, Dr. Schmidt-Focke, who was seriously ill in his later life, attempted to improve the colors of his rather pallid wild-caughts via line breeding, but his results were not encouraging. The yield was relatively low: when, after much effort on his part, his small number of parent fish were finally healthy and free of parasites, each brood consisted of just 20 or 40 fry. On one occasion he told me that one of his wild-caught pairs had produced just eight young discus.

I have no doubt that Dr. Schmidt-Focke would have immediately stopped breeding his fish, had he foreseen what outstandingly colorful wild-caught discus were to come. Instead, he had to watch as Asian breeders bred discus very successfully using the specimens they had bought from him, and expanded their premises to such an extent that some were able to accommodate more than 300 breeding pairs and their countless offspring.

Above: The author's discus community tank contains striped-all-over wild-caughts from assorted collecting areas.

H. KÖHLER

The most colorful discus possible

The trend toward the color-intensive Asian discus came about because aquarists wanted the most colorful discus they could find. It was all the same to them whether these "modern" color forms lacked some characteristic or other, such as the form of the body (which should be as round as possible), strength of immunity, the natural behavior of wild-caught fishes, or the ability to reproduce. And for a long time, introduced and infectious diseases were a major problem.

The talents of Asian breeders all over the continent are renowned. In the spring of 1996 I organized and led a group of discus enthusiasts on a trip to Malaysia, where we marveled at the multitude of discus variants for sale in many hundreds of tanks. But the success of Asian breeders over such a long period isn't just a matter of their talent: they have access to the best top-quality food (including live food), an extremely cheap workforce, and no need for tank

heating and filtration, and they are able to perform daily 100 percent water changes, which greatly stimulates growth and flushes away parasites and their eggs.

This article will discuss the most important, but not all of the "new" discus color forms of recent years. Readers may wonder how the Asian breeders have succeeded in producing such a multitude of attractive color variants. In the vast majority of cases they are not the result of planned breeding programs that adhere strictly to classic inheritance theory, such as those conducted by Dr. Schmidt-Focke and other early German breeders; many of them are produced via the trial-and-error method. Chance alterations in the genetic make-up—that is, inheritable changes in the organism—through mutation are the explanation. And sometimes non-inheritable change also plays a part.

Most of the Asian breeders that I know are very simple people, often native farmers, and it cannot be assumed that they know, for example, the difference between dominant-recessive and intermediate characters or are aware of the precise meaning of the terms "genotype" and "phenotype." Even the name of Johann Gregor Mendel, closely linked with his historic cross-breeding experiments with peas, is probably unfamiliar to this group of people. There are also successful Asian discus breeders who are college-educated and adhere to strict breeding programs, but as a rule they don't breed fish on a large scale.

The Ghost Discus

The evolution of the colorful Asian discus color forms began at the end of the 1980s in the discus capital—Penang, Malaysia—with the Ghost Discus, a color variant that still hasn't been completely accepted outside Asia. This variant was first discovered by a breeder named Cheang Thean Ewe, who established his Brilliant Turquoise strain through repeated inbreeding over several generations. This led to a genetic mutation: one day he found a number of transparent specimens among his youngsters. These looked completely different from most of their siblings.

Almost solid red wild-caught discus belonging to the author, from the Novo Olinda collecting area (Rio Madeira, Brazil). The fish do not receive any color-enhancing food.

There was, however, a major problem with these "oddities" once they became sexually mature: only around every tenth male Ghost turned out to be fertile. The breeder solved the problem by back-crossing female Ghost Discus to male Brilliant Turquoise.

The Ghost received wide publicity for the first time at the Aquarama international aquarium-fish exhibition in Singapore in 1989. It was not, as is often asserted, a hybrid form. This new variant, which has also been marketed periodically under the names Silver Dreamer, Moonlight Discus, and Midnight Discus, no longer possesses the brown base color and blue shading typical of the Brilliant Turquoise Discus, but has a rather dirty-looking silver-gray base color, overlain with solid splashes of color. The stress bars seen in the Brilliant Turquoise Discus are almost completely absent in the Ghost; the eyes were initially whitish.

The form is recessive, which at first caused great annoyance to customers with breeding ambitions. If a Ghost Discus was paired with

H. KÖHLER

This Ghost Discus is characterized by a generally bluish body color and dark fin edgings, an irregularly shaped yellow spot on the head, and a red eye with a half-length dark bar passing through it.

This Pigeon Blood from an earlier generation has a less inspiring body pattern and coloration, lots of sooty spots, and orange eyes. The photo is around 10 years old.

another discus, the offspring looked quite different from the parent fish. But the Ghost also had its good points: It could be used to breed out the barring seen in other discus color forms. If, for example, it was crossed with Cobalt Blue Discus, the offspring were blue in appearance but lacked vertical bars. However, it was not to be confused with the Blue Diamond cultivated form (see below).

Other breeders paired the Ghost with particularly attractive red-brown discus that exhibited only slight vertical barring. The result was solid red-brownish fish with no bars or striping. Further selective breeding then led to the solid reddish cultivated form called Virgin Red, in which, however, areas of black pigment (from the Ghost gene) still appear now and then.

Before long, a number of Asian breeders succeeded in producing more stunning discus via appropriate pairings. Examples include the color forms known as the Golden Crown Discus (a cross between Ghost and Golden Discus) and the Red Ghost Discus (Ghost × Solid Red Discus). If the Red Ghost is then crossed with the Golden Discus, the result is color races, such as the Nebula Discus and the Calico Discus.

Pigeon Blood: the Big Bang

Asian experts on the discus scene assert that nowadays roughly a third of the tank-bred discus being maintained worldwide are descendants of the Pigeon Blood. The history of this important color form, which has undoubtedly affected the entire discus trade, is rather interesting. A breeder from Bangkok, who was breeding the albino pigs popular in Asia, wanted to bring albino discus onto the market as well, as this, too, promised him financial success. He owned a group of patterned-all-over Red Turquoise Discus (Royal Red Discus) that received food containing hormones. One day he discovered a yellow male among the offspring of his Royal Red pairs and back-crossed it to a Royal Blue. The result was not, however, the expected albino fish, but a rather unimpressive, orange-yellowish discus with yellow eyes, black fins, and increased black pigmentation.

The breeder was able to sell only 70 specimens, which is a big flop for an ambitious Asian breeder. Nobody wanted these apparently unique fish. So he invited the best-known discus breeder in Thailand, Kitti Phanaitthi, to buy all his remaining fish, by now half-grown and in rather poor condition, along with the parent pair, and Kitti did just that.

It took Phanaitthi two years of selective breeding to improve the unattractive body pattern and change the eye color to reddish. But back then, these fish still weren't really attractive. Their most striking characteristic was the fragmentation of the vertical bar pattern into innumerable little black spots and dots scattered all over the body. Individuals of this color form thus had a really sooty appearance and were anything but pretty. The body base color could vary from orange to cream-colored. There were also bluish color forms.

Without submitting it for judging by a jury of experts, Kitti Phanaitthi exhibited his Pigeon Blood, a single specimen that still didn't have red eyes, at Aquarama in June 1991, and in September of the same year probably the first photo of the form seen in the western world was published in the magazine *Diskus Brief*. The fish aroused

LEFT: DISCUS BRIEF BILDARCHIV; RIGHT: H. KÖHLER

a lot of attention and gave rise to copious controversy worldwide. Hardly anyone in the West gave this color form a serious chance of selling. It was strongly suggested that the fish had been manipulated with dyes and treated with hormones.

The high price of this new variant was remarkable. In 1991 the Thai breeder was taking minimum orders of 100 5-cm youngsters for more than $300 U.S. per fish. For adult specimens the price was around $800 per fish!

The name Pigeon Blood supposedly originated with the well-known Japanese fish photographer Fumitoshi Mori. The unique appearance of the fish reminded him of pigeons. The word "blood" was appended to describe the blood-red pattern on the body of the fish. Some say that the Asian term for Pigeon Blood is a popular term for the loveliest ruby colors. Because the association with the blood of pigeons was distasteful to many people, in the U.S. the fish was also called Red Dragon. But eventually the name Pigeon Blood prevailed worldwide.

The Pigeon Blood color form, now greatly improved, is regarded as a typical "beginner's discus" that will forgive small errors in maintenance. Pigeon Bloods are relatively easy to keep and always full of vitality. They grow fairly quickly in size and weight, are not fussy eaters, are unusually resistant to many diseases, and are able to breed at a relatively early age.

This group of Red Pigeon Bloods from 2005 represents a further developed Pigeon variant. These fish have red eyes and a striking body pattern of white spots and broken red stripes.

There are disadvantages as well. Unlike other color forms, the Pigeon Blood and many of its derivatives no longer give the aquarist a clear warning sign of ill health and disease via dark coloration of the body, so often the owner reacts only when the affected fish is seriously ill and already past saving. This means that an infected Pigeon Blood can infect its tankmates before its keeper notices anything is wrong.

A further drawback is the fact that when Pigeon Bloods are bred, the brood often won't feed from the parents—a problem that is also known from other Asian color forms and sometimes causes breeders to despair. And finally, because of the enormous number of breeders who currently offer this color form, inevitably not all Pigeon Blood Discus breed true, so the offspring of such a pair can exhibit characteristics quite different from those of their parents.

Marlboro Red and Solid Red forms

In the early 1990s, Pigeon Blood served as the starting point for crossing experiments in Asia, and this led to an almost explosive increase in the numbers of ever more colorful discus, a development that left some western breeders speechless and envious. Once again, it was the Thai breeder Kitti Phanaitthi who, in 1994, amazed the discus world by producing a completely new color

M. HALLMANN

These half-grown Marlboros, bred by Jörg Stendker, already have a slightly reddish head region. The first Marlboros weren't as pleasing because of their white heads.

form: the Marlboro Red, a cross between Pigeon Blood and a red-brown discus. Once again, there was speculation as to whether hormones and treatment with chemicals or irradiation had played a part. But the breeder vehemently denied that he had used any unethical tricks. His reported fish foods consisted of beef heart, *Tubifex*, live bloodworms, and shrimp eggs, which are available cheaply and in large quantities in Thailand.

Kitti Phanaitthi wanted to get rid of the mask-like white head that he felt spoiled the looks of the first, otherwise solid-red Marboro fish. He mated tank-bred forms together, but also in-crossed wild-caughts to inject new blood. The mating of a wild-caught, red-spotted Green Discus with a Marlboro, for example, resulted in the Ruby (Red) Spotted form. He kept crossing the best specimens of this color form with wild-caught discus until he achieved the desired result. One of the color forms resulting from this effort bore the proud name "First of Universe".

By now, other breeders in Asia had noticed that the unattractive black dots and spots of the Pigeon Blood disappeared if they were crossed with other discus, preferably those without barring. A mating between Pigeon Blood and the Golden Discus (see below) led to a very similar result, via the Golden Pigeon to the Red Melon Discus. Other breeders arrived at the Red Melon in the following way:

M. HALLMANN

Golden Discus × Marlboro Red = F_1

Selected F_1 offspring × Rose Red = Red Melon

As soon as a new color variant appears in Asia and commands high prices (even if only for a year or two), other breeders jump on the bandwagon. Not infrequently they even obtain various fish of the latest color variant from their competitors to use as starting material for breeding, and then they develop it further. This sort of competition was particularly easy to follow in the case of the Solid Red color form a good 10 to 15 years ago.

For example, an Asian breeder crossed F_2 offspring of wild-caught Greens, using only those with a slight yellow coloration on the body, with the Ghost derivative Virgin Red mentioned earlier. The offspring of the cross received the trade name Rose Red.

In Singapore, in 1992 the discus breeder See Cheow San paired selected F_2 from wild-caught red-brown discus and obtained red discus that had no body patterning, but still had a trace of blue striping on the head region. After crossing only fish with minimal head patterning for four generations, he obtained solid red offspring without any striping or head patterning: the exquisite San Merah color form was born. With Asian discus there is often the worry that the offspring of a particular breeding pair will look only slightly like their parents, or won't resemble them at all, but it has been demonstrated that 90 percent of the offspring from a mating of two genuine San

Directly above: First of Universe, an extraordinary discus with an equally extraordinary trade name. According to its breeder in Thailand, it took seven years to develop this variant. This cultivated form includes blood from Marlboro Red and wild-caught red-spotted Brown Discus, as well as wild-caught Green Discus with red dots.

Left, top to bottom:

The Ruby Spotted color strain from Kitti Phanaitthi in Thailand appeared on the market around 1997–98. Its relationship with the Marlboro Red cannot be denied.

Breeding pair of Red Melons owned by breeder Adam Tan of Kuala Lumpur. He produced these fish by pairing a Marlboro Red with the Rose Red color form.

San Merah is still very popular. The head area is reddish in the further-developed variants. Black bars and black fin edgings can no longer be seen. The finest specimens have red eyes. The discus shown here originates from the Indonesian breeder Djudju Antony, and won him first place in the Solid Red category at the discus show in 2001 in Kuala Lumpur.

Merah will look exactly the same as their parents.

The only blemishes marring the beauty of the San Merah were a still somewhat lighter head region and dark fin edgings in some specimens. But by further inbreeding, See Cheow San managed to obtain discus that were uniformly red from the mouth to the base of the caudal fin and had no dark edges on the dorsal and anal fins: this variant came to be known as the Super San Merah. Achieving this result took six years.

Later, after the very attractive Golden Sunrise color form appeared on the market (see next section), another breeder crossed the two new Golden Sunrise color forms with San Merah and again obtained solid red fish that became well known under the name Red Passion.

A form similar to the Red Melon is the reddish Millennium Gold from the breeder Chai Koon Seng in Singapore, who began his fish farm in 1988 with six discus and was already running 160 tanks by the time of

ALL: DISCUS BRIEF BILDARCHIV: TOP LEFT AND RIGHT: K. PHANAITTHI, MIDDLE: A. TAN

my visit in 1999. Millennium Gold is the result of a cross between specially selected, very good Golden Discus and a yellow-brown wild-caught discus. Stringent selection was required to produce these color forms; some Millennium Gold Discus exhibit deep blue margins on the dorsal and anal fins.

In Solid Red Discus the red color is commonly intensified further, using color-enhancing foods. Such foods contain lucanthin or astaxanthin, for example. If normal food is used the red is paler, and the unwitting purchaser is often disappointed. Breeders and dealers should inform their customers when fish have been fed color-enhancing foods—which are now readily available to all aquarists.

Experienced discus-keepers can tell by looking at a fish whether its color has been influenced by the use of artificial pigments. Such discus are unnaturally red, especially in the mouth region and usually in the belly region; the pectoral fins are unusually red at the base, and frequently there is a red sheen to the caudal fin, which should be clear in discus. Unlike the practice of feeding hormones, which frequently cannot be detected, feeding with food containing carotenoid color enhancers is regarded as acceptable.

Beautiful, but delicate: the Golden Discus

The Golden Discus is an attractive color form that was first put on display to the public at the 1993 Aquarama. The Golden Discus is a mutation of the Brown Discus, which was very popular everywhere in the world in its day. Unfortunately, nowadays there are hardly any Brown Discus in their original color pattern.

This new color form originated from breeder Kim Kheng How in Penang, who purportedly suddenly discovered five individuals with a slight golden sheen and practically no vertical barring among his Brown Discus youngsters as long ago as 1979. He then found four more in another brood. The nine youngsters also had red-brown eyes and white stripes and spots on the anterior part of the body. These characteristics weren't actually passed on when the new color variant was paired with other discus color forms, but it proved possible to reinforce them via sibling crossing.

Later on, additional Asian breeders (Anthony Chew, Mr. Heng, Mr. Aik) discovered this mutation and thus arrived at the Golden Discus color form independently of Kim. As already mentioned, the Golden Discus × Marlboro Red cross led to attractive solid yellow discus with contrasting red eyes.

Initially the breeders had a problem: sooty spots and dots kept appearing in the offspring as a result of the Pigeon Blood genes. Only by subsequent pairing of the "least sooty" offspring was this negative characteristic eventually eliminated. The Golden Discus was also involved in numerous other new developments, such as the Golden Crown Ghost Discus (derived from the Golden Discus and Ghost Discus), Golden Sunrise, Golden Ghost, Golden Snake, Solid Red Golden, and others.

Even attractive solid yellow discus variants have originated from the Golden Discus. For example, Simon Pak of Singapore paired specially selected Golden Discus with

If Golden Discus are crossed with Solid Red discus variants, the result is yellow discus with a slight reddish sheen on the body. The fish in this sales tank were being sold as Golden Melon.

H. KÖHLER

Golden Pigeon, and the resulting F_1 offspring were then paired with the Golden parents. This process was repeated with the F_2 generation. Up to 80 percent of the resulting F_3 broods were solid yellow with a bluish striping in the fins. The trade name of this form is Yellow Crystal.

A recent derivative of the Golden Discus strain is the Golden Leopard Snakeskin (derived from Golden Discus × Leopard Snakeskin). Other breeders arrived at the same result using the Golden Pigeon. The "Leopard" and "Snakeskin" cultivated forms will be dealt with separately below.

This Millennium Gold from breeder Chai Koon Seng in Singapore has a solid yellow base color. Such fishes receive color-enhancing food that changes the body color to a solid red.

Naming madness

First, a few remarks on the naming of the Asian cultivated forms of discus. For the uninitiated, the enormous number of different names—I estimate that there are easily 500—is extremely confusing, and appears to reflect an equally high number of different color forms. But that isn't so, as different breeders actually use different trade names for the same or very similar discus, in order to compete in the marketplace: the layman, misled by the different names, ends up buying practically identical fish.

The names of Asian discus have now been adopted all over the world. They are almost without exception fantasy names, and sometimes one actually gets the impression that the longer the name, the more successfully the fish will sell. "Highfin Highbodied Red Scorpion Snakeskin Discus" is a ghastly example of this.

Nevertheless, the majority of breeders generally try to create a link between the trade name and the appearance of the fish and/or their origins. A Pigeon Turquoise Discus is derived from a Pigeon Blood × Turquoise Discus cross, a Yellow White Discus is noted for its white and yellow body color, and a Leopard Discus has body markings similar to those of a leopard. The Marlboro Red is characterized by a dark red body color that matches the red on the cigarette pack of the same name.

Sometimes breeders immortalize themselves in the names of discus. For example, the Golden Discus isn't thus named because its body has a golden sheen, but because the first breeder of this form had the family name Kim, which is Chinese for gold.

It is a particular honor if someone from Europe is invited to give a name to a new Asian color form. I was paid this compliment by a major breeder in Penang in 1996, but I politely declined—I didn't want to perpetuate the practice of making up excessively long discus names or be blamed for poor sales due to an undesirable name.

Blue Diamond from Hong Kong

Solid-colored discus have a very special charm, even though in many cultivated forms the striking color can be significantly reduced in vividness and brilliance by less than perfect water quality. This also applies to the Blue Diamond, a solid blue discus without any bars or stripes. It was discovered by Lo Wing Yat, a retired breeder living in Hong Kong.

In the last years of Dr. Schmidt-Focke's life, Lo Wing Yat took over some of his Brilliant Turquoise Discus, which showed no vertical bars at all—even in fright situations. By line-breeding these fish, Lo Wing Yat produced the Cobalt Blue Discus. In 1992, the Blue Diamond Discus followed. This fish proved to be a popular variant and sold very well at high prices all over the world.

Initially, there was still a problem. With increasing age, the eye color of these fish changed from red to yellow, but nowadays the eye color of the form breeds true. The Blue Diamond cultivated form now exists in different color variants, ranging from pale blue to a dark steel blue.

Japan, which apparently has very few experienced discus breeders of its own, proved a very good customer (not only for the Blue Diamond color form, but also for practically all Asian color forms). In addition, Japanese importers were prepared to pay high prices for the modern discus color forms. During all my visits to Southeast Asia on discus business, I have noticed that the finest specimens of the latest color forms have been reserved for Japanese customers, and are not offered for sale.

Asian discus breeders are well aware that the initially high sale price won't last. The sky-high 1991 price of the Pigeon Blood dropped so rapidly that five years later they were being offered as a "filler" in consignments of the more recent forms, at a price of only $5 each. And if you bought one or more new color forms from an Asian breeder, you received a free specimen of what the Asians now considered an obsolete cultivated form.

Snakeskin and Leopard

The period from around 1989 on was undisputedly the heyday of Asian discus breeding. Barely six months went by without a new discus color form coming to light. After around 1995, the production of exciting new cultivated

discus forms slowed down.

The early 1990s also saw the advent of the Snakeskin. The first discus of this color form appeared in 1992 or 1993 in Thailand. They were first displayed to a wider audience during the Penang Discus Fish Competition in 1994. The form traces its ancestry to the Brilliant Turquoise Discus or the Red Royal Blue, where a sudden mutation took place in the course of the mass breeding of these color forms.

The first Snakeskins had 14 narrow vertical bars instead of the nine (usually wider) ones of the normal discus, but selective breeding subsequently led to fish with no barring. Instead they had a spider's-web-like body pattern of very fine lines. This cultivated form was initially very expensive: at the end of 1994, a hobby discus breeder that I know paid $10,000 U.S. for a Snakeskin breeding pair from Kitti Phanahitti. As far as I know, he didn't get any young from them!

Like the majority of Asian variants, the Snakeskin was used to breed additional, even lovelier color forms. A few examples:

Red Snakeskin × Spotted Green Discus = Spotted Snakeskin

Snakeskin × Red-Turquoise Discus = Red-Based Snakeskin

Red-Based Snakeskin × Leopard = Leopard Snakeskin

The Leopard Snakeskin has remained one of the most popular forms to the present day. Beautiful, large specimens of this variant regularly take the top places at discus competitions and are often chosen as the Grand Champion. Teoh Beng Chye of Penang is regarded as one of the first breeders of this variant. In 1996 he began to

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Snakeskin Spotted cultivated form, photographed at the International Discus Championships in Duisburg in 2004. On close examination, the 14 vertical bars typical of the original Snakeskin form can still be seen. These bars, along with the orange eye, led to significantly lower marks during the judging: the fish was ranked 15th out of 28 Snakeskin Discus judged.

cross the Leopard Discus with Snakeskin fish with a reticulated body pattern, and thus obtained offspring with a reticulated body pattern set with striking red dots. This cultivated form was first exhibited in 1998.

The Leopard cultivated form was known internationally as long ago as 1993. The first breeders were probably Lo Wing Yat and his partner, Rocky Ng (Hong Kong). Unlike many other forms (Golden, Ghost, Pigeon Blood, Blue Diamond, Virgin Red, and Snow White), the Leopard is a discus in which sudden mutation has played no part. It is far more likely the result of a cross of wild-caught red-spotted discus from the Brazilian Tefé region and/or the Coari drainage with selected Red Turquoise Discus, followed by stringent selection and line-breeding in which only the fishes that exhibit at least the beginnings of the desired body pattern are paired.

The cultivated form looks attractive, but, like many others, has genetic drawbacks. These fish grow comparatively slowly, and it is fairly difficult to achieve large fish with the ideal round shape.

A decade of new forms

The main form to be mentioned here is the Snow White color variant (White Discus), which first became available in the West in

Above: Leopard Discus. It is easy to see evidence of its red-spotted wild-caught ancestor.

Left: This Spotted Snakeskin from Tong Joon Keng in Penang is a real champion and made its owner wealthy. Not only was it the winner in its judging category (the Open class) and the public favorite, but it was also the Grand Champion in Duisburg in 2000 and received a victory premium equivalent to $7,800. A year later, at an international discus show in Kuala Lumpur where 380 discus were judged, the same fish was victorious in the Spotted Snake class and took Grand Champion, the best of all the fish present.

1999. As with so many specially bred forms, mutation of the Brown Discus played an important role here. The first discus breeder to achieve this cultivated form was Robert Chin from Malacca in Malaysia. He was breeding with three pairs of wild-caught Browns from a group of 10 individuals that he had purchased in 1995. One day, one of the three pairs produced offspring with transparent bodies. The breeder raised these young discus and, to his surprise, they developed into largely colorless discus. Even the eyes showed no color, so the name was appropriate. When these fish were first seen in public at Aquarama in 1999, the experts among the visitors assumed that they were no more than a derivative of the Ghost Discus. Only later did their actual origin become known.

As is so often the case when a new discus color variant appears, other breeders tried to produce the Snow White. They bought groups of these fish and mated them with other, older discus forms, with the following results:

Snow White × Virgin Red (or × Red Melon) = Red White
Snow White × Golden Discus = Yellow White
Snow White × Blue Diamond = Blue White
Snow White × Leopard Snakeskin = White Leopard

A development that is even more recent than the Snow White is the Albino Discus, which made its debut in 2000/01 in Hong Kong and, to the uninitiated, looks rather similar to the Snow White at first glance.

This form was a result of mutation among the offspring of pairs of wild-caught reddish discus from the Alenquer region of Amazonia.

The Albino was immediately crossed with earlier color forms, resulting in the fish now traded under the names Albino Leopard Snakeskin, Albino Turquoise, and Albino Blue Diamond. These names show a welcome trend toward indicating ancestry instead of indulging in fantasy.

The intrinsically not very attractive Snow White Discus is the basis for the breeding of more beautiful "dream" discus.

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Above: A historic photo from November 1988: a wild-caught Alenquer female in breeding coloration with young, bred by Eduard Schmidt-Focke.

Below: Red and White breeding male, photographed on the premises of the German breeder Oswald Hanke. This cultivated form is the result of a cross between Snow White and Solid Red discus.

Oriental Dream

This still-popular color form is, apart from nuances of pattern and coloration, merely another fantasy name for an extremely attractive Snakeskin. Compared to the Leopard Snakeskin, the Oriental Dream has more numerous, but smaller red spots or dots on the body (see also the cover photo of this issue).

Other "aliases" for the same form are Spotted Eruption, Singapore Fireworks, and Scarlet. Additional trade names have been since this article was written. To some extent, all the breeders of these fishes took the following route on their way to the Oriental Dream:

Wild-caught red-spotted Green male × Snakeskin female = F_1
$F_1 \times F_1$ (or wild-caught red-spotted Green male × F_1) = F_2
$F_2 \times F_2 = F_3$ (Oriental Dream)
$F_3 \times F_3$ (or $F_3 \times F_2$) = F_4 (definitive Oriental Dream)

Concluding remarks

The main reasons for the great success of Asian breeders in the development of new discus color forms have already been mentioned. As I have shown, the basis of the numerous successful forms of the last 15 to 20 years has been mutation (change in the genotype) and selective breeding with subsequent mass production. The more sexually mature pairs of discus a breeder owns, the greater the likelihood of a mutation occurring. Anyone who works with just two to four pairs will probably never experience this. While in the West there are only a very few discus breeding establishments that have 300 tanks, for example, an operation of that size is common in Southeast Asia and the Far East.

REFERENCES

Au, D., S.S. Sun, and F. Denitto. 2007. *Trophy Discus*. Cichlid Press, El Paso, TX.

Chan, C. 2001. *Singapore Discus in the New Millennium*. Pethouse Supplies, Singapore.

Chan, C. 2003. *Exotic Discus of the World*. Clean Ace Printing, Singapore.

Köhler, H. 2008. Was ist eigentlich Oriental Dream? *Diskus Brief* 23: 60.

Sun, S.S. 2005. Züchterische "Entwicklung" von asiatischen Diskus-Farbformen. *Diskus Brief*: 146–152.

Weiss, M. 1993. Pigeon Blood-Diskus—eine neue *Symphysodon* Farbzüchtung. *Diskus Brief* 8: 4–7.

Yeng, S. 2003. *Penang Discus,* German edition. Penang. ISBN 9834043112.

TOP: E. SCHMIDT-FOCKE/DISCUS BRIEF BILDARCHIV; BOTTOM: H. KÖHLER

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Discus made in Germany

AN INTERVIEW WITH Heinz Stendker

Diskuszucht Stendker is one of the largest and most renowned breeders of discus in Europe, if not worldwide. Back in 1965, Heinz Stendker used two pairs of discus to lay the foundation of what is now the family business, run since 1998 by his two sons, Jörg and Volker.

Under the sign of the discus: Stendker family and staff; Jörg, right, and Volker, in striped shirt.

AMAZONAS: **Could you start by telling our readers how you developed your love of discus? Did you begin like everyone else, with a standard 57-L (15-gallon) tank, or did you set the bar higher right from the start?**

HEINZ STENDKER: Because discus attracted me right from the start, I acquired a somewhat larger aquarium with a volume of 300 L (79 gallons) and kept four discus in it, together with a bundle of *Cabomba* and two Amazon swordplants. The discus immediately did well, and it wasn't very long before the first broods came along.

Left, top: One of the rows of meticulously clean tanks full of adult fishes. Breeding pairs on top row.

Left, bottom: The huge Pigeon Bloods throng closely together, each more beautiful than the next.

How did you manage to get your sons interested in discus as well?

Stendker: That was easy. My sons had grown up with the fishes and developed a lot of interest relatively quickly, and that continued to increase over the course of time.

When did Volker and Jörg start to help with the discus breeding?

Stendker: At 11 or 12 years old Volker was already interested in the technical side of the aquarium hobby, and has now completely taken over that part of the discus breeding. Jörg took a bit longer, but eventually showed an interest at 13 or 14. He and his friends helped with obtaining food, for example by catching mosquito larvae.

Nowadays you have established yourself as one of the leading discus breeders worldwide and send fishes all over the world. How many aquaria do you run and how many discus do you have in stock, on average?

Stendker: At the moment we are operating just over 2,000 aquaria containing roughly 180,000 to 200,000 fishes.

That's a huge number.

Stendker: Yes, that sounds like a lot—and it is a lot, but we are in the fortunate position of needing to ship out around 20,000 fishes every month, and because it takes a while for

ALL PHOTOS: STENDKER

a discus to reach a saleable size, we have to make sure we have stock available at the right time.

And where do you send all these splendid discus?

Stendker: We have customers in about 20 countries, with the most important being France, the Netherlands, and the U.S. Naturally, lots of fishes also remain here in Germany, but you can also find our discus in South Africa.

What equipment do you use in breeding discus?

Stendker: We try to keep the equipment as simple as possible. We prefer to use only sponge filters. When breeding discus, a reverse-osmosis unit is indispensable for water treatment in the long term.

It is well known that regular water changes lead to significantly improved growth. How do you perform this job and how often?

Stendker: We change 10–15 percent of the water in the system daily. This has proved to be the most effective method for such a large facility. Partial water exchange takes place continuously, 24 hours a day. This guarantees consistently good water quality.

I really can't resist asking you about the use of medications in discus breeding. After all, everyone is using the attractive term "flagellate free," and lots of uninitiated people get the impression that large numbers of young discus can be reared only in water laced with medication. How do you solve the problem of infections and ensure that the young grow on healthily?

Stendker: Yes, that is always a popular subject for discussion. We toughen up our discus by maintaining a very high population density and hence a high infection pressure in our aquaria. By using good food and keeping the water quality high, we have been able to avoid using medications for over three years.

Do some fishes still fail to grow, and do you have a trick for preventing that?

Stendker: Yes, that does happen from time to time. But there is a fairly simple method for dealing with that. We simply put the growth-retarded discus in a separate aquarium and raise the temperature from 84 to 90°F (29° to 32°C). After two to three weeks their growth is very good again.

Above: Solid steel blue, perfectly circular Blue Diamonds have long been one of the trademarks of Stendker Discus.

Opposite page: A rack of rearing tanks for smaller youngsters, top. The next step, bottom, is 132-gallon (500-L) tanks for up to 500 small juveniles.

How do spawning tanks differ from rearing tanks?

Stendker: Our spawning tanks contain 80–100 L (21–26 gallons), which is perfectly adequate for parental fishes. The rearing tanks contain up to 500 L (132 gallons). The spawning tanks are kept as clean as humanly possible. This includes not using any substrate and regularly cleaning the inside of the walls. A 500-L tank accommodates 100 individuals of up to 7 inches (17 cm) in length, 150 of up to 5.5 inches (14 cm), 200 of up to 4.75 inches (12 cm), 300 of up to 4 inches (10 cm), or 500 of up to 3 inches (8 cm).

Those are extremely impressive figures. What are the water parameters like?

Stendker: Naturally, we try to achieve optimal water parameters in the breeding aquaria, and we work with preconditioned water. Hence the total hardness is 1, the carbonate hardness less than that, and the pH value between 5.5 and 6.0 at a conductivity of 250 µS/cm and 80°F (27°C). In the rearing tanks we use tap water with 800 µS/cm at 84°F (29°C), 16°dGH, 8°KH, and a pH of around 7.0.

What are your preferred methods for hatching the fry, or do you leave the brood care entirely to the parent fishes?

Stendker: We prefer natural brood care by the parents, or at least by foster parents. In the case of the Pigeon Blood variants it is often necessary to resort to fostering, as the natural parents are unable to turn dark in color. As a result, the fry don't swim to the parents and the rearing rate is no longer adequate.

Is there currently any new trend in the breeding of discus?

Stendker: There is no immediate trend noticeable. We are trying to stabilize particularly unusual color variants of the known varieties, so that their color characters are more strongly expressed and the new characteristics become fixed and reliable.

How long does it generally take to fix a new color sport so that it can be sold as a new cultivated form?

Stendker: If all goes well, a new color form

can be fixed in eight to ten years. But normally it takes two to three years longer. Then again, I have been working for 18 years on a particular cultivated form.

Do you have a favorite variant that you have maintained for a long time in its existing form, or tried to improve only marginally to particular standards?

Stendker: I'm particularly fond of the Red Turquoise and am trying to improve its form and color. I place great value on overall ap-

pearance, but the most striking points are the red color and the nature of the lines.

Do you also cross wild forms into existing strains?

Stendker: We no longer do that. The last time we did was probably 15 years ago, when we in-crossed Alenquer and Santarem discus.

Have you kept the original form of any wild discus?

Stendker: Yes, we don't cross them in any more, but we do try to retain the Alenquer and Santarem discus in their original forms and colors as far as possible. We rear 10,000 fishes of the two wild forms every year, in order to have the best choice. Naturally we place great value on a circular form, bold colors, nice fins, no faults in the striping, and being easy to breed.

What is your top seller at present, and has that changed over the course of time?

Stendker: At the moment the Pigeon Blood Red and Blue are probably the most popular. It used to be Brilliant Turquoise, and sometimes "Solid Turquoise" and Red Turquoise as well. But right now there is also an increased demand for Marlboro variants.

And in conclusion, the obligatory question about food: what do you put into the aquarium to be able to offer such fabulous fishes?

Stendker: We use a mix of foods, consisting of beef heart, top-quality sweet paprika, *Cyclops*, crustaceans, vitamins, and minerals.

Many thanks for the interview and the wealth of valuable information you have made available to our readers.

—Interview conducted by Thomas Weidner

Top, left: A pair of Snakeskin Red Spotted in a breeding tank.

Top, right: This wild-form strain has been bred for many years under the label "Alenquer".

Bottom: Pigeon Blood Red are the absolute top sellers at present.

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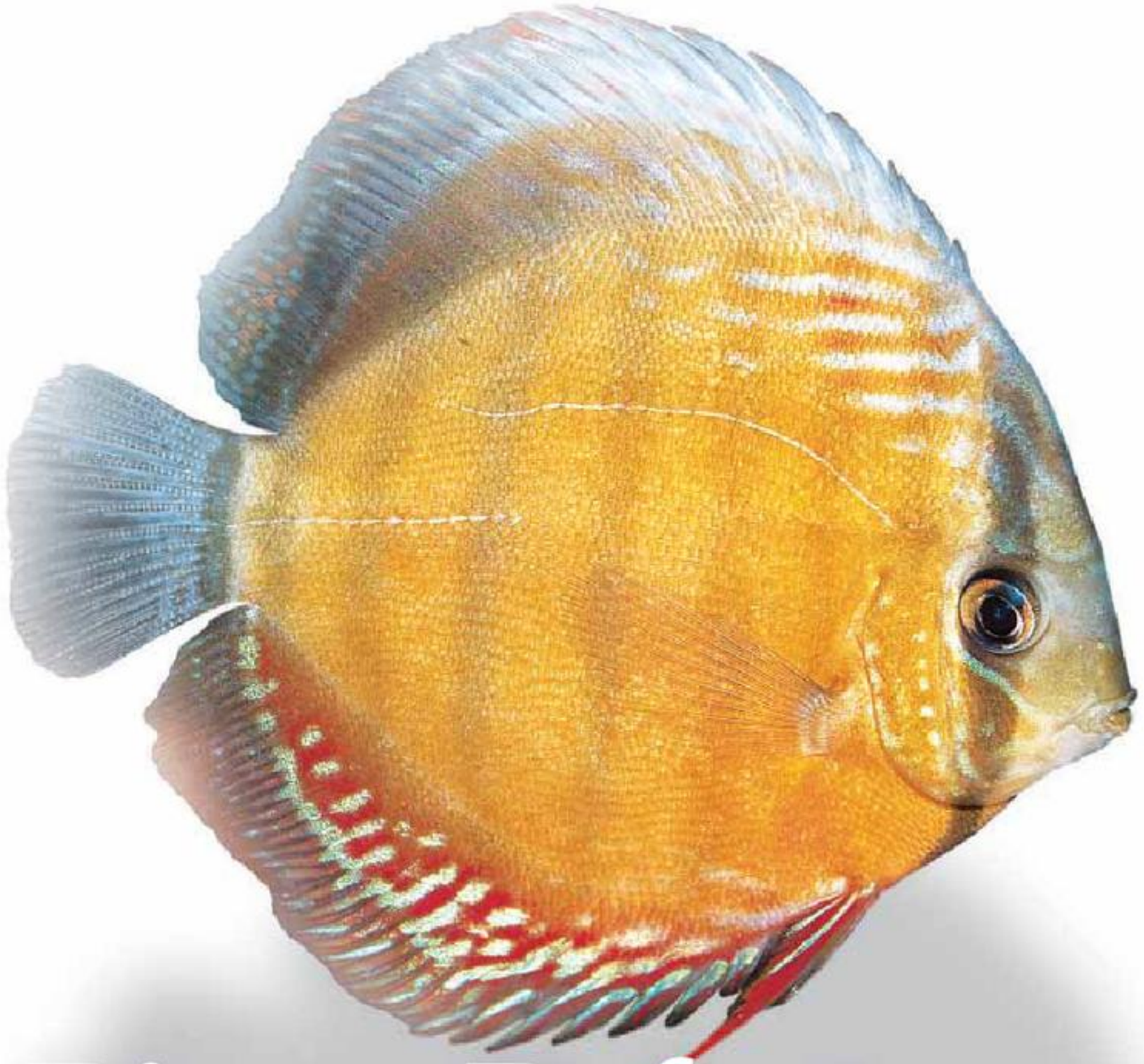


Discus Defeat

by Ole Klawonn • After 20 years of keeping fishes and various other forms of livestock in the house, I wanted to try my hand with a species that some people regard as the crowning glory of the freshwater aquarium hobby: the discus. The aquarium magazines are full of breeding reports in which people describe how they have successfully maintained and bred fishes. But here I explain why I resigned from the maintenance of a species, in order to prevent others, both aquarists and fishes, from suffering a similar fate.

As a small boy, I immediately took every coin that I was able to coax from my parents to our little pet shop, in order to buy another Kuhli Loach or a pot of food tablets. There was a long, narrow show tank decorated with bogwood and occupied by a number of armored catfishes and discus. These plate-sized fishes were unattainable for me—they were never even offered for sale to the rank-and-file customer. Besides, my tanks measured only 12 x 12 x 24 inches (60 x 30 x 30 cm).

As I grew up, my aquaria also came to exceed the meter mark (39 inches) in some cases. So there was no longer anything in the way of my childhood dream of discus.

I have remained true to my preference for invisible fishes, such as banjo catfishes. When I am visited by non-aquarists, they are always asking whether there are actually any fishes in my aquaria. But catfish enthusiasts know that it isn't easy to impress true beauty on the eye of the beholder, especially the blind beholder unfamiliar with the subject. These fishes show themselves for perhaps a fraction of a second if you spend half an hour sitting motionless in front of the aquarium. Some merely stick their noses out of the breeding cave and are usually best appreciated when, dried out or preserved in alcohol, they sit on the desk for use as paperweights.

Wild-caught Alenquer Discus—a jewel of the Amazon.

H.-G. EVERS

Discus without Pigeon Blood

I gradually became fed up with all the questions, and also felt sympathy for my wife, who had to endure a home full of bubbling and buzzing without any real aesthetic compensation. In addition there was a baby on the way, and I had no valid answer to give when asked why I was spending entire days working with buckets and hoses on those confounded glass boxes.

For some years thereafter I suppressed my childhood desire for a few discus, as there is a considerable risk involved when a serious catfish-keeper starts to get interested in big cichlids. Large-cichlid enthusiasts, and in particular discus people, don't have a good reputation on the catfish scene, although so far I haven't been able to find out what the problem is. Perhaps they are incessant show-offs who do nothing but talk about who's got the biggest trickle filter.

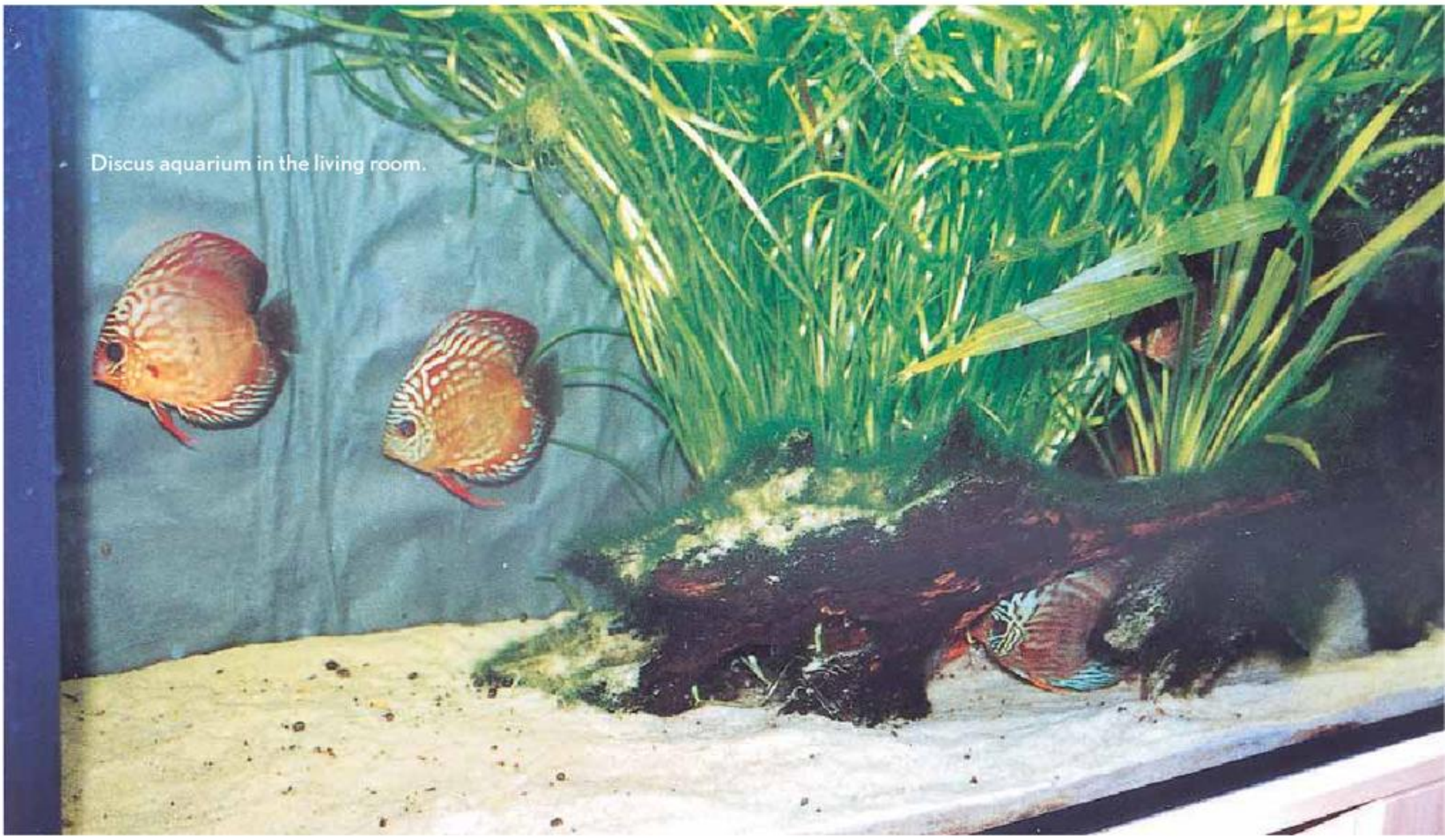
But then I found myself in the mood for a change, and no longer cared about losing my reputation. I made my 86-gallon (325-L) living-room aquarium a catfish-free zone and kept my ear to the ground to find someone from whom I might obtain natural-type discus with no admixture of Pigeon Blood and Snakeskin. I fairly quickly came across Wolfgang Tlok, who had been working for some time on keeping and breeding wild-caught discus.

For the first time ever, my wife accompanied me to go and see Tlok's fishes, and her eyes lit up even more than mine when we sat in his premises watching some 500 discus parading along the front glasses of his aquarium, all trying to display themselves to best advantage. We were particularly taken with the specimens with a high red component, which he offered to us under the fine-sounding name of "Alenquer-Cuipéua". We came away with six youngsters, though we were rather shocked that the breeder handed them to us in a plastic bucket lined with a plastic bag. The jewels of Amazonia in a trash bag? A bit more respect, please!

Their lordships are fussy

It was wonderful not to be sitting alone in front of the aquarium rejoicing in my new fish. The first evening, my wife and I watched with shared delight as one of the discus devoured its first mosquito larvae. And so things continued happily until I permitted myself to treat the fish—which my wife had practically given individual names—to a water change. The result was that for almost a month, none of them ventured out of the vegetation until after I left the room. Once again, visitors began asking whether there were any fishes in the aquarium. I suggested that they leave the room and peer in from the hallway if they wanted to see how beautiful our new fish were.

From then on I went from a single 50 percent weekly water change to twice-weekly 20 percent changes, and their lordships were reasonably happy with that. But although they ate like wolves, they wouldn't consume my worm cultures or the specialties I served up from the



Discus aquarium in the living room.

O. KLAWONN

Group photo of my Alenquer Discus.

freezer. Every bit of krill, every *Artemia*, whiteworm, or mosquito larva was checked over carefully before being taken into the mouth, spat out again, and then finally eaten. But because they eventually ate everything, I didn't worry about it too much. The fish, with one exception, were visibly growing and their colors were becoming more splendid day by day.

In general I agree with my aquarium buddy Olaf Deters, who always says, "Discus are only cichlids, after all." This has also been confirmed by Tlok and another discus breeder (who warned me, however, never to wear a red T-shirt in the presence of discus). So I didn't go to the trouble of pampering the fish with reverse-osmosis water or hydrochloric acid. They lived in city tap water (13°dGH, 12°KH, 490 µS/cm, pH 7.25) at 86°F (30°C) and didn't seem to be particularly unhappy.

But their fussy dining habits were a real thorn in my side. Should I make the effort to refill my big living-room aquarium using my ancient reverse-osmosis unit, which would easily provide me with 5–6 gallons (20 L) of purified water on a good night, or should I mess around with acids until a drop test told me that I had managed to imitate one of the numerous aspects of the water in the native regions of the discus (even if I might have ruined it in every other respect)?

If you don't have a whole lot of spare space in your home, the interim storage of the trickle of reverse-osmosis water is a problem. In addition you lose the option of making a quick water change, and being a fresh-water fetishist, that didn't suit me at all. During my research into acquiring a new reverse-osmosis unit, someone on the forum of the highly recommended Diskusportal website (www.diskusportal.de) suggested a Rowa Merlin producing 1,057 gallons (4,000 L) of purified water per day. It was for sale for less than $1,300, which was touted as a real bargain. Hmm, these serious discus people really do live in a different dimension!

Black discus

So I left everything as it was and, lo and behold, the first candidate turned black and sat in a corner, declining the proffered food. The discus-people answer to that is: "Simmer the fish gently at 95°F (35°C) and it will start eating again." But because I am a fan of planted aquaria and such temperatures inevitably destroy vegetation, I had to catch the little prince, immediately christened "Blacky," and parboil him in a separate aquarium. Even after seven days in a hospital tank with no home comforts, the patient was radiant in all shades of the color black and wouldn't even go so far as taking a look at the delicacies I offered. I gave up and put the little black fish back with his fellows, thinking that he would at least be more comfortable there until he died.

But it turned out otherwise. After a total of six weeks without food, out of the blue Blacky suddenly switched his colors back on and resumed feeding, as pickily as ever. So these are resilient fellows, and nobody will convince me otherwise. I am used to my catfishes (and I have tended to go for the more delicate among them) showing the first symptom of a disease the day before they expire, when it is too late for medication or a change in maintenance conditions. In the past I had always regretted this, but now I came to regard it as one of the major benefits of this group of fishes. If you have a feel for them, they feed well, look as fit as Brad Pitt, and then suddenly drop dead. Who does not know the old adage, "Ah, would that I could die like a catfish!"

Blacky became increasingly beautiful, grew perfectly normally, and began to make friends with the most splendid specimen, "Rougette" by name. He treated all the rest as enemies. The two of them now took over two-thirds of the aquarium and began to spawn—and my hobby became really fun again! We (by now there were three of us) watched the pair of them for hours on end,

O. KLAWONN

as they beat up the rest of the group and tended their eggs day and night. Unfortunately, the two of them had a falling out and the boss, Rougette, ate the eggs. This was repeated another four times, and it wasn't until the sixth attempt that we were able to watch the pair looking after the larvae, indefatigably collecting up any that fell to the bottom and spitting them back into the chosen spot. The roughly 80 larvae that had hatched from the approximately 100 eggs laid were periodically moved around on the bogwood, and Blacky and Rougette continued to have intermittent disagreements.

Dying plants

The next morning the larvae had disappeared. Maybe the pair needed to spawn a few more times before they would have the entire brood-care procedure for their species down pat, but the whole thing was getting to be too much of a strain for me. While they made a new attempt to disseminate their genes every three weeks, my own offspring and the wretched need to earn a living also required a certain amount of work. And now another member of the group, previously noticeable as having forgotten to grow, started displaying all shades of black and went on a hunger strike.

I heated the entire tank up to 95°F (35°C), but this didn't produce the desired result. Because I had forgotten to first remove the plants, I immediately watched my *Echinodorus uruguayensis*, which had tolerated a temperature of 86°F (30°C) well, and burgeoning *Valisneria spiralis* start to die back. Likewise my beloved thread algae that I had cultivated devotedly for years. (I'm absolutely serious! They grow exceptionally well and help bind up excess nutrients and remove them from the water.)

I had intended to improve the aesthetics of our home with the discus, and now I stood in front of the sort of wretched aquarium that has driven many a novice from the hobby. The tank looked so sad that I avoided looking at it any more than was necessary. Instead I feverishly sought a new home for the fish—I simply couldn't cope with the sensitive nature of the species!

I couldn't start by asking around among my aquarium acquaintances. Almost all of them had fallen flat on their faces with discus at some time or other and had specialized in species that use less perfidious methods to win sympathy. So I advertised on the Internet and, after sending photos of my fish, was informed how horrendous it was to have thread algae in the aquarium (they gobble up oxygen), that "genuine Cuipéuas" have a less extensive blue area on the head region, and that my fish hadn't grown properly, as they didn't normally start spawning at that size. I was not amused. The business about the algae was a laugh, and the gobbledygook about genuine and fake fishes has never interested me, but the suggestion that the fish hadn't grown properly preyed on my conscience.

All that effort in vain: all the eggs were infertile.

One day, maybe...

A fellow aquarist who had long been breeding discus successfully in even harder water had told me that the offspring of wild parents couldn't be maintained satisfactorily in my tap water. If I had obtained youngsters from him, it wouldn't have mattered if they contained a bit of Snakeskin, as long as they fed properly and grew! But by then I had given up my fishes and sold them for peanuts to an aquarist pal who was good with cichlids.

Discus and a few other large South American cichlids

O. KLAWONN

Above: Discus pair with newly hatched larvae.

Right: Closeup of the wrigglers.

continue to fascinate me, but I am taking a break before I try keeping them again. They require a lot of space, which can't be provided with movable aquaria. And if you also have to tinker around with the water for such voluminous aquaria, then you won't get very far with a 16-gallon (60-L) container and a shower-blocking reverse-osmosis unit. But when we move to a new home with lots of space and I have unlimited time, then I will devote myself to them once again. It seems that discus cannot simply be raised as a sideline to your main hobby, especially when you have a busy life. His Highness expects your undivided attention.

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DISCUS:

MYTH & REALITY

Discus are friendly, curious aquarium fish with big personalities. A pair can be kept in a modestly sized aquarium, while groups require more space.

by Mary E. Sweeney • Last St. Patrick's Day, I set out for JFK Airport on a mission to collect two dozen *Symphysodon aequifasciatus* from the cargo depot of the small Brazilian airline that had carried these so-called delicate fish 3,000 miles from Santarem, Brazil, to New York, New York.

My goal had been to "ark" and ultimately breed some of the wild discus forms based on my own concern for the future of their entire native range. Preserving some pure, undiluted discus genes in my home breeding tanks seemed the least I could contribute, considering the many threats, whether manmade or natural, that these majestic animals face.

When I opened the boxes in the cargo area of the tiny airline, the bags had collapsed and most of the water had escaped. It had been a long, hard trip for the fish, though I knew the handlers had done their best to bring them safely to me. The discus were in such distress that my only thought was to get them home as quickly as possible. The sump of my fishroom was the closest thing to their Amazon waters that I could give them, and I drove like a madwoman, 24 dear imports near death in the back of my compact wagon.

For weeks we called them the zombie fish. Their eyes glowed in the dark. They had wounds, scrapes, scratches. Oh, woe, surely all would perish.

But no, virtually all of them made it and are now approaching their first spawning events. Discus are made of far sterner stuff than anyone will admit, even—or perhaps especially—the grand wizards of discus keeping, who like to inflate the amazing things they have done personally with these fish. In fact, discus do not need to be reserved for this class of elite aquarists. This is my conclusion, with 20 years of discus-keeping under my belt (and I am no longer telling how long I've been keeping fish—just that I was born by the ocean), despite the incredible amount of advice, often conflicting, that is found in the discus literature and online and the secrets whispered only to best friends.

Discus mythology

Discus are steeped in myths that are deeply entrenched and have long served to scare newcomers away. Myth Number One is this: "Discus need special everything, and can't be kept by ordinary people."

Part and parcel of this are the too-common beliefs that discus need huge tanks, expensive custom diets, stark aquascapes, daily water changes, ultra-high temperatures, and an exotic-fish

M. P. & C. PIEDNOIR

These two Pigeon Bloods feel right at home in this planted aquarium with peaceful small tetras as tankmates.

When discus feel confident, they will school together beautifully. Stressed or unhealthy fish will turn dark and hide.

veterinarian on call. On top of that, they are reputed to be preposterously expensive and exceptionally flighty and delicate.

Some of this derives from the darker ages when pioneering aquarists were dealing with wild-caught discus suffering from transport shock and tag-along parasites and maladies. With today's available tank-raised fish, modern foods, better filtration, and less of the old "can't do" attitude, discus keeping is within the reach of virtually all aquarium enthusiasts.

Discus are cichlids, tough and vigorous; they can live and thrive in normal water in normal aquaria and eat normal foods. It is not necessary to formulate special diets or go hunting for organic, grass-fed-beef hearts. Some people like to do that, but the fish do not require it. A modest-sized aquarium will suffice for discus. Plant it as you would any other aquarium. Captive-bred discus can be downright hardy and surprisingly affordable.

The discus aquarium

A normal 20- or 30-gallon (76–114-L) aquarium, preferably with a "high" profile, is fine for a half-dozen growing discus or a mated pair of adult fish. Adult discus in the aquarium really do go "two by two." Mated pairs are happiest together, and like to be the reigning discus in their realm. Surplus males are unwelcome. Extra girls will be kept at the other side of the aquarium.

A large tank with a school of discus is possible. I have found that, like most other cichlids, they'll fight like mad if you have only two adult males. If you have a larger group, the "alpha" male will spread his aggression amongst a larger number of targets, and this will prevent

M. P. & C. PIEDNOIR

life-threatening injuries. You might even consider one spectacular discus in a planted tank with just a few special tankmates.

Plant the discus aquarium in whatever way pleases you. Tall *Echinodorus* swords of different types are perfect. Do exercise caution when fertilizing the plants, as excess can undermine the well-being of the fish. And don't add anything to the discus aquarium that you wouldn't add to your own body.

Some compatible species to keep with discus are dwarf cichlids of the genera *Apistogramma* and *Microgeophagus*; and *Aspidoras*, *Brochis*, and *Corydoras*. Small characins in schools—*Paracheirodon*, *Hemigrammus*, and many others—are charming, provided the specimens are too large to be eaten by the discus.

Loricariids, those sucker-mouth catfishes, are best kept elsewhere. Their penchant for discus slime can be heartbreaking. (Yes, they can kill a discus.)

Discus water

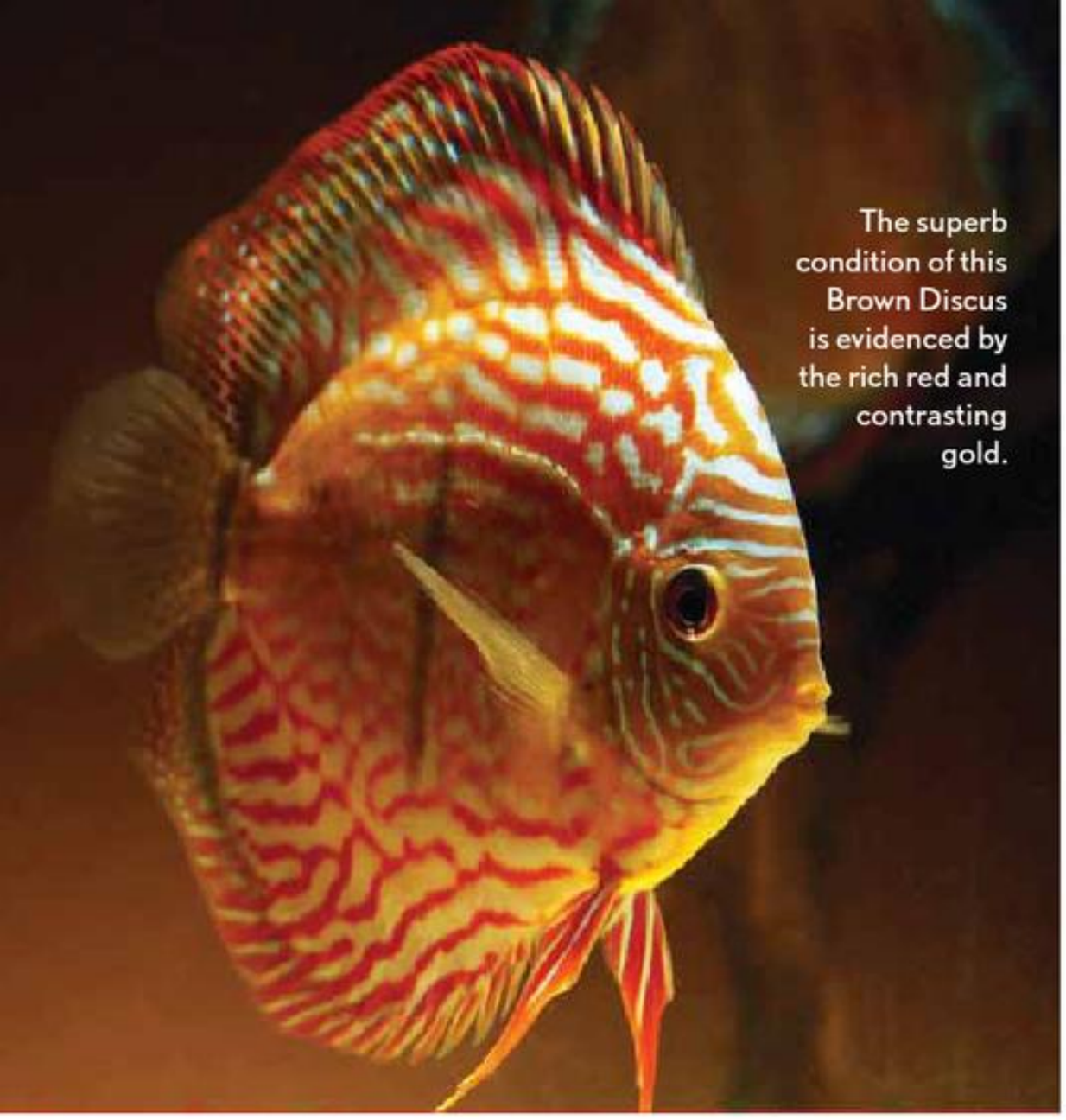
Keep it clean and keep it stable. As long as the water chemistry is not markedly different from the water that they were kept in just previously, discus will generally continue to thrive. Do use a good chlorine/chloramine removal product when preparing tap water for water changes.

"Clean water" in fish terms means free of pollutants and parasites. Be most conscientious about washing your hands and lower arms before (and after) splashing about in your aquarium. You may not remember the dab of scent or bug repellent or even perhaps the dry-cleaning fluid from your clothing before the fish start to swirl in the water. They are intolerant of chemical pollution.

Fish waste is another matter, and generally the responsibility of the biological filter. A well-aged aquarium filter of just about any type converts fish waste into harmless byproducts that are effectively removed by your plants and water changes. Do use a biological filtration starter culture; refrigerated product is recommended for this living culture.

About those water changes—25 percent a week is standard aquarium practice. Siphoning wasted food and debris is a good habit. I like to use a piece of Poly Filter (Poly-Bio-Marine) in the filter to help protect against accidental toxins and heavy metals.

The temperature can be between 74 and 84°F (25–30°C); 82°F (28°C) is ideal. Water hardness is not an issue in most areas of the United States, but when it is a concern, an economical reverse osmosis filter will eliminate the problem. If it is truly desirable to change water chemistry, try to do it during a rainstorm, when the fish will be "expecting" an influx of different water.



The superb condition of this Brown Discus is evidenced by the rich red and contrasting gold.

Feeding discus

Discus will grow exceedingly well on a diet of high-quality flake, pelleted foods, and frozen foods, supplemented with "clean" live foods. Favorite foods of discus are frozen *Mysis* shrimp, adult brine shrimp, and very small earthworms (Red Wigglers, *Eisenia foetida*, or compost worms) and whiteworms. (It is a myth that whiteworms are high in fat; *au contraire*, they are high in protein.) Freeze-dried blackworms are favored, as are bloodworms. Try minced frozen langostino tails; sometimes even sick discus will entertain the thought of eating this food. I won't enter the beef-heart debates here, but in many home discus aquaria, frozen beef heart causes overdependence on massive daily water changes. If discus do not eat any food within a half-hour, siphon the remains.

Discus disease

If you think your fish is sick, change some water, and don't feed the fish until it behaves as it usually does when you approach with food. (You won't really be able to tempt it to eat, and the uneaten food will make the water poisonous.) Don't rely on medicine to make your fish well. Once you start, it will be difficult to stop, because a remedy that cures one problem sometimes allows other problems to rear their even uglier heads. Formalin is a standard aquarium remedy for gill flukes (*Dactylogyrus* sp.), and it works quite well when used properly, but there's a very fine line between kill and cure. It's embalming fluid, folks.

While I am very much against the wanton use of chemicals and medications, some diseases simply will not heal spontaneously. Very often, when a disease or injury is caught at the beginning, a massive water change and a handful of salt will stop it in its tracks.

Use your head, and your fish will be fine. If they're not, use the net, and don't put in any new fish until Nature takes its course in that aquarium and all the fishes are either well or no longer extant. After an unhappy event, replace most of the water in a planted aquarium and wait 30 days before adding new fishes, which is the amount of time required to complete the life cycle of the usual fish pests.

Discus selection

Whether it's your first time or you're coming back for more, you want to start with the best fish you can get. Look for feisty, "come 'n' feed me" discus, bright-eyed (ideally bright red), with absolutely no signs of injury: scales, fins, and tail intact. Healthy discus radiate confidence.

Discus come in glorious red, blue, green, yellow, and brown colors. Modern breeders have extracted from these colors an amazing palette of enhanced colors and patterns almost beyond the imagination. The shape of the fish should be round in all but the high-body forms. Gills should be symmetrical and move evenly at about 60 beats per minute. Avoid fish with clamped gills or fins.

It's a lot of fun to grow out youngsters (six or eight virtually guarantees at least one of each sex), but investing in older pre-adult or even young adult fish gets the future discus mates to the goal soonest. If you really want a pair, go for that, and don't waste your resources on "grow-outs." Former playmates become "the enemy" to a year-old pair as instincts kick into high gear and the two young discus start to clean. Obsessive cleaning, a strong desire for privacy, and becoming real meanies marks the end of youth and the onset of adult behavior: *Spawning!*

At this point, the remaining fish in the average aquarium need to be re-housed. Make plans early. If you ask nicely, perhaps your local aquarium shop will take them, but move quickly, or they will be starved, injured, and eventually killed by the discus male as he assumes dominance of the tank.

Quality discus are healthy. Seeing your intended purchases live and eating is best, and the best aquarium retail shops will have healthy discus or can special-order them. Contact a local aquarium society to see if there are local breeders. Finally, mail order is a viable option and overnight shipping of discus is usually safe. All reputable discus sellers will guarantee live delivery.

Keeping discus does not have to be complicated. Honestly, it is often more difficult to keep fancy guppies. Remember the habits of good fish husbandry, and the project will be a success—with the regal discus swaying confidently in your own aquarium.

REFERENCES

Bleher, H. 2011. *Bleher's Discus*, Volume 2. Aquapress Publishers, Italy.

Crampton, W.G.R. 2008. Ecology and life history of an Amazon floodplain cichlid: the discus fish *Symphysodon* (Perciformes: Cichlidae). *Neotrop Ichthyol* 6 (4):599-612.

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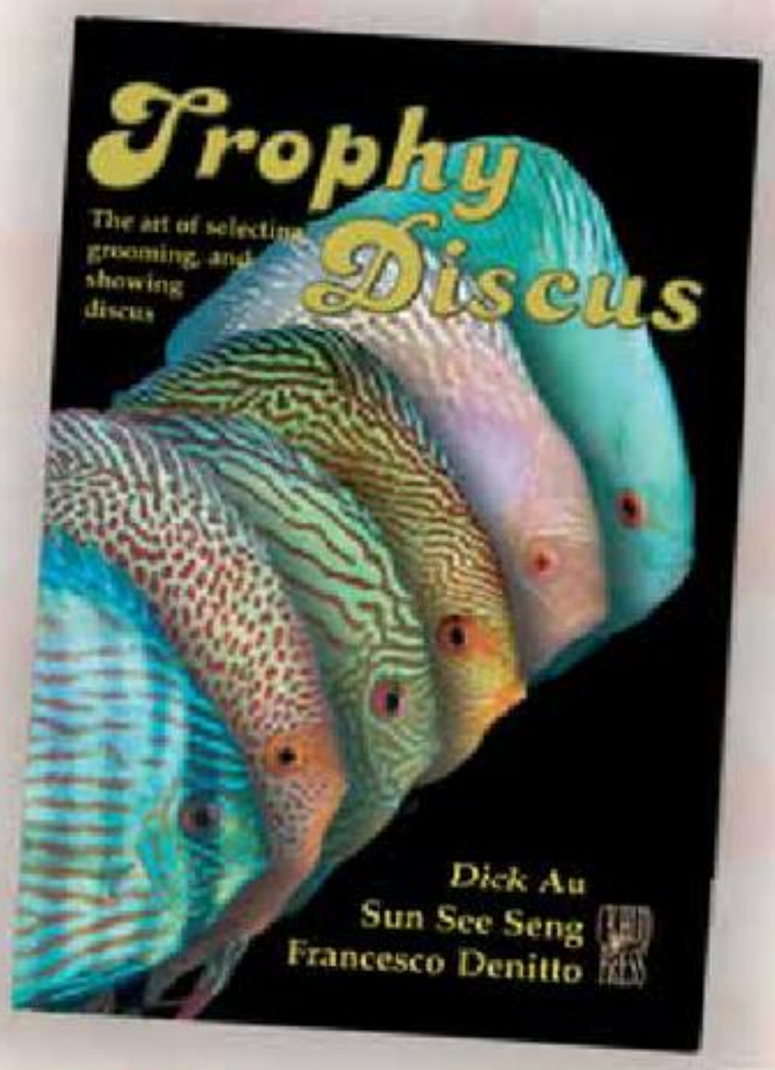

Trophy Discus

The art of selecting, grooming, and showing discus

This book celebrates the beauty of discus. For enthusiasts, it provides pinpoint advice on what to look for in selecting show quality discus and how they are judged in competitions. For breeders, it offers suggestions on how to improve existing strains and pursue new ones. It is also a photo journal of "Trophy Discus."

The principle author, Dick Au, has been an active aquarist and discus enthusiast for over 50 years. In addition to being a veteran speaker and show judge, he is also an accomplished author. His book, "Back to Nature—Guide to Discus", still available on disc, has been published in seven languages and distributed around the world.

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COVER STORY

Winning Discus

An expert's basic guide to raising, keeping, and grooming show-quality *Symphysodon*

• *by Dick Au*

For many years, Discus (*Symphysodon* spp.) were meant for advanced tropical fish hobbyists only. Not only was it difficult to find the fish for sale, but discus keepers were saddled with acclimating wild-caught fish, sophisticated water chemistry management, nutrition questions, and disease control and prevention challenges.

Today, farm-produced discus are readily available at local fish stores and from tropical fish mail-order retailers. They are generally hardier, have very attractive colors, and are very affordable. With dozens of books published on all aspects of discus keeping and abundant information available online, discus are now no more difficult to keep than many other tropical fishes. This has led to many more discus hobbyists, discus associations, and discus shows worldwide.

In the beginning, most discus shows were organized by commercial breeders to display and market their special discus varieties. These professionals provided most of the show entries and won most of the trophies. In some European and Asian shows, cash prizes for winners often ran to tens of thousands of dollars. These competitive shows also provide opportunities for hobbyists to appreciate how show-quality discus should look and challenge them to upgrade the quality of discus they have at home. In recent years, more and more hobbyists have participated in these competitions, and they have begun to take home many of the prizes.

Figure 1. Starting right in pursuit of trophy discus calls for selecting eight or more fish of the same variety, in this case young adult red discus of about 4 inches (10 cm).

MATT BEAMAN

Whether you are a hobbyist who simply enjoys a tank of show-quality discus at home or if you have aspirations to compete in a future discus show, understanding the process of selecting, grooming, and showing discus will definitely enhance your discus-keeping experience.

What makes a show discus?

A healthy discus, without deformities or scars and appropriately sized for its age, is the starting point. Its size, shape, patterning, and colors should all blend in harmony to please the eye. A show discus is confident of its surroundings and swims around gracefully. At times, like a proud peacock, it will strut and fan in front of its admirers as if to show off its beauty. Discus show judges evaluate competing specimens according to specific standards for many physical attributes.

A discus does not mature to become a show specimen accidentally. The owner carefully selects a group of young fish to work with. He or she nurtures them in an optimum environment, protects them from injuries, and interacts with them regularly to groom them for future shows.

Selecting a show-quality discus

Acquiring discus with show potential is the most important first step. Fish with genetic faults or those weakened by disease will not mature to become show fish even if they receive the best care. The selection process need not be bewildering; it is best to start working with a group of eight or more young discus of the same variety. Make your selection from a larger group of healthy, young, and robust fish (Figure 1, previous page).

Private breeders, specialized discus importers and mail-order retailers, and stores with dedicated sections for discus are likely sources for good quality discus. If the question of wild versus captive-bred discus comes up, I absolutely recommend captive-bred stock to anyone who is not an expert. Generation after generation of captive breeding has produced discus that are accustomed to an aquarium environment and are not nearly so demanding of the optimal water conditions and pH levels found in nature. Wild fish can come in with lots of parasites, and unless you really know how to deal with them, they can be the cause of ongoing problems.

Healthy young discus tend to have light body colors, clear eyes, and fully erect fins. They should school together, swimming back and forth toward the front of the tank, looking to be fed. A juvenile discus that has intensely dark colors, acts in a territorial fashion, and is aggressive toward tankmates is often a victim of disease or prior heavy chemical treatments.

Once you are satisfied that a discus is healthy, the next step is to make sure that it has no undesirable imperfections. A simple four-step process can be used to examine discus ranging in size from 2 inches (5 cm) in diameter and up. While imperfections are more pronounced in larger fish, a practiced eye can spot them in smaller fish.

Step 1. Examine the discus from a head-on view. Imagine a vertical line drawn from the tip of the dorsal fin to the bottom of the anal fin, dividing the fish in two halves (Figure 2). The halves should be symmetrical. It should be easy to observe irregularities, such as eyes that have different sizes or are positioned unevenly; the

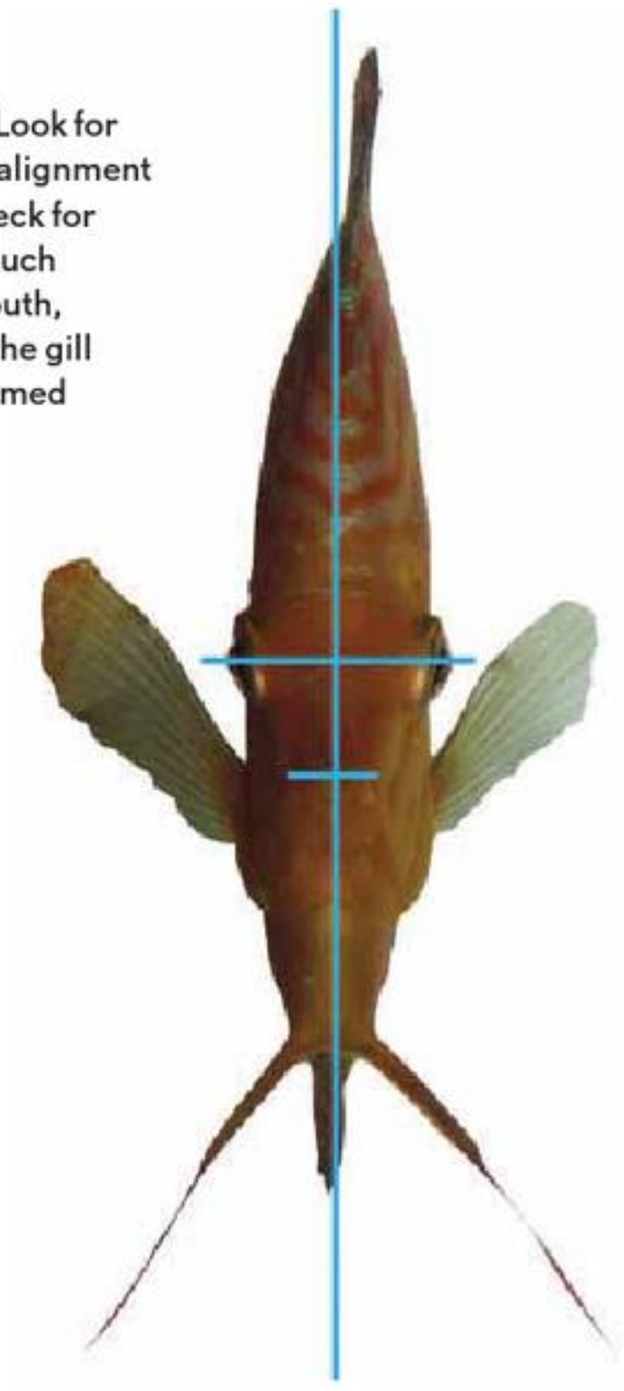


Figure 2.
View head-on. Look for symmetry and alignment of the eyes. Check for irregularities, such as a twisted mouth, deformities of the gill plates, or deformed vertebrae.

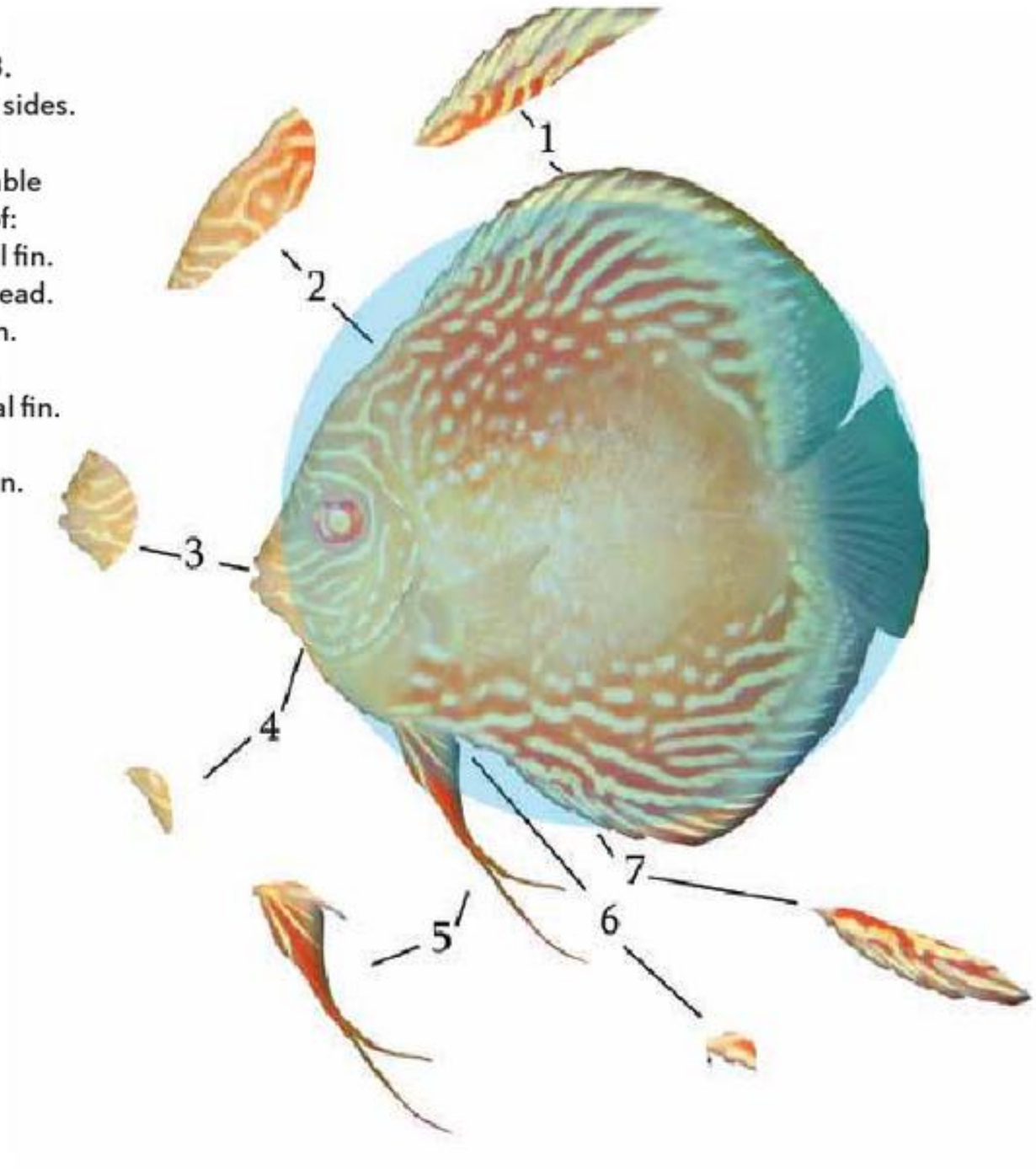


Figure 3.
View the sides. Look for undesirable shapes of:
1. Dorsal fin.
2. Forehead.
3. Mouth.
4. Chin.
5. Ventral fin.
6. Vent.
7. Anal fin.

mouth may be twisted to one side; the gill plates may be curled or deformed; and fins can be damaged and not even on both sides. On some discus, deformed vertebrae can be observed as a bump on one side immediately in front of the caudal peduncle or tail. Avoid all imperfections such as these.

Step 2. Examine the fish broadside on each side. The desirable body shape for a discus is either perfectly round or a vertically oriented oval, often referred to as tall body form. Look for the fish with a profile that fits nicely into an imaginary circle or vertically placed oval (Figure 3). The numbers in the figure indicate areas to pay attention to. Obviously, certain parts of the body will not align perfectly with the circle, but smooth transitions from point to point are more desirable. The most common imperfections identified with this step are recessed or missing fin rays on the dorsal or anal fins; a bumpy-looking forehead; a pointed or "beaky" mouth; and twisted pectoral fins.

Step 3. Examine specific areas of the body, again on both sides (Figure 4). Look for scars caused by injuries or diseases. The dreaded "hole-in-head" disease will leave crater-like scars above the eyes and around the lateral line. The gill plates should be flat and cover all the gill filaments. The eyes should be appropriately sized for the fish's age, very round, clear, and brightly colored, preferably red. The vertical bars on the body, if observable, should be straight and parallel. Bent or V-shaped bars may be a sign of vertebral deformities.

Step 4. Examine body colors and patterns on both sides. Every variety of discus has a unique look resulting from a "desirable" combination of base body colors and markings. Hobbyists interested in a particular strain should consult with breeders or hobbyists familiar with discus competitions to understand these definitions. In general, look for fish that have clearly defined patterns that uniformly cover the entire body and are complemented by harmonizing body colors. For patterned varieties, it is difficult to achieve and yet highly desirable to have the body markings also cover the abdomen, forehead, and fin areas. Colors and markings on discus evolve and intensify with age.

Some commercial breeders feed large amounts of color-enhancing foods to brighten the colors of younger discus. Be wary of fish that appear artificially red or that have red coloration bleeding into the base of their pectoral fins. If a fish looks like a Red Delicious apple, it may be due to color-enhancing feed rather than breeding.

These problems can be avoided by purchasing from reputable breeders.

Grooming

Raising quality discus and grooming them to become show fish entails much more than just keeping them alive. A well-maintained aquarium environment and good nutrition will assure that the discus grow at an optimum rate and ultimately reach the maximum size for the particular strain.

The appropriate basic parameters for keeping discus, such as temperature, water chemistry, frequency of water changes, and foods are amply discussed in many discus books and will not be repeated here. It should be emphasized, however, that stability in the aquarium environ-

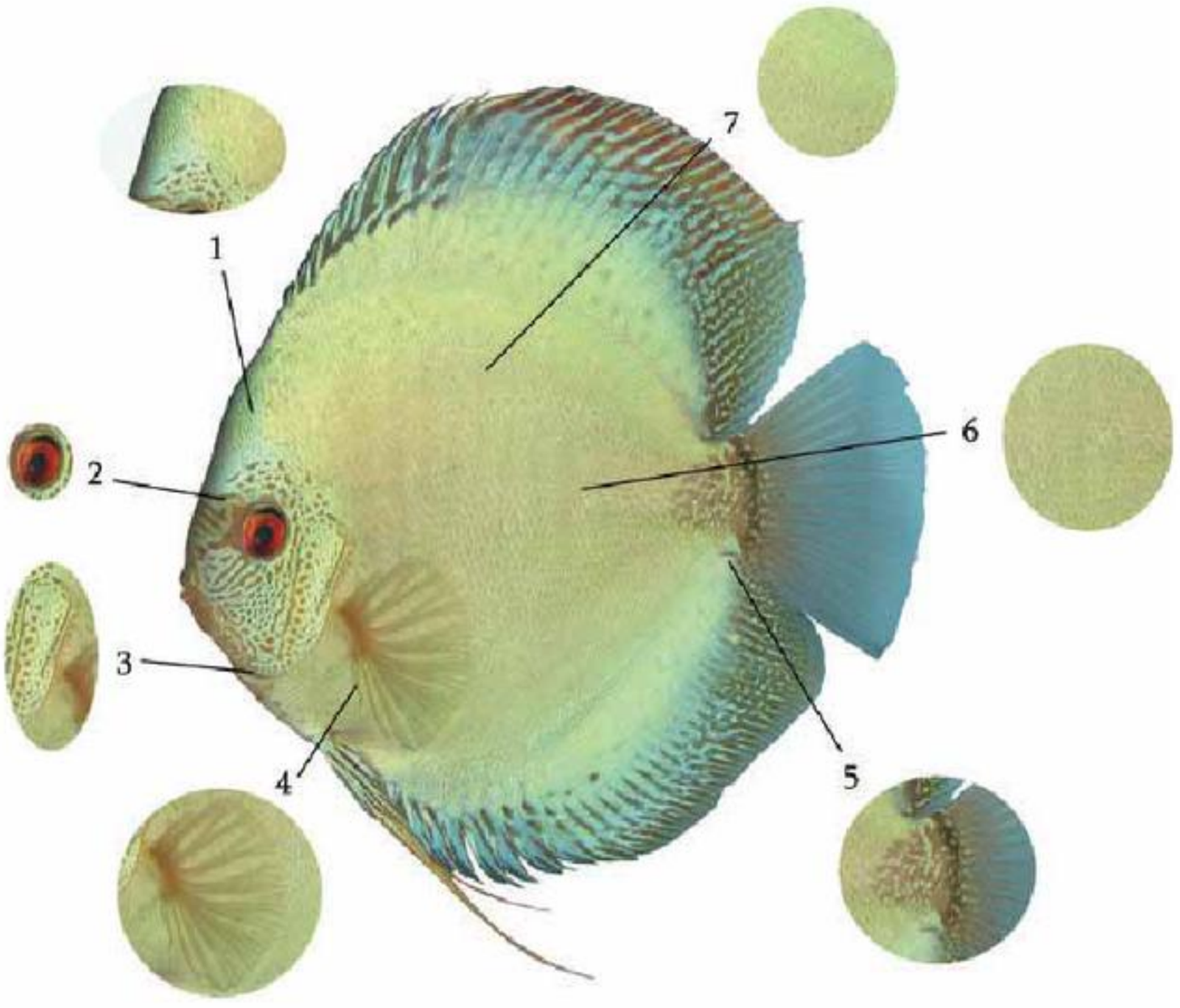


Figure 4.
Look for trouble spots:
1. Check for forehead scarring. 2. Eyes clear? 3. Gills even? 4. Base of the pectoral fins colored properly? 5. Check base of the caudal fin color. 6. Is midline of the body scarred? 7. Is barring even?

DICK AU

ment and minimal use of chemicals and medications are much more important to the health of your discus than simple reliance on instrument measurements. In my opinion, maintaining stable water conditions is more critical than achieving "perfect" parameters. I would rather keep discus at a stable pH of 7.2 than use chemicals to reach an "optimal" pH of 6.5 and then have the pH shift with every water change.

Also, maintaining steady growth through moderate water temperatures and a varied diet is preferable to trying to achieve the fastest growth rate by using high water temperatures and feeding only animal proteins, such as beef heart. I keep discus at a stable 82–84°F (28–29°C) most of the time. Breeders pushing growth may keep water temperatures at 86–90°F (30–32°C). Using a heavy diet of beef heart, which is rich in animal protein and fat, can produce fast growth, but it can also result in fish that are obese and less mobile and active than they should be.

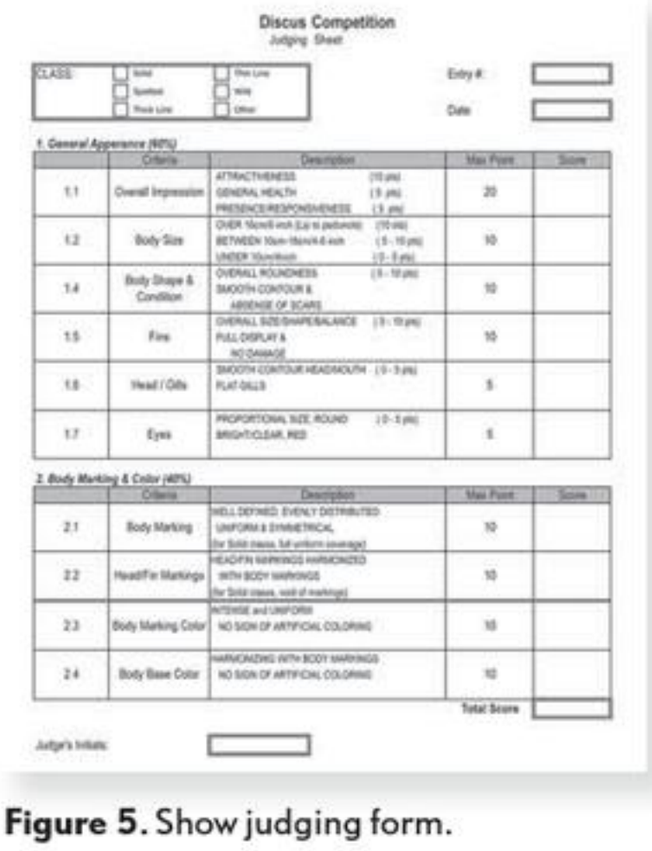
I feed a varied diet of high-quality protein (brine shrimp, *Mysis* shrimp, bits of prawn and fish fillets), with some vegetable matter. Commercial pellets from the best brands can be a part of the mix. If you use beef heart, be sure it is part of a diet with a good variety of different foods. Color-enhancing rations can be part of the mix, but don't overdo this.

Disease and injury prevention is essential. Even though most discus diseases are treatable, many will stunt growth and leave behind permanent, unsightly scars. Spend time observing your discus frequently and treat any disease or wound promptly. Avoid adding new inhabitants to the discus tank to reduce the chances of introducing infectious diseases. Remove any aggressive tankmates. Many varieties of cichlids and loricariids may be peaceful enough when they are young, but will become aggressive when mature or ready to mate. They may inflict wounds on your discus, leaving behind scars. The better choices of tankmates include small, peaceful South American tetras, *Corydoras* catfish, and dwarf cichlids, such as *Apistogramma* spp.

For those serious about showing discus, however, the best tankmates are other discus and nothing else. A bare tank also makes careful daily observation easier. Discus are naturally timid, and they will tend to hide if there are plants and driftwood available. Show discus do not need huge aquariums. A group of eight young fish can be grown out in a tank with a volume of 20-40 gallons (75-150 L).

It is natural for fish to flee from unexpected intruders. Therefore, a discus must be "trained" or accustomed to displaying in front of a show judge. To encourage interactions with people, it is best to raise discus in a bare tank placed in a location exposed to moderate human traffic. Spend more time in front of the discus tank during feedings and do not hesitate to feed them by hand.

Finally, not every young discus will mature into a show specimen. As discus grow, their body forms and color patterns evolve, and minor deformities may become more pronounced, thereby disqualifying them for competition. The grooming process includes periodic culling of less desirable fish to focus attention on those retained for competition.


Discus Competition
Judging Sheet

CLASS: Solid, Spotted, Three Line, One Line, Wild, Other

Entry #:

Date:

1. General Appearance (40%)

	Criteria	Description	Max Point	Score
1.1	Overall Impression	ATTRACTIVENESS (10 pts) GENERAL HEALTH (5 pts) PRESENCE/RESPONSIVENESS (5 pts)	20	
1.2	Body Size	OVER 16cm/6 inch (Up to pectoral) (10 pts) BETWEEN 10cm-16cm/4-6 inch (5 - 10 pts) UNDER 10cm/4inch (0 - 5 pts)	10	
1.4	Body Shape & Condition	OVERALL ROUNDNESS (5 - 10 pts) SMOOTH CONTOUR & ABSENSE OF SCARS	10	
1.5	Fins	OVERALL SIZE/SHAPE/BALANCE (5 - 10 pts) FULL DISPLAY & NO DAMAGE	10	
1.6	Head / Gills	SMOOTH CONTOUR HEAD/MOUTH (0 - 5 pts) FLAT GILLS	5	
1.7	Eyes	PROPORTIONAL SIZE, ROUND (0 - 5 pts) BRIGHT/CLEAR, RED	5	

2. Body Marking & Color (40%)

	Criteria	Description	Max Point	Score
2.1	Body Marking	WELL DEFINED, EVENLY DISTRIBUTED UNIFORM & SYMMETRICAL (for Solid classes, full uniform coverage)	10	
2.2	Head/Fin Markings	HEAD/FIN MARKINGS HARMONIZED WITH BODY MARKINGS (for Solid classes, void of markings)	10	
2.3	Body Marking Color	INTENSE and UNIFORM NO SIGN OF ARTIFICIAL COLORING	10	
2.4	Body Base Color	HARMONIZING WITH BODY MARKINGS NO SIGN OF ARTIFICIAL COLORING	10	
			Total Score	

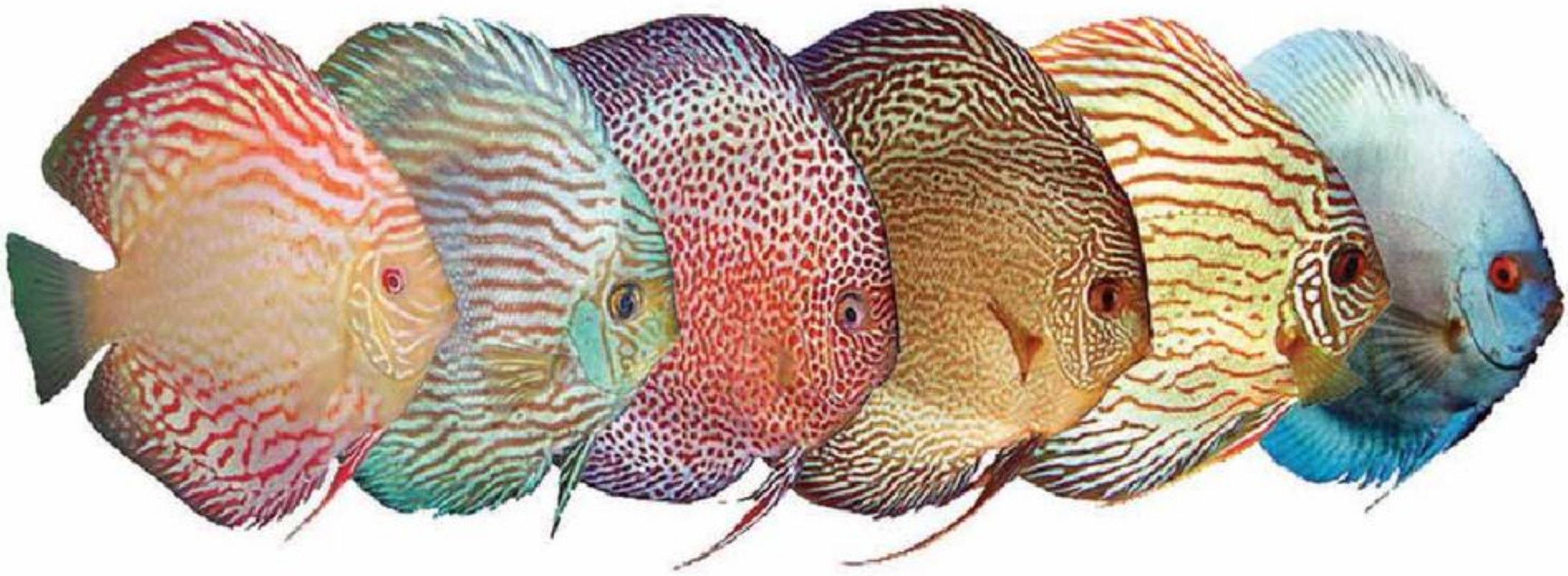
Judge's Initials:

Figure 5. Show judging form.

Discus shows and competition

With the increased popularity of discus, discus hobby societies have been organized all over the world. These organizations foster exchanges of information between hobbyists and host discus shows. They have also established standards and rules by which show discus are

Figure 7. These fish represent all the major colors of discus.



DICK AU

Figure 6. The Best of Show, North American Discus Association 2012. It is a Red Turquoise from Alex Piwowarski stock shown by Kraig Koontz of Kingdom Come Discus.

judged. In the United States, the North American Discus Association (www.NADA.com) hosts bi-annual shows. The most recent was in late June this year in Atlanta. The annual convention of the American Cichlid Association also has a competition category for discus.

While a small number of hobbyists will participate in a discus competition, many may wonder how their discus would compare with the trophy winners. For that reason, it would be worthwhile to understand how discus entries are judged in a show. Every discus show utilizes a similar judging form (Figure 5), modified to incorporate local preferences. For example, discus shows in European countries often have provisions in their judging forms to accommodate the participation of wild discus entries.

Discus entries are graded in two parts and the final score is the sum of both. The first part applies similarly to all discus varieties and is for the overall appearance of the fish. Points are given for body size and shape, as well as condition of fins, gills, and eyes. Each physical attribute can earn up to a maximum number of points; deformities or scars will result in points taken away. Under this evaluation system, the largest number of points is given for general health, overall attractiveness, and the "presence" of the fish (Figure 6). An exceptionally large fish will not guarantee the winning of a trophy.

The second part of grading is for body markings and colors. Since there are discus varieties with every color of the rainbow and very unique markings, they are grouped into categories for competition purposes. For shows with fewer entries, the basic categories are: Solid, Thick-line,

MATT BEAMAN

Thin-line, Spotted, Wild/Other, and Albino (Figure 7). Larger shows allow for more categories. Each of these categories is graded differently, based on certain preferred characteristics. For example, solid-colored discus will not be graded for pattern symmetry, but for color intensity and even distribution. Overall, the emphasis is on symmetry and even distribution of markings, color intensity, and harmony between the markings and base body colors.

Finally, the combined scores for the two parts are used to rank all show entries in each category, and to select category bests and the Best of Show.

Discus shows provide commercial breeders with opportunities to showcase and market their discus. Thus, they will continue to provide a large number of the entries. However, for the same marketing reasons, their emphasis is mainly on the newer varieties, thereby creating opportunities for discus hobbyists to compete in other categories. With patience and understanding of the techniques for proper selection and grooming, hobbyists' discus will not only live up to the reputation of being the "King of Aquarium Fishes," they will win their fair share of the trophies as well.

Dick Au *has been keeping and breeding discus for more than 50 years and is the author of* Trophy Discus *and the* Back to Nature Guide to Discus. *He lives in San Francisco.*

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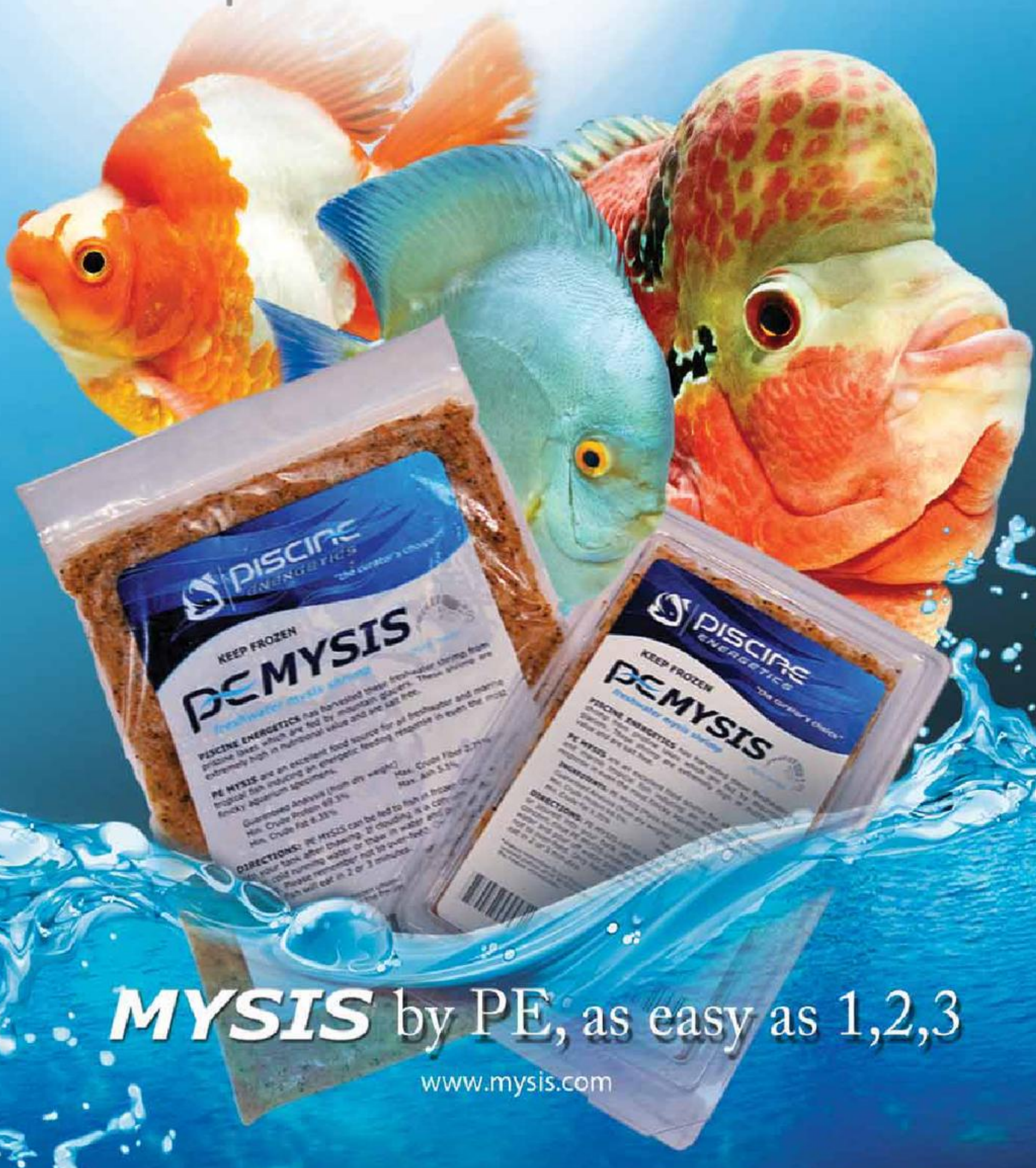

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NANO!

Think small (but lush): little footprints…big impressions

article and images by Karen Randall • What's the big new thing in the aquarium world? Tiny tanks. Actually, tiny tanks artfully aquascaped. For years, a truism for aquarists has been that the bigger the tank, the more stable the system. That is still true for fish-only systems, although our better biological filters are a huge improvement over the bubble-up corner filters that were standard in the community aquariums of my youth. But in the mid-'80s, the planted aquarium began to come of age. Due to the early work of Kaspar Horst and Horst Kipper in the '80s and Takashi Amano in the early '90s, people around the world started to have access to good information, allowing them to keep fully planted aquariums with greater ease.

As time has gone on, we have come to understand that healthy plants actually use many of the waste materials generated by the animals in an aquarium. In most reasonably stocked, fully planted tanks, the "nitrogen cycle" that we discuss with regard to a fish tank doesn't exist, because the plants immediately use any ammonium from the animals or uneaten food as soon it is produced. They also consume excess

Above: *Microsorum pteropus* "Windelov" is a great low-light option for the nano tank.

Left: *Staurogyne repens* threads through this aquascape, behind *Fissidens fontanus*.

Clockwise from top left:

Yellow shrimp (*Neocaridina heteropoda* var. yellow)

Rotala sp. "green" in front, *Rotala rotundifolia* behind.

This aquascape consists almost entirely of mosses and liverworts.

Hemianthus callitrichoides in front with *Rotala* sp. "green" behind. The grassy plant is *Blyxa japonica*, and will eventually outgrow this placement, though it looks lovely now.

Pogostemon helferi makes a diagonal swath between Flame Moss in the front and *Mayaca fluviatilis* and *Ludwigia palustris* behind.

phosphate introduced from food or other sources. Aquatic gardeners have found that while big tanks are fun, small, planted tanks that are thoughtfully stocked can be very stable too. I have kept tanks as small as .5 gallons (2 L) running for several years without any problems.

So what is a nano tank? Definitions vary widely, and the tanks most freshwater aquarists consider "nano tanks" would be considered "pico tanks" in the marine hobby. For the sake of this article, I will use my definition of a nano tank, and the one we use for the AGA aquascaping contest: any tank of 10 gallons (38 L) or less (sometimes they are a lot smaller).

Interestingly, the ubiquitous 10-gallon (38-L) "starter tank" is also a great shape for a starter nano tank. The nice thing about a 10-gallon tank is that it is really easy to get equipment to fit it, and it is very low in cost. Unfortunately, these tanks are, well, kind of ugly. The good news is that there are a plethora of small tanks available these days, and more entering the market all the time. Several companies offer packages including everything from lighting and filtration, and one even includes substrate and a CO^2 system!

Setting up your nano tank

A nano tank can be placed almost anywhere you have a spot for it in your home or office. Avoid placing it in direct sunlight, as this may overheat the small tank. But you don't have to worry about supporting a lot of weight—these smaller tanks weigh no more than a bottle of milk! Nano tanks are great desktop tanks, but—be

forewarned—they are great (wonderful?) time-wasters!

The smallest nano tanks do not require filtration. A good light and regular water changes will keep your tank in good shape. For larger nanos, especially if you plan to include livestock in your display, a filter is a good idea. Some of the nano "kits" available these days include an internal power filter. While they are perfectly capable of doing the job, they are not my favorite, simply because it is hard to aquascape around them. There are several hang-on-the-back–style filters that are small enough for nano tanks, and even some little canister filters. Keep in mind that if your tank will house shrimp, it is imperative that you cover the filter intake with something fine, like a sponge filter, to prevent the babies being sucked up.

Supplemental CO^2 can be provided via a yeast reactor or paintball-type CO^2 system, but is not necessary if you choose your plants appropriately. It is best to stick to slow-growing plants in these tiny tanks, or you will need to do a lot more trimming than you'll probably want to. For larger tanks, many people choose to use bottled CO^2 with a good regulator and needle valve, just as you would with a full-sized tank.

There are a number of lighting options for nano tanks, from compact fluorescents to HQI lighting to LEDs. Anything goes, as long as you can place it where it won't overheat the small volume of water. LEDs are particularly good from this perspective, and while the prices are generally still high for aquarium LEDs, they are quite affordable for a tank of this size. If you have an oddly shaped tank or want a really inexpensive solution,

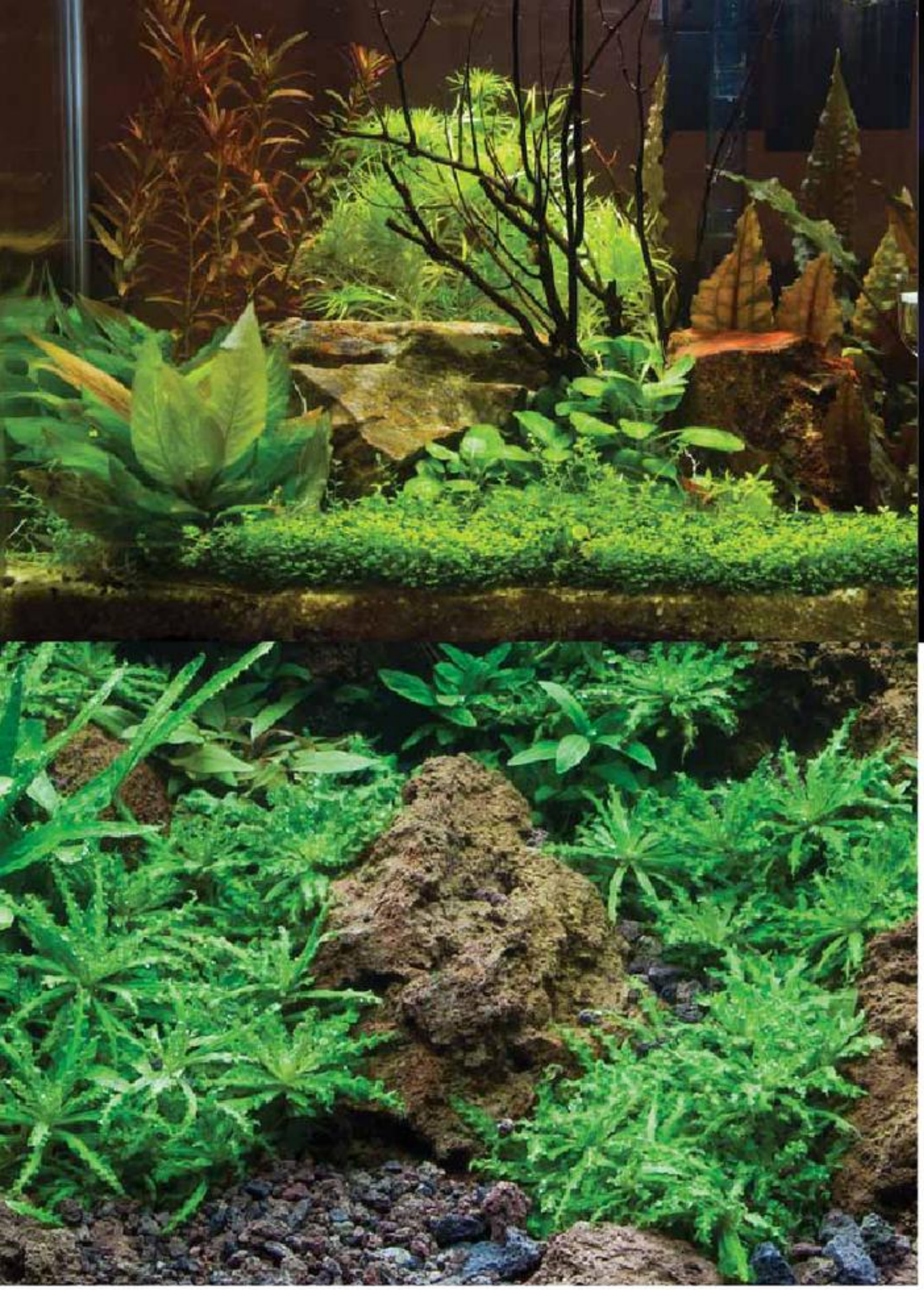
a compact fluorescent desk lamp will do an admirable job of lighting a nano tank.

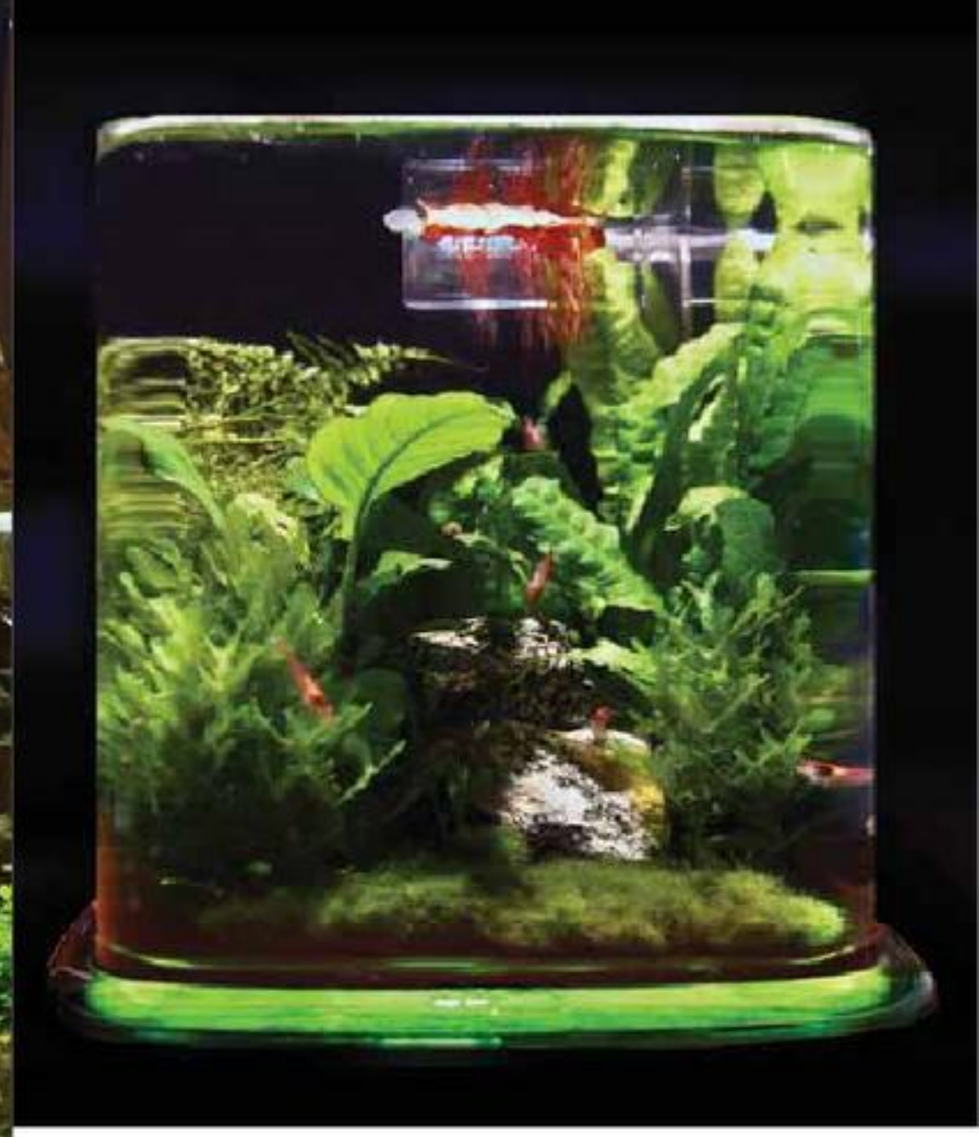
If your tap water is good for growing plants, it is fine to use it. But if you live in one of those areas with rock-hard water or there is too much nitrate or phosphate in it, it is not expensive to buy bottled water at the grocery store for a tank of this size.

For substrate you can use anything you'd use in a larger tank, but be careful about using anything with too many nutrients in it. Some commercial substrates are great for growing plants, but require a lot of water-changing to prevent algae in the first few weeks. This isn't ideal for a nano tank. One very effective way to solve the problems created by these high-nutrient substrates and still receive the benefits is to simply cap them with plain quartz or silica gravel. With a substrate set up this way, the plants have access to that nutrition, so you won't have to worry about fertilization for a while, but the nutrients stay out of the water column, minimizing algae problems.

In a very tiny tank, if you use epiphytic plants, you can get by with no real "substrate" at all. In a tiny half-gallon (2-L) tank I kept for several years, I cut up *Cladophora* balls and sewed them onto a piece of plastic needlepoint mesh to make a beautiful "lawn."

Heating can be an issue for nano tanks. There are good thermostatically controlled, submersible heaters available for tanks as small as two gallons (7.5 L). Below this size, the options are not so good. I would not advise the use of the "stick-on" pad–type "mini heaters." They only heat the water a few degrees above ambient room temperature, and the temperature rises and falls with the temperature of the room much faster than it would in a larger tank; in a nano tank without a thermostatically controlled heater, avoid keeping animals that would not





Clockwise from top left:

A lovely group of low-light plants including mosses, *Microsorum*, and *Anubias barteri* var. *nana* "Petite".

A pretty little tank designed by Bailin Shaw for the AGA table at the Northeast Conference of Aquarium Societies (NEC).

One of the author's nano tanks. This one is 4 gallons (15 L).

Another of the author's tanks, this one a mere half-gallon (2 L), with *Cladophora* used as a velvety ground cover.

Pogostemon helferi.

Rotala wallichii gives a great pop of color in an otherwise green palette.

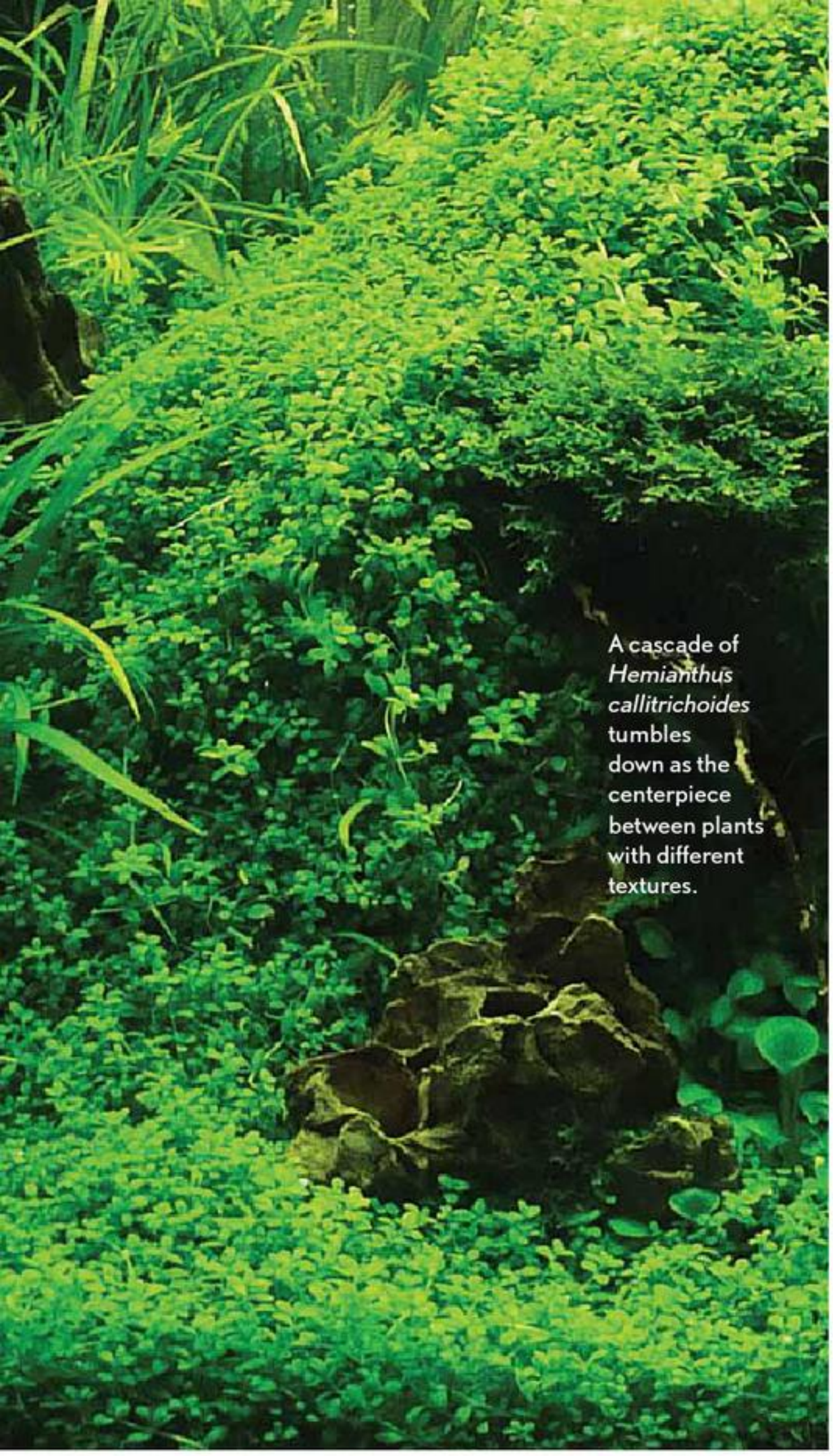
This mound of *Fissidens* is softened by the lacy look of the *Hemianthus callitrichoides* growing through it.

do well in your normal household temperature.

As far as hardscape materials are concerned, use anything you would use in a big tank, but smaller. Here is your chance to splurge a bit on really nice rock or wood—the amount you need won't break the bank. But you can also use "found" materials. Wood that has been submerged in a river for an extended period of time and is free of bark is suitable; just give it a quick scrub with a bristle brush to remove anything on the surface. Any rock is fine, as long as there are no metals to be seen and it is not a calcium carbonate–based stone. You can test this with a couple of drops of muriatic acid from the hardware store. If the rock fizzes, don't use it in such a small tank.

Pick plant species that are in keeping with the size of your tank. Many plants that would get lost in a large tank are exquisite in a little tank. For the very smallest tanks, it's best to choose plants that grow quite slowly. Some examples of these are *Anubias barteri* var. *nana* and *A. nana* "Petite", the smaller *Cryptocoryne* species, such as *C. parva*, the small *Microsorum pteropus* variants, such as "Windelov" and "Trident", and the myriad interesting mosses and liverworts that are available these days. For bigger nano tanks, it really depends on how often you want to trim the plants. There are many small-leafed stem plants that are the right scale for a nano tank. Some of my personal favorites are *Rotala* sp. "Green", *Hemianthus micranthemoides* and *H. callitrichoides*, *Rotala wallichii*, and *Ludwigia arcuata*. But this barely scratches the surface of all the possibilities. And because the tanks are small, you don't need to spend a fortune on plants to make a big statement.

When it comes time to plant your nano tank, those "fancy" aquascaping tools, especially a set of long forceps, are a must. Almost all serious aquatic gardeners, no matter



A cascade of *Hemianthus callitrichoides* tumbles down as the centerpiece between plants with different textures.

what size the tank, use them, but when you are working in such a limited space it is just about impossible to do a good job with your hands.

Animals used in nano tanks must be chosen with care. Tanks between 7 and 10 gallons (26–38 L) can house a carefully selected community of small fishes, while tanks from 5 to 7 gallons (19–26 L) are better as single-species tanks for small colonies of tiny fish. There are many new "nano" fish available these days, like Celestial Pearl Danios (*Celestes margaritatus*) and Jelly Bean Tetras (*Ladigesia roloffi*). And don't overlook the old favorites. White Cloud Mountain Minnows (*Tanichthys albonubes*), Endler's Livebearers (*Poecilia* sp.), and Clown Killies (*Epiplatys annulatus*) can shine in a nano tank all their own.

Below 4 or 5 gallons (15–19 L), it's probably better to stick to invertebrates only, or in a tank between 2.5 and 5 gallons (9.5–19 L), a single Betta (*Betta splendens*). Remember that a Betta is a warm water fish, and requires a thermostatically controlled heater to remain healthy. So don't be taken in by the smaller so-called "Betta bowls." They cannot be adequately heated, so this is not a humane or healthy way to keep these fish for any length of time. The smaller tanks are the perfect place to breed and enjoy the beauty of the many wonderful miniature shrimp that are now available in the hobby, as many of these do just fine at room temperature.

Maintaining your tiny tank

Water changes are necessary, even in small tanks. You can use airline tubing for this, or even a coffee mug to dip water out. The nice thing is that with a tank of this size, a 50 percent or even 90 percent water change is only a few minutes' work, so there is no reason not to do them frequently. On tanks that are a bit larger, there are small-diameter siphon hoses available commercially, or you can purchase a length of appropriate diameter tubing from the hardware store.

With a rich substrate, a nano tank can go a long time without fertilization. But if yours starts to need a boost, there are a couple of options. One is to very carefully measure tiny

In Taiwan, it is commonplace to find beautiful little nano tanks like this for sale, already completely aquascaped for you!

amounts of commercial or homemade aquarium fertilizers suitable for the size of the tank. The other option is much easier if you also have a large tank: do a water change on your large tank, dose your nutrients appropriately, and then do a large water change into the nano tank, using the fertilized water from the big tank.

Obviously, you will also need to trim plants and clean the glass as needed. A pair of sharp, long-handled scissors are helpful for the former task. I have found the most effective tool for cleaning glass in a nano tank to be a single-edge razor blade. This is the best tool for getting into tight spaces in a small tank. The one place that the razor doesn't work is in the rounded corners of many beautiful seamless glass tanks. A Q-tip is great for removing algae in these areas.

One of the best things about nano tanks is that if you don't like the way things are going, it is neither difficult nor expensive to start from scratch and try something new. Even though these tanks can be stable and beautiful for an indefinite period, don't be afraid to experiment with different designs.

Nano tanks are a wonderful way to gain experience in the art of aquascaping. So go out and get a little tank. Enjoy working with the wonderful tiny plants and animals that can get lost in larger tanks. Learn as you go along. But be warned, nano tanks are like potato chips... it's hard to stop at just one!

Dario dario:

The Scarlet Badis

Virtually an instant classic, *Dario dario* was first imported in 1999 and since then has been high on the list of the most popular fishes for small planted aquariums. The species is now part of the standard offering of many aquarium stores. But most of the specimens available are still wild-caught, and the vast majority of them are males. Anyone who can obtain one or more females would thus do well to breed these badids, as the percentage of females among tank-breds is significantly higher than among imported wild fishes. The Scarlet Badis can be bred both intensively and extensively. • *by Frank Strozyk and Andreas Sander*

Dario dario (Hamilton, 1822) comes from Assam and western Bengal in India, possibly also Bhutan, and occurs mainly in tributaries of the Brahmaputra River. These are small, shallow clear-water rivers and streams characterized by sand to shingle bottoms and, usually, dense aquatic or marginal vegetation.

Males, which measure .75–1 inch (2–2.5 cm) in length, have bold red and blue stripes and bright red fins with white-blue margins and fin membranes. However, the color intensity, number, and width of the blue stripes can vary considerably.

A striking feature of the Scarlet Badis is the typical black stripe running through the eye from the upper edge of the operculum to the mouth. Females are somewhat smaller at .5–.75 inch (1.5–1.8 cm) and have a gray-brown coloration with usually colorless fins, though the first ray of the ventral fin and the margin of the anal fin may be white-blue as in males, but is not as bright and elongate. Individual females sometimes exhibit irregular red spots and small, bluish, iridescent spots on the flanks.

Aggressive or stressed females exhibit a dark stripe pattern and their fins may take on a slight reddish hue. A further character that distinguishes females from males is the general shape of the body and above all the head: females have a blunter head profile (especially the relationship of head depth and length to eye size), and, when ready to spawn, a noticeably rounded belly

Below: Adult *Dario dario*, like this male, can manage relatively large food animals, such as bloodworms.

A. SANDER

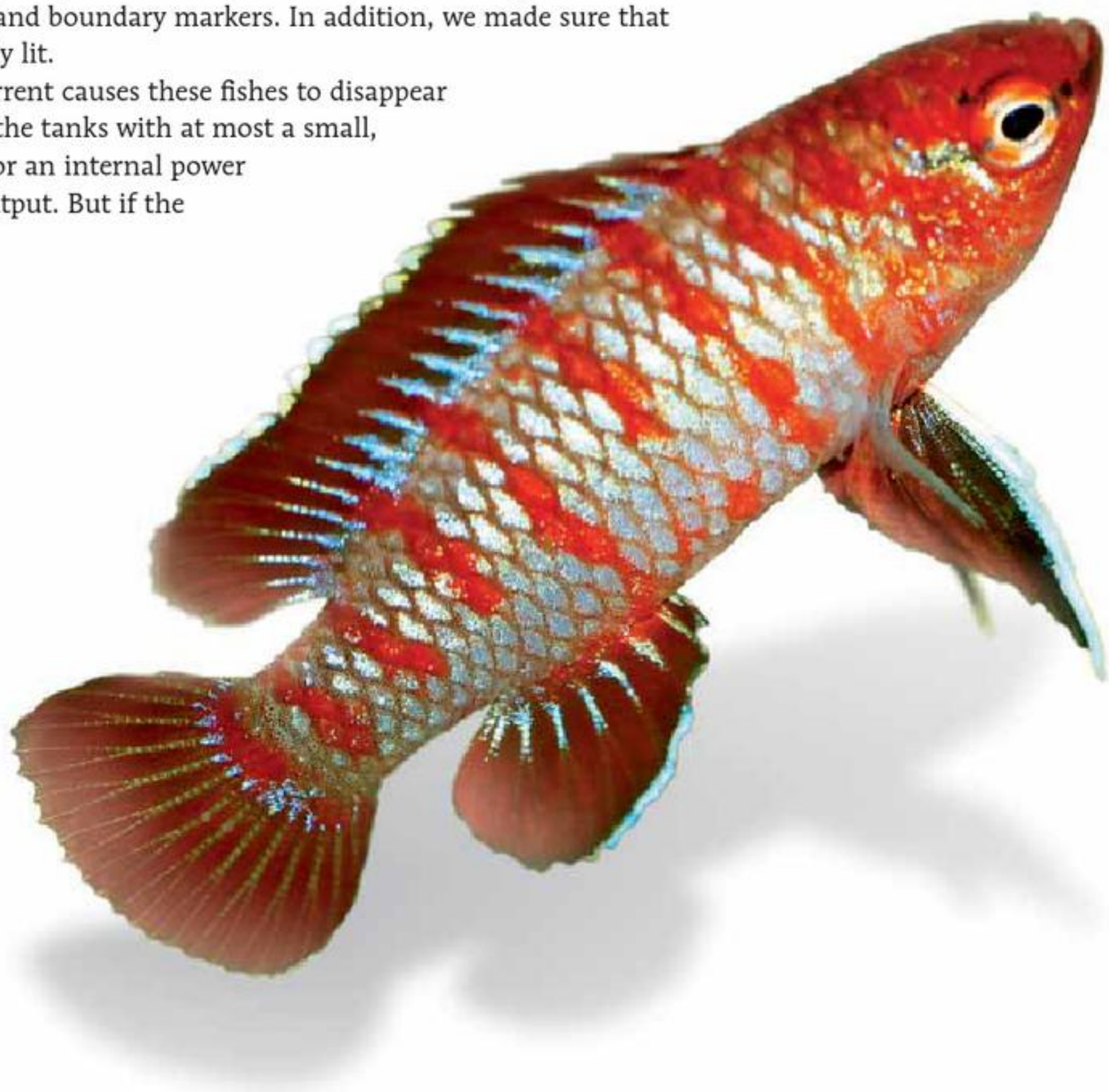
(sometimes with the yellowish eggs visible through the distended skin of the belly). Males are somewhat slimmer and more elongate.

Above: In ripe females the pale yellow eggs can be seen through the distended belly.

Dense planting

Because of its small size and territorial behavior, *Dario dario* is suitable for maintenance in a small aquarium with a volume of 5 gallons (20 L) or so. One or two males and two to four females can be kept permanently without problems in small aquariums of this type. Larger tanks with a volume of 10–15 gallons (40–60 L) can accommodate larger groups of eight to twelve individuals. Our tanks were densely planted, at least in places, with Java Fern (*Microsorum pteropus*), Java Moss (*Vesicularia dubyana*), *Cryptocoryne* species, and *Anubias*; wood and rocks provided the fishes with additional cover and boundary markers. In addition, we made sure that the tanks weren't too brightly lit.

Because too strong a current causes these fishes to disappear into the cover, we equipped the tanks with at most a small, air-driven Poret Foam filter or an internal power filter running at minimal output. But if the



Right: A fully colored dominant male. During courtship the male becomes an intense red.

TOP: A. SANDER; BOTTOM: F. STROZYK

Scarlet Badis juvenile.

Right: If *Dario dario* is maintained in groups, the males will constantly contest territorial boundaries, and this can rapidly degenerate into absolute chaos.

tank is large enough and more abundantly planted, it is also possible to dispense with filtration entirely. The same applies to heating, as *Dario dario* prefers fairly cool temperatures of 65–75°F (18–24°C), which can generally be guaranteed by room temperature. It is thus possible to do without a heater/thermostat.

Because we were able to breed *Dario dario* successfully in medium-hard, slightly alkaline water, as well as very soft, slightly acid conditions, it appears that the species is very tolerant with regard to water parameters. But if your tap water is very hard, it would be a good idea to mix it with soft water so as to arrive at a conductivity of around 300–400 µS/cm.

Generally speaking, when setting up an aquarium for *Dario dario*, it is important to bear in mind that the males will carve out small territories and defend them aggressively against one another. Even if no actual injury results, over time only the strongest and most colorful males survive. Dense planting and other décor, arranged so as to provide potential boundaries for the males' mini-territories, can noticeably defuse the situation.

Correct food is the most important criterion in the maintenance of *Dario dario*. It can generally be said that these fishes require live foods. We fed them mainly with sieved *Daphnia*, *Artemia* and *Artemia* nauplii, *Cyclops* and their nauplii, *Tubifex*, and small mosquito larvae, bloodworms, and glassworms. If you don't want to rear these fishes deliberately and in large numbers, you can keep them with a number of dwarf shrimps, whose offspring will supplement the menu extremely well. It is occasionally possible to trigger the feeding reflex with frozen food and a bit of water movement, but once the food is lying on the bottom the fishes usually won't touch it any more. In the majority of cases, dry food is completely ignored.

Spawning

If you have managed to obtain both sexes, and the fish are well fed and have been provided with a suitable aquarium, the males will very quickly begin to carve out their territories, court females, and drive away competitors. Fighting males intensify their colors, spread their fins, and swim slightly head-down toward one another. Usually only lateral threat display is required make one fish yield and be briefly but vigorously chased away.

During courtship the male again becomes more brightly colored, presents himself to any female that comes near, and swims after her, repeatedly butting her in the flanks and steering her in the direction of the

Equipment for the intensive rearing of *Dario dario*: plastic container with reverse-osmosis water and Sea Almond (*Terminalia catappa*) leaf, paintbrush for cleaning, food syringe, and forceps.

A. SANDER

spawning substrate (usually a dense tangle of vegetation—Java Moss, fern roots, and the like).

If the females have been well fed and are ready to spawn, then *Dario dario* will quickly become a continuous spawner. The loose clutch of glassy to slightly milky eggs, less than 1 mm across, is concealed as deep in a thicket of plants as possible. Depending on the water temperature, the incubation period lasts around two days. The newly hatched larvae are barely 3 mm long and completely transparent except for their dark eyes. They mostly stay on the bottom and among the plants, where they initially cling passively to the substrate and feed from their little yolk sacs.

After a short time the larvae become more active, and can sometimes be seen hanging from the glass near the water's surface (best to use a flashlight). In many cases, however, or to the unpracticed eye, they are impossible to see. They apparently feed initially on infusoria and the tiniest zooplankton, which they find among the vegetation and in the mulm.

At the age of around 8–14 days the free-swimming fry progress to larger foods, such as *Paramecium* and *Artemia* and *Cyclops* nauplii. Once the fry are taking foods the size of *Artemia* nauplii without problems, they are "out of the woods" and losses occur only rarely. After another four to six weeks they measure around .39–.47 inch (1–1.2 cm) and can manage to eat *Cyclops* and small *Tubifex*, though they can be reared very well and without losses by continuing to use *Artemia* nauplii.

Identifying the sexes is a major hurdle in the rearing of *Dario dario*. The sexual differences that are obvious in adult specimens are virtually indiscernible in juveniles of less than .59 inch (1.5 cm) long, and can only be determined with any degree of certainty after the age of three to four months. Initially the males begin spontaneously and rapidly to exhibit slightly darker coloration (espe-

There is considerable variability in the patterning of tank-breds. Specimens without any stripe pattern, like this one, crop up occasionally.

F. STROZYK

cially in the fins), and develop the typical blue and red stripe pattern within a few days. They don't all color up at once, however, so males may keep turning up among the putative females in the following weeks.

If in doubt regarding the sex of an individual, it is helpful to separate it out. Possible males color up significantly faster in the absence of competitors. However, individuals that still show no color of any kind in the fins and on the flanks at an age of more than four months are almost always females. In our experience the female-to-male ratio is usually between 1:1 and 3:1, though we also had a number of broods that were almost 100 percent female. (This can't be seen as statistically significant in view of the small numbers—fewer than 20 specimens).

Extensive and intensive rearing

Efficient and intensive breeding of *Dario dario*, with the painstaking separation of the larvae and loss-free rearing, can produce several dozen young fishes per week. We bred the species many times under a wide variety of conditions and over several generations, but always on a relatively small scale, usually producing fewer than 30 specimens. In many cases this "extensive" breeding was so productive that we didn't need to bother with "intensive" rearing. Because the extensive method always worked well and the number of young produced was perfectly adequate to continue breeding for a further generation, we undertook only a few experiments with intensive breeding.

When rearing *Dario dario* it is very beneficial to leave the adults in the breeding tank, and some of the offspring can be reared without problems under these circumstances. Thus, given the correct conditions, the species can be bred even by aquarists who are less focused on breeding. An important prerequisite is providing a dense thicket of vegetation. It has proved very effective to have the bottom of the breeding tank covered with a dense cushion of moss, ideally 4 inches (10 cm) deep and without gaps. It serves as shelter and a source of first foods for the brood.

If the adults are placed in a tank of this kind and fed generously with fine live food, after a few weeks the first fry, already a reasonable size, should appear. You will rarely see fry smaller than 5 mm in length, as they remain hidden deep in the moss cushion, so you may not know that breeding has occurred until larger fry appear. Anyone who has a supply of the tiniest live foods (for example, rotifers, *Paramecium*, vinegar eels) can, of course, supplement the diet with these. Using this method you won't get an overwhelming number of youngsters, but there will be enough for personal requirements and for supplying your immediate circle with young.

Higher yields

Moss that is "well stocked" with spawn can contain dozens or, depending on the number of ripe females, even hundreds of larvae. But the number of larvae decreases dramatically when using extensive breeding because of the presence of the adults (and other predators such as snails, shrimps, and other fishes). One possible way of increasing the "crop" of fry is to remove the adult fishes from the breeding tank and rear the offspring alone. In this way the average number of fry can be roughly doubled, as they can be fed more efficiently and any danger of the adults preying on the larvae and very small fry is excluded. The spawn should be separated right away; the longer you wait to separate them, the smaller the crop will be.

But finding the eggs and collecting them is no easy task. It helps to regularly remove all potential spawning substrates carefully and transfer them to suitable rearing containers (suspended nurseries, small tanks, or large plastic boxes). If you limit yourself to siphoning off the larvae, this can be done during water changes by siphoning water from among the vegetation into a white bucket. The next step requires patience and good eyesight. The larvae are around 3 mm long, very thin, and transparent. All you can actually see are the eyes—from above they look like two short, parallel black streaks and stand out very well against the white of the bucket.

We transferred the larvae, newly hatched and a few days old, to plastic bowls containing reverse-osmosis water and a small piece of Sea Almond leaf to keep the germ count low. We cleaned the containers thoroughly with a paintbrush two to three times daily after feeding and changed a large part of the water at the same time. Initially we fed infusorians from hay infusions and cultures, then later freshly hatched *Artemia* nauplii.

Initially, it is usually necessary to start *Artemia* cultures daily so as to have sufficient newly hatched, very small nauplii available. While the fishes are still very young it is advisable to strain out the smallest nauplii to avoid introducing any large nauplii into the container, where they will pollute the water if they remain uneaten.

Once our fry were also taking larger *Artemia*, we placed them in small, densely planted rearing tanks. This method was really successful—we experienced almost no losses. But there was a lot of work involved, and ultimately we reverted to the admittedly less productive, but much easier extensive method.

REFERENCES

Kullander, S.O. and R. Britz. 2002. Revision of the family Badidae (Teleostei: Perciformes), with description of a new genus and ten new species. *Ichthyol Expl Freshw* 13 (4): 295–372.

Interview by Hans-Georg Evers, accompanied by our Thailand correspondent, Kamphol Udomrhitthiruj • Patrick Yap lives the sort of life that many of us can only dream about. The owner of Aquaculture Technologies Pte. in Singapore searches for—and finds—new and unusual fish species all over Asia to satisfy the demands of freshwater enthusiasts worldwide. An engaging fellow, Yap is always on the move, so I was lucky to catch up with him at his business premises.

Patrick Yap:

Hunting for the new & rare

AMAZONAS:
Good morning, Patrick, and many thanks for letting us turn up here on a Sunday morning!

Patrick Yap:
No problem, in my line of business there are few free weekends. But that was my choice.

AMAZONAS:
Turning your hobby into a profession?

Patrick Yap:
Exactly. I have been an aquarist since I was eight years old, when I persuaded my mother to buy me an Angelfish and a few Kuhli Loaches, which we initially kept in a bowl. Later on, as a young man, I had lots of tanks of South American fishes at home, mainly large catfishes and cichlids. At some time or other snakeheads also found their way into my tanks, and my interest in native and other Asian fishes just kept increasing. Around

Patrick Yap in one of his quarantine areas.

Clean, modern aquariums with built-in pipework provide rapid, almost daily water changes from a variety of reservoirs, depending on the requirements of the fishes. The fishes need optimal conditions during quarantine, before they set off on their travels all over the world.

H.-G. EVERS

that time I got to know Peter Ng, the curator of ichthyology at the Raffles Museum in Singapore, who took me along with him on collecting trips near Singapore and the adjacent Malayan state of Johore. I learned a lot from Peter, and I am proud to have him as my mentor.

AMAZONAS:
But then your career took you in quite a different direction, right?

Patrick Yap:
Yes, I studied economics and then got a well-paying job—which I gave up after a week. It was incredibly boring and had absolutely nothing to do with what I had always wanted to do. I wanted to work with fishes!

I started my first business exporting unusual Asian fishes in 1998. I borrowed 5,000 Singapore dollars (around $3,900 U.S.) and used some of it to buy tanks and a few sturdy shelving units from IKEA. I rented space at a Singapore business building and was able to use their packing station and other facilities. In those days I was a one-man operation—I looked after the fishes, sent out stock lists, and did all the shipping myself. Naturally, I couldn't continue that way forever, and soon I was hiring staff. The real breakthrough began in 2001, when the Japanese company, Kamihata, placed a very large order with me. Thereafter I had sufficient capital to build up my business, which constantly grew in size and scope.

AMAZONAS:
So what's the situation now? You constantly travel across Asia, visit known and new collecting sites, and brief future partners on the spot?

Patrick Yap:
Exactly! I have suppliers in all the important Asian countries, such as Thailand and Indonesia, and more recently in Vietnam and Myanmar as well. They regularly send me their stock lists and I buy their fishes. Over time I have been able to build up an effective network, and I also have my own collecting stations in Indonesia. I make collecting tours lasting a few days once or twice per month, and have taught the people on the spot how to deal with delicate fishes, keep them in quarantine, and dispatch them. This works very well, and we have hardly any losses.

It isn't always easy to get the local people

The station where Yap's fishes are packed for transportation.

to understand, but they realize very quickly that good quality fishes are obtainable only if the natural habitat and its denizens are treated carefully. Overfishing and over-exploitation are not an issue for me; we try to establish long-term relationships that benefit both sides. In addition, some fish species are so difficult to transport that we would rather leave them where they are or develop special methods for them.

For example, the Burma Stickleback, or Paradox Fish (*Indostomus paradoxus*), shouldn't be packed with too much oxygen. Many labyrinthfishes are packed individually or with Sea Almond (*Terminalia catappa*) leaves as cover and a natural medication against stress in the transport bags. Many fish species, particularly those from the blackwaters of Borneo, have their individual peculiarities, and there are numerous tricks and tactics that we have developed over the years.

AMAZONAS:
You mentioned the Raffles Museum in Singapore—do you collaborate with their scientists?

Patrick Yap:
Yes, indeed. I work primarily with Peter Ng, and also with Dr. Heok Hui Tan and Dr. Heok Hee Ng. I

Rasbora lacrimula (Red Cherry Rasbora) is just one of the many cyprinid species that Patrick Yap introduced to the aquarium hobby.

TOP: H.-G. EVERS; BOTTOM: K. UDOMRHITTHIRUJ

Completely new fish species, such as this "Yellow Glass Rasbora" from Malinau (Borneo), are regularly seen in aquaculture.

send them preserved specimens of anything I collect that I believe could be a new species. This has already led to a number of original descriptions, for example that of *Gymnochanda verae*, a new glassfish, in 2011. But I also read all the scientific work published on Asian fishes and travel to the locations mentioned, in the hope that a species of interest to the aquarium hobby is involved.

My local suppliers also go looking for fishes and let me know if, for example, they find a new species for their region. Labyrinthfishes are particularly interesting, of course, especially the numerous forms in the genera *Betta* and *Parosphromenus*, which contain a truly incredible number of species and variants. I have recently made lots of expeditions with other aquarists. The well-known labyrinthfish expert Horst Linke has accompanied me on many such trips, and so have many others. We've visited many countries, thousands of islands and river basins. We haven't found everything, not by a long shot. I don't expect to live long enough to achieve that!

AMAZONAS:

The list of fish species introduced to the hobby via aquaculture is long. There have certainly been importations by traveling aquarists for a

Rasbora patrickyapi (Yap's Rasbora) was named in honor of its discoverer.

TOP: H.-G. EVERS; BOTTOM: H. H. TAN


H.-G. EVERS

Above: Healthy gouramis, bred in-house, are the latest top seller at Aquaculture Technologies.

Left: Discovered in the fightingfish area: the very rare *Betta compuncta*.

long time, but I think it is fair to describe you as the initiator and driving force of a worldwide fan club for Asian aquarium fishes.

Patrick Yap:
Thank you, you flatter me! We have, indeed, made lots of species available to the aquarium hobby in large numbers. I am thinking of the uncommon chocolate gouramis *Sphaerichthys vaillanti* and *S. selatanensis*, the numerous *Betta* and *Parosphromenus* species, the beautiful dwarf

puffer *Carinotetraodon salivator*, and the tiny *Paedocypris* species. We have also made large numbers of familiar species—the tiny *Boraras brigittae* (Chili Rasbora), *Puntius rhomboocellatus* (Snakeskin Barb), and *Puntius foerschi* (Boomerang Barb)—available for the market again. Our competitors now look very closely at my stock list and try to offer these fishes themselves.

AMAZONAS:
It's good to hear such things at a time when there is purportedly no longer much interest in the advanced aquarium hobby, at least in the western world!

Patrick Yap:
Oh, it's generally true that in 2010 and 2011 the market collapsed in the U.S. and Europe, and we, too, experienced setbacks in our sales figures. I sell almost exclusively rarities, except for the home-bred gouramis, a recent project. But with the exception of Japan, the Asian market is booming like never before.

AMAZONAS:
Tell me about the gourami project.

Patrick Yap:
I have established a breeding facility for *Trichogaster* species (Sarawak, Malaysia) so that I can offer guaranteed virus-free fishes for the European market. Import regulations in the EU, as well as here in Singapore, are becoming increasingly strict, so I am trying to produce fishes that are guaranteed to be healthy, in accordance with the biosecurity

Above: *Sphaerichthys vaillanti* (Samurai Gourami) has been made available to a wider circle of enthusiasts through the efforts of Patrick Yap.

The owner photographs new and rare fishes himself. The photographic tank in his little laboratory is always ready for use.

H.-G. EVERS

Below: Rarities such as the dwarf puffer *Carinotetraodon salivator* (Striped Redeye Puffer) are Patrick Yap's main stock-in-trade.

measures. This has been very well received by our customers. But we are also breeding wild forms in Kuching that are difficult to obtain in the wild, for example *Betta miniopinna* (SmallFin Betta), *Betta taeniata* (Banded Betta), and others.

AMAZONAS:

Many thanks for this very interesting discussion, and we wish you continued success with your business. The readers of *AMAZONAS* will be pleased to hear that you will continue to export new species from Asia.

AQUARIUM

CALENDAR

compiled by Mary E. Sweeney

NOVEMBER

4 **Annual Auction**
Tropical Fish Club of Burlington
Burlington, VT
www.tfcb.org/

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

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

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

20 **Bowl Show, Raffle, Auction**
Michiana Aquarium Society
Roseland, IN
michianaaquariumsociety.org

DECEMBER

1 **Holiday Party,** Potomac Valley Aquarium Society, Fairfax, VA
www.pvas.com

8 **Holiday Party and Awards**
Colorado Aquarium Society
Wheat Ridge, CO
www.coloradoaquarium.org

8 **Auction**, Motor City Aquarium Society, Madison Heights, MI
www.motorcityaquariumsociety.com

11 **Christmas Party,** Michiana Aquarium Society, Roseland, IN
http://michiana-aquarium-society.org

12 **Christmas Party,** North Jersey Aquarium Society, Lyndhurst, NJ
www.njas.net/

14 **Holiday Party,** Brooklyn Aquarium Society
Brooklyn, NY
www.basny.org/

JANUARY

12 **Meeting,** Pacific Coast Cichlid Association
San Jose, CA
www.cichlidworld.com/meetinginfo.html

19 **Annual Winter Swap Meet**
Grand Valley Aquarium Club
Grand Rapids, MI
www.grandvalleyaquariumclub.org

22 **Auction,** Greater Houston Aquarium Club
Houston, TX
www.houstonfishbox.com

MARCH

23-24 **The British Discus Show 2013**
The British and International Discus Keepers Association, Doncaster, UK
www.british-discus-show.com

30-31 **Spring Fish Show,** Eastern Iowa Aquarium Association, Cedar Rapids, IA
www.finflap.com

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❶ *HEPSETUS ODOE* ❷ *GALAXIAS ZEBRATUS* ❸ *PARAKNERIA CAMERONENSIS*
❹ *HEMIELEOTRIS LATIFASCIATA* ❺ *TAIA NATICOIDES* ❻ *OREICHTHYS CF. PARVUS*

20-inch (50-cm) Kafue, *Hepsetus odoe*

African or Kafue Pike, *Hepsetus odoe*

1 The African or Kafue Pike Characin, *Hepsetus odoe,* originates from West and Central Africa, where it is very widely distributed. The Kafue, as the local people call it, can attain a good 16–20 inches (40–50 cm) in length—and specimens as long as 28 inches (70 cm) have been reported. The males are quite colorful. With the onset of sexual maturity they develop a marked extension to the dorsal fin, which can be a very attractive red.

Supposedly, different local variants of this pike characin grow to different sizes and vary in coloration. Small *Hepsetus odoe* are not particularly difficult to keep. They will greedily devour most kinds of frozen foods, such as mosquito larvae and small fishes. A large, sexually mature *Hepsetus* can be rather boisterous. My "Rusty," as the kids called him, was forever chasing large *Brachyplatystoma* species around and wouldn't even leave significantly larger peacock bass of the genus *Cichla* in peace. Both small and large *H. odoe* often avoid strong currents. Food should be given only once or twice a week; otherwise they become seriously obese, and this is difficult to remedy. That apart, piscivore fans who have tanks at least 6–10 feet (2–3 m) long will get a lot of pleasure from the Kafue.

—Enrico Richter

Cape Galaxias, *Galaxias zebratus*: a chance find in South Africa

2 Galaxiids are a group of fishes almost unknown in the aquarium hobby. They are found mainly in Australia and New Zealand, but also have a few representatives in South America and South Africa. In January this year I was lucky enough to catch the only South African species, the Cape Galaxias, *Galaxias zebratus*, near Capetown.

These fish owe their scientific name to their beautiful zebra pattern on a yellow-brown base color. In addition, adult specimens exhibit a reddish coloration in the caudal fin area. However, the species vary considerably in both color and size. Most grow up to around 3 inches (8 cm) in length. Some populations have no patterning and are somewhat smaller at 2.5 inches (6 cm). *Galaxias zebratus* is supposedly sexually mature at 1.5 inches (4 cm), and it is only after they reach this size that these previously transparent fish begin to color up.

I found numerous Cape Galaxias in a small, fast-flowing stream 1.5–8 feet (0.5–2.5 m) wide and a maximum of around 2.5 feet (80 cm) deep. The stream bed was covered with a layer of leaf litter and there were pebbles in some places. There were at least 15 *Galaxias* per square meter, and the fish I caught were

E. RICHTER

Cape Galaxias, *Galaxias zebratus*

between .2 and 3.25 inches (0.5–8 cm) long. I was also able to observe the fish feeding on insects that had fallen onto the water's surface. The stream was also inhabited by a considerable number of frogs of the family Ranidae and a crab species I couldn't identify. I very much hope to be able to bring the very interesting Cape Galaxias back to Germany with me the next time I visit Capetown.

—Stefan Baldus

REFERENCES

Cambray, J. (1998): Kleiner Fisch mit ungewisser Zukunft. *DATZ Die Aquarienseitschrift* 51 (9): 571–5.

Cameroon Shellear, *Parakneria cameronensis*.

Parakneria cameronensis

3 | Most aquarists are probably unfamiliar with the genus name *Parakneria*. The genus is one of four belonging to the family Kneriidae, which is found in tropical Africa. It probably isn't deliberately imported, except as an unintentional bycatch or as the result of collection by aquarists or scientists. From a systematic viewpoint, the Kneriidae belong to the Ostariophysi, but they possess no Weberian apparatus—no special combination of "auditory bones," such as those found in cypriniforms, for example.

By chance, a few specimens of *Parakneria cameronensis* recently reached Europe. As the name suggests, the species occurs in Cameroon, but it is also found in Gabon and parts of the Republic of the Congo. The specimens currently in captivity originate from the southern drainage of the Ivindo River in northern Gabon, near the town of Makokou. These fishes grow up to 4 inches (10 cm) long. They are small, bottom-dwelling fishes, but are very lively and active most of the time. They are reminiscent of small lizards inhabiting the aquarium bottom. They aren't timid, but rather inquisitive when something is going on in front of the aquarium. They are likely to chase other fishes, but never really attack and probably aren't capable of it. Their mouths are very small and subterminal and are probably of no use for aggressive interaction.

Feeding *Parakneria* is exceptionally easy, as they will happily take any sort of food that will fit into their mouths, be it flake or small live foods. They can also regularly be seen scraping algae from plant leaves. When it comes to water parameters these fishes are apparently very adaptable, at least where maintenance is concerned. In the wild they inhabit waters with a slightly acid to neutral pH, but in the aquarium they don't seem bothered at all by hard water with a hardness somewhat above 15°dGH and a pH of almost 8.

So far nothing at all is known about reproductive behavior, so anyone can earn his spurs in this regard. All in all, the species seems to be very suitable as an aquarium fish, especially for fans of catfishes or loaches.

—Anton Lamboj

Pygmy Sleeper Goby, *Hemieleotris latifasciata*

4 | The rarely imported Pygmy Sleeper, *Hemieleotris latifasciata,* inhabits fresh waters on the Pacific side of Nicaragua, Costa Rica, and Panama, down to southern Colombia. It lives in ditches, still waters, and rivers. Derived from the Latin *latus* (broad) and *fascia* (band), the name means Broadstripe Goby. The broad

TOP: S. BALDUS; MIDDLE: A. LAMBOJ

The iridescent colors of the male Pygmy Sleeper Goby are pronounced.

stripe runs from the mouth through the eye to the base of the caudal fin, and is bordered by an iridescent green-yellow band, more prominent in males. Males also look somewhat slimmer than females and exhibit a number of metallic spots on the dorsal and anal fins. These fishes aren't very colorful, but are nevertheless very pretty as they swim quietly and elegantly around the tank.

Like most of the gobies, the Pygmy Sleeper Goby prefers to eat live food. I feed them mainly on live mosquito larvae, water fleas, and worms. They also enjoy frozen food. They tend to spit out flake food immediately.

The firm OF-Aquaristik has recently imported these sleeper gobies from South America, so I immediately ordered a number of specimens. On arrival the sleeper gobies were introduced into an 32-inch (80-cm) tank with dense background planting and plenty of swimming space. They spend a lot of time in the open water and rapidly lose their initial shyness. *Hemieleotris latifasciata* is very peaceful, so these gobies can be housed with other fishes. There is usually very little aggression among them.

Breeding has rarely been observed to date, so there is little about it in the literature. Spawning takes place in caves, and the eggs are small and ripen rapidly. The larvae are only slightly developed on hatching.

—Andreas Wagnitz

REFERENCES

Horsthemke & Eberhardt (1985): *Das Aquarium* 19: 566–7.

Baensch, H.A. and R. Riehl. 1993. *Aquarien Atlas*, vol. 2, 6th edition. Melle.

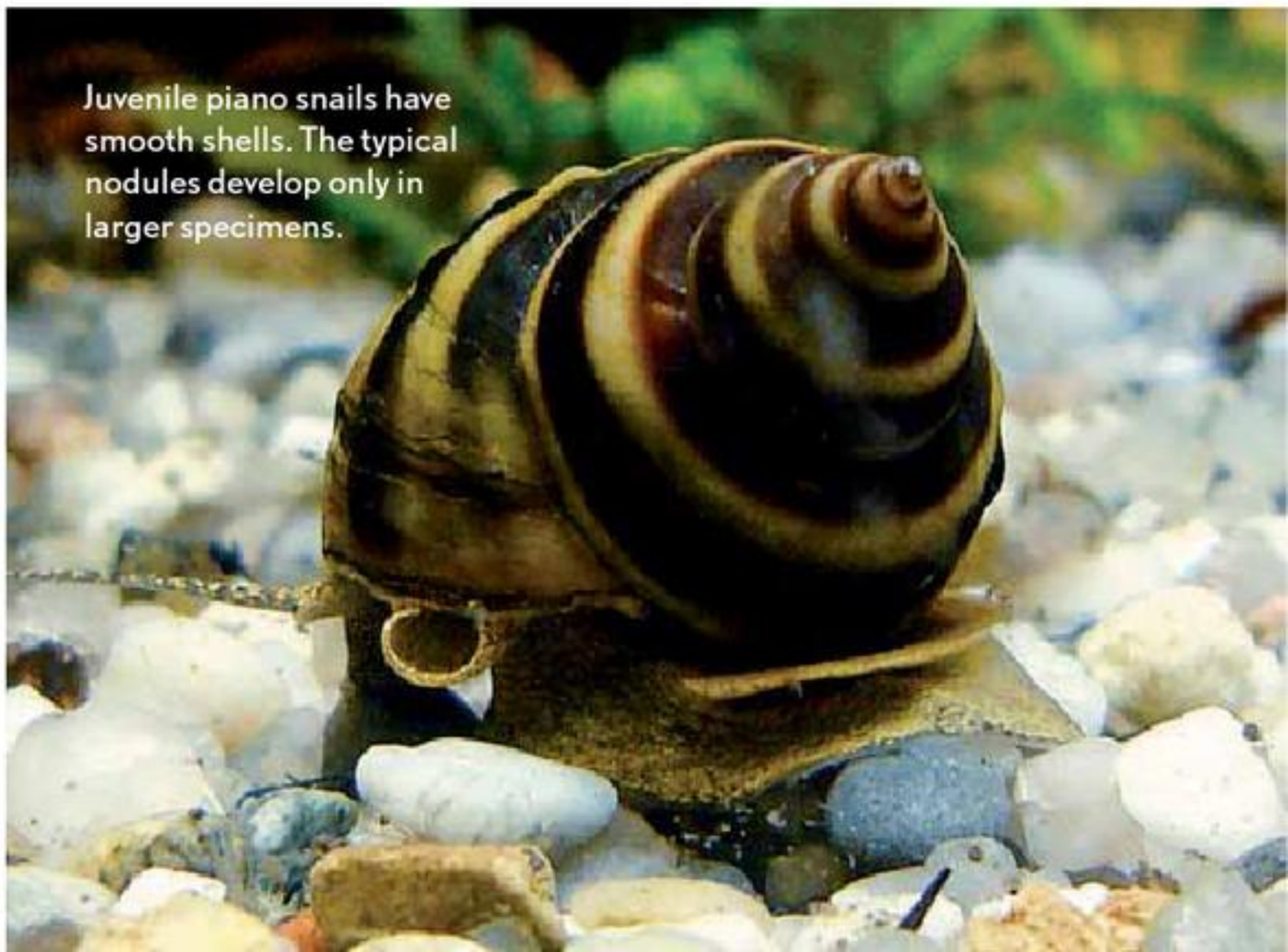
Nubby Piano Snail, *Taia naticoides*

5 | The Nubby Piano Snail, *Taia naticoides*, is an attractive livebearing snail that breeds readily in the aquarium. It was first imported around 2007 and has appeared repeatedly in the trade since then. Still, it is a rather poorly known species.

The shell of my largest *Taia* is 1.25 inches (32 mm) high and .9 inch (23 mm) wide. The little nodules, arranged in spiral rows on the shell, are characteristic. Sometimes the nodules are attached to spiral ribs; sometimes they are completely absent. The navel is closed and covered with a thick, smooth callus. The name piano snail derives from the coloration, which consists of light and dark spiral stripes.

The males can be distinguished from the females by having a thickened right-hand feeler. Usually this is rolled somewhat underneath, while the left-hand feeler is extended for touching. The shells of juveniles are already some .27 inch (7 mm) high and .24 (6 mm) wide at birth. If the mother snail is transferred to different water she will sometimes expel smaller juveniles only .08–.15 inch (2–4 mm) in size. The young don't exhibit the shell sculptures at birth—their shells are smooth. The first nodules are seen in larger specimens from a shell height of .6 inch (1.5 cm) and up. They are also sexually mature from around this size.

Taia naticoides comes from Asia. It lives in Lake Inlé in Myanmar, for example. Unlike our native viviparous species, it tolerates temperatures in the tropical aquarium well. It can be kept at 73–82°F (23–28°C) and a pH of 6–7.5. These snails will eat soft food of all types—food tablets, flake food, or rabbit pellets. The snails collect food particles in their airways and move



Juvenile piano snails have smooth shells. The typical nodules develop only in larger specimens.

them to the mouth in a thread of mucus via a channel on the right side. But it isn't necessary to feed them additional special foods for filter-feeders. They do well on food collected from the bottom and will breed without planktonic feeding.

Like other species of the Viviparidae, piano snails are slow-moving and react badly to disturbance. Hence they may starve if kept with aggressive fishes, apple snails, or shrimps. They can, however, hold their own against the smaller bubble and mud snails. These snails bury themselves now and then. Sand is a suitable substrate, but gravel up to .15 inch (4 mm) in size has never proved disadvantageous in my case. Groups of five to six adult specimens can be kept without problems in aquaria of 10 gallons (38 L) or more. The Nubby Piano Snail is a readily maintained, easy-to-breed species for tropical freshwater aquariums.

—Maike Wilstermann-Hildebrand

Hi-Fin Barb females exhibit a bright orange-red coloration in the dorsal fin.

Displaying male *Oreichthys* cf. *parvus*.

Red Hi-Fin Barb, *Oreichthys* cf. *parvus*

6 I am presenting this fish as *Oreichthys* cf. *parvus* here because at the moment, only *O. crenuchoides*, the Neon Hi-Fin Barb, can be identified with certainty. As *Oreichthys parvus* or *O. cosuatis* (the other described species of the genus *Oreichthys*) are often imported with possibly undescribed species, identification is difficult.

Oreichthys cf. *parvus* is found in southern Thailand. These fishes are not uncommon in lowland rivers and streams between the province of Surat Thani in the northeast of the peninsula and the province of Satun in the southwest. They apparently prefer medium-hard to hard karst waters exposed to limestone. In contrast to my observations, however, *O. parvus* has also been found in softwater biotopes in the province of Narathiwat (Vilasri 2002). Perhaps other species are "lurking" here awaiting identification.

My aquarium observations of this peaceful barb, which lives in loose groups, broadly coincide with those of the Neon Hi-Fin Barb (Ott 2009). And the biology and behavior of *O. parvus* agree surprisingly well with those characteristic of *O. crenuchoides*, in particular the large, blood-red pectoral fins of dominant males and the prolonged, red-colored dorsal fins in females.

The relatively quiet behavior of these barbs may come as a surprise to some barb-keepers. They require a species aquarium, or at least a tank with only one other fish species. The latter must be chosen carefully, as tankmates may compete for food with the slow-feeding *O.* cf. *parvus*. In my aquarium the barbs live with a *Pangio* species that comes from the same biotope. A small group of six individuals can be housed in a 10-gallon (35-L) aquarium. Neither a smaller aquarium nor a smaller group is wise. The planting can be abundant, but open swimming space near the bottom will also encourage the well-being of the Red Hi-Fin Barb.

Oreichthys cf. *parvus* can be regarded as a sporadic continuous spawner. I have not been able to detect any so-called "sneaker males" (males that intrude as unobtrusively as possible on an existing pairing) such as those that have been observed in *O. crenuchoides*.

—Jens Kühne

REFERENCES

Ott, G. 2009. *Oreichthys crenuchoides* Schäfer, 2009—Pflege, Zucht, Ichthyologie und Biologie. *Aquaristik Fachmagazin* 42 (2): 54–9.

Smith, H.M. 1933. Contributions to the Ichthyology of Siam III. A new genus and new species of cyprinoid fishes. *J Siam Soc Nat Hist Suppl* 10: 63–5.

Vilasri, V. 2002. *Oreichthys parvus* Smith, 1933 (Teleostei: Cyprinidae), an Addition to the Fish Record from the Peat Swamp, Southern Thailand. *Nat Hist J Chulalongkorn Univ* 2 (1): 64–5.

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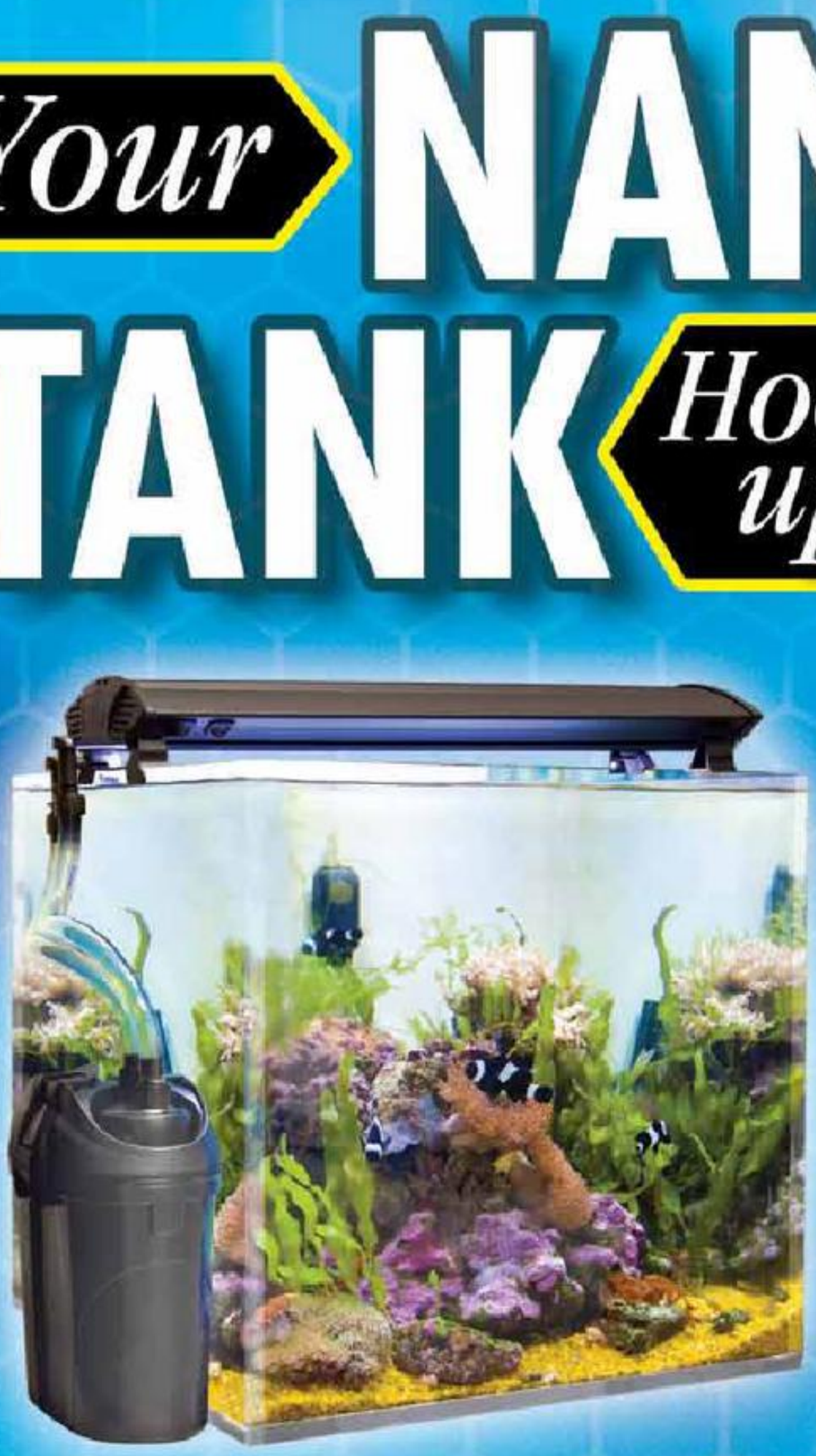

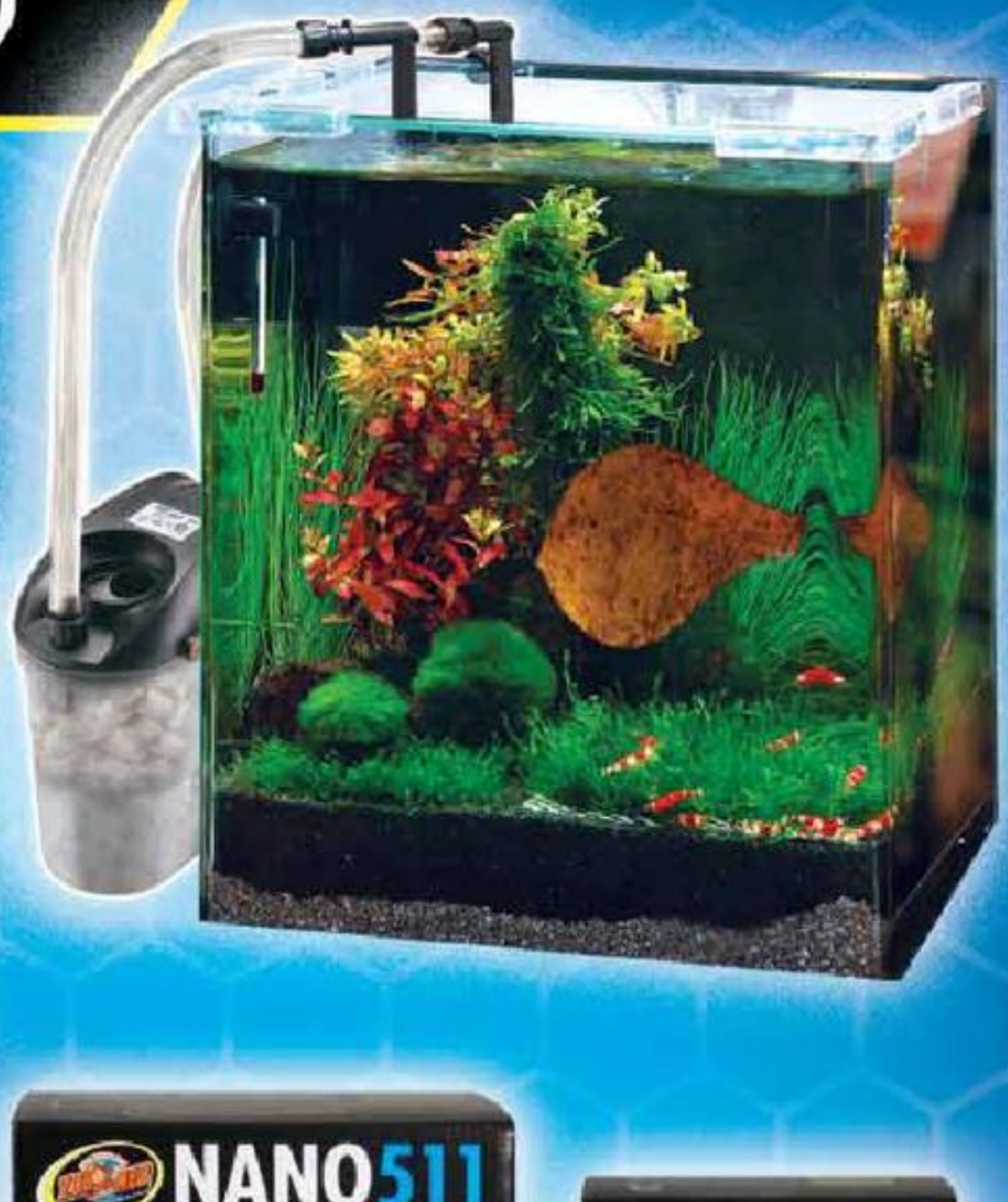

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