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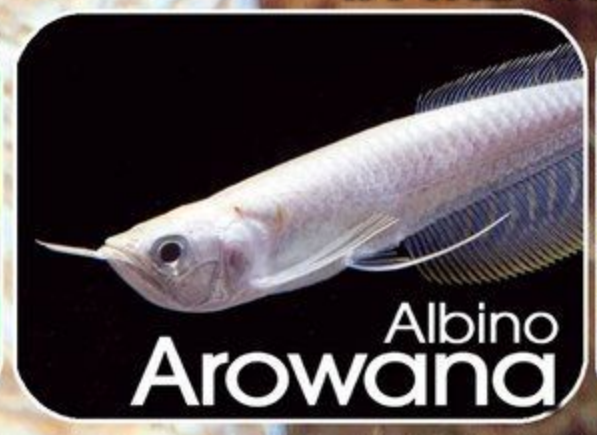

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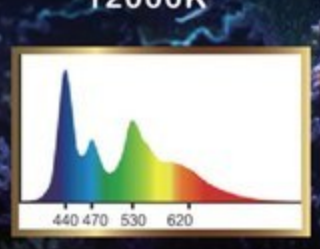

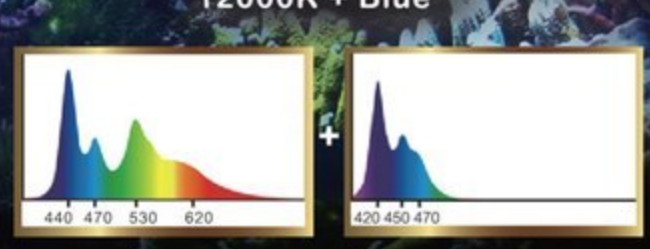

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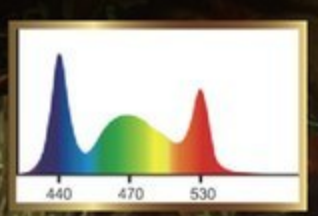

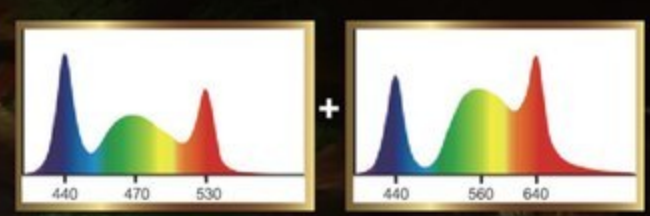

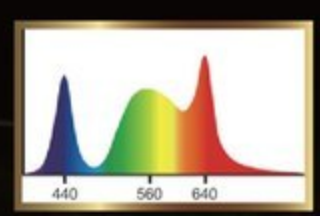

Color — Day Sun — Natural Sun — Warm Sun

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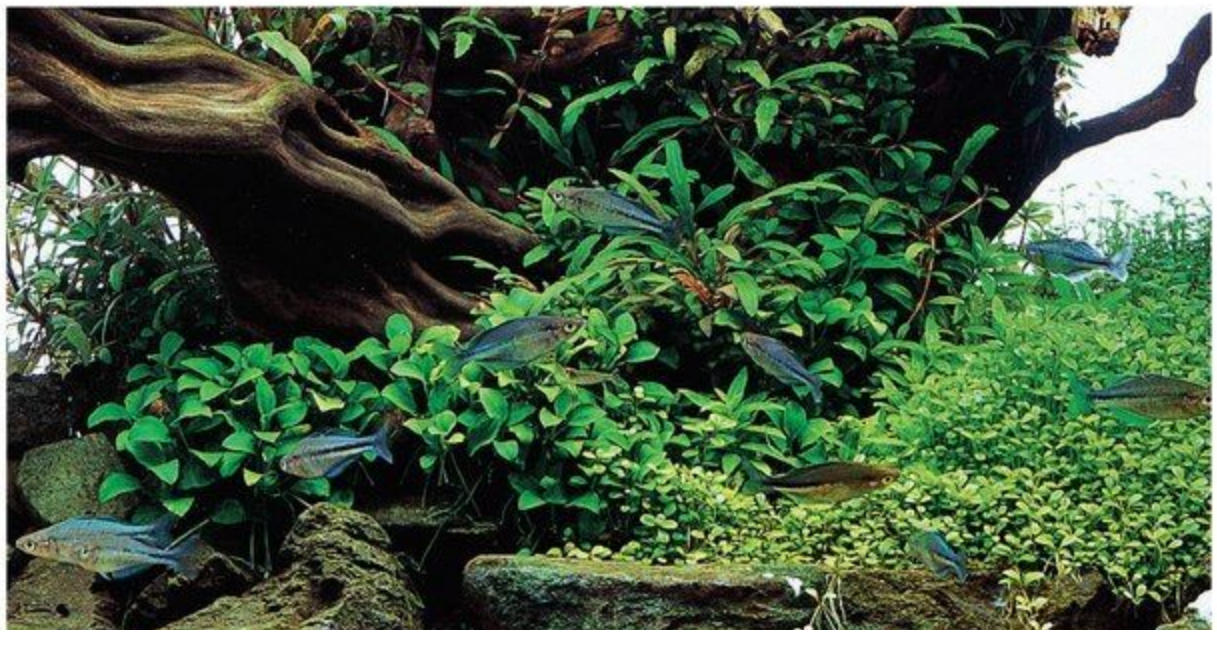

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cover

With their snake-like form, scale-less skin, and lack of pelvic fins, moray eels—such as the star of this month's cover, the yellow-mouth or starry moray (*Gymnothorax nudivomer*)—are quintessential cavity dwellers, occupying caves and rock openings in their natural reef environment. In the aquarium, they should be provided similar live-rock hiding places as well as the low lighting these shy, nocturnal creatures prefer. They often make a meal of sleeping fishes in their natural habitat, so make sure to keep them only with tankmates that won't fit in their mouth. For more on moray eels in the wild and in the aquarium, check out this month's "Mad For Morays" (p. 68).
Photograph by Richard Whitcombe/Shutterstock

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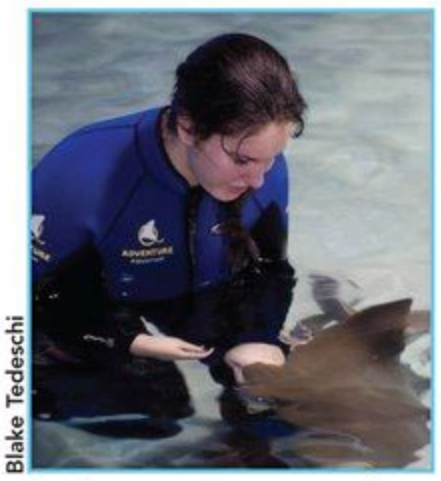
editor's note


Blake Tedeschi

Aquarium livestock may get most of the glory, but it is the hard goods and water treatments that are the most crucial components of the aquatics hobby. Knowing how to set up these items, use them properly, and fix them when they're broken is essential to success in fishkeeping.

Although it may sound like a given, the most important thing a marine hobbyist can do is correctly create salt water. To a new marine aquarist, even one with experience keeping freshwater tanks, the process of making up salt water can be daunting. You need to start with the purest water possible and then add enough salt mix to reach the right specific gravity when the water is at the desired temperature for your setup. And this water has to be made in advance and mixed overnight with copious circulation before adding it to an established tank. This month, avid marine hobbyist Phil Hunt breaks down the easiest and most reliable methods for making the perfect salt water every time (p. 74).

For the more advanced reef hobbyists, there is more equipment involved, more procedures, and more chances for things to go wrong. Luckily, there are also more advanced ways of monitoring what is going on to prevent disasters from occurring and controllers that can make reef systems easier to manage. Expert reefkeeper Jeremy Gosnell explores the array of monitors, controllers, and even webcams that can put your setup right at your fingertips anytime, anywhere (p. 82).

When it comes to freshwater aquaria, there can be difficulties with equipment too, and being able to recognize and solve a problem on your own is an indispensible skill. In our exclusive book excerpt of the Animal Planet *Freshwater Aquarium Problem Solver*, *TFH* alum David E. Boruchowitz reviews some of the most common equipment problems and offers easy, do-it-yourself solutions for them (p. 60).

Another critical element in aquarium setup is the hardscaping material used as the foundation of a planted tank. Aquascaper extraordinaire Takashi Amano provides his tips and tricks this month to give the underlying composition materials a starring role in a lush and vibrant aquatic-plants layout (p. 46).

Of course, most people are in the aquarium hobby mainly for the sheer enjoyment of keeping fish. If you're looking to spice up your community tank with an alternative to the ubiquitous tetras, livebearers, cichlids, and catfish, ricefish are an excellent way to go. Small, peaceful, and beautiful, these prolific schoolers are bound to make your tank stand out (p. 52).

On the other extreme, if you want to showcase a single, striking species or add a fearsome creature to your predator tank, moray eels fit the bill perfectly. These iconic fish are aquatic Houdinis, but if you can provide them with a large, tightly covered, well-maintained aquarium, you will be able to enjoy them for years to come (p. 68).

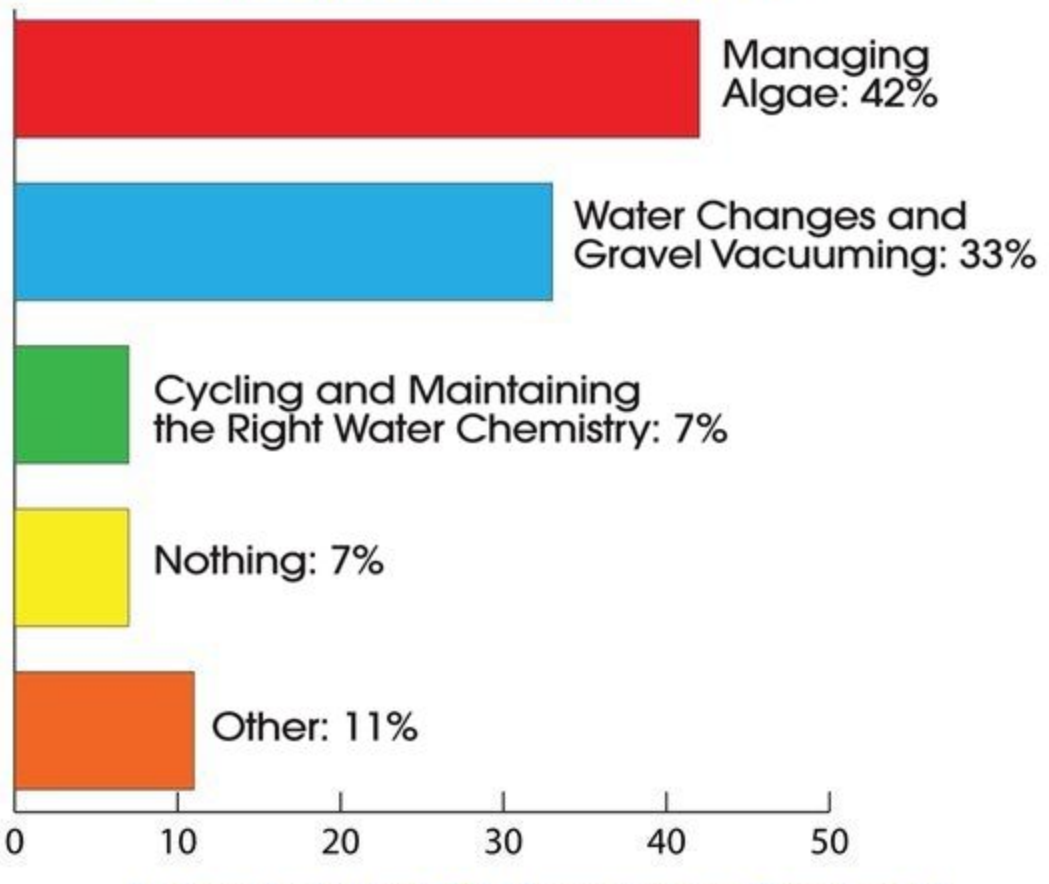
Whether you are interested in fixing or adding to your equipment, setting up that stunning display, or just looking for a neat fish to add to your tank, we've got something for you in this issue!

Shari Horowitz
Managing Editor
Tropical Fish Hobbyist

readers' forum

TFH Facebook Poll

What do you find is the most difficult part of fishkeeping?



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Always wanting a bigger fish tank.
Lewis David Lewis

I had to say gravel vacuuming, but I would say cycling the traditional way is pretty tough.
David Hawkins

The only difficulty I have is in finding the specific species of fish I desire (for a reasonable price) and more space in my house for more tanks.
Dawn Moneyhan

Not being able to get more fish.
Hoyt Kamish

Catching fish because they're fast and it well annoys me!
Adam Naylor

Convincing my wife that a breeder tank for my fancy clowns is a must have.
Darrell Dalton

Algae and fish compatibility. It's mostly trying to balance the amount of light and nutrients in the tank, but it's hard as variables are always changing. Trying to find consistency in all the excitement of an aquarium is hard to do. Once you find the sweet spot, you should try your best to not change it.
Sam Towns

Finding the time!
Simon Kowalinski

Keeping a planted tank tidy!
Darren Baker

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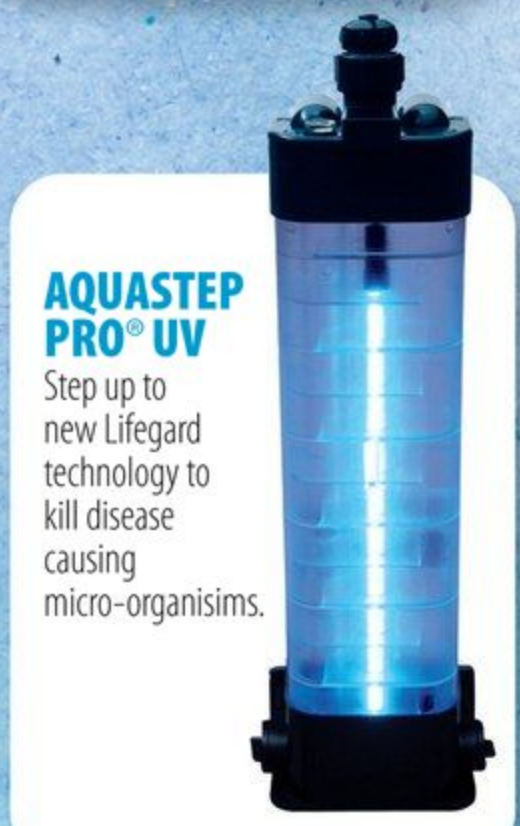

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Albino Silver Arowana

The silver arowana (*Osteoglossum bicirrhosum*) has been a favorite among aquarists for many years. Known as the "dragon fish" for its long serpentine body and large size, it is highly prized by Asian cultures, as they believe that the fish will bring good luck and good fortune.

Originating from South America, this fish belongs to the family Osteoglossidae, which is most notable for its members' bony tongues. These large, predatory fish can reach upwards of 36 inches in length and are suitable only for very large aquariums. In the wild, their diet consists mostly of fish; occasionally they will eat bugs that fall into the water as well as frogs and lizards. In an aquarium setting, the silver arowana is quite hardy, with most specimens learning to accept pellet and frozen foods not long after being introduced. Although not quick, they will try to eat tankmates that can fit in their large mouths. Unlike their Australian counterparts (*Scleropages jardinii*), silver arowanas are mostly peaceful fish, provided they cannot eat their tankmates, and commonly occupy only the upper areas of the aquarium.

Relatively new to the hobby is the albino version of the silver arowana. Developed in Asia, albinos are still very rare and only a small number have been available to aquarists, mostly in Asia. Pictured is a recently imported specimen. The albino silver arowana finally made its debut in the US in 2013. When first introduced, they were sold strictly on the Asian market and commanded premium prices. Measuring only 5 inches, they are just as active and hardy as the South American silver arowana and will attain the same massive size. These arowanas have been bred to get the recessive albino gene. Albinism is a genetic mutation that is best characterized as a complete or partial absence of pigment in the skin. Notice the lack of blue pigments found in the regular silver arowana; the albino is virtually all white with very little or no pigment in the scales.

Leighton Lum

Q&A freshwater

got a question?

Send your questions about the freshwater side of the aquarium hobby to "Q&A," T.F.H. Publications, P.O. Box 427, Neptune, NJ 07754, or submit via e-mail to editor@tfh.com. For answers to more time-sensitive questions, opinions on your setup, or just to converse with like-minded members of the aquarium community, please visit the *TFH* Forum at forums.tfhmagazine.com.

Q Scientific Nomenclature Confusion

I'm always hearing that it's better to use scientific names for fish rather than common names because different people use different common names for the same species. But it seems there's plenty of disagreement over scientific names, as well, and many of them have been changed multiple times. Why is that better?

Trevor Turner
via email

A *While there's no question that some groups of fishes have become a real taxonomic nightmare, on balance, you're still much better off using scientific names over common names whenever possible to reduce the likelihood of species misidentification and confusion.*

Even if a scientific name you come across has undergone a revision, you can usually pinpoint the current valid name with little difficulty by entering the previous name (or one of the previous names) into a taxonomic database, such as FishBase.org, because all synonyms for the species should be recorded there. The same isn't necessarily true for common names, however. A few of the ones most widely used for a species might be listed in the database, but since there's no formal recognition of common names, the one most familiar to you might be left out.

Take the species Gymnocorymbus ternetzi *for example. I know this species as the "blackskirt tetra," but this common name doesn't yield a result on FishBase. The common name given there for the species is "black tetra." If I'm not familiar with that name, but it's all I have to go on, I'm basically at a dead end. Now, let's say I try another FishBase search, except this time all I have to work with is an obsolete scientific name,* Tetragonopterus ternetzi. *Lo and behold, I'm taken right to the species profile with the currently accepted scientific name at the top of the page.*

Another reason to stick with scientific names is that it's not at all unusual for the same common name to be applied to two or more (sometimes several more) different species. Take the name rummynose tetra, for instance. I know of at least three very similar tetra species that share that common name, Hemigrammus bleheri, Hemigrammus rhodostomus, *and* Petitella georgiae, *and it takes a keen eye to tell them apart. You'll never run into a situation where the identical scientific name is used for multiple species.*

Q Time for a Gravel Change

Can I change the gravel in an established tank?

Kevin Hall
via Facebook

A *Yes, you can change the gravel in an established aquarium system. You just have to take into consideration how this change might affect your biological filter and tailor your approach accordingly. Some hobbyists advocate replacing all the gravel at once provided the system includes a power filter that contains adequate biofiltration media. Others will change out the entire bed but transfer some of the old gravel to a mesh bag and keep it in the tank long enough for the new bed to become colonized with nitrifying bacteria. However, I think the best approach is to scoop out and replace only a portion of the gravel bed (maybe a quarter*

to a third) at a time, allowing several days to pass in between changes. This incremental approach will allow nitrifying bacteria to begin populating each new gravel batch before the next is replaced, thus minimizing the disruption in biofiltration.

Q Egg-Eating Angelfish

Why does my angelfish keep eating her eggs? This is the second time in a month she has done so. The eggs are being laid on the filter tube.

Baz Price
via Facebook

A This is a very common scenario with angelfish, and there are various possible explanations for this behavior. One is that you have a relatively young, inexperienced breeding pair and they just haven't quite gotten the knack of caring for their eggs yet. If this is the case, give them time and their parental instincts may kick in with future spawns. Do keep in mind, however, that your pair may never get the hang of parenting. Many years of captive breeding and artificial hatching have diluted good-parenting traits in domesticated strains.

Another possible explanation for the egg-eating behavior is that something in the environment is stressing the pair. A few potential stressors to consider include the buildup of dissolved pollutants, inappropriate or fluctuating water parameters, overly boisterous or aggressive tankmates (if any are present), or even excessive human activity in the vicinity of the aquarium. Evaluating all these factors might yield a solution to your dilemma.

Proper conditioning of your pair can also help prevent them from eating their eggs, provided they're otherwise inclined to be good parents. Remember, spawning and protecting eggs takes a lot of energy, so in addition to providing excellent water conditions, be sure to offer your pair a varied diet of high-quality, nutritious foods.

With respect to the eggs being laid on the filter tube, this too is quite common, especially when no other suitable surface is available. Consider putting a piece of slate (positioned at an angle) or a terracotta plant pot in the tank to function as a spawning substrate. These items have the added benefit of being easy to move in case you want the option of hatching the eggs artificially in a separate tank.

Yuriy Chertok/Shutterstock

■ Although *Gymnocorymbus ternetzi* goes by several common names, like all fish it has only one valid scientific name.

Iancu Cristian/Shutterstock

■ After many generations of selective breeding, some angelfish strains have lost their parenting instincts.

Q Distinguishing Spiny Eels

Can anyone tell me whether the lesser spiny eel (*Macrognathus aculeatus*) and the peacock spiny eel (*M. siamensis*) are brackish-water fish? Also, how does one differentiate between the two?

Chris Szpara
via Facebook

A The peacock spiny eel (M. siamensis) *is found strictly in fresh water, while the lesser spiny eel* (M. aculeatus) *occurs in both freshwater and brackish environments.* M. siamensis *is light brown in overall color with a lighter-colored, thin, horizontal stripe on each flank, extending from the eye to the caudal peduncle. It also has several very prominent eyespots (ocelli), resembling the spots on the tail feathers of a peacock, along the base of its dorsal fin.* M. aculeatus *is also light brown overall but has a series of dark, obliquely oriented bars along its flanks. You're much more likely to come across* M. siamensis *in the hobby, as* M. aculeatus *is rarely collected for the aquarium trade.*

Li XinYue/Shutterstock

■ Guppies reach sexual maturity in only a few months after birth, and males can impregnate females immediately afterwards.

Q Texas Cichlids Spawned in Community Tank

I got home tonight to find my Texas cichlids had laid eggs, and they are standing guard. The problem is, they're in a 125-gallon tank with red devil, oscar, green terror, firemouth, convict, and managuense cichlids, along with clown loaches, giant danios, and plecos. Do you have any suggestions for their survival? I do not have another suitable environment.

Greg Austin
via Facebook

A *Wow! That's a hefty bioload and a powder keg of potential aggression you've got there, Greg. Texas cichlids* (Herichthys cyanoguttatus) *can reach a foot in maximum length and tend to be explosively aggressive toward tankmates, especially when breeding. Several of the other species you mention are no shirkers when it comes to maximum size and degree of belligerence, either. I'd give some serious thought to reducing the number of specimens/variety of species in the tank in the very near future. Keep in mind that 125 gallons is about the recommended minimum housing for just a pair of Texas cichlids.*

With respect to the survival of the Texas cichlid offspring, I wouldn't hold out much hope with that lineup of characters in the tank. If you want to raise the young, I think your best bet would be to transfer the eggs (assuming the object they're attached to is portable) to a separate tank and hatch them artificially. You don't need an especially large tank for this purpose. Something in the vicinity of 5 to 10 gallons would be just fine. Fill the tank with water from your main aquarium, and aerate the eggs with an airstone to replicate the fanning that the parents would normally provide. A little methylene blue added to the water to prevent fungus is a good idea, as well.

Q How Long Until Guppy Fry Arrive?

I have bought some guppies, four males and six females. How long will it take to get some fry?

Helen Hurlock
via Facebook

A *If you started out with sexually mature specimens and are providing appropriate housing, a good diet, and excellent water quality, I wouldn't be surprised in the slightest if you already have fry by the time this Q&A appears in* TFH. *It takes guppies anywhere from around a few months to several months (after birth, not purchase) to reach sexual maturity depending on various factors. Once a female is impregnated (a virtual certainty if she's kept with a male and both are of breeding age), her fry will gestate for approximately three to four weeks, again with variability depending on conditions.*

One point to consider: It's best to keep guppies in a gender ratio of one male to at least two or three females. That reduces the

likelihood of one or just a few females getting perpetually harassed by overly amorous suitors. So, you might consider adding at least a few more females, assuming your tank is large enough to accommodate them.

Q Using Natural Sea Water for a Brackish Tank

I have reasonably easy access to a source of natural sea water. Is it okay to mix it with tap water for my brackish tank?

Jay Bridges
via email

A *Yes, you can blend natural sea water with tap water to achieve the desired salinity level for a brackish system, just as some hobbyists who specialize in fully marine tanks use it in their systems. However, do be aware that using natural sea water for aquarium purposes is not without its challenges.*

One major hurdle is finding a collection location that offers suitably clean water. Areas that are easy to access are also likely to be contaminated with various pollutants such as watercraft fuel residue, agricultural runoff, etc. Oftentimes, you need to get out well beyond shore in a boat to reach sufficiently clean water. Also, keep in mind that natural sea water comes complete with natural microfauna, some of which could be harmful to your tank inhabitants. Many hobbyists who use natural sea water will age it in a dark room for a few weeks to allow any potentially nasty critters to die off before they use it in their tanks. Of course, the water also needs to be well filtered before it's suitable for use. Last but certainly not least, collecting and hauling heavy buckets of natural sea water is hard work!

When you consider all the effort it takes to collect natural sea water and render it usable, you might just find that the convenience and safety of synthetic sea water is worth the modest extra cost.

Q Acclimation After Quarantine

I have six bleeding-heart tetras that just finished quarantine. They came through with no signs of disease and are all eating well, so I'm just about to move them to my display aquarium. Do I need to acclimate them to the water in the display tank before introducing them?

Fay Huntley
Washington, DC

A *I would recommend acclimating your tetras to the water in your display tank just to be on the safe side. Even though you're probably using the same source water for both systems, conditioning it in the same manner, heating it to the same temperature, etc., there still could be differences in water quality between the two tanks sufficient to shock or stress the tetras.*

But there's no need to get into a complicated drip-acclimation procedure or anything like that. All you really need to do is lower the water level in your quarantine tank and then begin adding small volumes of water from your display tank to it every 5 minutes for a half hour or so. At that point, it should be safe to release the tetras into their new home.

Q&A saltwater

got a question?

Send your questions about the saltwater side of the aquarium hobby to "Q&A," T.F.H. Publications, P.O. Box 427, Neptune, NJ 07754, or submit via e-mail to editor@tfh.com. For answers to more time-sensitive questions, opinions on your setup, or just to converse with like-minded members of the aquarium community, please visit the *TFH* Forum at forums.tfhmagazine.com.

Q Can't Find Captive-Bred Marine Fish

I'm an environmentally conscious new saltwater aquarium hobbyist, and I'd like to stock my tank with all captive-bred fish if possible. However, shopping around at several fish stores has turned up only one species of captive-bred clownfish. Am I right in assuming there just aren't that many captive-bred marine species out there to choose from?

David McManus
via email

A *While most marine fish that enter the hobby are wild-collected, there are hundreds of captive-bred species on the market. You just might not be able to find too many of them at your local brick-and-mortar fish store. A very cursory online search turned up all kinds of results, including almost all clownfish species as well as various blennies, gobies, dottybacks, angelfish, grammas, basslets, jawfishes, cardinalfishes, dragonets, and seahorses for sale. And that's just barely scratching the surface. Stocking a marine aquarium entirely with a wide range of interesting and beautiful captive-bred fishes is entirely within reach. You just might have to order from an online vendor or ask your local dealer to special order them for you.*

Q Brown Longnose Butterflyfish?

Are there actually three species of longnose butterflyfish? I'm aware of two longnose butterflyfish that are yellow, one of which supposedly has a longer snout than the other. But I came across some photos online of an all-brown longnose butterflyfish that looks just like a yellow longnose except for the color. Is this a different species or just a different color form of one of the yellow ones?

Andre Thomas
Thousand Oaks, California

A *Actually, several different butterflyfish species are referred to as longnose butterflies, but I think I know which particular species you have in mind—most likely* Forcipiger flavissimus *and* F. longirostris. *These two species are most commonly known as the yellow longnose butterflyfish and the big longnose butterflyfish respectively. The latter of the two sports the longer snout—hence the* "longirostris" *part of its name.* F. longirostris *does have an all-brown color phase that was once thought to be a distinct species, so that's probably the fish you saw in photos online. Interestingly, as Scott Michael notes in his book* Angelfishes & Butterflyfishes *(TFH Publications, 2004), "Brown individuals in captivity have been known to change into the yellow phase over a period of several weeks to a month. However, there are no reports of yellow individuals turning brown." So, if you should ever have the opportunity to acquire an all-brown specimen, keep in mind that it may not stay brown for long.*

Q How Big Do Giant Clams Get?

I am eight years old, and I love fish and other creatures that live in the ocean. The sea animal that I like the most is the giant clam. Can you tell me how big it gets?

Sam Levinson
via email

Well, Sam, there are a lot of different clams that we call "giant clams," though some of them aren't actually all that big. The smallest of the giant clams grows to be only about 6 inches wide—not much of a giant, huh? Scientists call this clam Tridacna crocea. *Somewhere in the middle when it comes to size is a clam called* Tridacna derasa, *which gets to be about 2 feet across when it's full grown. The biggest of them all is a clam that scientists call* Tridacna gigas. *This clam really is a giant. If you look at the second part of its name, you can almost see the word "gigantic," can't you? In fact, it can grow to over 4 feet across. That's almost as wide as you probably are tall right now!*

Stephan Kerkhofs/Shutterstock

■ Many marine fishes, such as the orchid dottyback, are being captive bred.

Devilish Dottyback and Cherub Angelfish

I have a 20-gallon reef tank that is doing extremely well. I just introduced a very adorable cherub angelfish (Caribbean pygmy angel) into the tank, but I don't think it was a good idea. Seems my neon dottyback doesn't much like it and has done nothing but chase and torment the poor thing. I was under the idea that they could coexist in the same tank. Was I mistaken?

Nicole Clark
via Facebook

I'm afraid this is the outcome I would fully expect with this combination, Nicole. The neon dottyback (presumably Pseudochromis aldabraensis*), in common with most dottybacks, is highly territorial and prone to behaving hostilely toward tankmates that are smaller or similar in size, such as your* Centropyge argi*, and/or similar in color or morphology. I would expect compatibility issues with these two species even in a relatively large system, but in a 20-gallon, warfare between them is unavoidable. To be perfectly honest, your tank is big enough for only the dottyback.*

Compounding the aggression problem is the fact that the dottyback was established in the tank before the angel was introduced, which means it had already claimed the entire tank as its territory before the angel arrived. Would changing the order of introduction have made any difference in this case? Likely not, but it's always best to add fish in the order of least aggressive to most aggressive. At this point, one or the other specimen must be removed. My advice would be to move the angelfish, because a 20-gallon tank simply is not adequate housing for this species.

Stockpix4u/Shutterstock

■ The largest, most dominant clownfish in a group will become female, and she may or may not tolerate the presence of a non-breeding clown in her tank.

Clownfish Turned Nasty After Tank Move

I have a large clownfish that used to be the shy guy in the tank. We just moved, and after I put the tank back together, he is now the aggressor. The two smaller clowns were hosting in a coral, but now they won't go near it because of the bigger clown. Any clues on how to get the tank back in the order it was before?

Kelly Stockwell
via Facebook

As you may be aware, in a clownfish social hierarchy, the largest, most dominant individual becomes a female, the next in line in terms of dominance becomes a male, and any others on the scene will remain adolescents. So, your formerly shy "guy" is most likely a gal beginning to assert her dominance over the two smaller specimens. She may end up forming a breeding pair with whichever of the smaller specimens eventually becomes a male, at which time she may or may not tolerate the presence of the third wheel in the tank.

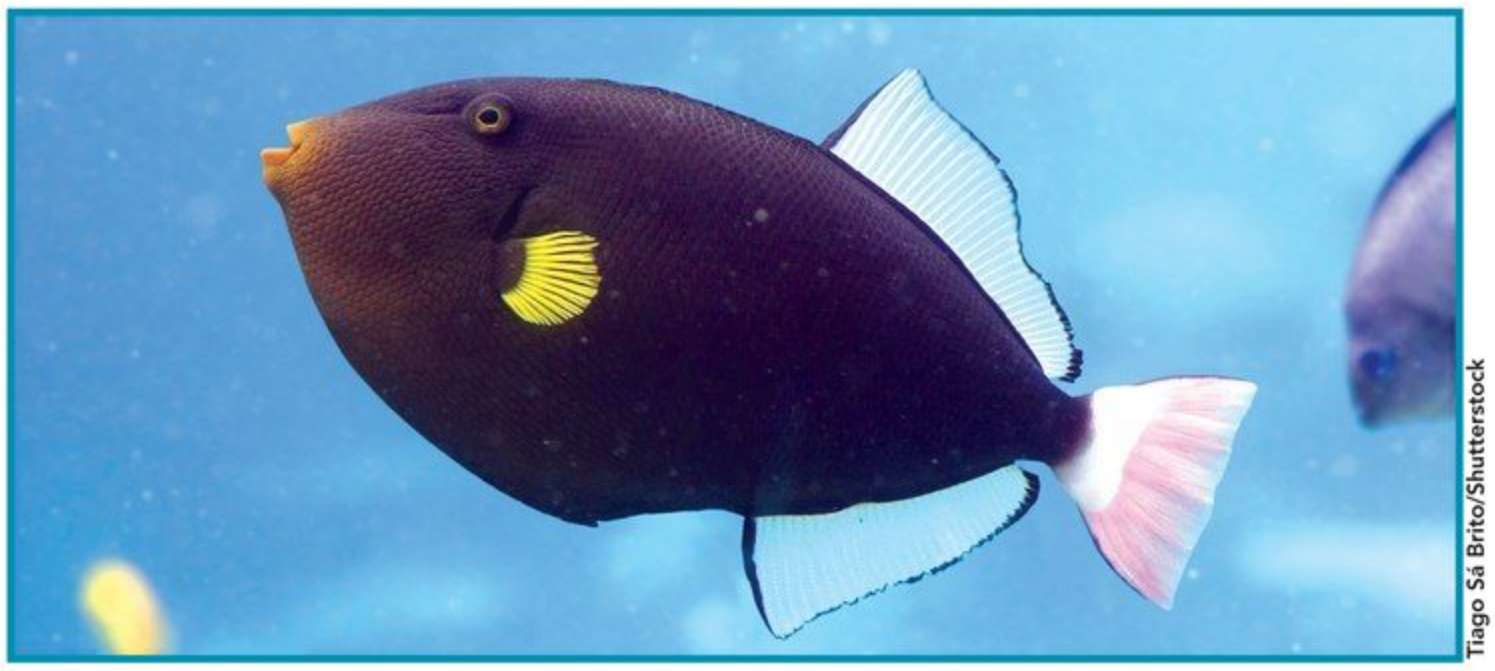
Why did this aggressive behavior manifest itself after you moved and reassembled the tank? My suspicion is that the specimens had already ironed out a hierarchy prior to the move and the territorial shakeup caused by moving the tank was sort of like hitting the reset button, making it necessary for the female to reassert her authority.

With respect to restoring the former order in the tank, I wouldn't get your hopes too high. Things may settle back down after the female re-establishes her dominance, but then again, they may not. Be ready to remove the subordinate specimens if the female's aggression becomes overly intense.

A Trigger in the Reef

One of my local fish stores has a nice reef tank, which I believe is around 100 gallons, and when I last visited, I noticed they have a triggerfish in there. One of the staffers told me it's a pinktail trigger. I wasn't aware that there are any reef-safe triggers. Am I mistaken, or are they headed for trouble with that trigger?

Anthony Cain
via email



Tiago Sá Brito/Shutterstock

■ You can keep pink-tailed triggers in a reef tank provided the aquarium is very large and there are no bite-sized crustaceans or fish.

The trigger you saw was probably Melichthys vidua, *a relatively peaceful trigger that is considered reef safe, provided the tank is large enough to accommodate its nearly 14-inch maximum size. According to FishBase, this species' natural diet consists primarily of algae and detritus but it will also eat crustaceans, sponges, and fishes. So, while it will leave corals and other sessile invertebrates alone, you can tell from the food items on its natural menu that you have to be careful about combining* M. vidua *with bite-size crustaceans or fish.*

By the way, M. vidua *isn't the only reef-safe trigger that commonly appears in the aquarium trade. For example, several species in the genus* Xanthichthys, *such as the bluechin trigger* (X. auromarginatus) *and the crosshatch trigger* (X. mento), *are suitable for reef systems, as is the popular Niger trigger* (Odonus niger). *I would apply the same admonition about small crustaceans and bite-size fish to these species, as well.*

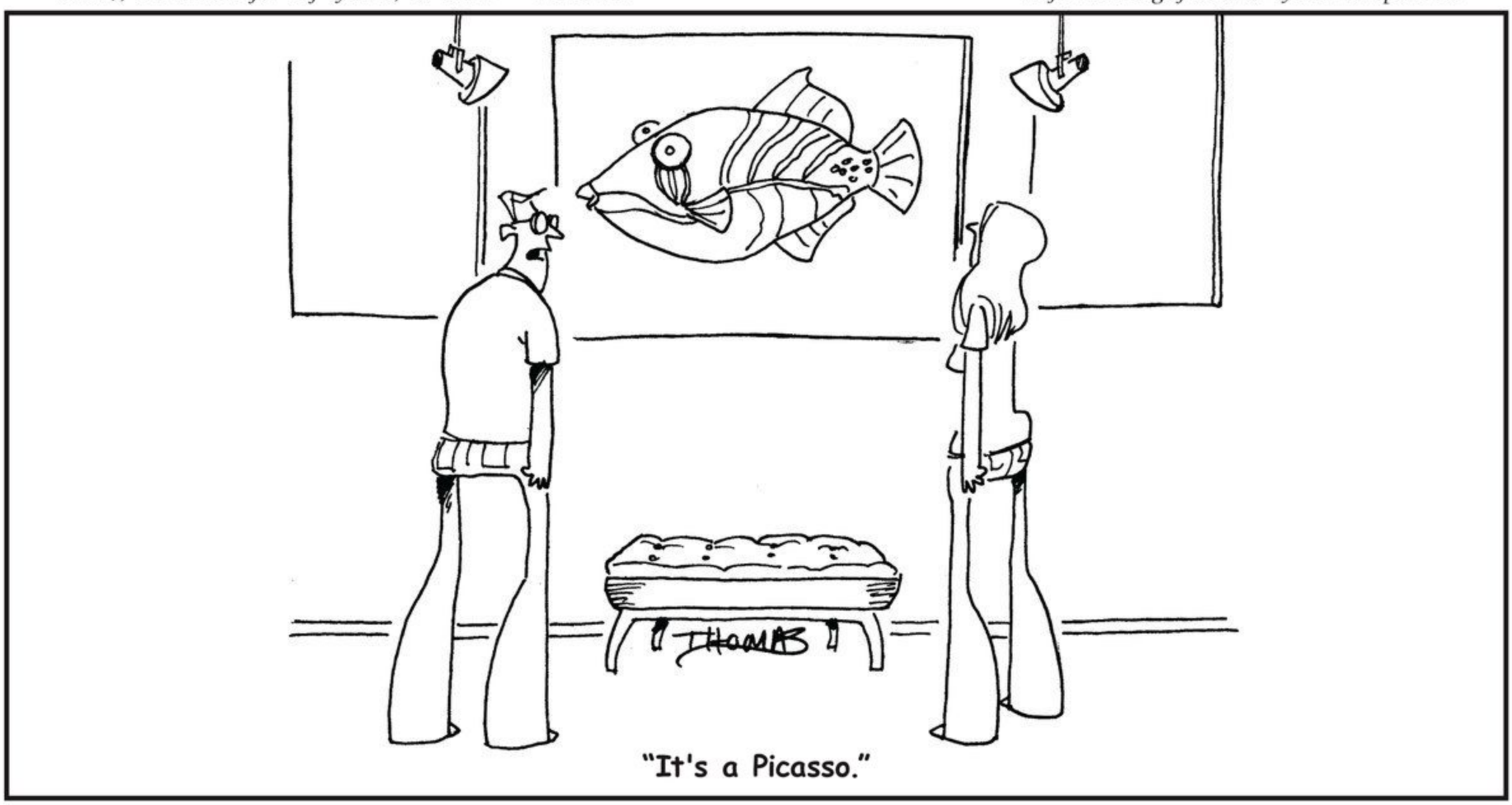
Total Tank Wipeout!

I just experienced a total wipeout in my saltwater tank and can't for the life of me figure out what went wrong. All the fish, which I've had for three years, looked just fine yesterday. Then this morning, I woke up to find them all dead and the ammonia level through the roof. Do you have any idea what could have caused this?

Mark Atkins
via email

I'm afraid you've given me very little information to go on, so the best I can do is list some of the usual suspects that cause such wipeouts. Using that information and a little detective work, you might be able to retrace your steps and figure out what went wrong.

The first issue to consider is that through-the-roof ammonia level. That could be the cause of your wipeout, a result of the wipeout, or a little of both. Given the fact that you had these fish for three years, it's safe to assume the tank was fully cycled at one time, but perhaps something recently happened to compromise your biofilter. Did you remove any filter media very recently or do any major cleaning of décor or system components



that might have reduced the population of nitrifying bacteria and upset the balance of biofiltration? Have you recently dosed your system with any medications? Some of these can have an adverse effect on biological filtration, as well.

Did your livestock include any fish species known to exude toxins, such as boxfishes or soapfishes? You didn't mention having any non-fish livestock, but could your system have contained (whether by intention or accident) any notoriously toxic invertebrates, such as certain species of sea cucumber?

Have you recently added any rocks not of marine origin or tank decorations that might have been of dubious suitability for saltwater systems? It's a long shot, but some such items have been known to sometimes release harmful toxins.

Do you recall detecting a strong rotten-egg smell when working in or around your aquarium? This could indicate the release of toxic hydrogen sulfide, which can build up in portions of the substrate that are anoxic and rich in decaying organic matter.

Can you recall anything being sprayed in the vicinity of the aquarium, such as cleaning products, room fresheners, pesticides, etc? Has anyone smoked around the aquarium? Any chemical that becomes airborne around an aquarium will end up in the water.

Last but certainly not least, how about your hands? Do you always wash and rinse them thoroughly before placing them in your aquarium? Any contaminants or residue present on your hands when working in your aquarium can be transferred to the water with potentially harmful effects on the livestock.

Odds of Success with Oriental Sweetlips?

I'm considering buying an oriental sweetlips for my aquarium, but I seem to recall there may be some issues with keeping this species. What are my odds of keeping one successfully?

Kirk Menard
Austin, Texas

A *You remember correctly that there are some issues with keeping the oriental sweetlips* (Plectorhinchus vittatus) *in aquariums. The biggest issue is that this species often fails to acclimate to aquarium conditions and can be very difficult to feed. Specimens tend to be outcompeted by more aggressive feeders at mealtimes, and some are very reluctant to wean onto non-living foods. Starvation and malnutrition issues are very real worries.*

If you can overcome the challenges of feeding, your next concern is going to be this species' growth potential. That cute little juvenile (the stage at which this species is typically sold) may eventually grow to exceed 2 feet in length. That means a very large aquarium—in the hundreds of gallons—is essential for the long-term maintenance of this species.

Your odds of succeeding with P. vittatus, *assuming you're able to provide adequate housing for this tankbuster? Let's just say I wouldn't bet the farm on it.*

ask jack

Answers to Common Discus-Keeping Questions

In your opinion, which do you consider to be the more important: heavy water changes or heavy filtration?

In my opinion, very heavy water changes are much more important than an overkill of filtration. With a daily water change of more than 50 to 55 percent, for example, I would question the need for any filtration at all. However, if the feeding program is excessive, or the tank has an excess of fish, then the whole picture would have to change. Have the feeding program in place, plus the correct number of fish in the tank, and your daily—and I repeat, daily—water change of 50 to 55 percent or more will operate without any filtration at any time.

An excellent application of this theory regarding water change is the following: I conducted a test with two tanks, one of 2 gallons and the other of 20 gallons. Both had the same water. Only the 20-gallon tank had filtration. In the 2-gallon tank were 50 small discus, and in the 20-gallon tank were 20 small discus. All the fish in both tanks were from the same spawning and were fed the same food. The fish in the 2-gallon tank were fed twice the amount of food as the fish in the 20-gallon tank.

I made 75-percent water changes six times a day in the 2-gallon tank, and in the 20-gallon tank, I changed 50 percent of the water once a day. After four weeks, the fish in the 2-gallon tank were approximately twice the size of the fish in the 20-gallon tank.

I have two confirmed pairs of discus that I obtained from two different breeders, and I can now begin to line and cross breed them, and I hope to breed them for a number of years. How long do I have before I must introduce new breeding stock?

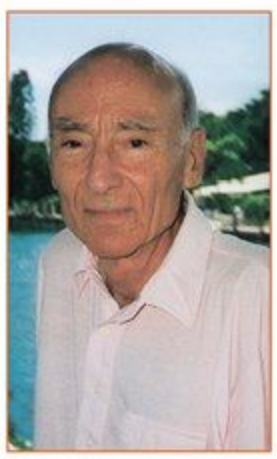
Before I can answer your question properly, I would need the following information regarding the history of all four of these discus: How old are they? Did the people you bought them from raise them from pairs that they are working with? If a seller is a tropical fish importer, and not a discus breeder, he won't be able to give you any helpful information. Even if he knows—and he probably doesn't—from what area in Amazonas the discus came from, that information will be of no help at all to you.

However, if the fish are all wild-caught specimens, they will certainly have enough genetic variety alone to survive well into your lifetime. But the fact that you obtained your four fish from discus breeders indicates that the information you need will have to come from the breeders.

Another point to consider is whether or not, at some point, you want to perhaps cross the two pairs themselves, placing both female discus with the two males. You said nothing at all regarding the color forms of any of the four fish. Are they species or simply color forms? Would you feel comfortable attempting to breed the male from pair #1 with the female from pair #2? If you are comfortable with this scenario, as I said before, this would give you much more genetic variety.

What disease in discus do you find to be the most frequently encountered by breeders?

Jack Wattley is worldwide the most recognized name in discus breeding. Breeder, judge, collector, scholar, Jack is the foundation on which modern discus keeping has been built. He has been sharing his experience and knowledge—and the discus he breeds—with aquarists throughout the world for decades, and just one of his many awards was his recent Lifetime Achievement award from the ACA. Long past the age at which most people retire, he still serves as ambassador of discus and goodwill across the planet.

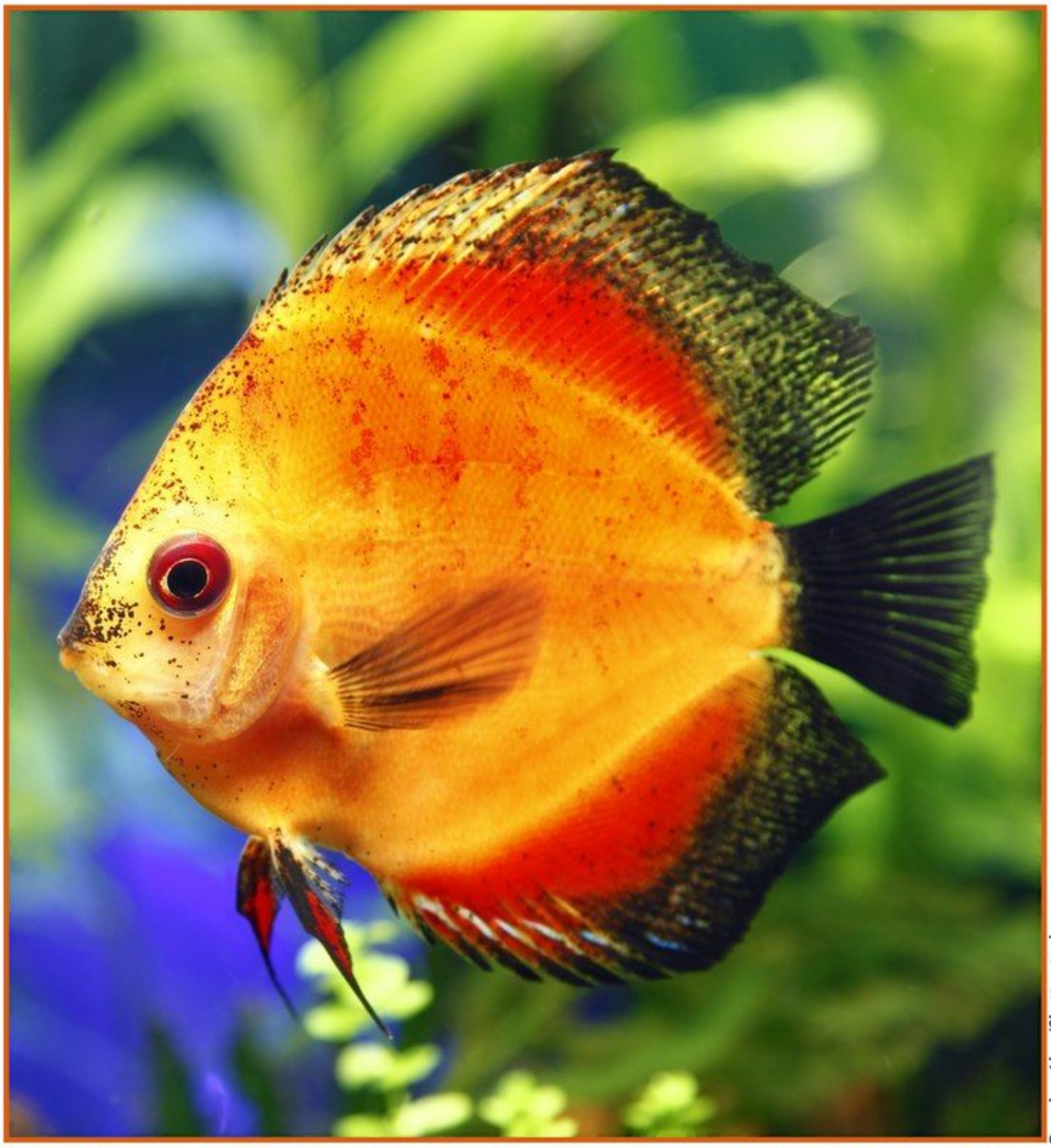


jack wattley

There are several tropical fish diseases that discus, among other South American cichlids, are very susceptible to. As to which is the most frequently encountered, I would probably have to say it could be one of the parasitic gill flukes, the more common egg-laying *Dactylogyrus*, or the livebearing *Gyrodactylus*. The normal rate of respiration in discus is approximately 60 to 70 breaths per minute, unless the fish has just been fed, in which case, the rate will be greatly increased. If the respiration rate in discus is greater than the general 60 to 70 breaths per minute, one can be fairly certain that one of the gill parasites will be the culprit, usually the *Dactylogyrus*.

Bacterial diseases in discus can also be a major problem. The *Pseudomonas* or *Aeromonas* bacteria are either gram positive or gram negative, but I still believe the gill diseases to be more common in discus. And how about the intestinal parasite *Capillaria* or the flagellate *Hexamita*? Both of these parasites can cause much damage to any discus.

With an inexpensive microscope, one can determine whether or not the discus are carrying gill worms or the already-mentioned *Hexamita* and *Capillaria*, any of which are much easier to identify with your inexpensive and easy-to-read microscope.



Brandon Alms/Shutterstock

■ The best water quality for discus can be achieved by performing large water changes daily.

I know you've written about discus water many times, combined with helpful discus information regarding the lowering of the pH with peat moss. I've missed these articles and hope that you can explain once more in some detail how one can successfully maintain an aquarium using peat.

First, what pH do you want to maintain in your discus aquarium? Most commercial discus breeders here in the US and Canada attempt to maintain a pH of 6.0 to 6.5, which is not difficult to do. In some parts of Europe, as well as in Southeast Asia, discus breeders are fortunate enough to have water available with lower pH readings.

I have used quality peat many times in order to lower the pH of the water, but I have not always had the time to prepare the peat first, or the filter, and for that reason I've lowered the pH with the use of phosphoric acid in liquid form. I have found that the best quality peat for discus is from certain sections of Germany as well as from Eastern Canada. Canadian peat can generally be found in most quality garden centers here in the States. If the water you are treating to lower your pH has a high conductivity, then the peat, regardless of its quality, will not have the desired effect, regardless of the amount used. Many tropical fish hobbyists are unaware that in most cases, their peat has a very short shelf life. However, if you have an outdoor garden, the used peat can make beautiful mulch among the plants and bushes. In nearly all cases, the efficacy of the peat will depend both on the amount of peat used as well as the flow rate of the water as it passes through the peat in the filter.

All new peat must be dampened before it is placed in the filter; otherwise, the water passing through the filter will encounter small, half-opened channels in the dry peat and bypass most of the peat. I have always found it best to place the peat in a fine-mesh bag, which prevents the peat from dispersing throughout the aquarium.

One must be certain that there are no additives of any kind in the peat to be used. Assuming that one has a pH kit, it's very easy to determine the shelf life of the peat; the higher the volume of water passing through the filter with the peat, the shorter the shelf life of the peat. If you have reduced the pH from, for example, a reading of 7.0 to 6.5 and the reading has stabilized at the 6.5 reading for a period of several days, then you can see that the humic and tannic acid properties are no longer in the peat. However, if the pH continues to drop and then stops at a 5.0 to 5.5 reading, then with a bit of engineering, you must either reduce the filter's flow rate or reduce the amount of peat that is in the filter. I have found that a pH reading of 5.5 is excellent in any discus water. Any traces of ammonia in the tank will be in the form of nitrate, which, in nearly all cases, will not prove harmful to the fish.

cichlid world

A Cichlid Challenge: Breeding ex*Cichlasoma beani*

Eric Hanneman brought goldfish home in those white, waxy paper boxes with the metal handle as a child and started his first aquarium in middle school in the Chicago area. He got into the African cichlid frenzy and started breeding Tanganyikans before moving to the West Coast for graduate studies in neurobiology. He has traveled to Mexico, Central America, and Africa to see cichlids in the wild. After owning and operating a tropical fish specialty store, he was the Coordinator for Fish and Invertebrates at the North Carolina Museum of Natural Sciences. He now works as a Research Technician for Oregon State University and the Alaska Fisheries Science Center.

eric hanneman

photographs by the author

I have a bucket list of cichlids I would like to keep and breed. Some of these have been torturing me for a while, challenging my aquaristic skills and making me feel incompetent. There are many reasons, or if you want, excuses, for failing with these fish. Sometimes the most challenging cichlids take three to four years to reach maturity, requiring both patience and skill. Sometimes they are just so aggressive that 6, much less 12, is not a large enough number and I have been left with one. Some of them are sensitive to water quality or demand specialized diets. Some of them may be smarter than I am.

I became fascinated with the cichlids of Mexico after traveling there several times. In the old days, pre-9/11, it was easy to bring some fish home from a collecting trip across the border. Now, Mexico protects its fish as much as any country and it is very important to have the proper paperwork if you want to collect anything but photographs.

The cichlids of Northern Mexico are a limited group, mainly belonging to the genus *Herichthys* and found along the Gulf of Mexico, but there are a couple of oddballs along the Pacific coast. Amazingly, just two species of cichlid are described from the western Pacific coast of Mexico. Starting in the North, at the Rio Yaqui, and along the coast down to the Rio Ameca at Puerto Vallarta, occurs that beast of a cichlid that I can now cross off my bucket list. Along this extreme northwest edge of mainland Mexico lives the extreme cichlid, ex*Cichlasoma beani*. Found at the western-most edge of the worldwide range of cichlids, the Sinaloan cichlid is the only cichlid found in the rivers it inhabits. South of Puerto Vallarta, at the Rio Armeria, and down to the Rio Papagayo near Acapulco, is found the other cichlid, ex*Cichlasoma istlanum*.

Both of these cichlids are found in at least two color forms, but I have not heard anything about them being split into more species. South of Puerto Vallarta is the gap between their distributions. I once hired a driver to take me to this area, but all I found was a lot of agricultural activity and some mollies.

The Rio Yaqui

The geology of the Rio Yaqui basin is complex, but the best scenario suggests that the ancestors of *C. beani* were found in Atlantic slope rivers, and as the mountains rose up, some of the headwater streams were captured and the water and the fishes in them began to flow to the Pacific instead. Relatively close relatives of *C. beani* would likely include *Herichthys bartoni* and *Herichthys labridens*, both found in Media Luna, and possibly *Herichthys minckleyi*, found in the springs known as Cuatro Cienegas.

The Rio Yaqui drains some of southern Arizona before entering Mexico. Found in its headwaters are native Mexican trout. To learn more about this interesting discovery, take a look at Truchas Mexicanus or visit the Desert Fish Council's website. Some locals even say that when the rains come and the rivers rise, large trout enter the

rivers still and make their way upstream to spawn. Many of the fish in the Yaqui basin are similar to the fishes found in the Rio Grande. In the lower basin, near the coast, where the *beani* live, are also found green sunfish (*Lepomis cyanellus*), but European settlers introduced them to the area and they are not native.

One of the interesting features of this group of northern Mexican cichlids is the color change that breeding adults, especially the females, undergo when tending to their spawns and free-swimming fry. Typically, the Texas cichlid types get a black chin and belly, with some extra black coloration on the caudal half of the body. In the labridens types, the black on the chin goes higher and comes above the upper part of the mouth, just underneath the eye. The black area on the caudal body is also restricted to just the upper half, giving the labridens types a checkerboard appearance. Finally, there is *C. bartoni*, which has the black on the face above the mouth like the labridens types, but also turns jet black over most of its body, except for a silver-white band along the top of the body from head to tail.

Managing Aggression

These animals are all aggressive and, except for *C. beani* and *H. minkleyi*, are off my bucket list; well, *H. labridens* is half off. It was just last fall when I received a care package from Rusty Wessel that included a handful of *C. beani* in the box. Already there was a notable size difference among the fry, the largest ones not even an inch long and already twice as large as the smaller ones. I could tell right away that this was not going to be a walk in the park. I also had some Jack Dempsey (*Rocio octofasciata*) and *Theraps microphthalmus* fry to use as dither cichlids, and I threw in the usual Mexican tetras (*Astyanax mexicanus*) and some swordtails, in this case *Xiphophorus montezumae*, to further mix it up and hopefully prevent the smaller, and likely female, *C. beani* from disappearing as the animals grew.

Right away there were problems. One of the *beani* started to grow like a weed and proceeded to knock off a few of the other *beani* and kill all the swordtails. The Dempseys were really getting pushed around, so I took them out after a few weeks. That one large male *beani* was up to 6 inches while some of his peers were just past an inch, and he finally had to go to the local fish store, whose owner

■ To manage the extreme aggression exhibited by ex*Cichlasoma beani*, the author added a lot of hiding places, such as flowerpots and caves, to their setup.

■ When breeding, female *C. beani* turn darker and develop stripes.

■ Both *C. beani* parents guarded their fry and mercilessly chased other fish in their tank.

was not really very happy to get the donation. Then the next largest male started to shoot up. He not only hogged all the food, but would not let anybody else have any. About this time, the Mexican tetras all disappeared and the micros made mad dashes between their rocky hiding places. I decided to see what was left.

What I found was one female and four small males and the big guy. I could spot the female by the black blotch on her dorsal fin; none of the others had that mark. The big male was 6 inches again, the female maybe three, and the smaller males 2 to 3 inches. I removed the large male again because I was sure that female did not stand a chance with him. The remaining five fish went into a 100-gallon tank packed with flower pots, cichlid caves, pieces of slate, river rock, and PVC pipe, both floating and sinking, of various diameters, so the little ones could find places to hide that the big ones could not get into.

Breeding *C. beani*

In another month, the female and, by then, larger male started to show signs of breeding. She started to get dark all over, sort of striped, while his colors did not change very much. They soon laid the eggs on the floor of a cichlid cave. The female suffered some, with torn fins and missing scales. The female mainly guarded the eggs.

When they hatched after about three days, the wigglers were moved just a few inches to another cichlid cave. It took another week before they were free swimming. During this time, the male and female shared their main duties of guarding the fry and actively seeking out the other three *beani* in the tank and mercilessly chasing them from where they were hiding and back into the same place.

All this was happening while I was interviewing for a new job back in Oregon. When the job materialized, the fish room of 40 tanks was torn down and sold off. The pair of *beani* went to another fishkeeper. But I wasn't sure they would have the same luck. By now, the male was again much larger than the female and the chances of them getting back together in a strange place were, in my opinion, slim to none. In the wild, they might go their separate ways and find another compatible mate, but in the close confines of the size of aquariums normally provided, just 6 feet in length, I don't see how it could happen.

The breeding color pattern of the female was unique. There was no black on the chin or under the eye. The first few spines of the dorsal and anal fins were black, but the rest of the unpaired fins were nice and orange, the colors of the school where my new job is located (go Beavers!). If you filled in between the black stripes on her body with more black, it would look almost like *H. bartoni* but without the black mask. I would have to say that *C. beani* is not very closely related to the labridens group or, at least, has been evolving along its own path for a long time.

Truly Knowing Cichlids

I think to really know a cichlid, it is not only important to breed it, but also to raise the fry and breed them. In this way, the aquarist really gets to know the animal. In this, then, I have failed. Perhaps someday, some fry of this amazing creature of the desert will swim in my tanks again. If you have any questions or comments or suggestions for future columns, please email me at primarypredator@gmail.com.

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the planted tank

The Introduction of *Ludwigia suffruticosa*

I hope you enjoyed the past two columns regarding the personal benefits of collecting your own plant specimens. This month, I want to give everyone an idea of what local plant collecting can do for the hobby as a whole, using an example I had some involvement with.

There's something of an impression, when one wonders about how all those exciting new species (of any kind of flora or fauna) find their way into the aquarium hobby, that the process in bringing them to us must involve some company sponsoring expeditions to exotic locales, possibly including scientists wading through jungles with a native guide or two, poking at unusual, never-before-seen wildlife.

That impression is not entirely inaccurate. In the case of aquatic plants, specifically, large nurseries do send people out to foreign countries to source new material to potentially add to their future offerings. Nurseries also have horticulturalists to work on hybridizing or cultivating specimens to produce new forms and mutations using existing stock—hybridization is, for instance, the primary source of the many new swordplants (*Echinodorus* spp.) made available to hobbyists in recent years. Cultivating particular mutations led to the introduction of plants such as *Cryptocoryne wendtii* "Florida sunset" and the Windeløv Java fern (*Microsorum pteropus* "Windeløv"). Nonetheless, these are by no means the only ways of bringing new plants into the hobby. Sometimes the plants come from the hobbyists themselves.

Local Clubs Introduce New Plants

In August of 2010, Aaron Talbot, a member of GWAPA (the Greater Washington Aquatic Plant Association), obtained a specimen of a *Ludwigia* species on an afternoon collecting trip intended to seek out a different plant altogether. An exact identification of the *Ludwigia* was impossible at the time due to a lack of inflorescences, but using historical records of the area plants, the specimen was tentatively identified as *L.* cf. *suffruticosa*. The presence of "cf." in a scientific name indicates an uncertain I.D.; in the case of plants, it often occurs because no one has yet procured flowers and compared them against a botanical key.

The *Ludwigia* was distributed among a few GWAPA members to test its suitability for aquarium cultivation. The species proved to be usable in aquaria, spreading more or less horizontally and acting as a good foreground plant for a larger aquatic-plant layout.

Subsequently, as GWAPA members grew the specimens out in their aquaria, cuttings were shared via online forums with other hobbyists across the United States. Attempts were made through 2011 to flower the plant in emersed culture, with no success, so the plant continued to be distributed as *L.* cf. *suffruticosa*.

Clinching the I.D.

In late spring of 2012, I acquired a specimen of the plant for myself via an internet purchase from another hobbyist, with the intent to cultivate it in my then newly assembled greenhouse. The plant was placed in a 4-inch square pot utilizing ordinary topsoil as a growing medium. It was kept well watered and lightly fertilized and trimmed back only when its stolons (long, horizontal stems sent out to root and produce new upright plants in the

Amanda Wenger is a lifelong hobbyist who inherited a love of aquaria from her father, when he gifted her with her first fish at age two. A decade and a half later, she started putting plants in the fish tanks and was hooked. Today, she lives in Connecticut, where she's the current President of the CT Aquatic Plant Enthusiasts (CAPE) and, with the assistance of her family, maintains a well-planted fishroom and a hobby-sized greenhouse filled with aquatic plants. She's also part of the moderating staff at AquaticPlantCentral.com. Aside from the aquarium hobby, Amanda is a professional illustrator and graphic designer with a soft spot for wildlife illustration.

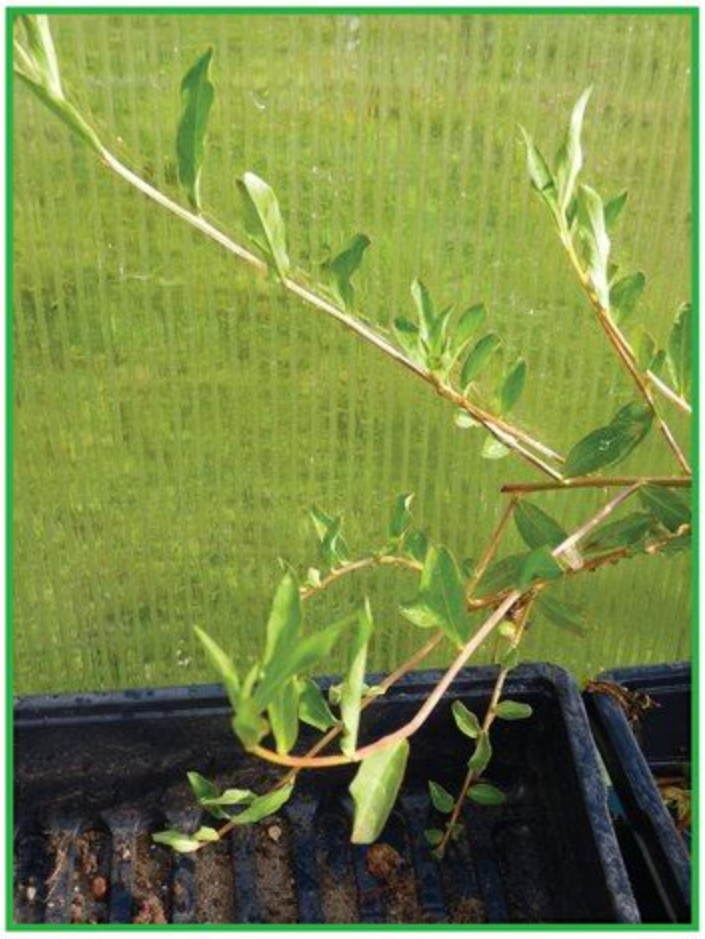
amanda wenger

photographs by the author

following growing season) threatened to invade other trays of plants. It proved to be a very vigorous grower and a large plant—some stolons exceeded 24 inches in length at the time of trimming. The upright stems were allowed to grow freely and reached a similar height.

Sometime around October 2012, as the weather cooled and the photoperiod shortened, I noticed buds beginning to form on my *Ludwigia* specimen. This being the first time any hobbyist reported an inflorescence, I documented the stages of its development with high-resolution photos of the structures of the buds and subsequent flowers.

The flowers turned out to be without petals, instead showcasing four large yellow-white sepals arranged in a spike. Each individual flower was approximately 8 to 10 mm wide. After receiving literature regarding *Ludwigia* section *Microcarpium*, a grouping consisting of stolon-producing, opposite-leaved species like the specimen in question, I began to wade through the text. Of the species in section *Microcarpium*, four were indicated to possess showy but apetalous flowers: *L. alata*, *L. pilosa*, *L. sphaerocarpa*, and *L. suffruticosa*. Of those, *L. alata* could easily be ruled out due to the lack of winged stems ("alata" is Latin for "winged"), and *L. pilosa* and *L. sphaerocarpa* are both notably pubescent (hairy/fuzzy) plants, also dissimilar to the specimen at hand. It was looking more and more as if the plant was, indeed, the *L. suffruticosa* it was previously suspected to be.



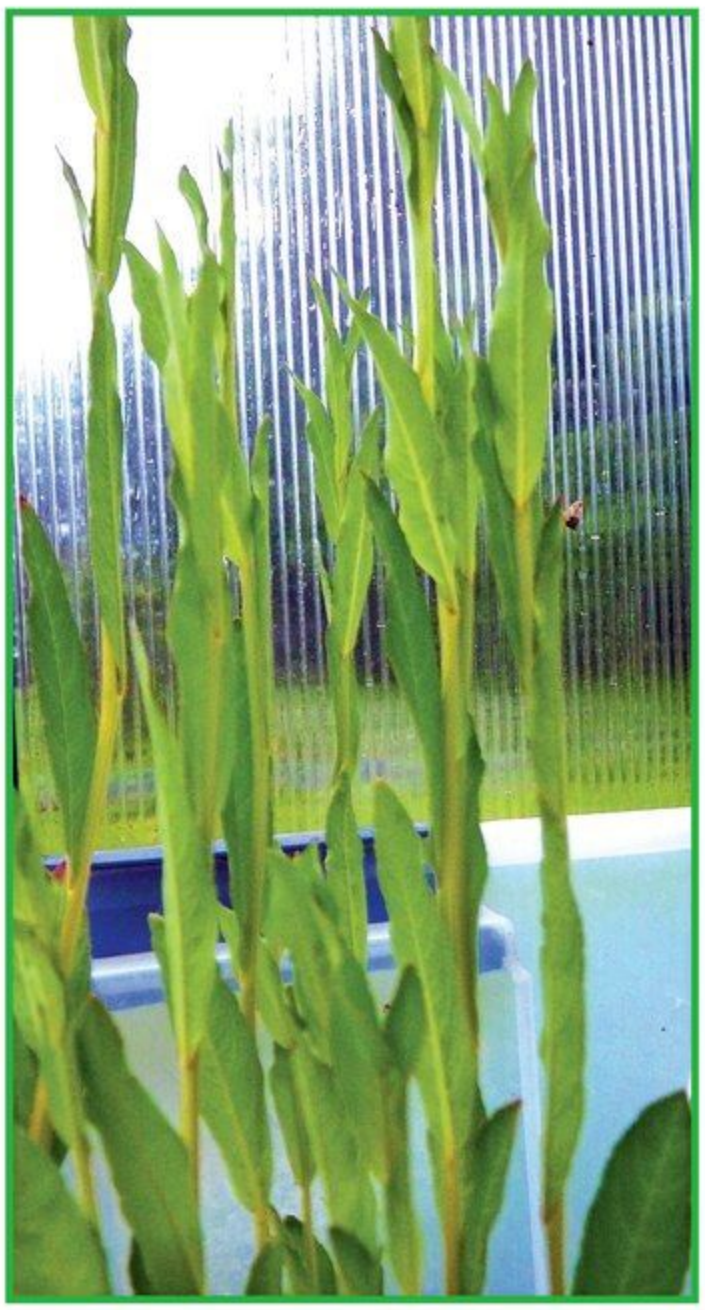
■ To prevent it from invading other plant trays, the author's *Ludwigia suffruticosa* had to be regularly trimmed back.

To confirm this, I showed my photos of the inflorescence to Cavan Allen, another member of GWAPA and also something of a go-to guy for identifying plants (an activity which is also his job). Cavan also ruled out the three other *Ludwigia* species, adding that *L. sphaerocarpa* never has sepals as white as those of the plant in question and *L. pilosa* possesses wider sepals with prominent line markings. With his confirmation, it was safe to remove the "cf." from the name and the plant is now traded as *Ludwigia suffruticosa*.

More Hobbyist-Introduced Plants

The above is by no means an isolated

■ The inflorescence of *L. suffruticosa* was used to properly ID the plant.



■ *L. suffruticosa* can be grown either emersed or submerged.

incident. Many North American plants have been brought to the hobby's attention by various local clubs and collectors. Two other *Ludwigia* species, *L. sphaerocarpa* (initially mistaken for *L. pilosa* due to the aforementioned similarities between the two) and the hybrid *L. palustris* x *glandulosa*, were brought to the hobby by HAAPS (the Houston Area Aquatic Plant Society). GWAPA has also introduced *Eriocaulon compressum*, a large, grass-like, soft-water plant; *Acmella repens*, an unusual aquatic representative of the daisy family (Asteraceae); and *Bacopa innominata*, among others. There is ultimately no reason you yourself couldn't introduce a new plant to the hobby by going out and collecting specimens of species that haven't yet been tested in aquaria.

A Bit More on *L. suffruticosa*

For those interested in keeping *L. suffruticosa*, be prepared for the plant's eventual size—it is not a small species by any means. Fortunately, most of that growth habit is horizontally oriented, so with some careful trimming, it can easily be shaped into a foreground bush. It's not a particularly needy species but prefers moderate to high lighting and CO_2 supplementation. Lower lighting results in green growth, while a brighter environment will encourage golden hues with red stems.

As no commercial nurseries currently distribute the plant, *L. suffruticosa* can only be obtained either by collecting some yourself (its native range includes much of the southern Atlantic and Gulf coasts) or purchasing from/trading with another aquatic-plant hobbyist. If you haven't already done so, seeking out this plant is a great reason to join one or more aquatic-plant forums on the internet (most of which have sale/trade boards to facilitate the exchange of plants). Alternatively, your local aquarium club may also yield a hobbyist cultivating the species.

I do strongly encourage hobbyists to consider obtaining and growing plant species distributed primarily by fellow hobbyists—it nearly doubles the available selection of aquatic plants to use in aquascaping and offers a whole new social dimension to the things we all enjoy.

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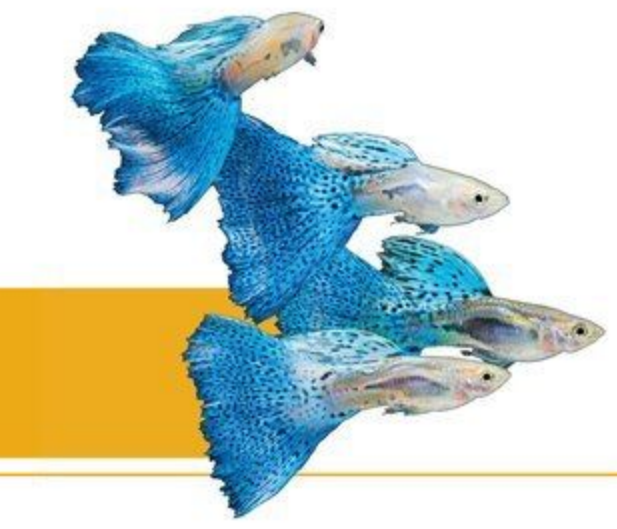

life with livebearers

Blue Mollies

For a while now, I've wanted to develop a truly blue molly. Blue isn't a prominent color in mollies. Most mollies sport various shades of greenish-gray, with yellow to red fins and breasts, or black ranging from a few speckles to full black. Some of the wild mollies display some blue. The males of the three sailfin species, *Poecilia latipinna*, *P. petenensis*, and *P. velifera*, all have turquoise in their tails. Both sexes of the short-fin molly (*P. mexicana*) often show some blue sheen in the body, especially on the bellies of the females. Unfortunately, no mollies approach the blue coloration displayed by some platies and guppies.

Quest for the Blue Molly

My quest for a blue molly started in 1998 when I noticed some male descendants of a male gold sailfin molly and a *P. latipinna* from Texas' San Antonio River had turquoise in the body. I segregated a couple of the best males, gave them a dozen of their sisters, raised a lot of fry, and grew them up. Whenever a son showed improved turquoise, I selected him to father the next generation. After a few generations, I achieved some success and named the strain "Santa Fe turquoise sailfin," since I'd started the process while our hatchery was still in Santa Fe, New Mexico.

After moving to south Texas, I continued to improve the amount and quality of turquoise on the body. Then, in 2003, Hurricane Claudette struck our hatchery and decimated our fish breeding stock, completely wiping out our Santa Fe turquoise sailfins. In an attempt to recreate this fish, I crossed our gold sailfin strain with *P. latipinna* and kept a few promising fish to breed, but I have yet to come close the turquoise of the lost strain. While continuing to select for turquoise, I despair of achieving my blue molly goal with that strain.

Other Attempts

I made other attempts at developing a blue molly. Some of our male marble sailfin mollies show a nice blue between the black blotches on their flanks. Unlike the turquoise of the Santa Fe strain, these fish have a royal blue, the very color I imagined in a blue molly. I isolated the best (meaning the bluest) of those males and gave them a bunch of their sisters. After a number of generations of inbreeding, the depth and coverage of the blue have improved and I now have a strain I call "blue marble sailfin." I plan to begin selecting for reduced black to see if the blue will remain. Unfortunately, it appears the less black, the less blue, but I haven't given up on the strain. Sooner or later, a male will be born mostly blue. He'll get a very large harem.

Yet another attempt was mating *P. mexicana* females from Campeche, Mexico, which often have violet/blue bellies, with some of the turquoise males and blue marble males. So far, these attempts haven't yielded a blue molly, although I'm only two to three generations into the process.

A Welcome Surprise

Now let's turn to a surprise step in the right direction on the way to producing a blue molly. In October of 2008, I set up a test cross of *P. petenensis* and our gold wag lyretail sailfin molly. *P. petenensis* males sport a short black sword on the bottom of the caudal fin. I held out the hope that the hybrids would have improved lyretails by combining the short sword with lyretail. This hope, by the way, hasn't been supported. I've gotten some nice lyretails from the descendants of this cross, but they aren't superior to the lyretails in our other strains.

Charles Clapsaddle began keeping fish at age 7, winning some goldfish at a carnival. Successfully spawning them, he was hooked on fish. Mastering goldfish, his attention turned to livebearers, locally collected mosquito fish (Gambusia affinis)*, and sailfin mollies* (Poecilia latipinna)*. By junior high he graduated to fancy guppies. His fascination with livebearers continues. Although his commercial hatchery breeds many other fishes, the development of new livebearer strains and the improvement of existing strains occupy his best efforts. Charles speaks to aquarium clubs across the country on various hobby topics. He has a BSc in Zoology from The University of Texas at Austin.*

charles clapsaddle

photographs by the author

Nevertheless, being aware that many times one has to go into several generations to yield results, I maintained this experimental line until May of 2013, periodically processing the fish and retaining the most interesting ones as breeders. Now, it would seem that with about 800 vats ranging from 55 to 1,200 gallons, I'd have plenty of space to experiment with fish, but I really don't. This is because Susie, my wife and our hatchery's business manager, has an unnatural obsession with profit. Susie takes a dim view of using tank space for fish that don't pay their way. So when our database report said it was time to process the vat devoted to my experimental fish, I agreed we'd discard the line unless something really interesting showed up.

Before getting to what happened when those fish were processed, let me give you a history of this line. By this time, we were in the sixth hybrid generation, or F_6. "F" here stands for "filial," which refers to the products of a particular mating. F_1 fish are the offspring of the two parental varieties, in this case *P. petenensis* as one parent and gold wag sailfin molly as the other. F_2 fish were the progeny of the F_1 fish, in other words, the offspring of brother-sister matings of the F_1 fish. F_3 fish were the product of brother-sister matings of the F_2 fish, and so on until the F_6 fish were the result of brother-sister matings of the F_5 fish.

Each generation, I selected fish to create the next generation. I culled fish that didn't appeal to me. F_1 fish exhibited ugly, muddy black-brown blotching on a pale yellowish body, which I've learned to expect any time I mate wild sailfin mollies with our gold mollies. All these fish were lyretails, showing the gold wag lyretail females I selected were homozygous for the dominant lyretail characteristic. Homozygous means the females each carried two copies of lyretail. Their F_1 offspring, however, were heterozygous for lyretail, meaning they were lyretails but carried the recessive non-lyretail characteristic.

F_2 fish were about three-fourths lyretails, which was to be expected since their F_1 parents were each carrying the non-lyretail characteristic. By chance, one-quarter of their offspring would inherit two copies of the non-lyretail characteristic.

Coloration was all over the board. Some were green, the wild color. Others were black marble with varying degrees of black from a few specks all the way to nearly solid black. Others were various shades of gold and gold marble. Most sported black streaking in their dorsals, a characteristic they inherited from their gold wag grandmothers. I selected some of the more interesting goldish fish and removed the rest, keeping some lyretails and some non-lyretails.

In an attempt to breed a blue molly, the author developed a strain he dubbed "Santa Fe turquoise mollies."

Blue marble mollies were created by mating the bluest marble mollies together.

The F_3 generation also was variable. Again I selected some of the gold fish, both lyretail and non-lyretail, and removed the rest. The F_4 fish were much the same with more gold fish, but still many greens and black marbles. I was getting a bit tired of this line of fish but decided to try one more generation. In the F_5, I got some fish that were light gold with opalescent bellies. Liking them, I decided to go one more generation and set up only the opalescent fish for breeding.

That brings us to the F_6 generation. With Susie wanting the F_6 vat to make a profit and faced with a database report saying the vat should be processed, it was do or die for this line of fish. I tasked Ashley, a hatchery technician beginning to specialize in livebearers, with processing the vat. I told her to keep anything interesting for me to see. I was working on some cichlids when Ashley excitedly told me she had blue mollies. She jarred them for me to look at. The two males and two females were blue on almost white bodies with black patterning in the fins and on the body. After photographing a pair, we set up both pairs in a 55-gallon breeding vat. We've decided the working name of this line will be "blue freckle sailfin," blue for the blue color and freckle for the black freckling.

Moving Forward

Where do I go from here? First, I'll continue working on the less-than-promising turquoise line and the more promising blue marble line. I have two breeding vats of each of these lines. Susie doesn't object to this use of vats since the turquoise culls can be sold as green sailfins and the blue marble culls can be sold as marble sailfins. Next breeding cycle, I'll also set up at least one cross of these two lines. Maybe the combination will produce something bluer.

With the blue freckle sailfins, the first batch of fry will be kept, but I expect them not to be blue freckles since the females were likely bred to other than the two blue freckle males. Since the genetics of this color isn't known, I'm not sure what we'll get in the second batch of fry, which should

A male blue freckle sailfin molly.

have our blue freckle males as fathers. I'm hoping, with some justification, the blue-white body color of these fish is the result of a recessive characteristic or characteristics. Why do I say with justification? Because they appeared after a few crosses, they were relatively rare, and none of their parents showed the color pattern. Since more than one fish (four in fact) showed the color pattern, it is unlikely to be a dominant mutation that appeared independently in four different fish.

Here's what I suspect: There are three recessive genes involved, one creating gold body color, one that modifies the gold to white, and another causing the blue color on the body. Since both females are virtually identical, as are the males, I don't think there are a lot of modifier genes impacting the blue coloration, since both females had some blue and both males had about the same amount of blue. I'll confirm these suspicions in about four months when their fry reach sexual maturity. My bet is all their offspring will be blue freckle sailfins.

What about the lyretail? There will be none since all four breeders are non-lyretail. Lyretail is a dominant characteristic, so none of these four fish carry the characteristic. If there aren't 100 percent blue freckles, then I'm wrong and it'll take more time to set the strain. There is a remote possibility the strain can't be set because the color pattern could be a result of being heterozygous, having two different copies of a gene. If so, only half the fish in each generation would have the desired color pattern. I'm hoping for a true breeding line of blue freckles so I can select for more and deeper blue.

I'll also mate females from my other two blue lines, the turquoise and blue marble sailfins, with blue freckle males to see what happens. I'll write about the results in the future.

Well, that does it for this month. Remember, you can send any questions or comments to me at charles@goliadfarms.com. If I use your e-mail, you'll see your name in print.

Good fishkeeping!

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import report

Ogilby's Rainbow (*Melanotaenia ogilbyi*)

An exceedingly rare rainbowfish hailing from the Timika region in Western Papua, Indonesia, the Ogilby's rainbow was known only from a handful of preserved specimens for many decades. Some wild-collected specimens made their way into the hands of breeders in Indonesia, and they only recently have become available to the US trade. We recently imported a farm-raised group of this attractive, medium-sized rainbow from Indonesia for the first time, and their subtle-but-attractive coloration caught my eye. A close relative of the Maculloch's rainbowfish (*M. maccullochi*), care and breeding for this species are presumably similar, as are preferred water conditions. Growing to a bit over 3 inches, the Ogilby's rainbow should make a fine addition to most planted community aquariums. In the wild, they can be found alongside the Goldie River rainbowfish (*M. goldiei*), and a biotope display including both species would make for a stunning tank.

Arrowhead Soapfish (*Belonoperca chabanaudi*)

A strange and rarely encountered deepwater fish from the Indo-Pacific, the arrowhead soapfish, or grouper, is a congener to the more famous (but vastly more rare) Dr. Seuss Fish (*Belonoperca pylei*). Nevertheless, it is nowhere near common in the aquarium trade, and we were pleased to receive a single very healthy specimen from our collection station in the Philippines. This shy ambush predator is usually found in the deeper reaches of the reef in and around large rock overhangs or caves. Feeding primarily on crustaceans, it typically requires live food in its diet at first but can be weaned onto frozen foods in a home aquarium. Despite its predatory nature, the arrowhead soapfish is generally not aggressive and is best kept with moderately peaceful tankmates.

Widespread but uncommonly seen, *B. chabanaudi* has been reported throughout the Philippines, Indonesia, and Fiji as well as the Indian Ocean and as far out as the eastern coastline of Africa. Their distinctive dark coloration makes them particularly difficult for divers to spot, although the bright yellow patch just before the caudal fin often stands out.

Molly Miller Blenny (*Scartella cristata*)—Tank Raised

A seemingly unremarkable addition to our ever-growing repertoire of domestically bred and raised marine fish, the Molly Miller blenny (*Scartella cristata*) is small with subdued coloration and an indisputably ugly face. Their fascinating antics combined with their propensity for eating undesirable algae and other pest species, however, make them an ideal choice for a reef or fish-only marine aquarium.

Mike Tuccinardi began working at a local fish store on weekends at the age of 13, and even then it was obvious that working with fish in some capacity was all he wanted to do. He spent many years learning all he could about the amazing variety of fish brought in. This fascination led him to follow the supply chain upward and make the move from Massachusetts to Florida to begin working for Segrest Farms, the world's largest tropical fish wholesaler. His first few months there were a continual learning experience, as he not only learned about how imports went from a local collector and into a facility but also how domestic production and the fish farm industry works.

mike tuccinardi

photographs by the author

Incredibly widespread in the wild, Molly Millers can be found from the Carolina coast on south through the Western Atlantic and Caribbean, as well as the Mediterranean and Eastern Atlantic. They are generally found in near-shore habitat, including grass flats, tidal areas, and coral reefs. This natural adaptability lends itself well to life in aquaria, as they are incredibly hardy and will thrive in a variety of environments. Omnivorous by nature, these gregarious blennies are often found in small groups but are known to squabble over territory, so they are best kept singly in smaller tanks.

Why, some may ask, would a drab fish that can be found all over the world be a good candidate for aquaculture? The answer lies in the fact that this fish has an interesting habit of eating *Aiptasia* anemones and many types of algae (including anecdotal reports of them consuming red slime algae, or cyanobacteria). This knack for attacking some of the most loathed pest organisms in the reef hobby makes them a great addition to the standard cleanup crew of fish and invertebrates invaluable to keeping a well-stocked reef tank free of nuisance algae and detritus. Molly Miller blennies are demersal spawners, which means they lay adhesive eggs on an overhanging surface. They breed relatively easily, although as with most marine fish, raising the tiny larvae (3 to 4 mm) on appropriately sized foods can be a major challenge.

Titanic Panaque L-203 (*Panaque schaeferi*)

The titanic panaque L-203 (*Panaque schaeferi*) is, without a doubt, the most impressive loricariid I have ever come across in the trade or hobby. What we expected to be a very large L-191 royal pleco (so large that it required its own specially constructed crate) arrived as this incredible slate-gray monster of a

Panaque from one of our exporters in Colombia. It took a good deal of research (and lots of very helpful comments on our Facebook page) to narrow it down to the tentative identification of *Panaque schaeferi*, a species only described in 2010 by Lujan, et. al in their paper titled "Revision of *Panaque* (*Panaque*), with descriptions of three new species from the Amazon Basin."

This species has a fairly wide distribution throughout the Amazon Basin, although most descriptions do not include Colombia in its range. Our supplier indicated that this particular specimen had been collected in the lowlands in some of the same river systems where common royals are found, in fast-moving whitewater streams.

P. schaeferi was known in the trade as L-203 or LDA065 for some time before being scientifically described, and it is known by various common names, including titanic pleco (not to be confused with *Panaque titan* or *Pseudacanthicus* sp. L-273) and Volkswagen pleco, both allusions to its immense adult size.

Like all its congeners, this species is equipped with a powerful rasping mouth and requires a substantial amount of driftwood and tough foods in its diet. Ours had no problem devouring whole squash and zucchini as well as making a dent in the pieces of driftwood we placed in its holding tank.

Interestingly, juveniles of this species look remarkably similar to L-090, the lyretail or papa panaque, and it is entirely possible, given the source, that some of the fish we had been importing from this same exporter as L-090 are actually juvenile *P. schaeferi*. I did take a closer look at the L-090 shortly after we positively identified "the beast," as it was affectionately referred to here, and noticed several fish scattered throughout the tank with a slightly different pattern and patches of iridescent bronze on the gill plate and dorsal fin. In any case, it would likely take decades for any of those 3-inch fish to reach the spectacular size of the *P. schaeferi* we imported!

Frilly Dwarf Sea Hare (*Dolabella* sp.)

The frilly dwarf sea hare is a bizarre and rather ugly gastropod that has more than a few endearing characteristics, and like the previously mentioned Molly Miller blenny, earns its keep in reef tanks not based on looks alone. The sea hares, family Aplysiidae, are found in tropical and subtropical seas worldwide, although most are definitely not suitable for the average home aquarium due to their massive size or specialized diets. The frilly dwarfs of the genus *Dolabella* are one notable exception, as they are relatively small and reef safe with an incredible appetite for nuisance algae of all kinds.

The *Dolabella* species we have been receiving somewhat regularly of late are collected in the tropical Pacific around Bali, Indonesia. They frequent grass flats and tidal areas where they can be found in fairly large groups, unconcernedly grazing on algae and vascular plants of all types. Sea hares have few natural predators and have a unique defense mechanism against predation in the form of a noxious "ink," superficially similar to that which cephalopods famously expel in order to make a quick getaway. Although I've never personally seen any of the *Dolabella* species ink in a tank, they are capable of doing so and keepers should be cautious

when introducing them to an aquarium with aggressive fish that may harass them.

Care in the aquarium is exceedingly simple: Provide reasonably good water quality and lots of algae, and the frilly dwarf sea hare should thrive. I have had the opportunity to keep several members of this genus in various tanks over the years, and after the initial shock of their weird, blob-like appearance wore off, they became some of my favorite inverts. Between their insatiable voracity for diatoms and other forms of nuisance algae that my snails and blennies refused to touch and their bold, almost outgoing nature, it is safe to say there will always be room for a sea hare or two in my marine tanks.

A word of caution—like anemones and nudibranchs, sea hares can easily get sucked into overflows, powerhead intakes, or other filtration devices, so be sure they are screened off and not accessible. Also worth mentioning is that the dwarf sea hares have a tendency to hide when first introduced to a tank, so don't be surprised if they do a disappearing act for several weeks before finally venturing out in the open. But once acclimated and comfortable, they will prove an energetic cleaner and fascinating accent piece for almost any aquarium.

Retroculus lapidifer

The South American eartheaters have always been my uncontested favorite group of cichlids. Something about their placid attitude, subtle, understated beauty, and constant substrate-sifting behavior just perfectly embodies the evolutionary link between the fish and their incredible habitat in the Amazon basin. *Retroculus lapidifer* is a member of the subfamily Retroculinae and extremely rare in the hobby. Though it doesn't belong to the same subfamily that includes the bulk of the eartheaters, it's a close cousin in terms of morphology.

A shy, cryptic fish by nature, *R. lapidifer* is found throughout much of the Amazon basin in Brazil and is chiefly (but uncommonly) exported through Belem on the mouth of the river. All *Retroculus* species have a greatly reduced swim bladder and are primarily bottom dwellers, living in sandy and rocky shallows in fast-moving, oxygenated streams. Social fish, they are often found in small groups, and in the breeding season, they excavate nests using small rocks. Care in aquaria is straightforward, but all *Retroculus* species are particularly sensitive to water quality, so frequent partial water changes are a must for long-term health.

Photograph by Peter Maguire

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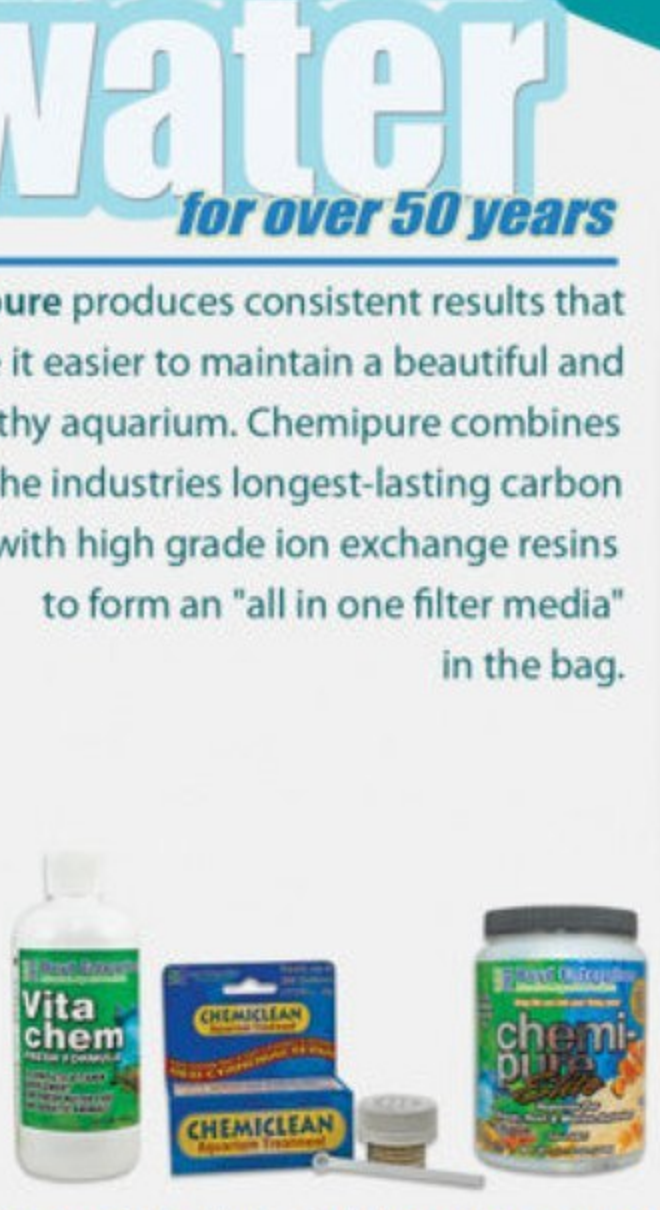

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A Slice of the Ocean, Part 4: Bringing the Aquarium to Life

Nic Tiemens is the co-owner of Infinity Aquarium Design in Los Angeles. He and his team design and install aquariums across the country and maintain their local installations in Southern California. Nic has been keeping aquariums for 25 years and has been professionally involved in the industry for more than a decade. Since 2004, Infinity Aquarium Design has installed hundreds of aquariums for clients throughout the United States and last fall gained international exposure with the launch of the reality special "Ultimate Aquariums" on HGTV, which featured Nic and his business partner, Joe Pineda, installing over-the-top, high-end aquariums for Hollywood's elite.

nic tiemens

photographs by Ed Chang

When we last left off, the majority of our installation was complete. The tank had been filled, the life support system was up and running, and the time had come to begin the initial cycle of our aquarium. The only hiccup that we encountered was that the original cabinetry selected for the canopy and fascia around the aquarium turned out to be a bit of an eyesore.

The brushed aluminum finish gave the entire display a rather cosmic appearance and didn't exactly convey the high-end design we were aiming for. Although a last-minute change had delayed our final reveal to the client, it was an easy fix that would take only a few days to address and it wouldn't slow down the addition of livestock. There was still plenty to do, and cycling the aquarium would lend us some extra time.

Luckily, we weren't under any huge time constraints and our client was willing to accept the slow, yet predictable, timeframe of the nitrification cycle. Depending on the volume of an aquarium, along with the engineering of the life-support system, the initial cycle of a new aquarium will take anywhere from four to eight weeks.

For those over-eager new tank owners, it can be a seemingly prolonged wait. But for anyone who has tried to cheat Mother Nature, you know that increasing a new aquarium's bioload even a few days too early will result in a lot of extra work, time, money, and, unfortunately, fish. Even when the cycle is complete, patience and care are very important. Fully stocking a large aquarium and bringing the display to its full potential takes several months, and taking things slow is very critical to the animals' health.

Choosing the Fish

Once cycling was complete, we were prepared to discuss livestock selection. Because Infinity Aquarium Design provides aquarium maintenance in Southern California, we make sure we have a very solid understanding of what our LA-based clients want to see inside their new aquariums before we tighten the first bulkhead. Providing fish encyclopedias to our customers and having them create a wish list allows us to review their selections, assess them for compatibility and hardiness, and narrow them down to the most appropriate group.

Oftentimes, we have requests to import species of fish that are not only known for being incredibly fragile and sensitive in new aquariums, but also extremely expensive. And when it comes to larger aquariums that have both the volume and the capabilities to house several show-sized fish, it is very important that they be added in the proper order to ensure an appropriate hierarchy is established and the life-support system is not overloaded too quickly.

Upon reviewing the wish list for this aquarium, we realized that our client had big, but not oversized, expectations. His travels had taken him all around the world to corners of our planet that very few have the time or budget to see. His experiences abroad brought to life a fondness for marine life and a general knowledge of what is available in the aquarium trade.

A few of the selections on the list were immediately excluded. Sharks were not an option due to the shape of the tank and the restrictions on obtaining certain species. Jellyfish wouldn't survive due to the temperature of the water and their inability to coexist in an aquarium with fish. And a few of the options had to be

weighed against each other, knowing that compatibility was a major concern and a peaceful aquarium was ultimately best for all of us! Eventually, we ended up with a very impressive and exciting roster for our new aquarium.

His selections were vast and not at all limited to one region of the world, although Hawaii and the Caribbean were at the top of his list. The naso tang (*Naso lituratus*) had been a regular encounter in his dives to the Molokini Crater just off the shores of Maui, and a queen angelfish (*Holacanthus ciliaris*) was a fond memory of his excursions in the British West Indies.

We took a huge leap over to the Red Sea to select a pair of golden butterflyfish (*Chaetodon semilarvatus*), a species known for being both beautiful and fragile, requiring expert care and a very particular diet. Circling the globe, we would need to make pit stops in Australia and the Indo-Pacific region to pick up a harlequin tuskfish (*Choerodon fasciatus*) and a Niger triggerfish (*Odonus niger*), two very beautiful species with hearty attitudes and voracious appetites. We were off to a great start. The fish that were selected for the aquarium would offer an array of colors and activity and would no doubt be the topic of conversation for anyone visiting the house.

Redoing the Cabinets

Things were underway, and we now had plenty of time to address our cabinetry revisions that were necessary to give the display the added detail and quality we had promised. Since the idea of a brushed-aluminum finish didn't lend the impact we were hoping for, we decided to try an entirely different approach and finish off the aquarium with a dark, textured oak facade.

While this particular material hadn't been incorporated into the design palette of the room, it was a bold contrast to the existing textiles and would likely help the aquarium stand out even more than we had expected. The sharp contrast of the dark wood against the bright whites and blues that the decorative coral exhibited under our LED lighting would offer a punch of color and deliver a magnificent display. By the time the nitrification cycle was complete, our cabinetmaker was able to fabricate and install our custom canopy and fascia and polish off the aquarium with plenty of detail to captivate its viewers. It was immediately obvious that our change in cabinetry was the right decision, and the entire display looked and felt even more high-end than we had imagined it would be.

■ The homeowner chose a queen angelfish for his tank to remind him of his trip to the British West Indies.

■ To add a splash of red to the aquarium, a bigeye soldierfish (*Pristigenys alta*) was included in the lineup.

Bringing the Fish Home

During this portion of the installation, I took the time to visit the local livestock distributors and handpick all of the fish that were to be slowly introduced into the aquarium. When the day finally arrived to begin acclimating them to the tank, our client was as eager as ever.

The first introduction was small—two golden butterflies and a naso tang. With those species being the most sensitive of the group, putting them in first would give them plenty of time and space to establish their territories and develop a good comfort level in their new environment.

In due time, I continued to follow up with additional tankmates. The Niger trigger and harlequin tusk were in the proceeding group, leaving the queen angel as the icing on the cake. But even with all these great fish populating the new aquarium, there was room for more. I could tell that our client had a desire to display the most colorful and exotic marine fish available, and I knew just the right species to add in order to put this particular fish tank over the top.

With room for only a few more fish, I decided to go for as much color as I could obtain. One of my all-time favorites was up first, the powder blue tang (*Acanthurus*

■ The author aimed for a thriving, active fish community.

■ The final aquarium is flourishing, and the homeowner is pleased with its overall look.

leucosternon). Known for being a bit of an aggressor, this fish would be able to stand its ground against some of the sizeable inhabitants that had been in the aquarium for over a month and would be an energetic swimmer throughout the entire day.

Next, I sought a bigeye soldierfish (*Pristigenys alta*) to bring a strikingly bold splash of red against the black-and-white backdrop of the tank. My final two selections each had an important role in the aquarium. A small school of blue-green chromis (*Chromis viridis*) would offer a unique contrast to the larger species of fish, and a beautiful emperor angel (*Pomacanthus imperator*) would act as the trophy inside the tank.

A Striking Setup

It was impressive to say the least. Not only was our client proud of his new aquarium, but also our entire team was just as delighted. We couldn't have been happier. The heavy lifting, detailed engineering, laborious fabrications, and overabundance of patience for biology resulted in one of the best-crafted aquariums we've produced. Our maintenance regimens continue to this day on a weekly basis and consist of significant water changes, filtration diagnostics, feedings, and observations. In addition, several hours each month are dedicated to swapping out the coral sets as they begin to show algae growth.

It's a lot of work to design, fabricate, install, and maintain an aquarium of this caliber, but as my grandfather always tells me, "All things come to those who wait, but work like heck while they wait." It is, after all, a labor of love.

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the salt mix

A Look at the Calcareous Algae *Halimeda*

James Fatherree, MSc, is a physical and environmental sciences professor in Tampa, Florida. He has been an aquarium hobbyist since childhood, a reef aquarium hobbyist for over 20 years, and has spent many days diving in Florida, Hawaii, the Bahamas, Japan, and Indonesia. In the past he has managed a large retail aquarium store, owned and operated an aquarium design, installation, and maintenance business, and spent a summer working for an aquarium livestock collector/wholesaler in Florida. James has also published numerous articles in the U.S. and Europe, and has written and illustrated several books on the topics of reef organisms and marine aquariums, the latest of which is Giant Clams in the Sea and the Aquarium.

james fatherree

photographs by the author

Most land plants and some that live in the ocean are called vascular plants because they have a lot of plumbing on the inside, from the tips of their roots to the tips of their leaves. If you think of all the arteries and veins that make up your vascular system and then apply that same idea to the plumbing system in a tree's leaf, you can see why they're called vascular plants. The name "algae," on the other hand, refers to various sorts of simple plants that are non-vascular and may even live as single-celled plankton. Basically, it's anything that uses photosynthesis to stay alive and isn't vascular, but also isn't a moss or lichen. Many may produce structures that look just like roots and leaves, but they're actually quite different on the inside.

Anyway, while there are many, many types of algae, almost 10 percent of the non-planktonic types have the ability to precipitate calcium carbonate within their "bodies" in the form of calcite or aragonite. This is the same stuff that corals, clams, snails, and such use to build their skeletons and shells, and the algae that do so are called calcareous algae. Pretty red, pink, and purple coralline algae, popular in the hobby, is one type of calcareous algae, as is the green cactus algae, which is the subject of the month. Going by the scientific name *Halimeda*, it's good-looking stuff and can be a great addition to any reef aquarium.

Basic Information

Lifestyles

There are many species of *Halimeda*, all of which look very similar. Their body, which is properly called a thallus, is made primarily of strands of flattened green segments that are calcified and hard. These segments are also articulated and can flex to some degree, as they're held together by non-calcified joints. The strands of plates can also be anywhere from a few inches to a few feet in length, with each of the segments being composed of up to 90 percent calcium carbonate.

The really amazing thing about it (and many other types of algae) is that, despite its size, when you look at a clump or patch of *Halimeda*, you're actually looking at a really big single cell. Of course, there's a cell membrane/wall that packages the whole thing, but on the inside, a clump is filled with freely moving cytoplasm and numerous cellular nuclei. This is called a coenocytic organism, with the other well-known example being algae of the genus *Caulerpa*.

In fact, whole areas of seafloor can be covered by *Halimeda*, which may all

be the same organism and is technically one gigantic single cell. All of the separate clumps that you might see rising from the substrate in such an area may actually be connected to each other by fine strands of tissue below the surface, making these some of the largest and most complex single-celled organisms on Earth.

About a fourth of the species live like this, spreading across areas with muddy or sandy bottoms and staying in place through the use of fibrous root-like structures called rhizoids. Others live attached to hard substrates, using numerous rhizoids or a bulb-like base to stay affixed. Various species can be found living from very shallow waters all the way down to almost 500 feet where the light intensity is less than 1 percent of what it is at the surface. They can also be found in tropical waters throughout the Pacific, Indian, and Atlantic oceans, as well as the Red and Mediterranean seas.

■ *Halimeda* growing on a sandy bottom along with turtle grass.

Growth

Halimeda can grow very quickly under optimal conditions, as new segments can be produced at the tips of developed ones or arise from the base of a clump, and are quickly calcified. As is the case with many stony corals, areas of new growth are white at first, with the color actually coming later. Don't fret if you see white areas showing up on the ends of otherwise healthy strands. Do note that this rapid growth can easily lead to the depletion of calcium and alkalinity in an aquarium.

Halimeda is also difficult to eat since it's calcified, so most herbivores leave it alone. It can also produce noxious substances that apparently make it taste bad to most hard-mouthed herbivores, such as parrotfishes. In fact, the only animals I could find that do eat it are some nudibranchs, sea hares, sea turtles, and a sea biscuit, but I doubt you have any of these in your aquarium. Still, it is subjected to storms, sedimentation, poor water quality, etc., and clumps effectively die when they undergo sexual reproduction, as well.

Since it can grow fast, can be up to 90 percent carbonate material, and doesn't last forever, *Halimeda* is also one of the dominant suppliers of carbonate sediments in reef environments and other areas. In fact, in some areas that are covered with *Halimeda*, it can produce close to a half pound of carbonate sediment per year for every square foot of coverage, meaning it can add a lot more carbonate material to some areas than corals can.

■ *Halimeda* can grow on a hard substrate.

Reproduction

How a clump of *Halimeda* increases in size is easy enough to see, but how new clumps are formed can be a lot more complicated at times. Sometimes it's easy, but sometimes not so much, as it can spread and reproduce in a number of ways.

■ *H. opuntia* is a commonly offered species with uniquely shaped segments.

As is the case with many other types of algae, like *Caulerpa*, *Halimeda* can reproduce asexually through fragmentation. If a strand, or even a single segment, is somehow mechanically detached from a clump, the freed piece(s) can settle down and eventually produce a whole new clump. Under optimal conditions it doesn't take much.

As mentioned above, thin strands of tissue can spread out from the base of a clump. These can extend inches to feet away from a clump, and a whole new clump can arise from any part of such strands. Not to be too picky about it, but if a new clump remains connected to the old one, then the whole thing is still a single cell/organism. However, if they become disconnected from each other for any reason, then asexual reproduction has occurred in a different way.

Regardless, it's the way that *Halimeda* reproduces sexually that's really interesting. *Halimeda* is holocarpic, which means that a single-celled clump can reproduce sexually by converting almost all of the cytoplasmic fluid it contains into numerous tiny reproductive cells that are discharged from the thallus into the surrounding seawater in a process called sporulation.

Vascular plants have specific organs that produce reproductive cells and structures, but *Halimeda* can produce these reproductive cells throughout the thallus in a simplistic sense by bundling up a little cytoplasm with one of the many cell nuclei that are in it. Again, essentially all of the cytoplasmic fluid inside a clump is packaged up like this and then released, which leaves the rest of the clump dead in the end.

You can see it coming too, as the segments will turn white but will also be covered with dark, fuzzy-looking spots until the process is completed and the cells are released. Then, the dead carbonate husk that's left behind will be completely white and will start to fall apart into individual segments. This is often called "going sexual" by hobbyists and has the potential to rapidly degrade water quality if it's not dealt with.

■ Being calcareous in nature, *Halimeda* requires high calcium and alkalinity levels in the aquarium, not unlike corals.

■ *Halimeda* during sporulation; when finished, only the white carbonate material will be left behind.

In the Aquarium

When keeping *Halimeda* in the aquarium, there are no special water-quality requirements to meet. Everything should be what's considered normal, with particular attention being paid to calcium and alkalinity. Calcium should optimally be kept at 380 to 450 ppm, and alkalinity should be kept between 7 and 12 dKH, the higher the better for both. I point this out because *Halimeda* can grow fast and if you have a lot of it relative to a tank's volume, it can rapidly reduce both as well

as compete with corals, clams, and such for what's available.

Water flow can be anything from low to high. Really, anything is fine, as long as it isn't so strong that it blasts a clump over and keeps it from assuming a normal posture or actually tears it up the way big storms can. I doubt that will ever be a problem in an aquarium.

Lighting is an easy one, too. While some *Halimeda* lives in shallow, very brightly lit waters, I've seen several different types growing just fine under a broad range of reef-aquarium lighting. I think it's safe to say that as long as you have anything that's considered reef-aquarium lighting, you can keep *Halimeda*.

The only other thing to mention with respect to basic care is that types of *Halimeda* that live on soft bottoms and have lots of fibrous rhizoids that spread down into and through the sediments should likewise be placed in the substrate in an aquarium. If conditions are suitable, soon enough you'll find new clumps springing up here and there from the substrate, sometimes well over a foot from where the clump was placed. Conversely, those that have a smaller, compact base and typically live on hard bottoms should be placed on rockwork, in either a hole or crevice or between two rocks where it can grow and take hold.

Next, we need to get back to sporulation. For reasons unknown, it never seems to work in aquariums. The released material dies off rapidly, and I've never heard of sporulation resulting in the appearance of new clumps. It oftentimes happens on a large scale too, with several clumps dumping their contents at once.

In most cases, such a crash won't be a problem, except that it results in the loss of any clump that does so. However, if you have a whole lot of sporulating *Halimeda* relative to the volume of a tank, it can lead to a rapid drop in oxygen levels as the released material begins to decompose in the water. A quick water change and some mechanical filtration may be in order to help remove any cloudiness. Just remember to take any mechanical filter off the tank and clean out the media as soon as the water clears so that the green stuff doesn't just die in the filter and foul the water anyway. Luckily, I haven't had anything else in a tank die due to a sporulation event, so don't worry about it too much. I'll add that, as is the case with *Caulerpa*, hobbyists have found that regular pruning and removal of some of the algae is apparently fairly effective at preventing sporulation events in the first place.

Lastly, if any *Halimeda* dies in your aquarium and turns white, you can just leave it there if you want to. It'll fall apart, and as occurs in the wild, the pieces will just become more carbonate sediment in your sand bed. You can even reach in and easily grind it up with your fingers if you choose to.

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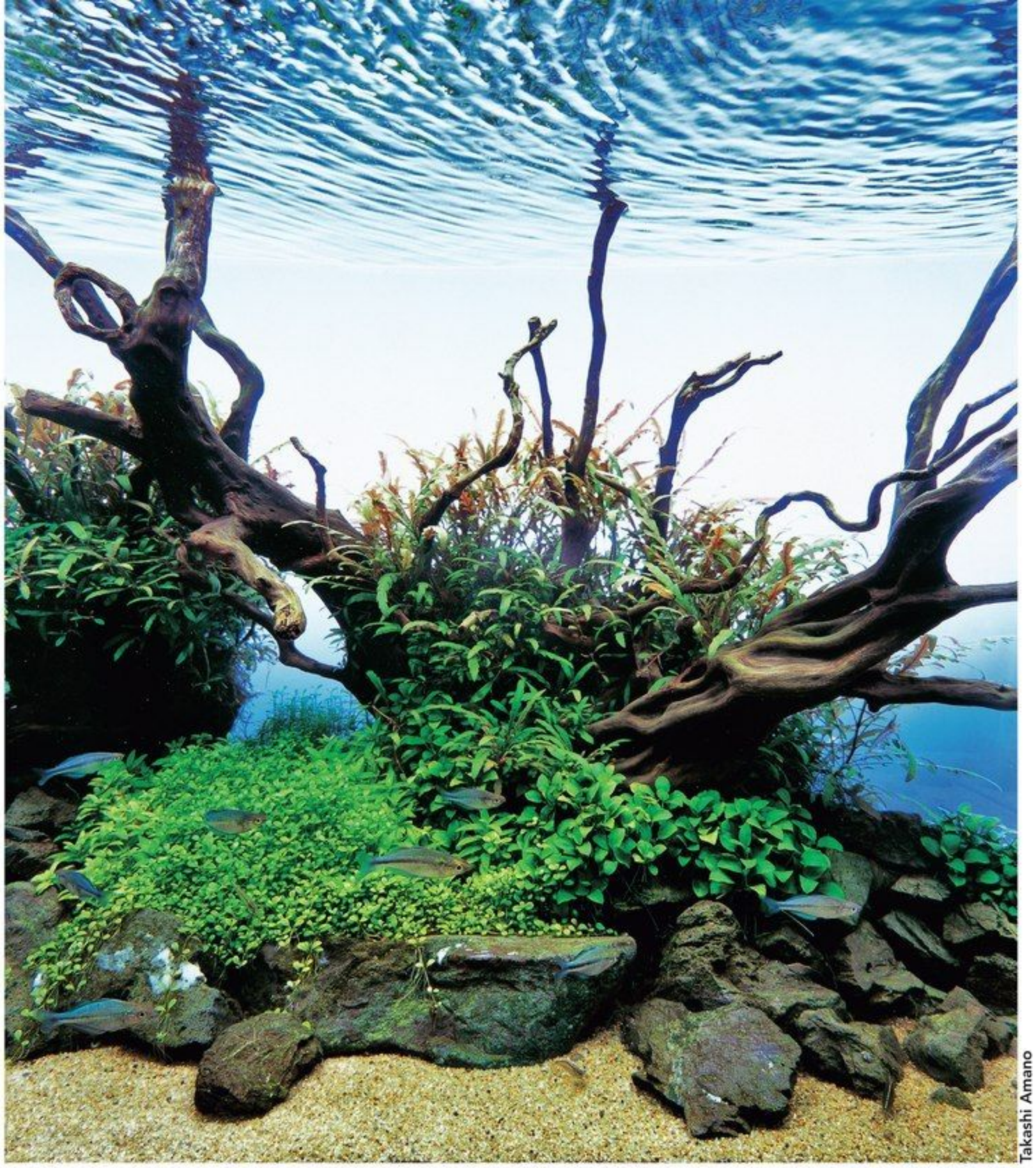
■ The cosmetic sand in the foreground and the simple arrangement of aquatic plants bring out the natural appeal of the composition materials to create a striking layout.

A Layout That Emphasizes the Beauty of Composition Materials

Takashi Amano

translated by Tomoko Schum

Takashi Amano



Takashi Amano

■ Slender, twisted branches are the primary feature of branch wood. The author created a powerful composition with branches spreading in a radial manner to make the most of this feature of the driftwood.

Takashi Amano

■ The appearance of the layout right after planting; since dry branch wood is very buoyant, the author placed a stone on top of it until it sank on its own.

While materials such as stones and driftwood are sometimes hidden by the aquatic plant life in the Nature Aquarium, at other times they are exposed to take advantage of their shapes. Since an *iwagumi* layout is often created in the latter manner, the shape and texture of the stones are important for this type of layout. On the other hand, a layout with driftwood is often created in the former manner because intentionally hiding a severed end or an unattractive part of driftwood with aquatic plants is one of the common techniques used for such a layout.

While it is not intentional, as stem plants grow and increase their volume, stones and driftwood are engulfed by and practically disappear in the bushes of aquatic plants. The layout material is still useful as a framework to maintain the composition in such a case. This is because the layout materials serve as a guide for cutting when trimming aquatic plants. If the shape of a stone or piece of driftwood is good, a layout is often enhanced by exposing the material.

Since stones are almost always exposed in an *iwagumi* layout, their shape and texture are important considerations. In the case of driftwood, moss and ferns are often grown attached to the pieces regardless of the attractiveness of their shape. Therefore, even if the shape is not perfect, an unattractive part can be hidden by this method so that only the attractive part of the driftwood can be displayed to its advantage.

Using Branch Wood in a Layout

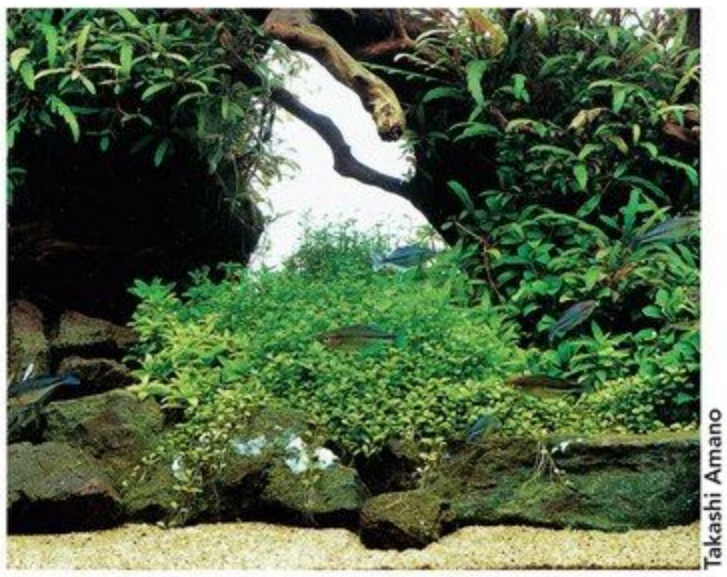
The layout in this article uses branch wood and *manten-seki* stones as composition materials, and exposing these composition materials makes the layout striking. Branch wood is characterized by its twisted branches. One can create an exciting composition or add a natural feel by making the most of this characteristic. In this layout, a dynamic and powerful composition was produced by arranging the branch wood in such a manner that its branches spread radially from the center of the layout to the surrounding areas.

Although such a composition can be produced by combining a number of slender driftwood branches, the branches tend to fall over easily and spoil the composition.

DATA

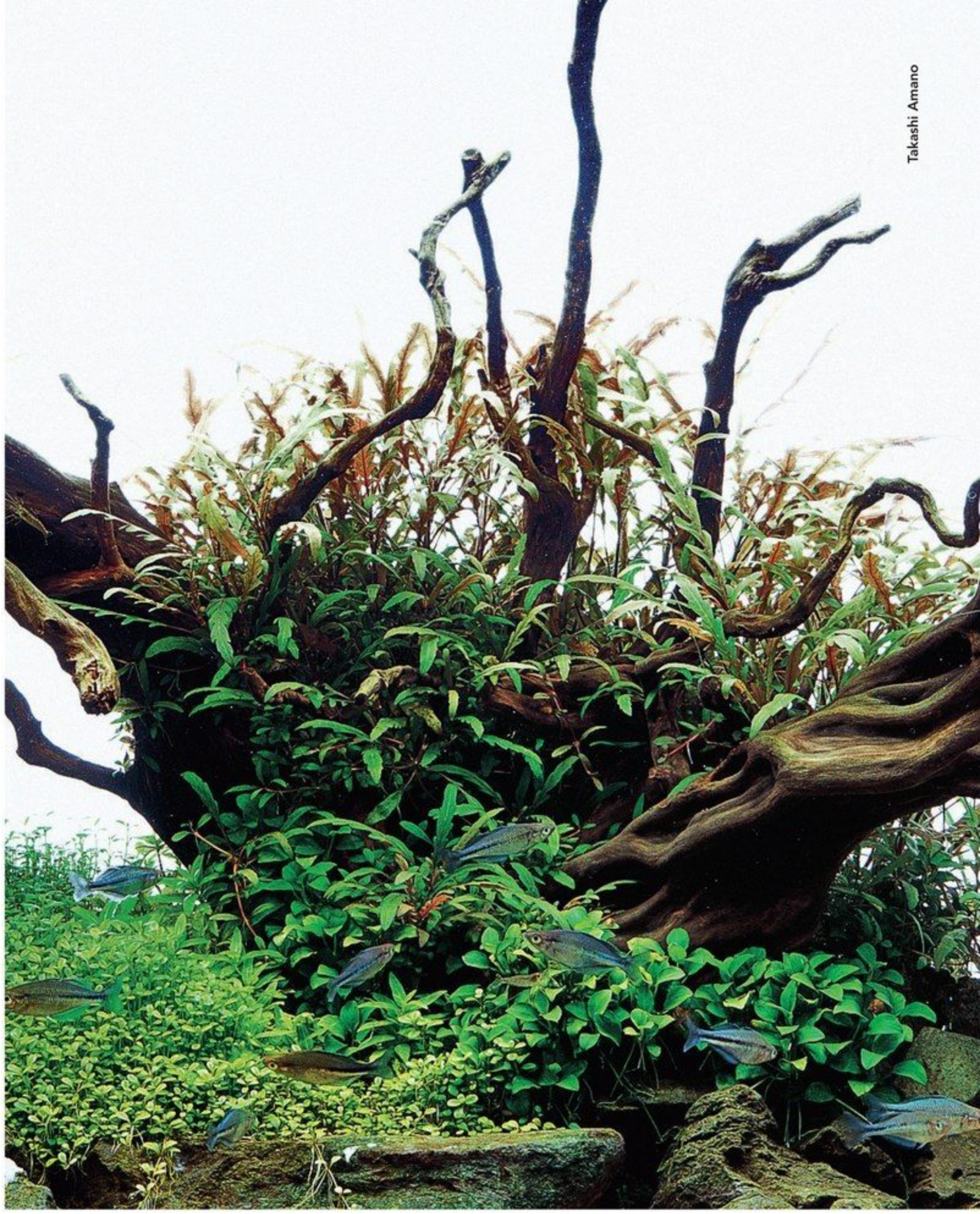
Aquarium: Cube Garden W120 x D45 x H60 cm
Lighting: Solar I (NAG-150W-Green) x 2 units, turned on for 10 hours per day
Filter: Super Jet Filter ES-1200 (Bio Rio M, NA Carbon
Substrate: Colorado Sand, Aqua Soil Amazonia
Additives: Brighty K, Green Brighty STEP2
CO_2: Pollen Glass Beetle Series 40 mm, 4 bubbles per second via CO_2 Beetle Counter (using Tower)
Aeration: For 14 hours after the light is turned off using Lily Pipe P-4
Water Change: ⅓ once a week
Water Quality: Temperature 25°C (77°F), pH 6.8, TH 20 mg/l
Aquatic Plants: *Hygrophila pinnatifida, Glossostigma elatinoides, Staurogyne repens, Anubias barteri* var. "nana petit"
Fish/Invertebrates: *Melanotaenia lacustris, Crossocheilus siamensis, Otocinclus* sp., *Caridina japonica*

[Note: The hardware itemized above represents the author's specific choices; equivalent results may be obtained with other equipment and accessories—Eds.]



Takashi Amano

■ *Glossostigma* and *Staurogyne* were planted in the center area where the nutrient-rich soil was placed. The arrangement of aquatic plants was kept as simple as possible.



Takashi Amano

■ Although *Hygrophila pinnatifida* is a stem plant, since it tends to attach itself to stones and driftwood, it can be used in a variety of ways. In this layout, it grew attached to the base of the driftwood and looks as though it is a type of fern.

On the other hand, branch wood is often stable and keeps the composition from falling apart since several branches are coming out of one root. While an artificial cut is occasionally found on the base or a branch tip of branch wood, the unsightly part can be obscured by turning the cut on the base downward or toward the back or breaking the branch tip that has an artificial cut to make it appear more natural.

In this layout, I used branch wood that had been soaked in water for a while. A new piece of branch wood is pale and cream colored. Since it contains a large amount of organic materials, aquatic fungus develops occasionally on the surface. The organic materials leach out when new branch wood is soaked in water for a while, making it difficult for the fungus to develop and turning the color of the wood darker. Additionally, since new branch wood tends to float in water, soaking it will waterlog the driftwood and make it less likely to float.

However, the branch wood that was used in this layout was allowed to dry after soaking and it became buoyant again. In such a case, an appropriately sized stone should be placed on the driftwood to sink it deliberately. Although it depends on the condition of the driftwood, if left like this for one to two weeks, the driftwood will absorb enough water and no longer float.

Creating the Final Composition

The steps to create this layout are different from the usual ones. I first arranged *manten-seki* stones and driftwood in the aquarium and then laid the substrate materials, cosmetic sand and a nutrient-rich soil, around them. *Manten-seki* stones not only secured the driftwood, but they also functioned as soil retainers to keep the cosmetic sand and soil from getting mixed up. The layout was planted primarily with *Hygrophila pinnatifida,* and then *Glossostigma*, *Staurogyne*, and *Anubias* were added to create a simple layout. The natural characteristics of the composition materials were enhanced by the simple planting of aquatic plants and the use of the cosmetic sand.

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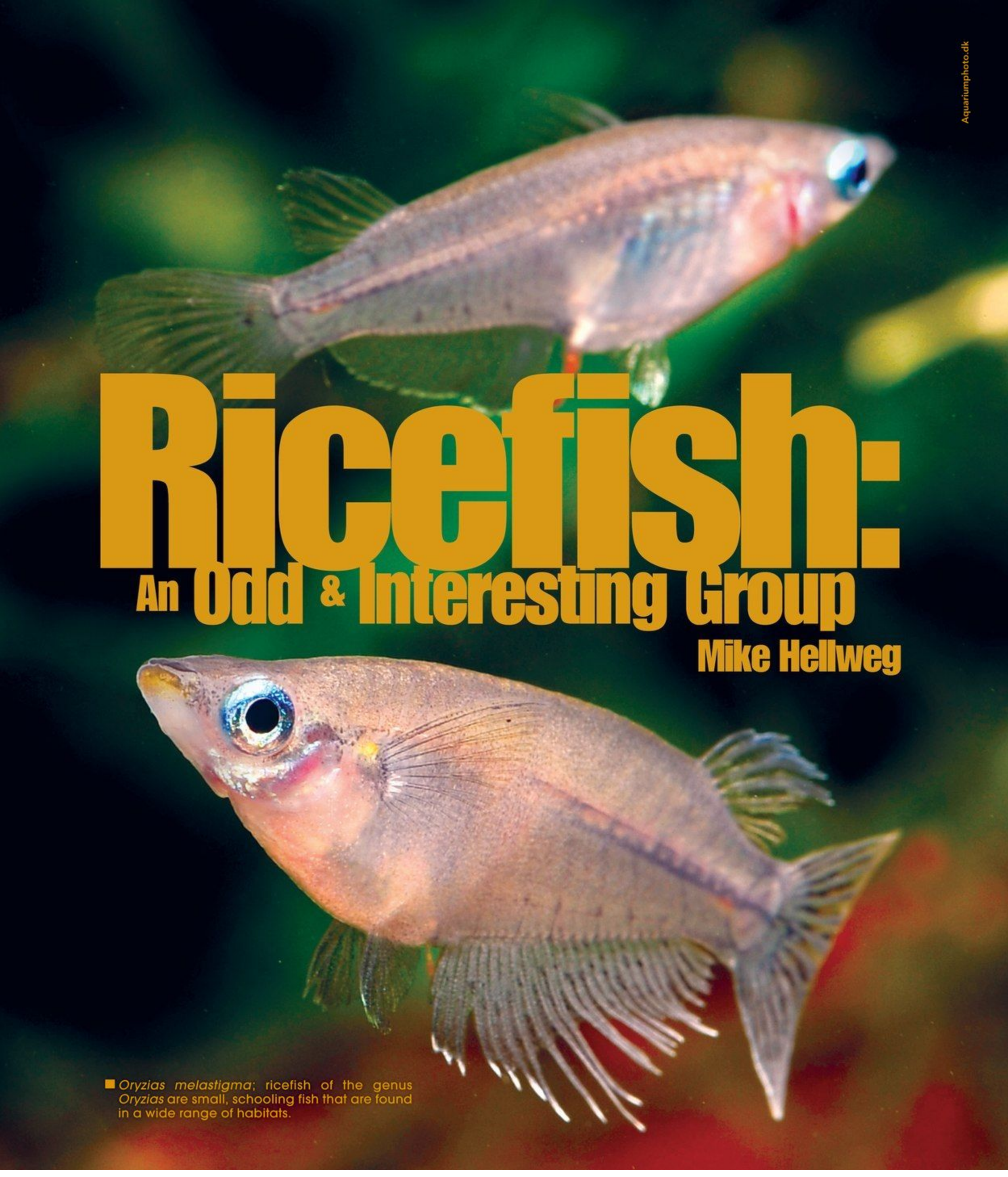

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Ricefish: An Odd & Interesting Group

Mike Hellweg

■ *Oryzias melastigma*; ricefish of the genus *Oryzias* are small, schooling fish that are found in a wide range of habitats.

I'm always amazed when I talk to someone who says that they're bored with the aquarium hobby. They've kept "all" kinds of fish and there's nothing new to keep. How far that is from the truth! Given the limited selection available locally to some people, one might overlook some really interesting fish. The group of fish we call ricefish falls into that category. They might be overlooked in a shop as small and plain looking, but when taken home and given a planted tank, their subtle beauty quickly becomes apparent. Then their behavior comes out and the fascination begins.

They are called ricefish because they are often found in the shallow flooded rice paddies throughout their range. This is an ideal habitat for many small species of fish—plenty of warm water, a lack of predators, lots of places to breed, and lots of food in the form of small insects and their larvae.

I'm sure many of you are familiar with the best-known ricefish, *O. latipes,* usually called the Medaka. Medakas probably originated in Japan, but are now found in Japan, China, and Korea. This is likely due to its popularity as a pet, which is recorded as far back as the late 17th century. It has been bred into a beautiful golden morph that is more commonly available today than the original creamy-white fish.

They are often used in scientific research and have even gone into space, where they have the distinction of being the first vertebrate to mate and produce healthy young in space. A group of them currently resides in an aquarium on the International Space Station. They are also at the forefront of genetic research, and a transgenic green, glowing variant is available to hobbyists in some countries. Along with the zebra danio (*Danio rerio*), *O. latipes* is likely the most widely studied vertebrate species in the world.

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■ The recently described neon ricefish (*O. woworae*) is one of the more attractive members of the genus.

Background

The genus *Oryzias* is an interesting and widespread group of just under three dozen species of small fish, ranging from India through Southeast Asia to Korea and across the sea to Japan and through the islands of the Philippines, Malaysia, and Indonesia. They are usually found in fresh water, though many species can be found in brackish and even marine environments—moving freely between them.

They are not closely related to killifish but are small, schooling fish that spend much of their time near the surface feeding on insects—filling the same niche as killies do in their respective habitats. This similarity has led many killie keepers to also seek out and work with the various species.

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■ Topping out at about an inch in length, Mekong ricefish (*O. mekongensis*) can do well in nano setups.

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■ The Javanese ricefish (*O. javanicus*); ricefish can thrive in room-temperature water.

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■ Generally speaking, ricefish are not picky about the pH of the water in their aquarium.

Most hobbyists seeing ricefish in a shop would dismiss them offhand as being too drab; in truth, they are anything but! And even the drabbest of species has stunning bright-blue eyes that can draw a viewer's attention from across the room. Many of the ricefish are very attractively patterned, and a few, such as the recently described neon ricefish (*O. woworae*), are downright spectacular.

All of the species are small with most topping out at less than 2 inches. Several, like the diminutive Mekong ricefish (*O. mekongensis*), are downright tiny at just about an inch or even less. The real giants of the genus seem to be concentrated on the island of Sulawesi, where there are several species that top 2 inches and one, the yellow-fin ricefish (*O. profundicola*), that reaches nearly 2½ inches.

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■ Plants, such as Java fern and Java moss, should be placed around the perimeter of the ricefish tank, leaving a large open area for swimming in front.

Aquarium Care

Since many species are found distributed over a wide area, often with wide expanses of saltwater in between their freshwater habitats, ricefish are very adaptable. For example the Medaka (*O. latipes*) is found in Japan, Korea, and China, although recent studies are suggesting that what was thought of as one species (*O. latipes*) may actually be a complex of several species. The Javanese ricefish (*O. javanicus*) is found from the island of Java all the way up to Thailand!

This is great for hobbyists, as they usually can adapt to local tap water with little more being done than removing the chlorine or chloramines. We can instead concentrate on doing large, regular water changes to keep the dissolved pollutants to a minimum. Many killie hobbyists keep them in smaller tanks with clumps of plants like Java moss or Java fern. Often they are kept without even having a filter in the tank!

As long as you feed live foods and do large, regular water changes, this isn't a problem. They will thrive and even breed when kept in pairs in tanks as small as one gallon. These smaller tanks make necessary care, like water changes, pretty easy. The biggest thing to remember in small tanks is to stock lightly and keep the water clean. It is hard to regulate temperature in small tanks, but fortunately, most species are not too picky when it comes to temperature, either. As long as you are comfortable in the room, it is likely they will be as well. Temperatures in the 70s seem to be ideal for most species.

One thing that is important to remember is that ricefish are excellent jumpers, so the tank has to be kept covered. If you want to use a small sponge filter in the tank for biological filtration and aeration, it is a good idea to drill a ¼-inch hole in the lid, if it is not equipped with a punch-out, and run the airline tubing through this hole. A glass top can be notched at one corner for the airline, and then any excess open space can be covered with packing tape.

They do well in small-fish community tanks, where they are model residents. Provide them with plants around the perimeter and a large open swimming area in the front. Most often they are found in areas where the current is slow to nonexistent, so they should be kept in tanks without strong filtration. A canister or sponge filter is ideal. In such a tank, a

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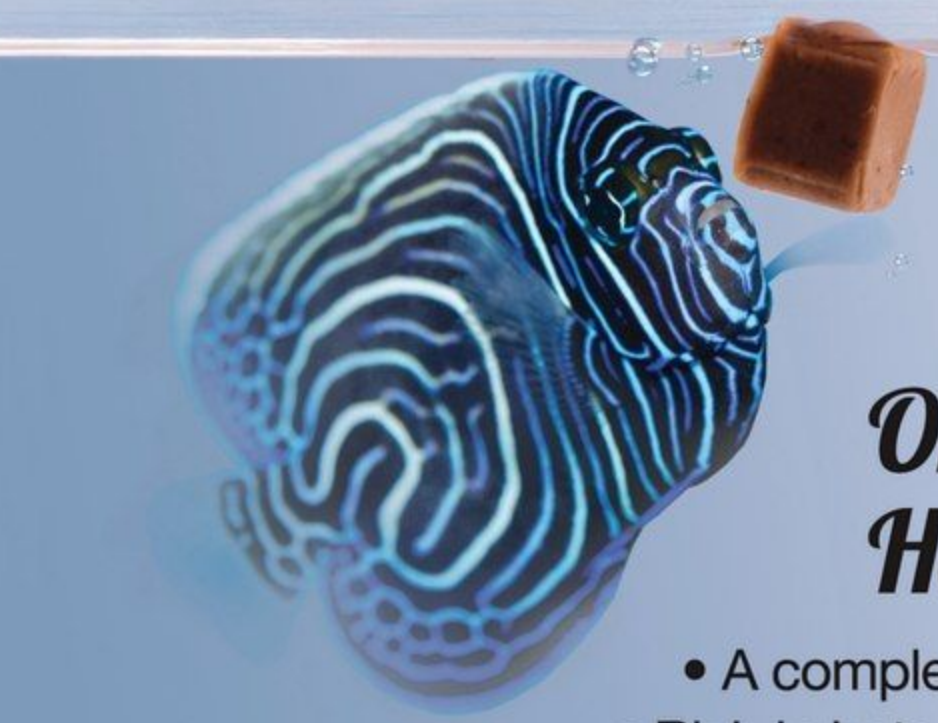

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■ Ricefish eggs have thin filaments that keep them clustered near the female's vent for a period of time before they get brushed off against plants or fall to the bottom.

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■ *Oryzias* spp. exhibit rapid growth and will be able to breed at about three months old.

group of a half dozen or more will spend most of their time schooling out front and center, watching for their next meal.

In the wild, ricefish are omnivores, consuming everything from biofilm to insects to fish eggs, whatever is edible and most prevalent in the area while they are feeding. Anecdotal reports from friends in Japan say that even wild fish will take flake food sprinkled on the water surface! Modern high-quality flake and pellet foods are a perfect diet for them in the aquarium. If you want to breed them, however, it is important to improve this diet just a bit by offering live foods, such as daphnia, newly hatched brine shrimp, fruit flies, and/or Grindal worms, for several days. Other live foods, if available, are greedily taken as well.

Breeding

Adults of most species are easy to sex. Females are generally a bit larger than the males. Males are generally a bit to a lot more colorful, depending on the species. In many species, the males have extensions on their anal fins, which can become spectacular. Females generally have a much fuller body, while that of the males is usually much more slender. A close look at the area right in front of the anal fin will reveal a small pointed bump in the males—this is the genital papilla. In females, this area is usually fairly flat with only a small, rounded protrusion. And many times, even in a community tank, females can be seen swimming around with clusters of eggs in the morning, which is one of the most interesting things about the ricefish.

Scientists are still studying their reproductive behavior, and in many species it is still unobserved. In those that have been described and observed, males have a single, pointed, tubular genital papilla and females have double, flattened, rounded, lobular papillae outside the urogenital pore. In addition, in some species the first couple rays of the anal fin are thickened and thought to be used in mating, though that has yet to be proven. In other species, males have small contact organs on the middle and back rays of the anal fin that are also used in mating.

Males fertilize the eggs internally in most, if not all, species of *Oryzias*.

Mating occurs almost daily for several months, then the fish rest for a few months before beginning again. The fertilized eggs develop inside the female for several days. Each day, she lays up to 20 eggs early in the morning. The eggs have thin filaments that keep the eggs clustered near the female's vent for a period of time, usually just a few hours, making her look as though she is swimming with a cluster of grapes attached. She swims through fine-leaved plants and the eggs brush off, attaching to the plants or falling to the bottom. From then on, she provides no care to the developing embryos. Depending on the species, the eggs hatch in a few days to as much as two weeks after being deposited on the plants.

In a few open-water species, such as *O. sarasinorum* and *O. eversi*, which are found in lakes and streams on Sulawesi, the female has extended pelvic fins that form a protective pouch in front of and around the developing eggs, and she actually carries the eggs until they hatch. This can be up to 18 or so days after they are laid. In these species, the female's body actually forms a notch behind the abdominal cavity and in front of the anal fin to help hold the eggs in place.

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■ Coming from slow-moving waters in the wild, *Oryzias* spp. do not require a strong current in their tank.

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■ One way to get ricefish to spawn is to isolate a pair in a small tank for approximately two weeks and provide them with live foods and regular water changes.

It's amazing to me that the eggs of the diminutive *O. mekongensis* and the relatively large *O. celebensis* are just about the same size! As more species are studied, it wouldn't be surprising to see more interesting reproductive habits appear in this group.

Well-fed adults rarely prey upon fry, but larger siblings might consider their younger siblings as a tasty morsel, so it's a good idea to separate fry with more than a week's difference in age. Fry are ready to feed upon hatching, and good first foods include items such as vinegar eels and microworms. The fry of many species will also take fine-powdered prepared fry diets. Growth is rapid, and they will be able to take newly hatched brine shrimp by the end of their first week. Many species are ready to spawn for the first time when they are barely three months old. Considering that they live for only a year or so in the wild, this is likely an adaptation to both a short lifespan and being near the bottom of the food chain. In our aquaria, where they live well-fed, sheltered lives, they can often live for two or three years and some of the larger species can live as long as five years.

How I Breed Them

I maintain my specimens in mixed-species tanks for most of the year. I feed them daily with a high-quality flake or floating micropellet food. Several times a week, I add some live foods to the tank—daphnia, newly hatched brine shrimp, various worms, flour beetles, etc. When I want to get a spawn, I move from one to several pairs to a 5- or 10-gallon tank. For the smaller species, a 3-gallon critter tank works just fine. Whatever sized tank you choose, remember the lid! I add several clumps of fine-leaved plants or a couple of spawning mops and feed the adults heavily with live foods. I usually add a small sponge filter to the tank, too, though this isn't strictly necessary, and sometimes I'll just add a gently bubbling airline to the tank. I change the water every other day by simply pouring about half of it out through the slots in the lid and refilling. I feed live foods like daphnia and several types of small worms two or three times a day. After two weeks, I move the adults back to the main tank.

Over the next several days, the eggs will begin to hatch. The tiny fry will be found right at the surface. The fry need to be fed right from the start. I leave daphnia in the tank all the time, and the fry can eat the daphnia nauplii as they are born as a supplemental food. They can be fed vinegar eels and microworms right from the start as well. As I mentioned earlier, they grow quickly and can take newly hatched brine shrimp by the end of their first week. The fry grow fairly quickly, and after two or three weeks, they can be over ⅜ inch long. At this time, I move them to a 10-gallon tank for growing out. I don't net fry. I slowly pour them from the hatching tank to this new tank. I always add a few small ramshorn snails to the tank at this point to help clean up any excess food. I don't keep snails in the spawning tank, as they can eat the eggs. For the next couple of weeks, I do water changes every other day.

A good two-weeks' spawn from three pairs can produce several hundred fry, so it is a good idea to keep moving them to larger tanks as they grow. After a few more weeks, they'll be nearly ½ inch long, and then I move them to a 30-gallon breeder in my fishroom, where they will stay until they are ready to head out on their own. Surprisingly, for what some folks consider bland fish, they are almost always in demand and I have no trouble finding new homes for them. Of course, I only raise a few dozen to a hundred or so of any given species, so I'm not flooding the market. One could theoretically raise thousands, but finding homes for so many would not be very practical. It's much better to enjoy these fascinating fish, breeding just enough to keep the population going and maybe make enough to cover their maintenance and care.

A Pretty Little Fish

Though often passed over, once you stop and take a closer look, the members of the fascinating group of fish known as the ricefish make interesting additions to our aquarium hobby. A school of them in a community tank will draw the eye of even the most jaded viewer. Add in their ease of care, model behavior, and fascinating methods of reproduction, and you have a winning group of fish for the aquarium hobby. The next time you're in your local independent fish store looking for something new and different, don't look any further than the fascinating ricefish. You'll be glad you brought them home.

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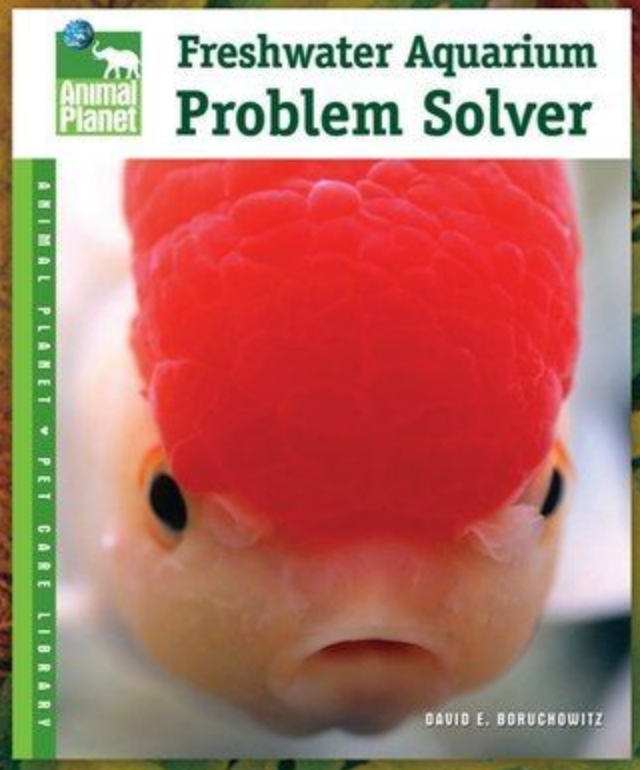

Freshwater Aquarium Problem Solver

Chapter 7

Equipment Problems Solved!

David E. Boruchowitz

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Much of the equipment in your aquarium can be considered the life support system for your fish, and problems with it can be very serious.

My Pump Won't Pump!

Most aquarium systems rely on an air pump, a water pump, or both. These are used both for filtration and for water movement and aeration. When they cease to function, conditions in the aquarium can deteriorate rapidly. It is a good idea to have a spare on hand, but let's look at the various problems that may cause a pump to fail.

Ah! Vibration!

Although piston air pumps were once popular, they have been replaced by modern vibrator pumps. As you can tell from their name, these pumps have a vibrating motor that is the mechanism that pumps the air.

Many of the problems with vibration noises are caused by imbalance. Usually this is from the pump being on a non-level surface, or being in touch with a rigid or unstable object. In the first case, the pump itself vibrates erratically, producing the noise; and in the second, the object touching the pump resonates with the pump's vibration, producing noise. Obviously, both situations are corrected by placing the pump on a solid, level surface. The use of a foam or other non-rigid pad under the pump will prevent its vibration from being transferred to the table or shelf on which it sits.

The other cause of vibration noise is from the pump producing more air than the system to which it is connected can handle. This causes back pressure, which, besides being noisy, reduces the life of the pump. There are two ways to handle this, the first being to increase the outlets. If you have nowhere else to use the air, you can open a valve at the end of the line, bleeding off enough of the surplus to quiet the pump. If your pump has an adjustable air output, you can also turn it down until the noise stops.

No Air!

You may find that your air pump is still vibrating away, but there is very little air coming out. First confirm that the pump is the problem by removing the airline and checking to see if air is pumping out from the unit itself. If it is, the problem is farther down the line.

In hard water, a buildup of scale (lime) can completely block the end of an airline that is underwater. The solution for that is to snip off the blockage and reattach the line at the clean cut.

If the problem is diminished output, it is likely that the pump's diaphragm(s) need replacing. The rubber diaphragms can wear out or tear. In either case, the bellows-like effect is impeded. You can purchase repair kits for most models that will quickly and easily restore the pump to its original output, and it is a wise move to have a kit in reserve.

If an airpump with two outlets has not been in use long enough to justify worn out diaphragms, you may have an imbalance between the outlets, which causes the diaphragms to wear prematurely. The proper way to hook these pumps up is to attach a short piece of tubing to each outlet, then attach both of them to a tee (a small plastic or brass fitting that allows one airline to be split into two). Then attach the tubing that feeds your various devices to the third leg of the tee. In such a setup, there is an even backpressure on each diaphragm, and they wear evenly.

Water Pump Problems

Water pumps, sometimes also known as powerheads, are not usually part of a first aquarium setup, but you may very well be using one or more of them in your tank. These submersible water pumps are quite reliable, but problems can develop.

Loud sucking or gurgling noises are typical when the powerhead's intake is at the surface. Restoring the water level should fix the problem quickly. Occasionally air becomes trapped inside the powerhead. Simply tip the pump from side to side while

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■ Airstones provide much-needed oxygen to your fishes—not by way of the bubbles but rather by way of the surface movement the bubbles produce.

Airstones Are Not Forever

Even if you have an air filter in your supply line, an airstone will eventually become clogged with minute particles of dirt that get wedged in the pores, decreasing the output of bubbles—and increasing the strain on your air pump. Fortunately, airstones are cheap. When they slow down, toss them out and replace with new ones.

■ Canister filters are very powerful and efficient.

completely underwater, and the air will bubble out.

My Filter Won't Work!

Each filter design creates its own opportunities for problems, but these all fall into general categories.

Failure to Start

The most common cause of starting problems is the loss of a prime. Almost all hang-on filters operate by suctioning water up from the tank and pumping it through the filter; it then returns to the tank by gravity. The standard outside filter needs to be primed—filled with water—in order for the pump to be able to pull water up from the tank.

Having the water too low on either side of the siphon will cause the prime to break, and the pump will labor in vain to pull water into the filter from the aquarium. Thus, if the water level falls too low in the tank, or if there is insufficient water in the filter compartments, the prime will be lost.

Keep in mind that the pump can maintain a prime under conditions in which it cannot establish a prime. That is, as long as water does not stop flowing, the filter will continue operating even with reduced water levels in the aquarium. If the water flow is broken however, as by a power loss, the pump may not be able to restart when power is restored. Sometimes replacing the water in the filter itself is sufficient, but with really low water levels, you'll need to refill the aquarium, too. Of course, it's never a good idea to let the water level drop that much in the first place.

Clogged Media

For maximum efficiency, filters are designed not to allow channeling, which is when the water finds a path of least resistance through the medium, bypassing it and exiting the unit largely unfiltered. This means, however, that if the medium becomes so saturated with dirt that the water flow through the medium is

Different Circuits

Plug your aquarium's equipment into plugs serviced by different circuit breakers, if possible. That way, if one circuit trips, you won't lose all the life support.

Don't Inhale!

Sucking on the far end of a siphon tube is a colorful way of starting water flowing out of your aquarium, but it's not necessary. If you are using a short hose, simply put the whole thing into the tank and maneuver it until all the air is out. Then plug one end with your thumb and put it into the bucket while leaving the other end in the tank, under the water's surface. Now simply release your thumb, and the siphon starts. With a longer hose, put the gravel tube underwater, then lift it up so the water it contains drains into the hose. A couple of tries will usually start the siphon successfully.

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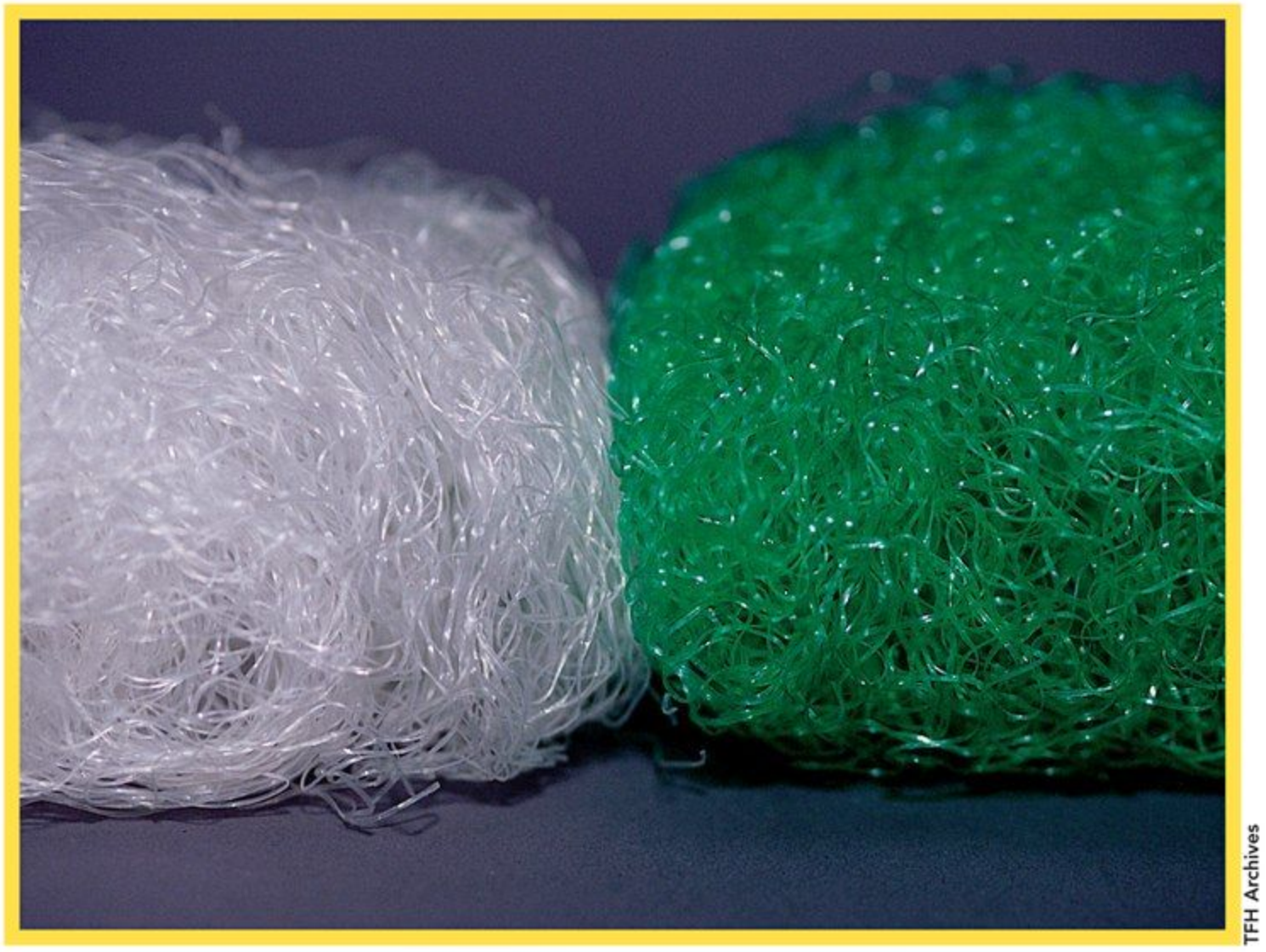

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■ Filter floss comes in many densities and types.

impaired, the water flow through the filter will decrease.

Some filter designs have a back channel through which the water is diverted in such a case, alerting the aquarist to the problem, and others have meters built in that indicate when the flow is inadequate. With any filter, however, you can notice when the return flow has decreased. The solution, of course, is to clean or replace the filter media, restoring unimpeded flow and normal output.

It is important to operate the filter the way in which the manufacturer describes in order to avoid a more serious case of clogged media. For example, mechanical filtration properly takes place first, trapping suspended debris before the water arrives at the biofiltration medium. Since micropores are the heart of a biofilter, if you do not have the proper mechanical filter medium in place ahead of the biomedium, the latter will quickly get clogged with dirt.

Aside from a rapid decline in the water flow through the filter, this may result in the destruction of the biomedium. Foam, ceramic, and carbon media can be very difficult to clean when they are plugged with particles of debris, and they may need to be replaced. This means, of course, that you may have to recycle the tank, since you are removing the biofilter.

Plugged Holes

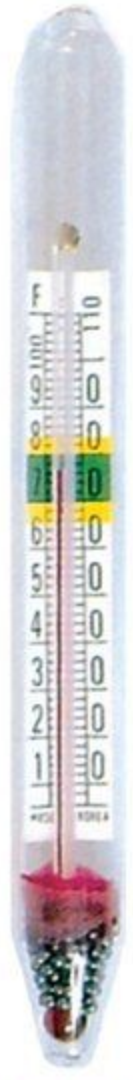
Many filters, especially those with biowheels or spraybar returns, rely on water spraying from a series of holes along a tube. The design places these holes after the filtration media, so they cannot usually be plugged by dirt. They can, however, get clogged by algae or with calcium deposits left behind when hard water evaporates.

The solution is usually as easy as taking a toothpick and clearing the holes so that they all permit normal water flow. In cases in which the white crust is particularly thick and hard, soaking the tube in a small dish of vinegar for a half hour or so will loosen the scale so you can clean it off.

Impeller Problems

The impeller is the heart of a power filter. It normally sits at the base of the siphon uptake tube that conducts water out of the tank; it sucks water up from the tank and pushes it out into the media. If it is not operating properly, water will not flow properly through the filter.

The instructions that came with your filter will describe how to remove and clean the impeller. A very common problem that slows down an impeller is fibrous material getting wrapped around it. Usually this is hair algae or some other plant material. In the same way that tall weeds can get wrapped around a mower blade or tiller tines, this material is wound around the impeller. You may need to use a small pointed tool to remove it if it is wrapped too tightly to pull off.



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■ Thermometers are important tools that allow you to gauge how your heater is working.

You may be surprised at what you find when you open up a filter with impeller problems. If you do not have an adequate strainer on the uptake tube, a dead fish, chunk of plant, or some foreign object like a rubber band may have gotten sucked into the filter and jammed around the impeller. Live fish have been known to swim up the tube and meet their demise in the whirling impeller.

The impeller is the only moving part in many filters, and after whirring away 24-7, it can become worn or broken over time. In this case replacing it with a new one can greatly rejuvenate the filter.

Almost all filter impellers are magnetic driven; a magnet attached to the impeller spins in a well in the plastic filter body, a socket surrounded by the magnetic drive motor. This magnet and the hole into which it fits may get clogged with dirt, which will also impede the operation of the impeller.

Why Is the Filter So Noisy?

Most modern aquarium filters are virtually noiseless in operation. Usually the trickle of water is louder than any humming or buzz from the filter motor. If a filter loses its prime, it may make a chugging or gurgling sound, which is good, since it alerts you to reprime it.

A rattling sound usually indicates an impeller problem, with the rattle being caused by the magnet spinning irregularly, hitting the sides of the well in which it sits. Checking and cleaning or replacing the impeller will often solve this.

Sometimes people object to the sound of the water returning to the aquarium. Often just raising the water level in the aquarium slightly so the water will not

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■ Cabinet stands allow the hobbyist to conceal the aquarium's equipment.

fall so far will solve the problem. If not, you can adjust the water flow to eliminate the noise; almost all filters have a means of regulating the volume of the flow, the angle of the flow, or both.

My Heater's Stuck!

A heater is crucial to most aquarium setups, so crucial that many aquarists throw out the heaters and replace them with a new one(s) each a year. Typically these are people who have had a disaster due to a broken heater. Heaters can certainly operate for many years, but if they malfunction, they can cook your fish.

Broken Glass

Many heaters have their components sealed in a glass tube. A hard blow can break the glass, shorting out the heater.

Beating the Weather

If your aquarium becomes too hot due to summer weather, replace the solid top with a screen one and position a fan to blow over the water. This increases evaporation, which can lower the water temperature.

Aquarists very commonly forget to unplug the heater when doing a water change. The high-and-dry heater becomes very hot, and when the tank is refilled, the cool water cracks the glass. This usually does not present a problem for the fish, but if you stick your hand into the tank, you can get quite a shock, since you provide a ground for the current.

Heaters with unbreakable stainless steel or titanium tubes are becoming more popular, and some models have sensors that turn off the heating element when the heater is removed from the water. Ask your favorite pet retailer to show you the different models that are available.

Thermostat Problems

When a heater's indicator light stays on but it does not produce heat, obviously the device is broken and needs to be replaced, as it does when it sticks in the on position

and just keeps pumping out heat no matter how low you adjust the setting. It is always a good idea to have a spare heater on hand for such situations.

Another approach is to divide the total wattage between two or more heaters; if you need 150 watts to heat the tank, use two 75-watt heaters, for example. This protects against both extremes. If the heater sticks on, the functioning unit will stay off if the water overheats, making the rise in temperature slower. In the event that one heater fails completely, the other one will keep the temperature from becoming dangerously low.

Hey, I Got a Shock!

Unlike water and oil, water and electricity do mix—but with potentially lethal consequences! If you receive a shock when you touch a piece of equipment or stick your hand into the water, this is a very serious matter, and you should unplug all electrical devices until you have discovered and remedied the problem. Much better still is to prevent such problems in the first place by using the correct setup. Whenever water and electricity are known to be in proximity (kitchens, bathrooms, swimming pools, etc.) special protection is required by law. You should feel a similar urgency about protecting your aquarium installation.

We've already mentioned the possibility of an aquarium becoming electrically charged by a broken heater, making touching the water much like sticking your finger into an electrical outlet. Many other hazards also exist, both from equipment failure and from human intervention, such as dropping the aquarium light into the water. Let's look at several important things you can do to protect yourself, your family, and your aquarium.

GF(C)I Devices

Anything electric connected to your aquarium must be plugged into a GF(C)I device. That stands for Ground Fault (Circuit) Interrupting, and it can mean the difference between life and death. Regular circuit breakers only monitor the total flow of electricity; if it exceeds the specified amperage, the breaker trips, cutting off the electricity. A GFI breaker also monitors the difference between the hot and ground sides of the circuit. If the flow through the hot side is greater than the return flow to ground (meaning there is a ground fault, a flow of electricity from the power supply to something other than the proper return to ground), it trips.

Thus, in the event that an electrical device becomes charged, the interrupter will trip the circuit as soon as a ground is completed. So, if a broken heater charges your aquarium water with 120 volts, when you stick in your finger, giving all that electricity a way out to ground through the soles of your feet, a GF(C)I device will trip, and you'll stay standing.

There are different ways to get GF(C)I protection:

- A GF(C)I circuit breaker installed for each circuit into which your aquarium devices will be plugged. The circuit breaker affords protection for all outlets on its circuit throughout the house.
- A GF(C)I outlet installed in every box into which your aquarium devices will be plugged. An electrician can replace any duplex outlet with a GF(C)I duplex. This will protect anything plugged into its two outlets.
- A GF(C)I power strip into which all your aquarium devices will be plugged. Anything plugged into the strip is protected. Note that regular power strips or surge protectors are not ground fault protected. You must use one that is specifically rated as GF(C)I.

Air Pump Positioning

When an air pump is placed below the water level of the aquarium, in the event of a power failure, water will siphon back up the airline and drain into the pump. When the power comes back on, this can cause a shock hazard. There are two ways of preventing this: use a check valve, or place the air pump on a shelf higher than the water level. A check valve allows movement in one direction but not the other; thus, air can leave the pump and enter the tank, but water cannot siphon back down the tubing from the tank.

Kid Watch: Hands Off!

Small children must be made to understand from the start that they cannot touch the aquarium's equipment. Cuts, burns, and electric shocks are among the dangers to your child, and your fish could easily be killed by unauthorized manipulation of the equipment.

Drip Loops

There are many ways in which water that should be in the aquarium can find its way out of the tank. One that may not be noticed is the condensing of fine water spray on some surface above the water level. This water can then drip down wires that are hanging from lighting or other equipment. As it follows the wire, it can find its way into the outlet into which the wire is plugged. A simple drip loop prevents this from happening.

Arrange the cords so that they make a U-shaped loop before they are plugged into the wall outlet. This places the lowest point below the outlet, and any water sliding down the cord will drip off at the lowest point, preventing it from reaching the outlet.

The wire can be secured with clamps, special staples, or heavy tape.

Secure Equipment

All equipment must be securely attached to the aquarium. Do not use makeshift installations. Specifically:

- Never place an aquarium on or above an electrical appliance like a stereo or a television. Even routine maintenance could send water into the appliance.
- Always unplug a piece of aquarium equipment before moving it—you might slip and drop it into the water.
- Use only appropriate covers and light fixtures that sit securely and completely on the top frame of the aquarium without wobbling.
- If using a hang-on heater, make sure the clamp is screwed tightly to the tank frame so the heater cannot fall into the tank.
- Make certain that water pumps (pumps, powerheads, power filters) are not allowed to run dry; they can burn out their seals and perhaps start a fire.

Excerpted from the Freshwater Aquarium Problem Solver *ISBN 0-7938-3761-8.*

THE BEST THING TO HAPPEN TO AQUARIUMS SINCE WATER

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Sawbwa resplendens / photo by Takashi Amano

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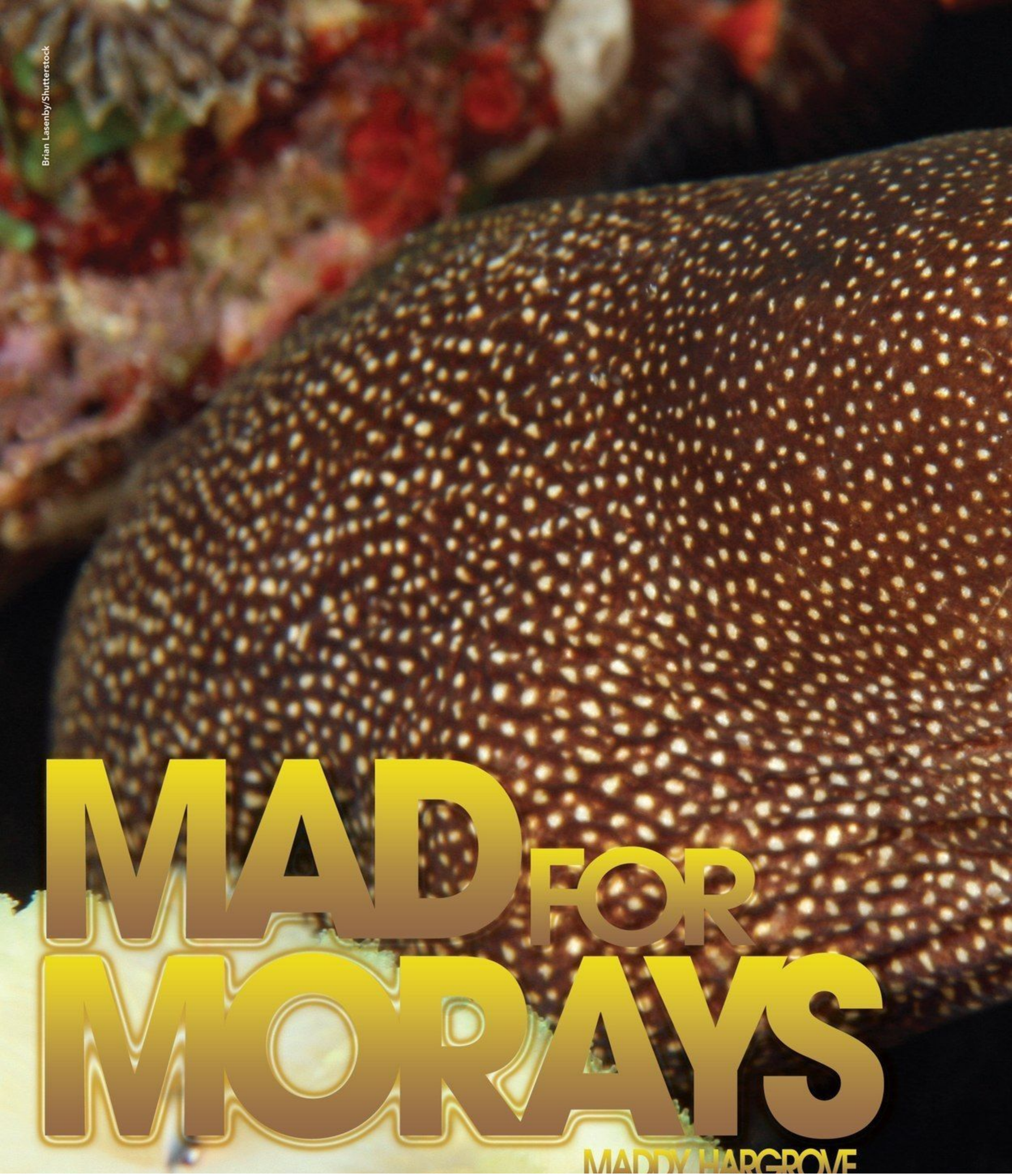

Have you ever wandered aimlessly through a well-stocked aquarium store and then suddenly stopped dead in your tracks, eyes bulging, mouth hanging open in awe when you spotted a particularly stunning aquatic creature? Maybe it was a golden-colored pineapplefish or a stunning Spanish dancer that caught your eye. Or maybe you happened to wander by a dealer's tank that contained a simple guppy with unusually bright color. For me, it happened when I saw a moray.

The Madness Begins

Actually it was a snowflake moray eel in a dealer's shop. Instantly, I was hooked, but restrained myself from purchasing the eel until I researched it further. A year later, my new aquatic obsession became even more intense while I was scuba diving in the Pacific Ocean and had an unplanned encounter with the wolf eel (*Anarrhichthys ocellatus*), which is not a moray or even an eel, though it appears to be.

I was diving through the thick kelp forests when I noticed a large gathering of wolf eels that were near a rock structure. I think I beat the world's swimming record on my way over to view the eels, despite the fact I was wearing full gear and carrying a bulky underwater light. As I stared in amazement at the horde of eels, I noticed that they were casually slithering in and out of a catacomb of holes in the rock. I floated inches from these creatures, mesmerized, while my panicked dive guide was searching frantically through the kelp forests for this AWOL customer. By the time he finally located me, it was too late. Eel madness had begun.

Never before had I become so enthralled with a marine creature so quickly! (Ok well maybe a couple of times.) Anyway, I quickly began to mentally calculate how large of an aquarium I would have to purchase and how many pieces of furniture I would have to sell in order to squeeze a few eels into my house.

I am not sure who began to run out of air first, my frustrated dive guide or myself. I almost managed to escape his grasp as he slowly dragged me away from the eels and toward the surface. His candid suggestion that our next tour dive take place in the safety of his children's backyard kiddy pool did not go over very well, but always ready to compromise, I agreed to take a tour of the Monterey Bay Aquarium.

■ Golden moray eel (*Gymnothorax miliaris*).

Rich Carey/Shutterstock

■ Snowflake moray (*Echidna nebulosa*); morays swim in a serpentine manner and have greatly reduced fins.

Shortly after entering the aquarium, I managed to ditch my guide, who was casually explaining the growth cycle of kelp, and headed toward the upper floor. By chance, I wandered over to a moray eel display where I noticed several varieties swimming happily in a bunch of built-up rocks. An amazing-looking snowflake moray (*Echidna nebulosa*) peeked right at me. Once again, I was enthralled.

I decided to visit a wholesale fish outlet after setting up an aquarium to house a snowflake moray. It was a wonderful adventure, indeed, as I browsed excitedly through the building like a customer who had just won a 10-minute shopping spree. I spotted a very large tank that, to my delight, contained a wide variety of moray eels that were separated by glass partitions. I wanted to take them all, but finally I settled on one beautiful snowflake moray that went on to find a very happy new home in my apartment.

History

There are about 600 species of true eels in the order Anguilliformes, including conger eels, pike eels, gulpers, morays, and many others. In addition, there are many other fishes that are commonly called eels because of their body shape. Eels have been around for a very long time. Skeletons of morays have been unearthed in Pleistocene deposits that have been dated at two million years old. Ancient mariners passed down accounts of giant eel-like creatures, but these stories may actually be attributed to the unrelated deepwater oarfish (*Regalecus glesne*), which can reach lengths of 35 feet. During Roman and Greek periods, owning a pond of morays was considered a symbol of wealth and great power. It is said that Nero threw slaves into moray ponds to amuse his bored aristocratic friends.

Body Plan

The moray eel's gill-cover bones are reduced, so the bellows action and volume of the gill cavity are limited. The mouth and gills are relatively far apart. When an eel breathes, it forces water toward the gills with a swallowing action. This breathing form may be an environmental adaptation to their habit of wedging themselves into small coral holes. The snake-like form, scale-less skin, and lack of pelvic fins are other adaptations to cavity dwelling.

Morays move in a serpentine manner, with waves of contraction creating thrust to propel them forward. There are a large number of vertebrae in the back for flexibility. Their unearned reputation as threatening comes largely from the fact that they must open and close their mouths continually in order to pass water through their gills to obtain oxygen, which does make them look menacing.

Another interesting physical trait of some morays is the short tubes that can be located on either side of the upper lip. These sense organs are used for smell. They are very practical considering morays are nocturnal feeders. Some leaf-nosed and bearded morays also have barbels located near the jaw, which are employed as organs of touch. Although they have an outstanding sense of smell, moray eels have poor eyesight. It's wise to avoid feeding them by hand because they can easily mistake your fingers for dinner! As with any toothy predator, feeding tongs are recommended.

Aquarium Conditions

As far as habitat is concerned, morays love to live in caves and rock openings. Hiding places and low lighting are essential because

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■ Common morays (*Muraena helena*) are among the species that are regularly available in the trade.

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these beautiful eels are nocturnal, shy by nature, and have eyes that are sensitive to light. They often feed on sleeping fishes on the reef. Any fish kept with your moray must be too large to fit in its mouth, unless you want to lose it.

To make your eel feel right at home, you can build niches for it using live rock in a tank that is at least 55 gallons for the smallest species. The larger the eel, the larger the aquarium must be. Take several large pieces of rock and stack them against the glass toward one corner of the tank. If you are going to house more than one moray in a tank, make sure the aquarium is large enough and that each eel has its own private quarters to avoid conflict.

The water temperature in the tank should remain between 75° and 82°F and the specific gravity between 1.020 and 1.026. Eels tend to be very forgiving of water conditions and are disease resistant. But remember, as responsible hobbyists, we should always strive to maintain the best environment for them that we possibly can. Always use a good filter system, including skimming, with eels because they produce a lot of waste.

Make sure that the tank you have is well covered. Eels are generally bottom-swimmers, but are masters when it comes to escaping from the top of their captive environment. Even the smallest hole in an aquarium hood will provide them with the incentive to pull a Houdini. I remember one morning when my own moray managed to slip out of the tank through a small hole in the hood. Fortunately it had only very recently escaped, and I found it happily slithering across the kitchen floor. (I think that was the same day my roommate moved out.)

Feeding

Providing a diet for morays in the home aquarium is not much of a problem at all. Morays greedily devour frozen shrimp, mussels, clams, abalone, lobster, and fresh fish. Feed once or twice a week during the evening hours. Feeding is never really a chore, as they seem to readily accept any type of food.

Food is swallowed whole by morays and may take several days to digest. This digestion delay is similar to the physiology found in most sharks. A single eel can hold up to 10 percent of its own body weight in food for several days because of its elastic stomach.

Hobbyists need to remember that morays have very sharp teeth and can inflict a painful bite. The bite of a moray often becomes infected. Always use caution when handling them.

Ethan Daniels/Shutterstock

One of the hardier morays, the snowflake moray is one of the best aquarium candidates because it is readily available and grows to a relatively small size.

Hand Feeding—Literally!

An incident in 2005 in Thailand illustrates both the willingness of morays to eat just about anything and the dangers of hand feeding these smell-oriented predators. A diver fed a moray sausages to entice it out of its den. He then began teasing the fish with a sausage wrapped in a plastic bag. The animal kept nosing against the diver, trying to locate the food it could smell. It clamped down on the man's thumb, severing it, swallowing it, and swimming away. The whole incident was captured on video and has made the rounds on the Internet with descriptions of varying degrees of accuracy.

Types of Eels

There are several hundred interesting types of eels in the world besides the morays, and a few are worth briefly mentioning due to their interesting lifestyles. Freshwater eels (family Anguillidae) live in rivers and migrate to the ocean for spawning at sexual maturity.

One deep-sea eel (*Simenchelys parasitica*) attaches onto its host and chews pieces of flesh from its prey.

The American eel and European eel (*Anguilla rostrata* and *A. anguilla*, respectively) begin their lives in the Sargasso Sea. Spawning occurs at great depths, and then the parents die shortly after. The eggs hatch into larvae, drifting and feeding on plankton for up to two years. The American eels eventually arrive in America and the European eels in Europe, where they enter the river systems, morph into glass eels, and grow to adulthood.

Several varieties of marine morays are readily available through wholesalers and retailers throughout the world. Among these species are the common moray (*Muraena helena*) and the beautiful snowflake moray (*Echidna nebulosa*).

The snowflake is probably the most popular eel and is a good one to start with when you decide that you want to purchase a moray. They are easy to obtain at fish shops and very hardy. The snowflake has yellow eyes and a white body with rows of black blotches. This species grows up to 36 inches. They have a really amazing expression that is truly captivating.

Do not keep your snowflake moray with any type of crustacean, such as lobsters, crabs, or shrimp, because they are part of their natural diet and will be eaten. They will generally not bother other invertebrates, such as urchins, starfish, corals, and anemones. As far as other tankmates are concerned, you need to keep your snowflake with larger fish that cannot be swallowed and eaten. Mine peacefully existed with a puffer and several large clownfish. Other good tankmates include triggerfish, wrasses, tangs, and lionfish.

Life with a Moray

I have to admit that my aquarium-keeping life was always better with a moray. It was a real joy for me to interact closely with my own snowflake. This is not something you can do with most types of fish. Morays give you the opportunity to really become friends with one of your aquatic pets and to develop a bond like you would with your favorite canine.

If you ever have the opportunity to own a moray, jump right in! You will never regret the time that you share with this wonderful and precious animal.

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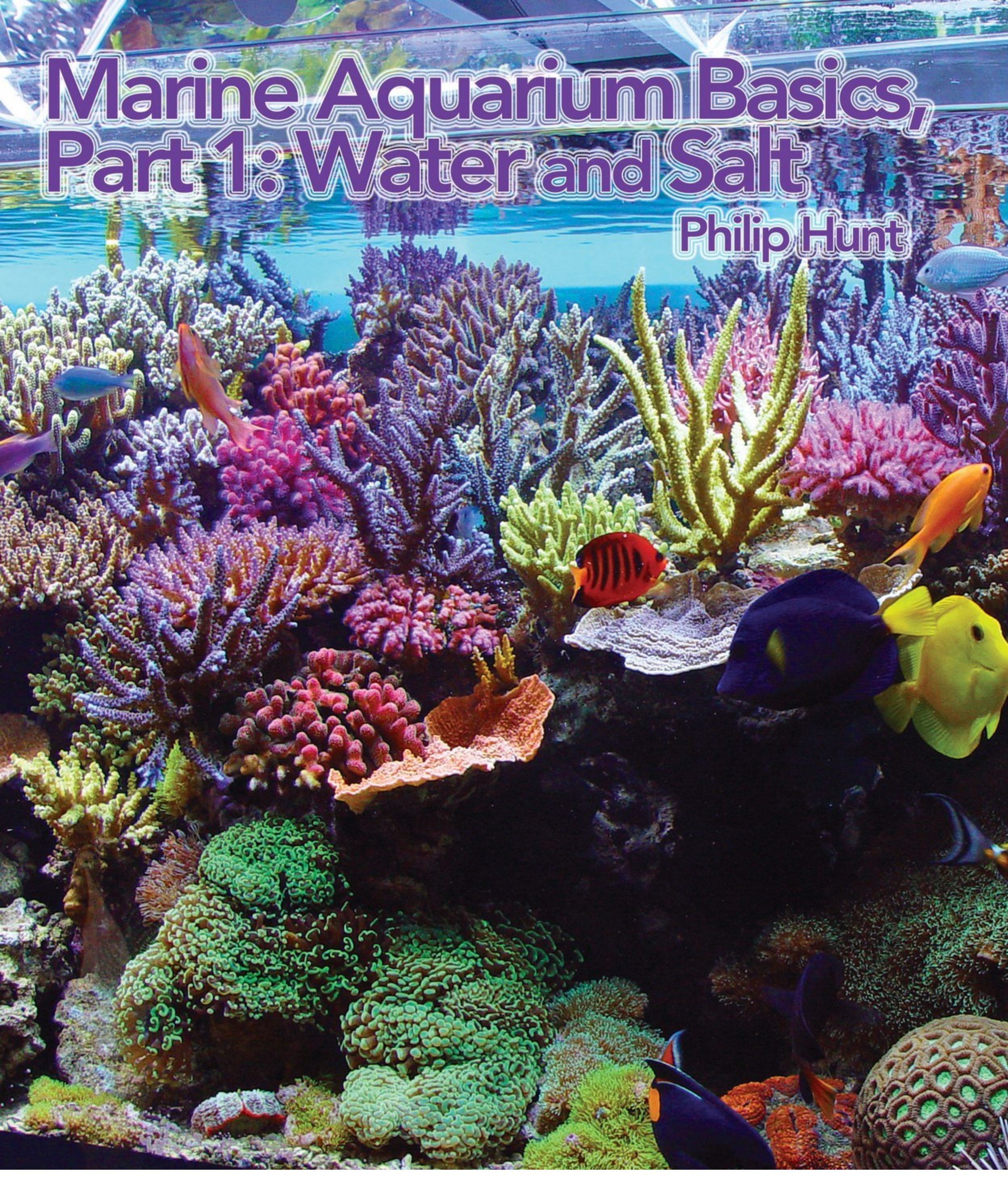
Marine Aquarium Basics, Part 1: Water and Salt

Philip Hunt



■ Without clean salt water that is made up properly, a reef aquarium will never thrive.

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In this series of articles, we'll be going back to the basics of marine fishkeeping, providing the kind of information that anyone starting out in the hobby will find useful and that will also provide a reminder for more experienced enthusiasts. This month, we'll start with water and salt—the most basic elements of the marine aquarium. Together these make up the artificial sea water that most marine fishkeepers use to fill their aquariums. While some fishkeepers collect water from the ocean and others buy ready-mixed artificial sea water, mixing a commercial salt mix with fresh water is the norm, so that is the focus of this article.

Water: 96.5% of the Issue

In natural sea water, the total salt content is about 35 parts per thousand, or 3.5 percent, which means that 96.5 percent of sea water is water. From this simple statistic, it's easy to see just how important it is to have water of high quality for the aquarium. But what does high quality mean in this context? Surely the water in your domestic supply is high quality if it's good enough to drink, right?

Reference to natural sea water around coral reefs provides the answer: The water in such areas has extremely low levels of dissolved plant nutrients, such as nitrates and phosphates, and the inhabitants of coral reefs have evolved to live under such conditions. To some of these organisms—most importantly, from the aquarium perspective, corals and their relatives—these nutrients are deleterious. In addition, as might be expected, high levels of plant nutrients will encourage vigorous algae growth, especially in the brightly lit environment of a reef aquarium.

Domestic water supplies often contain significant levels of nitrates and phosphates. This is the result of a number of processes, the most important of which is probably agricultural use of fertilizers that eventually find their way into the water supply. At the levels usually seen, these don't appear to have adverse effects on human health. However, if your water supply does have significant levels of nitrates and phosphates, it's not a good idea to use it to make up artificial seawater: the result would be water with maybe 500 times more nitrate in it than your corals would like. Some method of purifying the water is needed to remove harmful dissolved substances so that when a salt mix is added, the result is something close to the water around a coral reef.

Cleaning It Up

Three main water-purification methods are used for aquariums: reverse osmosis, deionization, and ion exchange.

Reverse-osmosis (R/O) systems work by forcing water under pressure through a membrane that acts as a kind of molecular filter: Small molecules, such as those of water, pass through the membrane, but larger molecules, including nitrate and phosphate ions, are held back. The process produces very pure water but is not particularly efficient in terms of water use—in small systems, 90 percent of the water entering the unit is discharged as waste, with only 10 percent emerging in purified form. Domestic R/O units typically produce somewhere between 20 and 150 gallons per day.

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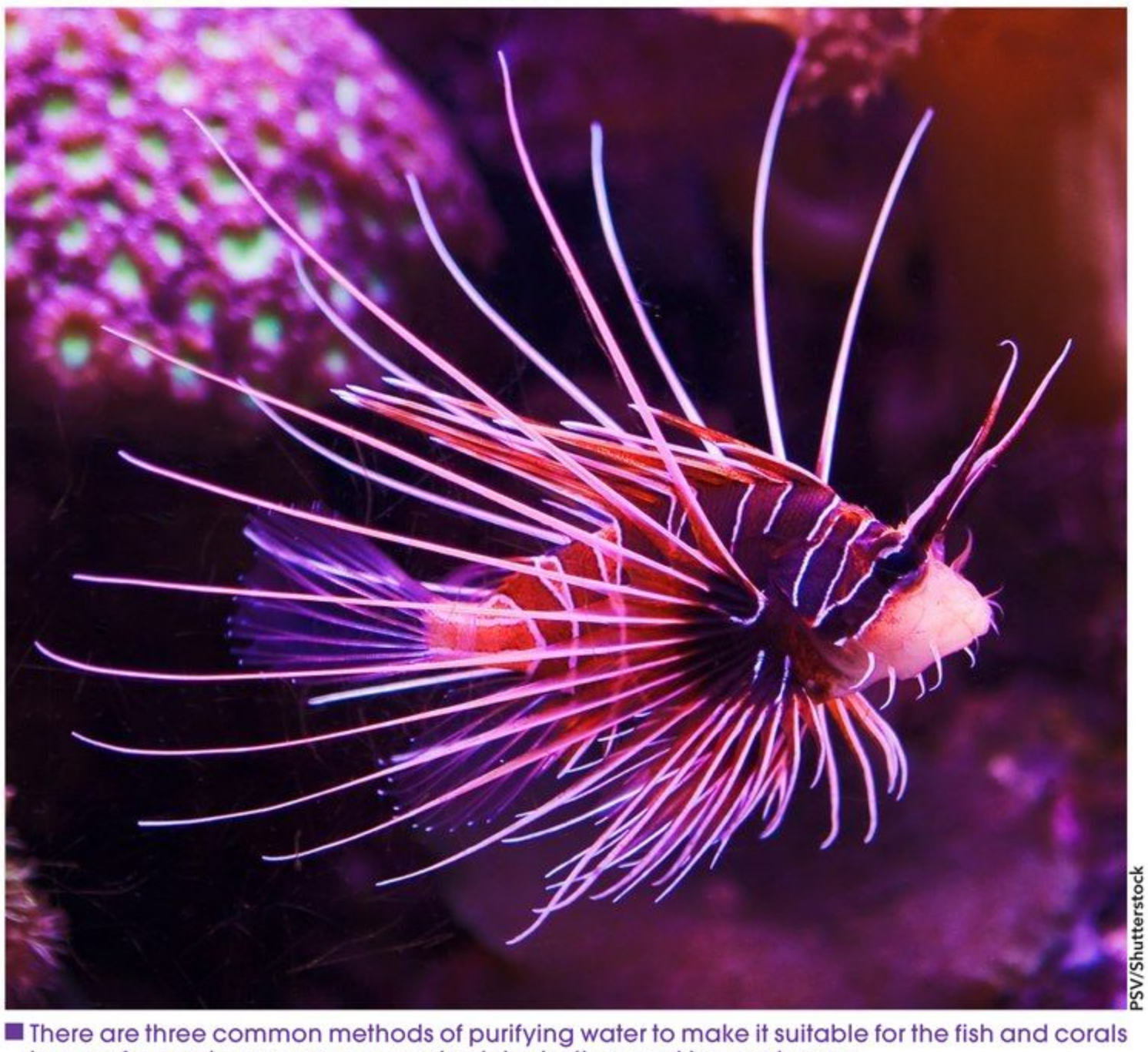
■ Corals are particularly sensitive to the buildup of nitrate and phosphate in their water, as those pollutants are very rare on a wild reef.



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■ There are three common methods of purifying water to make it suitable for the fish and corals in a reef aquarium: reverse osmosis, deionization, and ion exchange.

Deionizers work by binding charged particles (ions) onto a special resin. Deionizers generally consist of a column packed with resin and sometimes also include a carbon filter to pick up other dissolved substances that can pass through the deionizing resin. Deionizers produce high-quality water, with no waste, and are relatively inexpensive to buy. They tend to run quite slowly, although they have a higher flow rate than small R/O units do—aquarium models might deliver 10 to 12 gallons per hour. The major downside of deionizers is that the resin binds all ions going through it, which in hard water areas means that the resin, which is expensive, becomes saturated with ions (i.e, exhausted) quite quickly and will then need replacement. Many deionizing resins have indicators that change color when the resin is exhausted, so it is easy to see when replacement is needed.

Ion-exchange systems provide an alternative to R/O units and deionizers. As with a deionizer, the water passes over a resin column, but the ions in the water don't simply bind to the resin. In ion-exchange resin, each positive ion that binds displaces a sodium ion from the resin, and each negative ion displaces a chloride ion. This means that the water coming out of the unit contains sodium chloride, so it isn't quite as pure as water from an R/O unit or a deionizer, but in the context of using the water to make up sea water (using a salt mix that is primarily sodium chloride, of course) it is adequate. Ion-exchange units are inexpensive to buy and have higher flow rates than either R/O units or deionizers. They are also inexpensive to run because when the resin is exhausted, it can be regenerated by running a concentrated solution of common salt though it. This has the effect of displacing any ions already bound to the resin, leaving it ready to bind more.

While many fishkeepers purify their own water, it is also possible to buy R/O water from many aquarium dealers. On a per-gallon basis, this is not usually very expensive, but if you're going to fill anything other than a nano aquarium, the cost does mount. Perhaps more significantly, transporting large volumes of water can be problematic, as it requires food-grade

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■ Because fish are less sensitive to water quality than corals, it is possible to use tap water with less than 5 mg/L of nitrate for fish-only aquariums.

containers and the weight soon mounts to back-threatening levels.

Do You Need to Purify Your Water?

Domestic water supplies vary tremendously in their nutrient levels, so before investing in water-purification equipment, it is worth finding out whether it is needed. While you could go to the trouble and expense of sending your water to a lab for a full analysis, simply testing the water for nitrate will, in most cases, tell you everything you need to know. The two big problems with water, as far as marine aquariums are concerned, are nitrates and phosphates, and as both usually derive from agricultural fertilizers, they tend to be found together. A nitrate test is usually simpler, less expensive, and more reliable than a phosphate test (you can even get dipstick tests), so unless your water is very unusual, it will give you a very quick answer to the question of whether or not to purify.

So what is the exact nitrate threshold at which you should clean up your water? An obvious answer is anything above zero, and if you are using the water for a reef system, this is probably a good rule to follow. The ideal in a reef aquarium is to keep nitrates as close to zero as possible, and although there are many ways to control nitrates in the aquarium, it's probably best to avoid introducing problems that you'll then need to solve. If you're planning a fish-only system, while the same zero-nitrate approach is best, things are less critical, and nitrate levels up to 5 mg/L shouldn't cause problems.

Phil Hunt

■ When using a hydrometer (left) to measure specific gravity, be careful to correct for temperature, as the final reading is temperature dependent. Refractometers (right) are often more expensive than hydrometers, but they tend to be more precise and auto-correct for temperature.

Salt

While you might need to put in some work to get the water right for your marine aquarium, the salt component is a whole lot easier to deal with. Essentially, any of the commercially available salt mixes will produce good-quality artificial sea water. There are minor variations between brands with respect to their speed and ease of dissolving and the precise levels of certain components. Some brands, for example, are formulated specifically for reef aquariums, having higher levels of calcium, carbonates/bicarbonates, and sometimes magnesium, which promote good stony coral growth—although it's hard to say whether the higher levels of these ingredients in the salt mix make much difference in the context of an aquarium with either a calcium reactor or regular calcium supplementation.

The Right Mix

In general, it's best to aim for an aquarium salinity similar to that of natural seawater, namely around 35 grams per liter (or 35 parts per thousand), equivalent to a specific gravity of about 1.026 (at 20°C [68°F]). While it used to be common practice to run fish-only aquariums at a lower salinity than natural seawater, typically about 28 grams per liter (specific gravity 1.022), this seems to have fallen out of favor recently. There are some specific applications for different salinities, for example in low-salinity quarantine or for disease treatment, but for everyday fishkeeping, it's best to keep things as close to natural as possible. It's also good to keep the salinity in the aquarium stable, topping up evaporation losses regularly and matching the salinity of your replacement water and existing tank water when doing partial water changes.

Measuring Salinity

There are three main ways to measure salinity: using a hydrometer, a refractometer, or an electronic salinity meter. Hydrometers measure the density of liquids, which in seawater is a function of three things, how much dissolved salt is present, temperature, and pressure. The density of the liquid is expressed as specific gravity, which in the case of seawater is the ratio of the density of the water being measured to the density of pure water. Pure water has a specific gravity of 1; therefore, natural sea water, with a specific gravity of 1.027, is 1.027 times denser than pure water. While fishkeepers can basically disregard the effects of pressure on specific gravity, it's important to pay attention to temperature. Hydrometers are calibrated to work at a certain temperature, which is

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often 20°C (68°F). With some hydrometers (float hydrometers), it's necessary to use a table to correct readings taken at different temperatures. Others (swing-needle hydrometers), because of the materials they are made of, claim to be self-correcting for temperature. Hydrometers are an inexpensive way to measure salinity but are not always as accurate as other devices.

Refractometers measure the refractive index of liquids, which varies with the concentration of dissolved salts. Aquarium refractometers often self-correct for temperature. Usually more accurate than hydrometers, they are also more expensive, but not prohibitively so. They do require occasional calibration with pure water, which is used to set their zero point, and must be cleaned carefully after use.

Electronic salinity meters measure the conductivity of salt water, exploiting the fact that more concentrated solutions conduct electricity more easily. The meters then translate this into the equivalent salinity. Like refractometers, salinity meters need regular calibration (in this case using a standard salt solution) and careful cleaning after use. They provide an accurate method of measuring salinity but are expensive compared to both hydrometers and refractometers.

Which device you use to measure salinity is largely down to personal preference. Refractometers and electronic meters may be more accurate, but this comes at a price in terms of both cost and a need for calibration and more careful cleaning than hydrometers. It is also worth considering that keeping your aquarium at a consistent salinity is more important than the exact value in parts per thousand, so provided your hydrometer is not wildly inaccurate, and you use the same one each time, you might not need a more sophisticated instrument. If, however, you will need to adjust salinity and do so very carefully, as, for example, when using reduced-salinity water to treat fish diseases in reef aquariums, then a refractometer or salinity meter will be a better bet.

Making It Up

There are two primary reasons for making up artificial sea water: filling a new system and preparing water for partial water changes. In most cases, when setting up a new system, the most practical way is to make up the water in the aquarium itself due to the volume of water required. To do this, fill up the tank with water (purified if necessary), allowing some space for displacement by live rock, sand, or other substrates. If you are using a rectangular tank, you can measure the length and front-to-back depth of the tank, then the depth of water, and use this to work out the volume of water you have added. For other tank shapes, it can be useful to measure the amount of water going into the tank as you add it.

Phil Hunt

■ Before adding salt to water, make sure the water is heated to the proper temperature and adequately circulated.

Phil Hunt

■ When adding salt water to a newly set up aquarium, you can calculate how much salt is needed based on the volume of the tank, weigh it out, and add it directly to the tank.

With the water now in the tank, turn on the heater-thermostat and get the water up to your chosen temperature—salt will dissolve more quickly in warm water—and use a water pump or air diffuser to get the water moving, which will mix the salt. Having either calculated or measured the volume of water, you can now work out how much salt you need—on the basis of 35 grams per liter of water or 4.7 ounces per US gallon. Weigh out the salt, and then add it to the heated, circulating water in the tank. Allow a few hours for the salt to dissolve, or leave it mixing overnight. It is worth noting that some salt mixes have a small quantity of insoluble residue, which usually looks like (and in some cases is) very fine sand. This is harmless.

Measure the salinity (it is useful to be able to read this as parts per thousand, rather than specific gravity, as this will make it easier to calculate quantities of water or salt to add if you need to make adjustments). If it is too low, you need to add more salt mix. For example, if you have 100 liters (26.42 gallons) of water in the tank and the salinity is 33 parts per thousand (which is the same as 33 grams per liter), you need to add approximately 100 x 2 = 200 grams more salt to raise the salinity to 35 parts per thousand. The figure is approximate, because dissolving the salt you added already will have increased the volume in the tank, although not by much.

If your salinity is too high, you will need to add more water. Again, you can work out how much by comparing your desired salinity with the reading you have. If you get a salinity of 37 parts per thousand in 100 liters of water and you want to reduce this to 35 parts per thousand, you need to have a total volume of 37/35 x 100 liters of water. That works out to 105.7 liters, which means you need to add 5.7 extra liters of water. This might give you a problem if there isn't enough tank volume to fit the extra water in, but if you did leave some space for displacement, you should be okay.

When preparing water for water changes, the general principles are the same, but before you start, check the salinity and temperature in the aquarium and aim to match these parameters in the water that you make up. This is particularly important if you are making a large water change, as you need to avoid a sudden change in aquarium conditions.

Salt water may be the most basic element of the marine aquarium, but making it properly is crucial for a successful system. The most critical aspect, in most cases, is ensuring that the water going into the system is pure enough and then getting (and keeping) the salinity in the correct range.

Next month, we'll take a look at temperature control.

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Automating Your Aquarium

JEREMY GOSNELL

Marine aquariums are a source of relaxation and joy for many aquarists. They re-create an underwater world that, for many of us, is thousands of miles away bordering a Pacific or Caribbean island. While these complex, closed ecosystems can bring us stress relief when they are under our direct care, they can cause a lot of anxiety when we travel or are unable to precisely monitor them. Simple equipment failures (such as a heater sticking in the on position, a drop in pH, or water overflow) can spell disaster for any marine aquarium. Sometimes our beloved home oceans feel like a leash, tethering us by requiring constant supervision and care.

Years ago, before advances in communications technology, aquarists were often left not knowing the status of their aquariums while traveling, or trusting their tank's safety to an often unqualified family member or friend. Today, along with the rise of broadband technology and home automation, we have seen a transformation in how accurately an aquarium can be cared for, even if you are thousands of miles away.

Everything from the internal temperature to humidity can be controlled in your home using a variety of network-compatible devices. Smart phones have applications that can monitor a number of variables and provide constant updates. Why wouldn't this be possible for the home aquarium? The good news: It is possible. The even better news: It's far more affordable than you might think. The only bad news is that it takes a bit of technical knowledge to make it work. To figure out first what level of monitoring or control works for you and, second, how you want to implement and access it, we should first review a few key concepts.

Monitors

On the market today are a variety of monitoring devices. Most of these are electronic and utilize lab-grade probes that take constant readings of aquarium parameters: pH, temperature, salinity, calcium, nitrates, and more can be read and monitored with such devices. The main downside is that some of these monitors are expensive and they all require frequent re-calibration using the appropriate solution. I personally calibrate my aquarium's probes at least once per week.

The question becomes, can we monitor these variables while we are away, and how? Recently, we have seen monitors using HTML 5 coding hit the market. This is the same language many websites are written in. Using HTML 5, devices are able to collect data from your aquarium and synchronize with your home network. This allows you to access that information remotely.

Deciding What to Monitor

There are a variety of devices, and depending on your aquarium's needs and your budget, you can decide just how much you want to monitor from afar. I personally monitor pH, temperature, and water level using an online-capable device.

Calcium, nitrate, and other probes are expensive, and typically those values don't fluctuate enough in the short term to really require constant monitoring. Temperature and pH can change quickly, however, and some attention is immediately required in the event that something happens. Also, a sudden water leak can be a major disaster for both the aquarium and surrounding home.

How to Access the Information

Once you have decided what you want to

■ Large, complex reef aquariums can be easily monitored and maintained with the aid of monitors, controllers, and webcams.

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monitor and selected a web-capable device, then you must decide how you want to access it online. Typically, the easiest option is to use a process called IP Forwarding. The device should connect to your network router using a network cable. One thing that makes this process easier is having your router and a computer close to the tank. In an office, this can be fairly easy; in a home living space, it gets a bit tougher. Some monitors have wireless bridge options, but it can be hard to get these up and running if you lack technical experience.

Once the device is connected to the router and turned on, it will be assigned an IP address by the router, just like a computer. Depending on your brand and type of router, settings can be applied through the router, allowing that address to be forwarded (i.e., broadcasted over the internet). When you access the router through your broadband modem's IP address, it will bring your device to life and allow you to log into it.

Some things you will need include a broadband internet connection, router, and access to your modem's and devices' IP addresses. A quick Google search on IP forwarding should provide you with instructions on how to set up your router. Most monitoring devices that have a network interface display their IP address for you.

What you will need to know is your modem's IP address. This can easily be obtained by visiting a website like www.ipchicken.com. Once your router settings are applied and your monitor is working, you would simply visit ipchicken (or any IP-address-providing website) to get your modem's IP address. For example, say your modem IP address is 106.92.12.4 and the IP address of your device is 10.1.1.3, you would enter 106.92.12.4:10.1.1.3 into a browser search bar, asking your modem to contact the router and display the device (your monitor) you have requested. From here, you simply log into your device and view the parameters.

Another, sometimes easier option is to use software called Log Me In. Log Me In is free and easily allows you to access any computer remotely over the internet from another computer, tablet, or your smart phone. Just visit logmein.com, install the software on the computer you want to access, and create a username, password, and security code. This will give you direct access to a computer attached to the same router as your monitoring device, allowing you to view your aquarium's parameters and change the monitor's settings.

Many monitors also have settings that will alert you via email or text message if a parameter within your aquarium drops below a set value. Modern-day monitors also create graphs, which can be exported to Microsoft Excel, showing the rise, fall, and baseline average of critical aquarium parameters. For example, if you have a carbon-based nitrate reactor, you may want to monitor pH because these systems have a reputation for affecting aquarium pH, causing it to drop. Using the monitor, you can chart a graph of the reactor's effect on your aquarium pH and come up with a plan to offset the change.

Controllers

A controller works much like a monitor, with a host of more practical features. While a monitor can show you that something is wrong in your tank, a controller actually allows you to control various pieces of equipment, even from thousands of miles away.

Controllers communicate directly with a power bar attached to the controller unit. Here you can program the controller to turn lights on and off at certain times, activate heaters at certain temperatures, and even control when reactors of various types activate. Like monitors, they display aquarium parameters in real time.

Controllers come in a few different varieties, and I have yet to find one that is super easy to set up. They all require some time, and you may find yourself online, searching Google to find a helping hand in getting them programmed.

Through IP forwarding, controllers allow you to access and control each device plugged into the power bar.

For example, if you are away and find that your aquarium has reached an almost disastrous temperature of 85°F, you can use a controller to see that the heater module is staying on, even though the heater is set at 75°. You know now that the heater is stuck in the on position and can program the controller to take over, switching it off, letting the tank cool, and only activating it when needed. Also, if you have a cooling fan, you can activate that to speed up evaporation and cooling as well. Float switches communicating with your controller can then pump top-off water from a reservoir into the tank when needed. You now not only have a picture of the parameters in your tank while you are away, but also direct control over certain equipment that can affect them.

Anky/Shutterstock

One parameter worth monitoring is pH, which can change quickly with devastating results for marine livestock.

Jeremy Gosnell

With the ability to record a variety of parameters, monitors can help you detect trends in your aquarium.

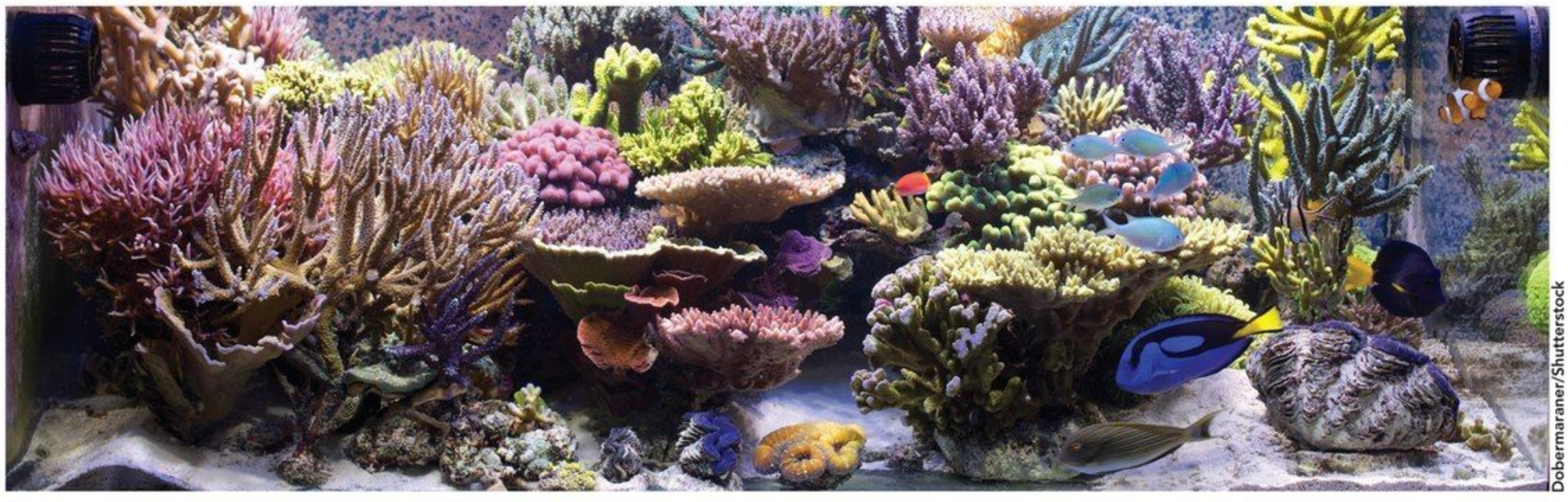
Like I said earlier, Log Me In software working on a computer may make the entire process much easier to configure. Since Log Me In works with tablets and smartphones as well as computers, it opens up a host of access opportunities.

Viewing Your Aquarium

The pinnacle of aquarium monitoring for many aquarists is the ability to view your aquarium remotely, in real time, using a webcam. This allows you not only to see how the tank and its inhabitants are doing, but also to make sure lighting schedules are working as programmed, as well as display your tank to friends while out at dinner or on vacation. Today, webcams have come a long way from the 3-megapixel early versions to full 1080p high-definition cameras. Even today's smart phones often have high-definition displays. There are a variety of ways to remotely view an aquarium from a webcam. Most webcams can be programmed to share a live feed, and I use free software called Yaw Cam to do just that. A simple tutorial should have you up and running in no time. The downside to this approach is that your webcam needs a host computer connected to your network.

If a host computer cannot be placed close to the aquarium, allowing a USB connection to the camera, there is another approach. There are a variety of cameras on the market that connect to a wireless network, allowing you to control them remotely from a tablet, computer, or phone.

They share an IP address, making them a literal stand-alone unit on your home network. Most have a username and password built in so only you can access them. Simple configuration offers you a camera unit that, unlike a webcam, can be rotated, zoomed, and



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Monitoring the water level in an aquarium is critical to prevent potentially disastrous overflows from occurring.

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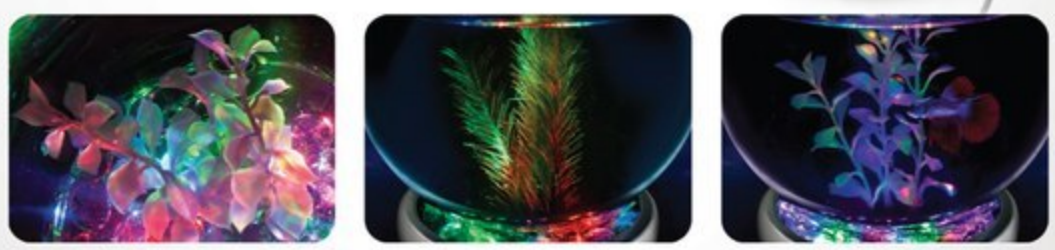

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■ Controllers can do everything from turning the lights on and off to feeding the tank for you.

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■ If you want to check up on your tank when you're away and see the antics your fish perform, you can always set up a webcam.

focused—even offering a night-vision mode for after-hours viewing.

If the controller or monitor option is logistically unfeasible due to the aquarium's location, a well-placed stand-alone camera could be used, in conjunction with wireless pH and temperature monitors, to help watch your tank while still seeing important tank parameters. These camera units are surprisingly inexpensive, and while I personally use a webcam to view my aquarium remotely, I use a unit like I just described so that we can share story-time with our young daughter across the internet, letting other family members tune in and see how she is doing.

Putting It All Together

My current controller-monitor-webcam aquarium system seems to work well and was very easy to implement. A controller turns the T5 lighting (actinic only) on at 8:00 a.m. each morning. Then at 9:00 a.m., it activates the white 10K T5 lights. At 10:00 a.m., it turns on the high-output LED spot lighting, turning each off in a synchronized pattern as well as activating the refugium light. The controller is responsible for the heater, turning it on when the tank temperature drops below 75° and turning it off when it's warmer, eliminating the fear that the heater will get stuck in the on position. If the tank temperature hits 80°, it turns on the fan system while float switches signal a pump to pull RO water from a 4-gallon reservoir if needed for top off. The controller also monitors the tank's pH.

A monitor, equipped with HTML 5 and network interface, monitors the pH and temperature along with probes in the aquarium stand and surrounding floor that check for leaks. If the pH drops below 7.6, it notifies me with an email, and if it rises to

Jeremy Gosnell

■ If it's possible to locate a computer near your aquarium, it will be easier to set up your monitoring and control devices.

about 8.4, it also emails. I will get an email if it detects a fault (meaning a leak) in the sensor wires in the aquarium stand and on the surrounding floor. I broadcast the monitor via IP forwarding online, so I can access it anywhere and view graphs and trends.

A webcam running on the nearby PC shows a bird's-eye view of the aquarium, so remotely I can see the tank in real time and share it with others. Also, it allows me to be sure that the controller is activating and deactivating lighting at the proper times.

Some things to remember: Even frequently calibrated probes can fail. I recently had a temperature probe fail, reading a tank temperature of 89°. I rushed to my office, where the tank is located, to find a non-functioning probe and an aquarium with a safe temperature of 79°. No controller or monitor can replace good and consistent aquarium maintenance and testing.

Also, probes need to be replaced just about every 6 to 12 months. When setting the sensors for the email or text option, make sure you keep the range within reason. When these units enter a cautionary mode and begin sending out messages, they often will not stop until the parameter is corrected. Most aquariums experience some rise and fall in temperature and pH between day and night. If your unit isn't configured to accept that as normal, you will be bombarded with email alerts.

Any reef aquarium represents a tremendous investment. Time, money, and a passion for aquatic life are all resources that we pour (no pun intended) into our captive aquatic ecosystems. While not a guarantee that a problem won't disrupt the harmony of the tank, controllers and monitors can, when properly calibrated and set up, provide accurate and consistent information and control, even when you are far away from your tank. This all goes without mentioning the overall cool factor of viewing your aquarium in real time via webcam!

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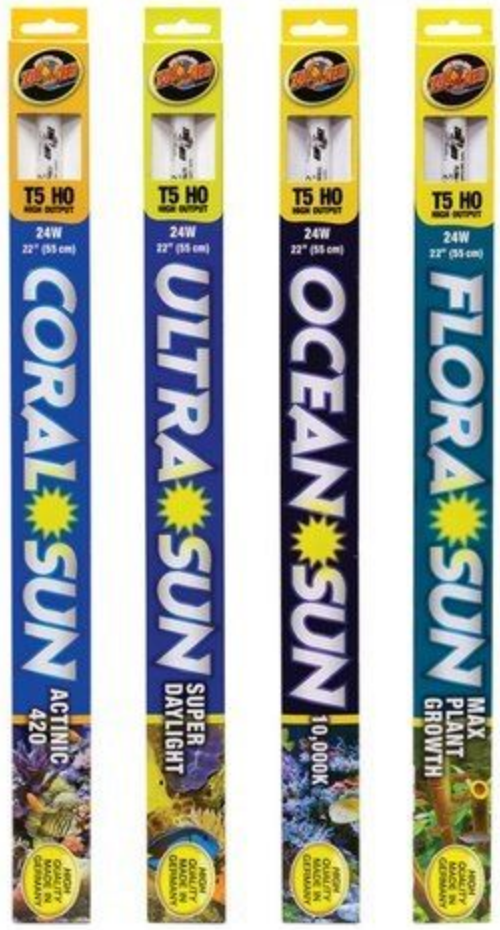

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Behind the Brand: S.T. International

photographs courtesy of S.T. International

This year marks the launch of a new aquarium-products company out of Newport Beach, California: S.T. International. Simon Tu, CEO of S.T. International, started the new company to fulfill a personal ambition spawned by his love of the aquarium hobby.

■ Co-founder and CEO of S.T. International, Simon Tu.

According to Simon, the idea behind starting the company originated from the difficulty he was having trying to find quality, affordable products to meet his personal needs in the fishkeeping hobby. Being an avid aquarist, he described himself as a "diehard aquarium-product consumer." In order to fill what he identified as an underserved niche in the "dry goods" needs of hobbyists like himself, he decided to launch an aquarium-product company of his own.

"My personal ambition led to the creation of S.T. International, which I co-founded with a preeminent investment firm that for decades has had a history of superior customer service. Using that philosophy, we are carrying on with unmatched customer service. S.T. International is offering innovative aquarium products at affordable prices," he said.

Establishing Product Lines

One of the greatest challenges that Simon reports having encountered thus far is in narrowing down the range of products he wants to offer while still meeting the diverse needs of his customers and providing them with the most advanced solutions available. Ultimately, he chose to offer product lines under the banners of four different brands, each comprising a wide range of products.

■ S.T. International produces Ellion brand koi food.

■ Takemi & Masako Adachi (left and middle), and Simon (right) at California Koi Farm.

The first brand, Arisen, offers a range of substrates, salts, water conditioners, and fertilizers. Next is Ellion, which is S.T. International's line of koi foods. Rolden is the brand of aquarium-hardware products, including gardening tools for planted tanks. Finally, Primecare is, according to Simon, S.T. International's "more affordable brand," offering consumers a diverse selection of lower-cost aquarium solutions.

Trying to Stand Out

Simon's goal for S.T. International is to "be a global leader in the aquarium-supply business by offering innovative solutions through impressive products lines, while at the same time maintaining excellent customer service."

He cites the little details, such as the metallic-shine finish on many of their products, as well as more general attributes attractive to consumers like the extensive warranty the company offers on many of their products, to explain how S.T. International will stand out from the competition.

While preparing to launch, one of the more interesting moments occurred when a customer was evaluating the Ellion koi food. Simon explained, "Before purchasing our Ellion food, one of our customers ate the fish food to sample it and make sure it had the taste of high-quality food before purchasing it. The good news is, our customer liked what he tasted, and the even better news is, his fish liked the food even more than he did!"

Although S.T. International launched their product lines only recently, in July of 2013, Simon says that the response to the new company has been overwhelmingly positive. "The most encouraging thing for us thus far is the positive feedback we have received about our products from our customers."

"Behind the Brand" is presented for purely informational purposes and does not constitute an endorsement of any brand or products by Tropical Fish Hobbyist *Magazine. All interviews are edited for length and content.*

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Charles Clapsaddle

ALA 2013 Convention

The American Livebearer Association's (ALA) 2013 Convention was hosted by The Grand Valley Aquarium Club in Grand Rapids, Michigan, April 25th–28th. The convention featured two collecting trips, four speakers on various fish-related topics, a workshop on live foods, vendor displays, a judged fish show, an awards banquet, and an auction. There were attendees from 19 states and three countries. From all I've heard, the local sponsoring club, headed by show chairman Tim Boelema, did an excellent job. I know how hard it is to coordinate a function like this; I was the ALA 2008 Convention chair. It's a lot of underappreciated work.

The four featured talks were "Halfbeaks" by Mike Hellweg, "Goodeids" by Michael Koeck, "Guppies" by Ron Kelley, and "West Indian Poeciliids" by Pablo Weaver. Also, Rich Eberly conducted a workshop on live foods.

The collecting trips yielded some interesting fish, such as the killifishes *Fundulus notatus* and *F. dispar*, darters including the rainbow darter (*Etheostoma caeruleum*) and least darter (*E. microperca*), daces such as the blacknose dace (*Rhinichthys atratulus*) and western blacknose dace (*R. obtusus*), sunfishes like the warmouth (*Lepomis gulosus*) and bluegill (*L. macrochirus*), the lake chubsucker (*Erimyzon sucetta*), the central stoneroller (*Campostoma anomalum*), and the central mudminnow (*Umbra limi*).

The fish show attracted a wide range of entries, including wild species and domestic livebearers. There were 172 entries. Judging from the photos I've seen, there were some spectacular fish. I shipped fish to the show and donated them for the auction.

As is tradition, the ALA board of directors granted a scholarship to a young researcher who conducted experiments regarding livebearer fishes. This year's award and scholarship was awarded to Molly Schumer, a Ph.D. student at Princeton. Additionally, the board approved two grants, one to Arcadio Valdez, University of Nuevo Leone, to study *Gambusia*, and another to Omar Dominguez, University of Michoacan, Morelia, to work on *Xenotoca*.

Ben Van Dinther

■ Breeder Scott Tetzlaff's platy won first place in the Variatus and Platies: Domestic: Common Finnage category, as well as best domestic livebearer.

Ben Van Dinther

■ The winner of the Goodeids: Torpedo Body Shape class also won the award for the best goodeid in the show.

ALA conventions always end with lively Sunday auctions. This year's auction featured thousands of fish, many plants, and some equipment; a total of 748 auction lots.

Next year's ALA Convention will be determined at a later date. I hope to see you there!

in next month's issue...

copperband butterflyfish

An iconic species, the copperband butterflyfish is loved not only for its good looks, but also its propensity for eating *Aiptasia* anemones. However, it can prove challenging to keep in aquariums. A copperband enthusiast provides a number of steps to purchase and maintain healthy specimens.


Vladimir Wrangel/Shutterstock


Horst Linke

threadfin rainbowfish

A demure beauty, the tiny threadfin rainbowfish will make for a fantastic display in your setup. If you're looking for a true challenge, you can try breeding the species. An expert hobbyist was able to succeed and offers his tips and tricks for raising the fry.

keeping corals together

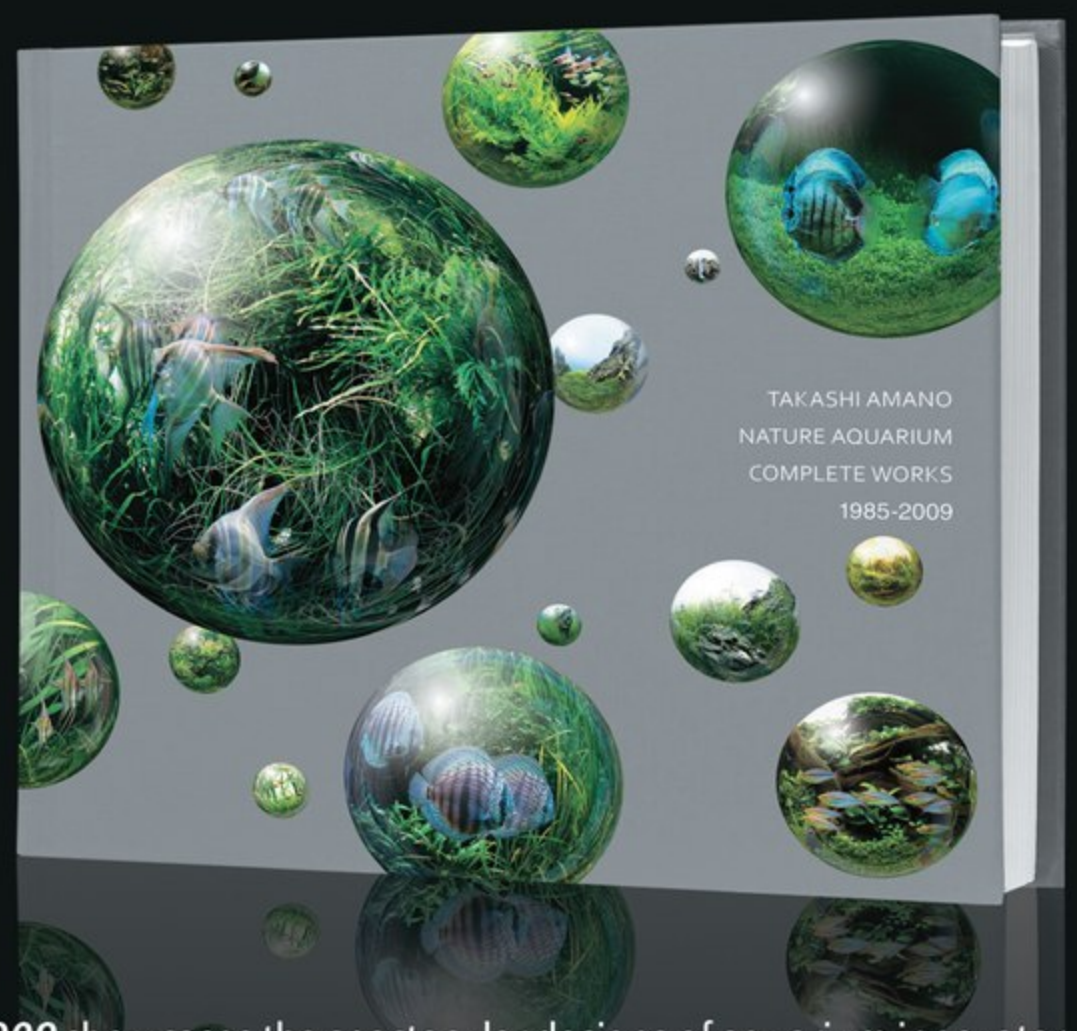
There are many challenges when it comes to nano tanks, and a very important one is finding the right assortment of corals to fit such a small space. One reefkeeper lists the many factors that must be taken into consideration and profiles species that are known to thrive in nanos.


Tyler Fox/Shutterstock

Read About All This and Much, Much More in the September 2013 Issue of *TFH*!

Content subject to change.

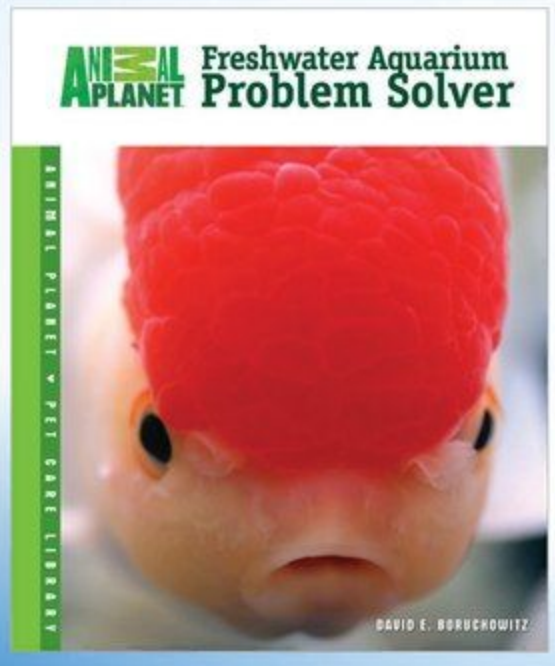
Aquatic Inspiration
at Your Fingertips

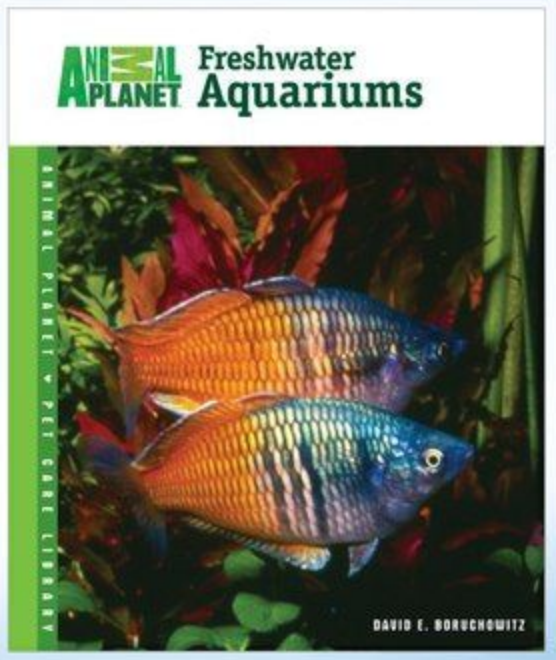


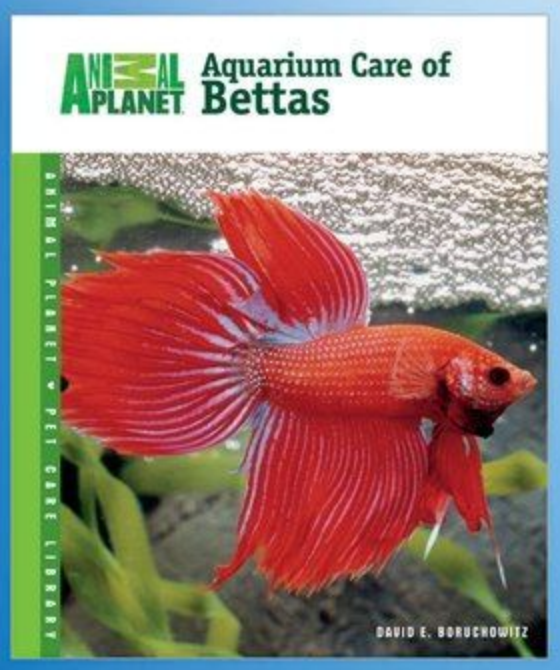
Nature Aquarium: Complete Works 1985–2009
Takashi Amano
ISBN: 9780-7938-0649-2
264 pages; hard cover with jacket; $**59.95**

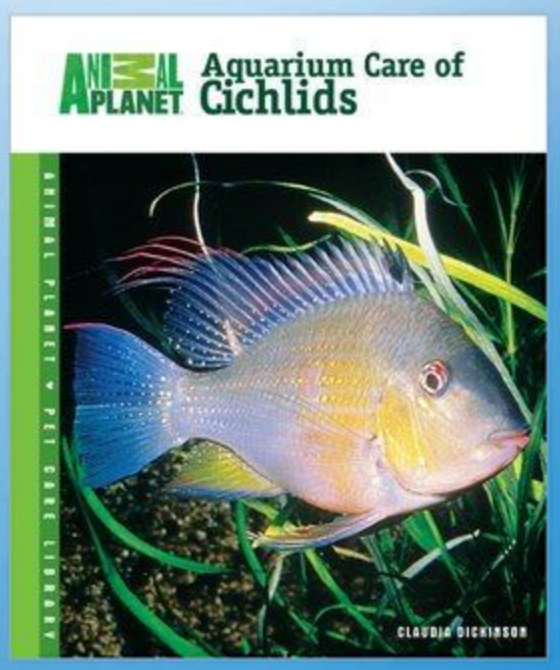
Nature Aquarium: Complete Works 1985–2009 showcases the spectacular designs of aquarium innovator Takashi Amano. Inside are more than 200 photos of his lush aquascapes—perfect inspiration for you to try your hand at creating your own. Each photo is accompanied by a full list of the equipment, plants, animals, and water chemistry used to create it. Along with the fantastic images of nature aquariums, Mr. Amano includes entertaining and insightful essays on his design philosophy that will stimulate any aquarist's creativity. This beautiful volume is sure to find a welcome spot in your aquarium library or on your coffee table.

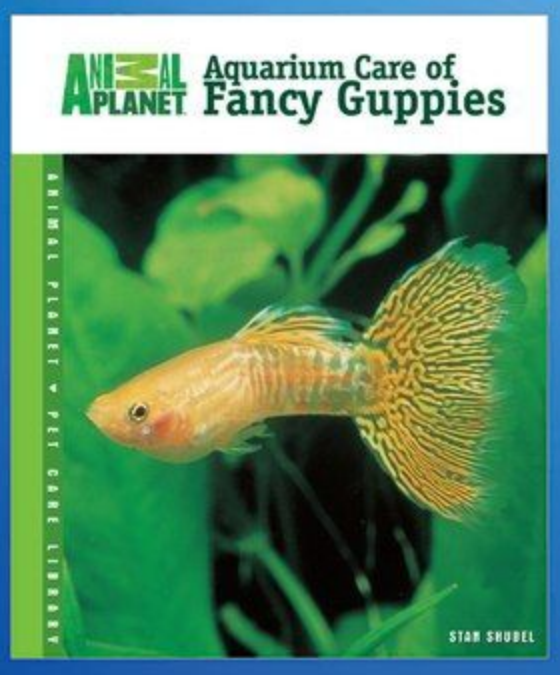
advertiser index

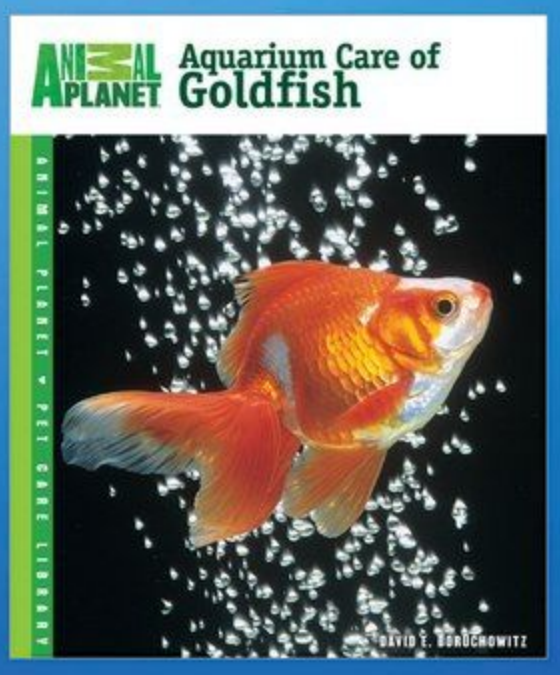


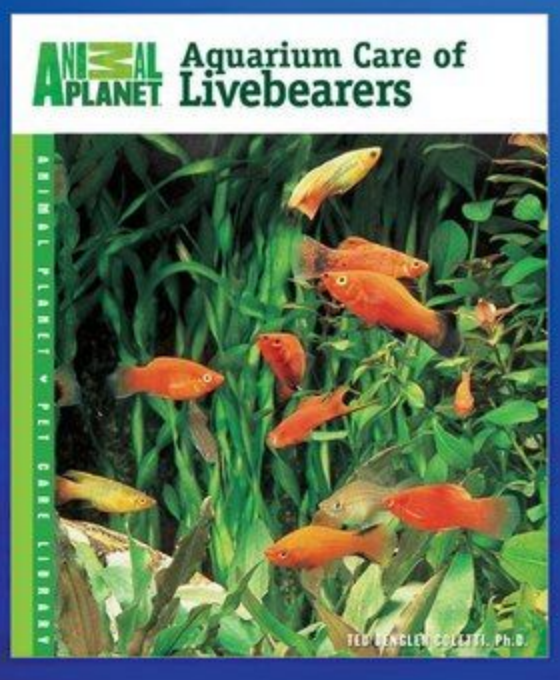


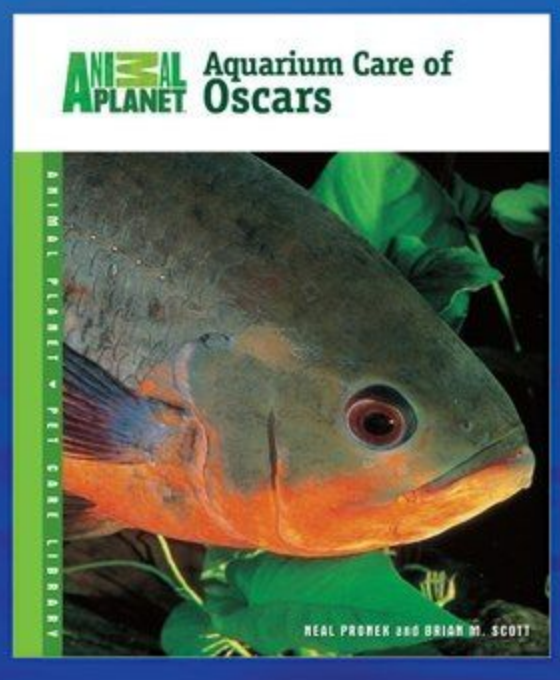












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PARTING SHOT

Photo: Beth Swanson/Shutterstock

queen angelfish

(Holacanthus ciliaris)

An icon of the Caribbean and tropical western Atlantic, the queen angelfish (*Holacanthus ciliaris)* is among the most beautiful fish in the aquarium trade. Shimmering blue and vibrant yellow in color and crowned with a dark spot ringed in blue, the queen angel becomes the highlight of any aquarium it is placed in.

That being said, it takes a lot to house a queen angel. It must be kept in a minimum 300 gallon tank to accommodate its prodigious adult size of 18 inches. While it can be kept with tankmates, it must not be kept with other large angels (including members of its own species) and it should not be kept with corals, giant clams, or other sessile invertebrates since it has a propensity to nibble on them. Also, when choosing tankmates, keep in mind the queen angel's extremely aggressive attitude. If you have the room to dedicate to a queen angelfish, you won't regret it!

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