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# TROPICAL FISH

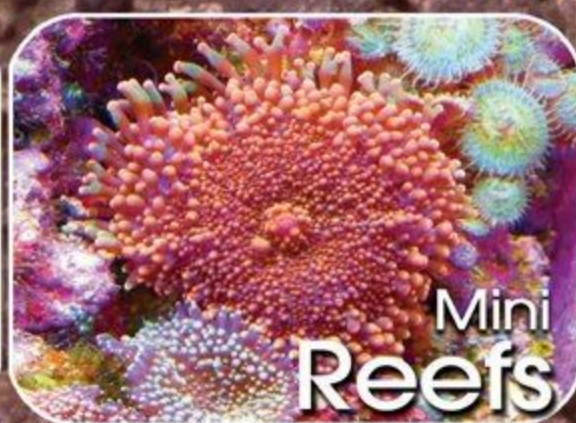
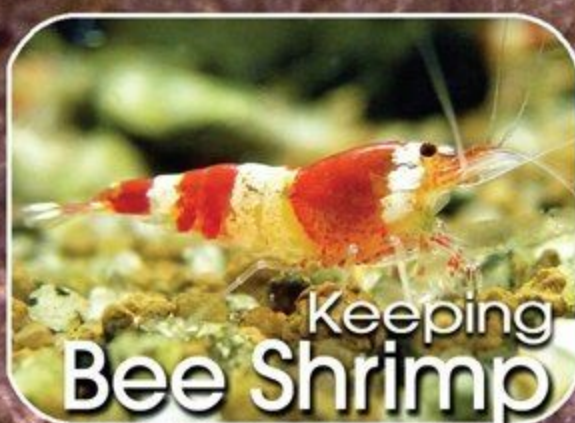
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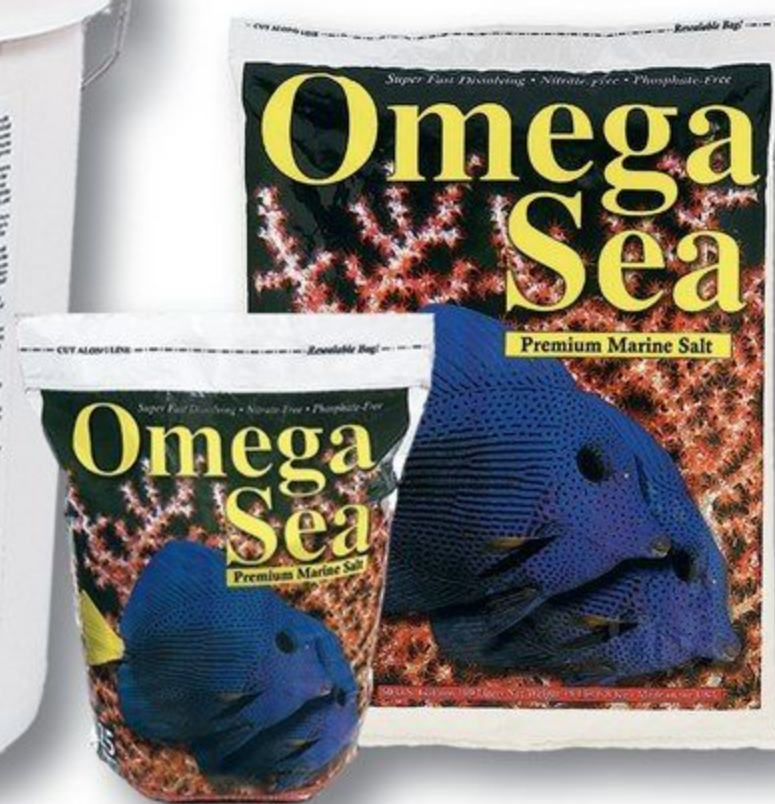
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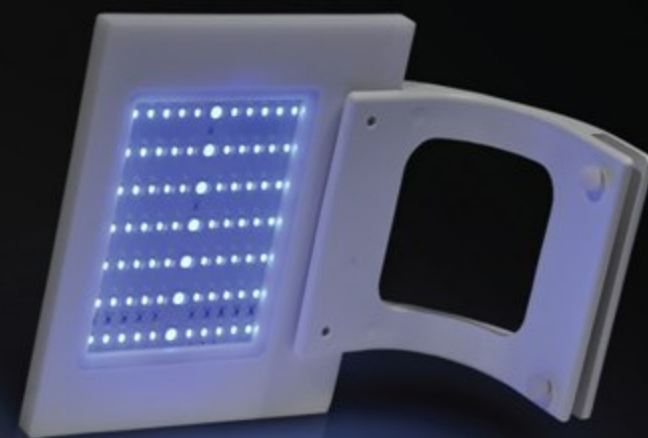




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## features

- 52** **Using *Unzan-seki* Stones to Create a New Impression in the Nature Aquarium**  
The aquascaping master introduces a new type of layout stone, *unzan-seki*, and demonstrates how it can be used to create a rugged feeling in the Nature Aquarium. **Takashi Amano**

- 58** **African Plant-Spawning Killifish**  
Although many people think of killifish as annuals, only living for one year, a large subset of killies spawn continuously on plants and live for much longer. Learn how to keep and breed these colorful gems. **Charles Nunziata**

- 66** **The *Fundulus* of Missouri**  
Killifish are among the few types of fish you can collect right in the United States. Add to that the fact they are easy to care for and absolutely stunning, and you have a great fish for the adventurous aquarist. **Mike Hellweg**

- 74** **The Latest Buzz: Freshwater Bee Shrimp**  
Freshwater shrimp are the latest craze in the planted aquarium hobby. With dozens of variations, bee shrimp are highest on the list, as they make stunning additions to peaceful nano tanks and are perfect for a selective breeding project. **Amanda Wenger**

- 80** **Mosquito Larvae**  
If you want to watch your fish exhibit their natural predatory behaviors, live food is a great way to go. One dedicated hobbyist offers a simple procedure for raising mosquito larvae, a perfect project for someone beginning to raise their own live foods. **Peter Jekel**

- 84** **Father's Day in the Ozarks**  
Are your kids less than excited about the aquarium hobby? The best way to get them involved is to do something they enjoy. One hobbyist dad took his kids on a Father's Day collecting adventure they will never forget. **Ted Judy**

- 90** **An Aquarist's Journal: Creating a Nano Reef, Part 1: Setup**  
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With their myriad of colors and patterns, killifish look as if their bodies were hand painted by an artist. Their vivid appearance is part of their appeal, as are their interesting reproductive habits—many live only for a year, and their eggs have to be incubated in peat moss before hatching. Others, like this month's cover killie and the emblem of the American Killifish Association—the blue gularis (*Fundulopanchax sjostedti* "Niger Delta")—can live for many years and spawn in foliage, as Charles Nunziata explains in his article "African Plant-Spawning Killies" on p. 58.

Photograph by Hristo Hristov

Our cover photo is available for your wallpaper and/or screensaver in the downloads section of [tfhmagazine.com](http://tfhmagazine.com).

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# TROPICAL FISH

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## editor's note



Blake Tedeschi

Let's face it; many of us often want to be somewhere we're not. I flip through the gorgeous photos in this magazine and find myself reminiscing about diving on the Great Barrier Reef, wishing to go back, or thinking about a trip to the Caribbean, trying to figure out how to fit one into my schedule and budget. But whether or not I can discover a reasonable way to travel around the world, this magazine also shows that you should appreciate what you have locally.

Expert fishkeeper Ted Judy already knows that there are great things right in your own backyard. Wanting to get his sons excited about fishkeeping, he decided that Father's Day was the perfect excuse to take them on a fish (and invert) collecting trip in the Ozarks. After a fun-filled weekend outdoors in rivers and streams, the boys have developed an interest in both aquarium keeping and exploring beautiful wetlands (p. 84).

Ted's friend and winner of the *TFH* Breeder's Challenge, Mike Hellweg, has a similar interest in caring for local aquarium fish. Also an avid killie keeper, Mike offers his tips for keeping and breeding the killifish of Missouri. These jewels of the aquarium, coming in an array of shapes and sizes, are dressed in a rainbow of colors that can easily rival those of any tropical species (p. 66).

Speaking of killies (and Missouri), the American Killifish Association's 50<sup>th</sup> Annual Convention will be held on May

25–27 in St. Louis, Missouri. The convention will feature an impressive lineup of speakers, workshops, and a fish show. Mike will be there, as will *TFH* author Charles Nunziata. At the show, Charles will offer tips and tricks for collecting native killies, but for this issue, he went with something exotic: breeding African plant-spawning killifish (p. 58).

When it comes to breeding projects, developing a new line of a species is one of the more interesting challenges you can undertake. In the freshwater shrimp hobby, there has been a profusion of different types of *Caridina* species, including many varieties of bee shrimp. With these interesting and colorful freshwater crustaceans creating quite a buzz in aquarium circles, Amanda Wenger explains how to care for and breed your own (p. 74).

If you're interested in something salty, experienced reefer David Bell—who has always been skeptical of nano tanks—decided the small aquarium trend was here to stay, so he tried one out for himself. Using the knowledge he already had, he was able to start up a mini-reef just as impressive as any larger version (p. 90).

Whether you want to take an aquarium-related summer "staycation," find inspiration to acquire fish from around the world, or simply enjoy what you have in your own tanks, this issue is bound to have something for you!

Shari Horowitz  
Managing Editor  
Tropical Fish Hobbyist

## readers' forum

### Readers Respond:

"Magnificent Mollies" by Bill Allen

You are spot on. There are few fish as beautiful as healthy, mature adult sail-fin mollies displaying to each other.

Graham Pead

Mollies are one of my favorite fish to keep—very good article on them!

Michael Hampton

It all started with mollies, and then I began to raise egg-layers, such as *Albonubes*, and then others such as danios. I personally prefer, and have practiced for many years, raising the characins from Amazon and Africa.

Carlos Acosta Sàenz-Pardo

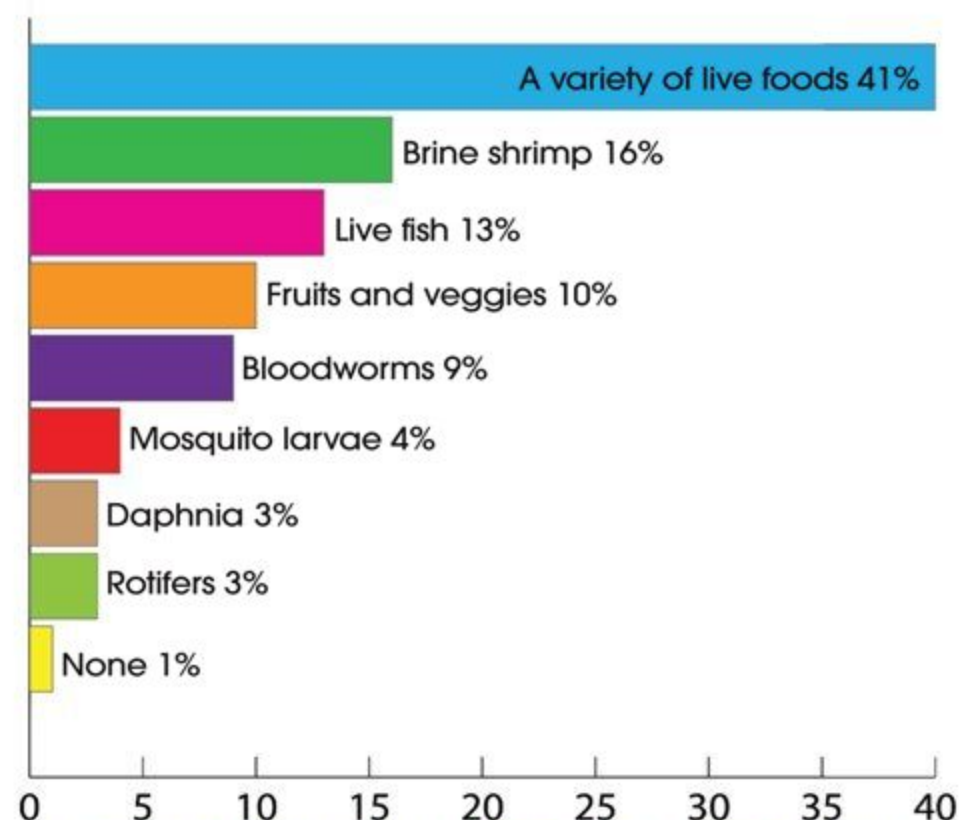
Excellent article, Bill, an informative yet easy read.

AllNaturalPetCare.com

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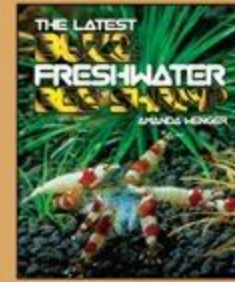


# contributors

**In This Issue:** “I like (and keep) shrimp of all kinds, but bee shrimp have really captured the imagination of the hobby in recent years. Because shrimp mature quickly, selective breeding can produce new color variants with remarkable speed—it seems every few months they’re coming up with a cool new shrimp to work with. The genus *Neocaridina* has almost as many color variants, but bees have the most variables in color and pattern within any one species. Despite their global popularity, though, we don’t have much printed literature about them in the States—most of the information and trade is web-based.”

**Affiliations:** Connecticut Aquatic Plant Enthusiasts (President)

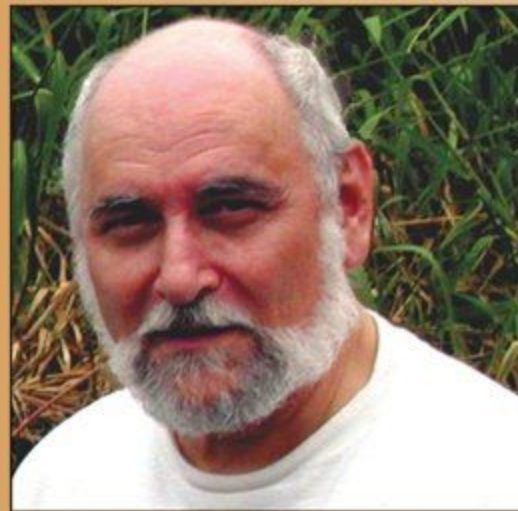
**Why Join an Aquarium Club?** “Getting together and meeting people to discuss similar interests or experiences is far from being unique to the aquarium hobby—people who are into fitness join gyms, people who like reading have book clubs, students have study groups, etc. Thus, people who really like their aquariums should join aquarium clubs. Aside from the social benefits, private hobbyists often keep species that can’t be easily obtained through local fish stores, which brings variety to people who want to try something new or different.”



amanda  
wenger



charles  
nunziata



**In This Issue:** “Killifish encompass a very large group of beautiful and scientifically interesting aquarium fish that remain essentially unknown to the general hobbyist. Their unique reproduction methods and fascinating egg morphology provide a rare glimpse into the extraordinary complexities of life on this planet. Keeping and breeding killifish provides an experience not otherwise available from our hobby, one that should be shared as widely as possible. For this reason, I always take the opportunity to tell the killifish story whenever and wherever I can.”

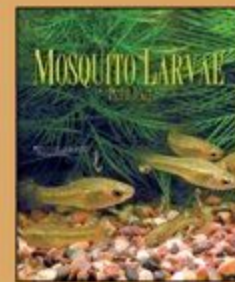
**Other Works:** Coauthor of the *Florida Collection Guide*

**Why Killies?** “The factors that attracted me to killifish are the reasons I recommend them to all but the beginning aquarist. They are easily maintained and bred in small tanks with simple filters and no heaters. Together with their relative rarity, the mystique surrounding their embryology and, most assuredly, their stunning beauty make them very hard to resist.”

**In This Issue:** “I generally write science-related articles for several popular publications. I also have a couple of freshwater aquariums. After reading some editions of *TFH Magazine*, I came upon the idea of combining my interests in writing science articles and aquarium keeping into an article about mosquito larvae. I also, in our summer season, raise larvae to feed my fish.”

**Other Works:** Freelancer for many titles, including *Diver Magazine*, *Outdoor Canada*, and *Nature’s Voice*

**Favorite Aquarium Setup:** “My favorite aquarium setup is a freshwater community tank with species from specific geographic zones to best mimic a natural environment.”



peter  
jekel

**In This Issue:** Keeping fish is fun, but going out collecting them can be even better—especially when your kids come along. According to the author, “I always have fun searching for native fish, but this time around, I had more fun watching the boys get excited about something I like to do. As they say in the commercials: Gas to Missouri \$200, four nights in a hotel \$300, restaurant food for two growing boys \$200, watching your sons be excited about their dad’s hobby—*priceless*. I wrote the article to share that experience and hopefully encourage other hobbyists to involve their kids in the fish hobby.”

**Other Works:** “Cichlid World” columnist, [www.tedsfishroom.com](http://www.tedsfishroom.com)

**On Setting Up a Fishroom:** “I only recommend a fishroom to people who have the time to maintain one. Before you jump into the expense of building a fishroom, be honest about your free time. Even a small room will require several hours of attention each week.”



ted  
judy



also in this issue: Takashi Amano, Lea Maddocks, Mike Hellweg, David Bell, Jack Wattley, Kenneth Wingerter, Rhonda Wilson, Mark Callahan, and James Fatherree.



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## Nature Aquarium Setup Video

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Takashi Amano

## Stocking a Nano Tank

Interested in knowing what David Bell stocked his tank with in his article "An Aquarist's Journal: Creating a Nano Reef"? Stocking a nano reef is harder than stocking a regular-sized reef tank because there is less room, meaning a greater potential for aggression and overstocking. Learn about what the author chose on the *TFH* Extras blog, and then read part two of his story to see what he did right, what mistakes he made, and how you can be successful with your own nano aquarium.



David Bell

## Breeding Pearl Danios

If you enjoy keeping danios, the pearl danio is sure to please. It is an active, surface-dwelling fish with a glittering blue body and an outgoing personality that pops wonderfully in a planted tank. In this month's article extra, Jennifer Wilkinson relates her experiences with the pearl danio, including multiple different ways to raise the fry. Check out the *TFH* Extras blog to learn more about this fascinating fish.



Tony Terceira

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## The Blue Peacock Bass

Cichlids can be kings of aquaria, and the blue peacock bass (*Cichla piquiti*) undoubtedly bears this title. With the potential to grow to approximately 2 feet in length, this brute would require a huge aquarium—300 gallons or more. Members of the genus *Cichla* are generally sensitive to metabolic waste buildup, which has been associated with incidents of head-and-lateral-line erosion. Ensure that you have superb filtration and change the water regularly if you are planning to keep this species.

Being a skilled predator, any tankmates kept with the blue peacock bass must be its equal in both size and temperament—think other large cichlids and large armored catfish. Wild-caught specimens will likely take only live foods to start, but they can usually be





# Q&A freshwater

## Q Thick-Lipped Gourami

Is the thick-lipped gourami one of the dwarf gouramis? I noticed that it looks a lot like *Colisa lalia*, but I don't know whether it reaches about the same maximum size or if it's a bigger species. My dealer has this fish labeled as a member of the *Trichogaster* genus. Aren't the species in that genus usually larger? For instance, I know that *Trichogaster trichopterus* can grow to about 6 inches. I'm looking for something in the 3- to 4-inch range.

Hayden Degroft  
via email

Many of the popular gourami species have been reassigned to different genera in recent years, so it might be necessary to rethink some of your size assumptions. Just to give you a sense of the changes in classification that have taken place, the gouramis of the *Colisa* genus have been moved to the *Trichogaster* genus. For example, the popular dwarf gourami (formerly *Colisa lalia*) is now classified as *Trichogaster lalius* and the thick-lipped gourami (formerly *Colisa labiosa*) is now *Trichogaster labiosa*. The aforementioned *Trichogaster trichopterus*—the three-spot gourami in all its color variations—is now *Trichopodus trichopterus*.

So, getting back to your original question, the thick-lipped gourami (*Trichogaster labiosa*) has a maximum total length that is virtually the same as that of *Trichogaster lalius*—right around 3½ inches, which is right in your desired size range.

## Q Brackish/Freshwater Disagreement

I've kept freshwater aquariums for many years, and lately I've been exploring the possibility of setting up a brackish tank. In researching these systems, I've noticed that there's often disagreement, sometimes even between experts, over whether a fish really needs to be kept in brackish water or not. Why is that?

Mike Conroy  
via email

Such disagreements arise largely because many brackish species' distributions span a wide range of salinities, so individual experiences with them can vary considerably.

It's important to note that "brackish" is not defined by a set salinity level. Brackish conditions occur anywhere that fresh water and seawater meet and mix, such as the estuarine environment where a river empties into the sea. The salinity level of this type of environment is highly variable depending on your proximity to either the freshwater or saltwater source (as well as factors such as rainfall and changing tides). In other words, the farther you travel upriver, the lower the salinity, and the closer you get to the ocean, the higher the salinity.

Some fish will travel back and forth routinely from one environment to the next; some will spend different life stages in different environments; and some will temporarily move into an area of differing salinity for a specific purpose, such as spawning or eliminating external parasites. In some cases,

## 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](mailto: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](http://forums.tfhmagazine.com).



different populations of the same species will adapt to different salinity levels depending on where they occur in the species' natural range.

So, considering all these factors, it's not always so cut and dried whether a species should be given brackish conditions in the aquarium setting.

## Q Leveling Aquarium

How big a deal is it if an aquarium isn't completely level? I just filled up my 20-gallon tank, and it's about a half inch out of level from side to side. If you think I do need to level the tank, is it okay to put shims between the glass aquarium and stand, or do they have to go between the stand and the floor?

Greg Reno  
via email

A A tank that isn't level can be a really big deal. I learned that from experience many years ago when a 29-gallon tank in my dining room, which was about a quarter inch off level, sprang a leak at one of the front corners. Fortunately, I noticed the leak before too much damage was done to the hardwood floor, but you might not be so lucky. I would strongly urge you to drain the tank and level it before you've got a real problem on your hands.

When leveling the tank, you definitely want to place the shims between the stand and the floor rather than under the tank. If you shim between the tank and stand, uneven stresses will be applied to various points along the bottom of the tank once it's filled, which can result in a leak or, worse, cause the glass bottom to break. You really want to make sure that the entire bottom edge of the tank stays in contact with the surface of the stand.

## Q Fishy Friend for Red-Eared Slider?

Hello there, TFH! I am a nine-year-old hobbyist, and I have one red-eared slider in a 20-gallon tank. I would like to put some fish in the tank with him so he has friends. Can you tell me what kind of fish will get along okay with my turtle?

Zack Sharp  
Owensboro, Kentucky

A I'm afraid it would be best not to keep any fish with your red-eared slider, Zack. You see, the turtle would consider any fish you put in there to be food instead of a possible friend. If the turtle is very small, it might not eat the fish right



Andrzej Zabawski

■ Dwarf gourami (*Trichogaster lalius*); *Trichogaster* gouramis were once grouped in the *Colisa* genus.



Altug/Shutterstock

■ Red-eared slider (*Trachemys scripta elegans*); turtles and fish should not be kept together, as the latter would become inevitable fodder.

away, but as it grows, you will almost certainly start to see fish disappear. There's also another reason fish and turtles don't mix well. That is, turtles are very messy animals and will pollute the water in an aquarium very quickly. So, even if the fish aren't eaten, they won't live for very long in that dirty water!

## Q Vacation Feeding Question

I'll be leaving for a two-week vacation in a month, and I'm not sure how to make sure all my fish are properly fed while I'm gone. I have automatic feeders for the fish that eat mostly flakes or pellets, but I have some fish that won't eat anything but frozen foods. I think two weeks is too long for

them to go without eating. Do you have any suggestions?

Ron Colburn  
Mount Vernon, New York

A I agree that two weeks is a bit long to leave fish unfed. But that doesn't mean they have to be fed every day while you're away on vacation. Perhaps you can ask a family member, friend, or trusted neighbor to stop by every other day or just a few times each week (whatever schedule you can work out) and feed the specimens that won't accept dry foods.

One note of caution, however: It's very easy to foul an aquarium by overfeeding frozen foods, and it's very common for nonhobbyists to feed



more than is necessary. So, I would suggest that you preapportion the food. Whenever I have to go out of town and rely on someone else to feed my fish, I use a sharp knife to cut frozen foods into appropriately sized portions (just enough for the desired number of daily feedings) and place each day's ration in its own compartment of an ice cube tray. Then, I instruct the person to thaw the portions in a cup of aquarium water before feeding. That way, I can eliminate any guesswork that might result in overfeeding.

Q

### Convict Julie a Mouthbrooder?

Does the convict julie incubate eggs in its mouth like so many Malawi cichlids? I'm just curious because I'm considering buying and breeding them.

Connell Dashner  
El Paso, Texas

A

First, I should clarify that the julies, or *Julidochromis* species, are not found in Lake Malawi. They're actually endemic to (i.e., their range is restricted to) Lake Tanganyika. The species in question could be *J. regani*—though many *Julidochromis* species are similarly striped and hybridization among them is common, so I can't be certain. And, no, *Julidochromis* cichlids are not mouthbrooders. Rather, they are cave spawners, with the females typically depositing their eggs on cave roofs.

If you want to breed them, be sure to provide several cave-like structures, such as overturned terracotta pots or suitably arranged rockwork. It's best to purchase several young specimens and allow them to pair up naturally. Breeding pairs will behave aggressively toward tankmates, so it's usually best to remove the other specimens once a pair has become established. However, if your tank is sufficiently large and offers plenty of room and



Andrzej Zabawski

■ *Julidochromis transcriptus* require cave-like structures for breeding.

structure to allow for multiple territories, you should be able to keep more than one breeding pair together.

The fry can be fed newly hatched brine shrimp and be left with the parents until they are approximately an inch in size. At around that size, the parents will usually try to drive them away.

Q

### pH Explained

Can you clarify what pH is for me? I understand that on the pH scale, 7.0 is considered neutral, readings lower than 7.0 are more acidic, and readings higher than 7.0 are more basic. But what exactly is being measured to determine where the pH falls on that scale?

Cindy Tate  
Sparks, Nevada



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**A** When you test the pH of your aquarium water, what you're actually measuring is the relative concentrations of hydrogen ions ( $H^+$ ) and hydroxyl ions ( $OH^-$ ). At a neutral reading of 7.0 (on a scale from 1 to 14), the concentrations of  $H^+$  and  $OH^-$  are in balance. Below 7.0, the concentration of  $H^+$  ions is higher. Above 7.0, the balance tips in favor of  $OH^-$  ions. It's also important to note that the pH scale is logarithmic. That means a difference of one whole unit represents a ten-fold change in pH. For example, a pH of 5.0 is ten times more acidic than 6.0 and a hundred times more acidic than 7.0. The same holds true going in the opposite direction on the scale. A pH of 9.0 is ten times more basic than 8.0 and a hundred times more basic than 7.0.

## Q Well-Behaved Tiger Barbs?

**Q** I have a 40-gallon freshwater aquarium that contains 15 tiger barbs, a pleco (not sure of the species), and an angelfish. I'm relatively new to the aquarium hobby, so it wasn't until after I introduced the angelfish that I learned it wasn't such a good idea to add this long-finned fish to a tank full of fin-nipping tiger barbs. But the odd thing is, I've been watching the fish very closely since I added the angelfish, and from what I can tell, the tiger barbs haven't bothered it at all. In fact, they seem to ignore it completely. Did I luck out in getting especially well-behaved tiger barbs?

Leslie Geoffrion  
via email



Formiktopus/Shutterstock

■ Tiger barbs (*Puntius tetrazona*) should be kept in larger groups to encourage their natural behavior and minimize their nippiness toward tankmates.

**A** I'd say you definitely lucked out—not in the sense that you happened to get especially well-behaved tiger barbs (*Puntius tetrazona*), but because, whether by happenstance or design, you're keeping them in an appropriately large group. Tiger barbs certainly can be nippy toward tankmates, but this tends to be a bigger problem when specimens are kept singly or in small numbers. When kept in large schools—the natural social structure for *P. tetrazona*—the individuals in the group focus their energy and attention on one another as they vie for position in the social hierarchy. But when kept singly or in undersized groups, all that energy is more likely

to be directed outward toward heterospecific tankmates. That's when fin nipping becomes a problem. Nonetheless, I would keep a close eye on things to make sure your luck—and your angelfish's luck—doesn't run out. If you observe evidence of harassment by the barbs or stress in the angelfish, I would recommend finding a new home for it.

## Q Lake Rocks as Live Rocks

**Q** What's your opinion on the feasibility of collecting rocks from a local inland lake for use in an aquarium as freshwater live rock? I shared this thought with my dealer, and he advised against it because of the risk of introducing diseases or pests. But don't marine aquarists run the very same risk when they put wild-collected live rocks in their tanks?

Dylan York  
Kalamazoo, Michigan

**A** I would be inclined to agree with your dealer in this situation. While there certainly is a risk of introducing undesirable organisms with wild-collected live rocks destined for saltwater aquariums, these rocks are collected from reef environments where dissolved nutrients and pollutants are extremely low. Hence, you're not likely to accidentally pollute or poison a saltwater tank by adding live rocks. My concern with adding rocks collected from a local inland lake is that, in addition to the potential of introducing undesirable pests or pathogens, you'd necessarily have to

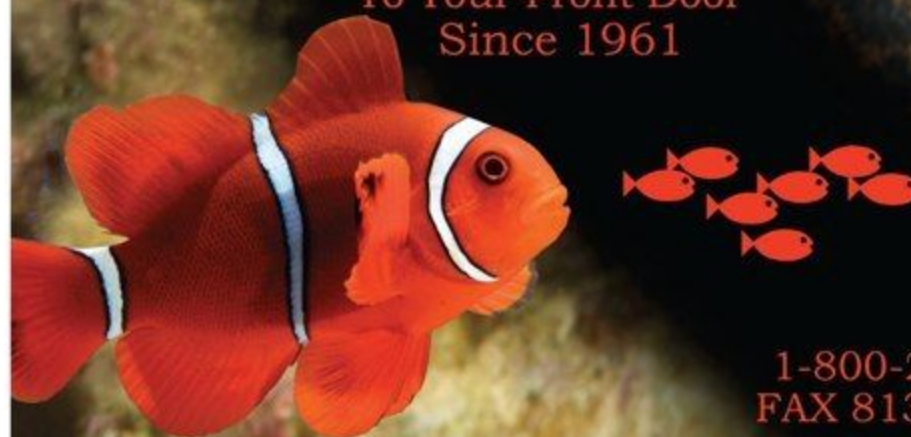
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collect them from a near-shore location where there's a good chance the rocks have been contaminated via fertilizer/pesticide runoff from the land, oil or fuel residue from boat traffic, etc. So, in my opinion, the risk of introducing some sort of chemical contaminant, parasite, or pathogen outweighs any benefit the rocks might provide in your tank.

**Q The Key to Keeping Cardinals**  
Why is it that I have great success keeping schools of neon tetras but fail every time I try to keep cardinal tetras? Am I overlooking some key requirement that differs between neons and cardinals?  
John Esch  
via email

**A** The biggest mistake many hobbyists make when keeping cardinal tetras (*Paracheirodon axelrodi*) is providing them with the same environmental conditions they would provide for neon tetras (*P. innesi*). This is certainly an honest mistake given the striking similarity in the appearance of these two species, but cardinals and neons will not thrive under the same conditions. Both species favor water that is on the soft, acidic side, but cardinals demand much warmer temperatures than neons do. In fact, they do quite well at temperatures in the low to mid-80s.

It's also important to note that, whereas neon tetras are commonly bred in captivity, the cardinal tetras in the trade are still



Andrzej Zabawski

■ Cardinal tetras (*Paracheirodon axelrodi*) have a preference for warmer waters.

predominately wild caught and have undergone quite a stressful journey prior to arriving in hobbyists' tanks. That means they are much less forgiving when it comes to water parameters that fall outside the norm for the species. They must be handled cautiously to minimize additional stress, and they must be acclimated to their new home very carefully.

Also, and I can't stress this enough, make sure you get healthy specimens to begin with. You don't necessarily want to buy a batch from a shipment that has just arrived at your local fish store. Put some money down to hold the specimens that interest you, and allow them a couple days to recuperate from their journey before taking them home. Also, if you notice dead or sickly specimens in the sales tank, hold off for a healthier shipment.

**Q Dwarf Ctenopoma Care**  
Can you provide any information on how to care for dwarf ctenopomas? I'd like to set up a small tank for some if I can find them (which hasn't been easy so far).  
Mark Lorenzo  
via email

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**A**s you've observed, acquiring dwarf ctenopomas (presumably *Microctenopoma nanum*) is no easy task. This small African anabantoid, one of the so-called climbing gouramis, is not commonly sold, so you'll probably need to ask a dealer to special order some specimens for you or at least advise you when a shipment is likely to arrive. If you're a member of an aquarium club, society, or online forum, fellow members might be able to help you source them or refer you to others who can.

If you are able to get your hands on some specimens, provide a well-planted tank so this shy species has ample places to hide. The water should be moderately hard with a pH somewhere between slightly acidic and slightly alkaline. Any tankmates must be equally shy and peaceful. Favored natural food items include insect larvae and aquatic invertebrates, so good choices for aquarium feeding include offerings such as mysis shrimp, brine shrimp, mosquito larvae, and blackworms.

**Q Indoor Pond?**

A water gardening center in my city has several rectangular above-ground ponds that they use to display pond plants. Seeing these got me thinking about reproducing something like that in my home and putting fish in it. Have you ever heard of people setting up ponds indoors?

Jim Sofo  
via email

**A** Oh, yes, I have heard of people setting up ponds indoors. In fact, it's something of a growing trend. An indoor pond can range anywhere from something around the size of a tub or half whiskey barrel water garden to much larger designs using rigid or flexible pond liners framed with wood, brick, or other construction materials. However, this is not a project you should enter into lightly. Just as when setting up a large glass or acrylic aquarium, a lot of prior planning is necessary, and there are myriad factors to consider when setting up an indoor pond.

Some of these factors include the amount of weight the pond will exert on your floor (not surprisingly, the basement is a popular choice of location); the possible consequences a water leak would have on your home's structure and furnishings; accessibility of power, sewer, and other utilities; the presence



■ Indoor ponds are captivating but require substantial preparation for success.

of young children or curious pets in the home; the type of fish, plants, or other livestock you'd like to keep; the filtration and heating needs of the livestock; the lighting needs of any plants or other livestock; and whether you want the pond to function as an attractive aquatic display or a utilitarian holding tank (e.g., for overwintering fish or plants).

I would advise starting with some online research on indoor ponds and, depending on the size and scope of your envisioned project, seeking the counsel of a professional builder before beginning construction.

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# Q&A saltwater

## Q Four-Line and Bluehead Wrasse Compatibility

What are the odds that a four-line wrasse and bluehead wrasse will coexist peacefully? I already have the four-line wrasse in my 125-gallon tank, and I have an opportunity to get a bluehead wrasse from a friend for free. I'd really hate to turn it down! I'm not worried about any of the other fish in the tank because they're all big enough that the bluehead shouldn't bother them, but I'm not so sure about the four-line wrasse.

Brad Billmeier  
St. Louis, Missouri

A I think the odds are pretty slim that your four-line wrasse (*Pseudocheilinus tetrataenia*) will coexist peacefully with a bluehead wrasse (*Thalassoma bifasciatum*) for the long term. *T. bifasciatum* is known to include small fishes in its diet, so *P. tetrataenia*, which reaches only about 3 inches (compared to *T. bifasciatum*'s maximum size of around 10 inches), would likely find itself on the menu at some point. Even if it doesn't eat the four-line wrasse, I'd still be concerned that the bluehead will torment its much smaller cousin to death. If you're really determined to add the bluehead to your 125-gallon, I would recommend that you first find a new home for the four-line.

## Q Calcium Requirements

What is the proper calcium level for a reef tank, and how much liquid calcium supplement would I need to add each day to a 55-gallon tank?

Shaundra Keyes  
via email

A A good target calcium level is somewhere between 400 and 450 ppm. I can't tell you how much liquid calcium to add to your tank daily in order to maintain that desired level because that depends entirely on the calcium demand of the organisms in your system. For example, a tank containing only a small number of soft corals would require much less calcium supplementation than one containing a large number of small-polyp stony corals and/or giant clams, which utilize a great deal more calcium in the development of their skeletons/shells. I would suggest that you start with the manufacturer's minimum recommended dosage, monitor your calcium level with regular testing, and then adjust the dose if necessary.

Keep in mind that calcium supplementation goes hand in hand with alkalinity supplementation. You'll need to add a buffering product to keep your system's pH in the desired range of 8.2 to 8.4 as well as to provide the carbonates corals need (in addition to calcium) to build their skeletons. Most manufacturers that offer a calcium supplement also include a buffer in their product line. As with adding calcium, you'll need to experiment a bit with the buffer dosage to reach and maintain an appropriate level.

Also, don't be surprised if your system's calcium and alkalinity demands increase over time. This is to be expected as the corals and other invertebrates grow.

## Q Jackknife Fish

One of the aquarium dealers in my area has a neat little fish called a jackknife fish for sale. It's silver with black stripes and has a really long dorsal fin and tail. It's about 2 or 3 inches long. Can you tell me anything about this species? Is it a good candidate

## 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](mailto: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](http://forums.tfhmagazine.com).



for a fish-only-with-live-rock aquarium?

Jeffery Archer  
Chicago, Illinois

**A** The species you saw was probably a juvenile specimen of *Equetus lanceolatus*, a drum (family Sciaenidae) that hails from the tropical Western Atlantic. Some years ago, I had the pleasure of encountering a juvenile of this species while diving in the Florida Keys. The tiny thing was fluttering a few inches above the sand right at the base of the reef and seemed utterly unperturbed by my presence. It was a delight to behold! Sometimes it's the little things you see while diving that are the most memorable.

Unfortunately, *E. lanceolatus* does not have the best track record for success in captivity. It tends to suffer in shipping and doesn't always acclimate well to aquarium conditions and fare. Oftentimes, live foods are needed to elicit a feeding response and may be the only foods a specimen will learn to accept. Also, this species will grow much larger than the 2- to 3-inch specimen you saw at your local fish store. Expect it to reach somewhere around 10 inches.

To improve the odds of success in keeping this species, start with a healthy, uninjured specimen and provide a large aquarium (at least 100 gallons), ample hiding places in the form of caves and overhangs, a bed of live sand, and, ideally, a productive refugium as an additional source of live food. Also, avoid aggressive tankmates and any species that will outcompete the jackknife fish at mealtimes.

## **Q** What Eats Slime Algae?

My 30-gallon saltwater tank is experiencing an outbreak of some type of slimy, black algae, and I need some advice on what type of fish or invert to add to get rid of it. Do you know of a species that does a good job of eating this stuff? It's starting to take over my tank, and it's really gross! I can clean it off the rocks really easily with a brush (it comes loose in sheets) and siphon, but then it grows right back again a few days later. Thanks in advance for any help you can give me!

Devon Smith  
via email

**A** The black, slimy stuff growing in your tank is most likely cyanobacteria, also known as blue-green algae. Despite this common name, cyanobacteria can appear in



Andrzej Zabawski

■ Tankmates for bluehead wrasses (*Thalassoma bifasciatum*) should be similarly sized, as this species will likely bother or feed on any smaller fishes.



NURC/UNCW and NOAA/FGBNMS

■ Albeit challenging to keep, the jackknife fish (*Equetus lanceolatus*) can be kept successfully in a large-enough aquarium with ample hiding places.

many different colors, including black. I don't know of any fish or invertebrate that will eat cyanobacteria in sufficient quantities to bring a major outbreak under control. In fact, I wouldn't recommend adding any organisms to your system at this point, as doing so will only make matters worse by increasing the level of the dissolved nutrients that are fueling the outbreak.

You'll need to attack this problem using a multipronged approach. To begin with, you should assess your stocking level and feeding regimen to make sure both are appropriate for

your system. Cyanobacteria outbreaks are most common in tanks that are overstocked and/or overfed. Adjust either variable as needed.

Next, you need to step up the volume and frequency of water changes to reduce the level of dissolved nutrients. During each change, try to dislodge and siphon out as much of the cyanobacteria as possible. Vigorous protein skimming is a vital ally in keeping dissolved organic compounds under control as well, so you may need to consider either adding a skimmer to your system or upgrading the one you have.



Another important factor you'll need to address is water movement. Cyanobacteria tends to thrive in dead areas where water movement is slack and detritus accumulates. The addition of a powerhead or some other current source with its effluent directed into the problem area will help keep detritus in suspension so it can be filtered out and make it difficult for loosely attached cyanobacteria to maintain a foothold on the rocks and substrate.

By taking a good hard look at the various factors that influence nutrient import and export—and taking the necessary steps to tip the balance in favor of nutrient export—you should be able to bring that nasty cyanobacteria outbreak under control.

## Q Misidentified Humbug?

I recently bought a fish that was identified as a humbug damsel, but after looking at some photos of humbug damsels online, I'm concerned that my specimen might have been misidentified at the dealer. In all the photos I've seen, the humbug damsel has a solid white tail, but I noticed that my specimen's tail is half



Stephan Kerkhofs/Shutterstock

■ Humbug damsel (*Dascyllus aruanus*); despite subtle differences in its black-and-white coloration, *D. aruanus* looks largely identical to *D. melanurus*.

black. Do you think the one I bought is the same species but just a different color variation, or is it another species?

Joyce Ricks  
Gainesville, Georgia

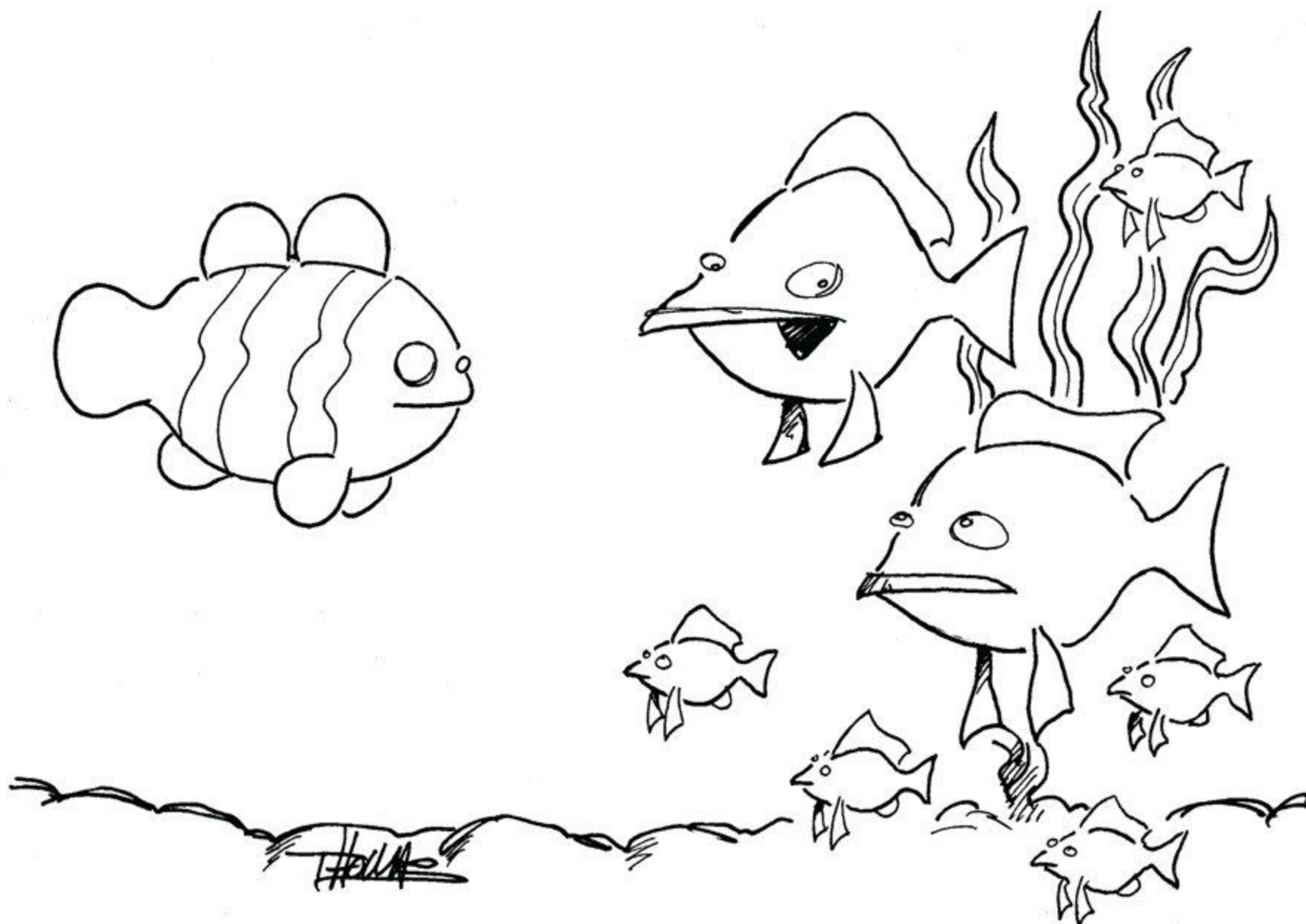
**A** Two damsel species, *Dascyllus aruanus* and *D. melanurus*, are commonly sold as "humbug damsels." The former species has a solid white tail, while the latter's tail has a black band along the trailing edge. Your

specimen is very likely *D. melanurus*. There's also another obvious (once you know to look for it) feature that distinguishes these two species from one another. That is, *D. aruanus* has an almost completely black dorsal fin, while on *D. melanurus* the white mid-body coloration extends up into the dorsal fin so the black is interrupted by a white band. Owing to the black on its tail, you might see *D. melanurus* identified as the black humbug or blacktail damsel. To confuse matters even more, both of these species are sometimes identified as the striped damselfish as well. Notwithstanding these subtle differences in coloration, *D. aruanus* and *D. melanurus* are virtually interchangeable in terms of their ultimate size (about 3 inches), behavior (belligerent), and care requirements.

## Q Midas Lost Golden Touch

My Midas blenny, which was a nice golden yellow when I bought it three days ago, has suddenly changed its color to a dull brownish gray. Why do you suppose that happened?

Norm Koldenberg  
Warren, Michigan



"It's the clown I hired for the kids' birthday party."



**A** The Midas blenny (*Ecsenius midas*) is notorious for undergoing rapid color changes. One could say it's quite chameleon-like for a fish. In fact, when it transitions from resting on the bottom to swimming in the water column, it will often assume the color of other fishes surrounding it in order to blend in. For example, *E. midas* is known to school with *Pseudanthias squamipinnis* and, when doing so, takes on this species' orange-yellow coloration. Also, *E. midas* may change color to blend in with the substrate it's resting on or as a response to various stressors. It's a good idea to check all your water parameters and monitor your livestock for any evidence of harassment by tankmates so you can rule out stress as the cause. Otherwise, if your specimen appears healthy and is eating well, I wouldn't be overly worried about the color change.



Dray van Beeck/Shutterstock

■ The Midas blenny (*Ecsenius midas*) is capable of changing colors.

## Q Pom Pom Crab Reef-Safe?

Is it safe to add a boxer crab to a reef tank? I can get one at my local fish store, but before I commit to buying it, I want to make sure it won't cause any problems with my corals.

Joe Gomez  
via email

**A** Assuming the crab you're referring to is *Lybia tessellata*—a fascinating species that carries a tiny anemone in each claw for defense and food acquisition—it's probably safe to add one to your reef tank. The emphasis here is on "probably" because despite the fact that this species is generally considered reef-safe, even the best-behaved crabs can sometimes turn rogue in reef systems and begin nibbling on valued invertebrates.

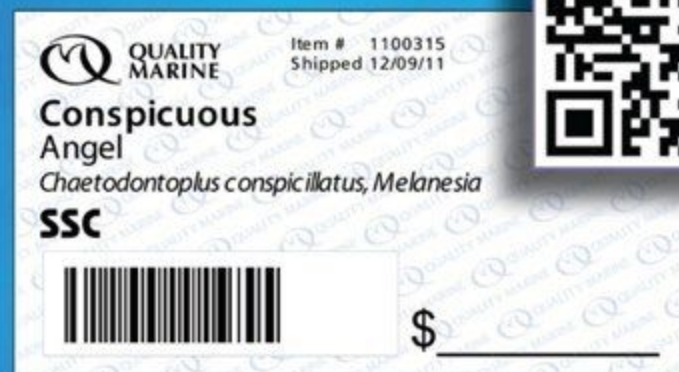
You didn't provide any information on the size of your system, but you should be aware that *L. tessellata* is not ideally suited for large systems. It reaches only an inch or so in size and is easily lost in a big reef aquarium with lots of hiding places. It also tends to fare poorly when kept with aggressive tankmates. I very frequently find myself advising readers that this or that species gets too large for the average home

aquarium, but *L. tessellata* is one of those rare exceptions where smaller is definitely better with respect to tank size (provided every effort is made to maintain stable parameters and exceptional water quality, of course). In fact, I'd say this species, with its beauty, diminutive size, and fascinating symbiotic behavior, is about the perfect candidate for up-close observation in a nano tank. 🐠

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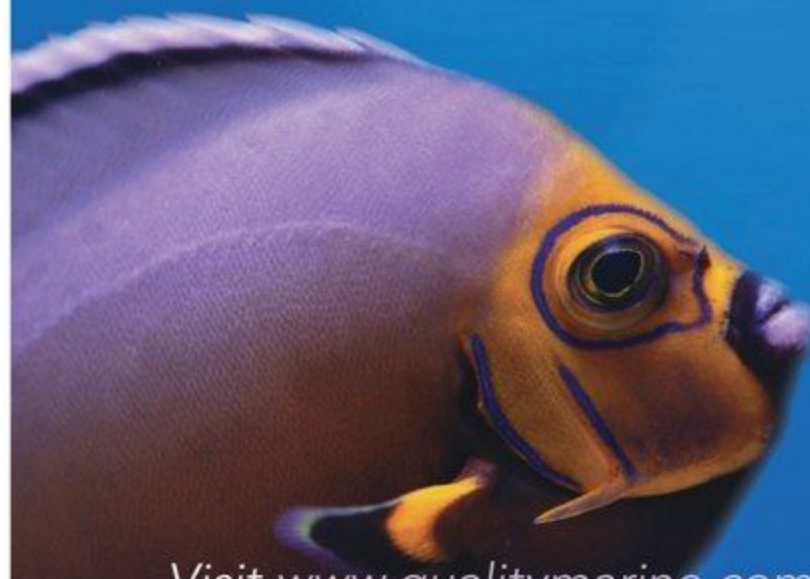
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# ask jack

## Dear Jack,

In the different discus literature I've read, much has been written about live foods. Many species in the animal kingdom require live food, and I am certain that discus fall into this group in their native streams. They certainly aren't finding any dry pellet or flake foods in these streams. I live in a part of Costa Rica where almost any aquatic live foods can either be found or raised. Can you tell me if dry foods for discus are as good as, or better than, the live foods available here?

Jose Garcia

San Jose, Costa Rica

## Dear Jose,

Much discussion regarding the merits of live foods for discus has taken place since discus first appeared on the scene here in the United States. It was said that any success with discus depended on live food in their diet. That live food probably consisted of tubifex worms, daphnia, and enchytraeid whiteworms. Over time, Artemia came along in many forms, as well as frozen bloodworms, krill, Spirulina algae, and Chlorella algae.

At that time, any dry foods for tropical fish were not of the best quality, but with heavy marketing, the foods were accepted and used by many hobbyists. When I came along with discus, I was certainly no advocate of flake foods for tropical fish. However, a good friend of mine, a Japanese-American tropical fish breeder in South Miami, was feeding canned dog food to a number of Amazonian tropicals he was importing. He suggested I try the food for my discus, which ultimately led to my use of fresh beef heart for my discus.

After seeing small cichlids in Brazil eating algae from a small floating log, I added a bit of green food to the beef heart. The formula didn't end there; I added shrimp, liver, egg, even banana, and was experiencing success. I began sharing this formula with discus breeders in Japan. Many discus breeders still feed a discus formula similar to this one, though the flake and pellet foods on the

market have since advanced to the point where I consider them superior to most any other forms of tropical fish food. There are so many variables that affect optimum protein percentages in discus rations that it is difficult for me to recommend an appropriate level for maximum growth of the fish. After I gave a discus presentation in Yucatan, Mexico, one breeder told me he added brewer's yeast to his discus formula and got excellent growth from his young fish.

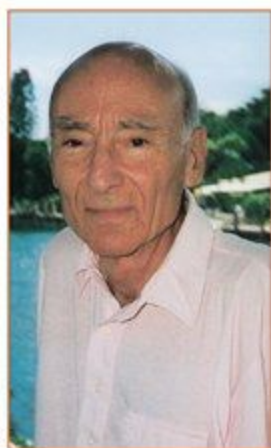
The ten amino acids that have been identified as indispensable for most tropical fish, including discus, are included in quality dry foods. However, if you should go the way of the live foods that can be cultivated, I would certainly include the tropical flake foods in their diet. You'll be able to find flake food easily in San Jose.

Animal protein, in general, has a higher nutritive quality for discus than plant protein. And if you should look at the percentages of protein in the different discus dry foods, you'll see that these percentages are generally higher than the protein percentages of foods for cage birds and pet animals. I don't know why this is, but it is interesting to note. I generally make up my formulas with a protein percentage of 38 to 40 percent for discus kept at a water temperature of 82°F.

If you doubt the value of animal protein matter in discus diets, make a little three-week dietary test with as few as eight small discus, 4 inches in size, each in a 5-gallon tank, with the same water conditions (temperature, pH, percentage of water changes). Feed one of the tanks twice daily an animal protein diet and the other tank a plant protein diet. You can use soybean meal with Spirulina as your plant protein food. Needless to say, both diets must be as close to equal in weight as possible. Results showing the advantages of the animal diet will be seen quickly—you shouldn't even need to complete the three-week test period.

When it comes to vitamins and minerals for discus, in the early discus-keeping period, no supplements were considered necessary, as the fish obtained them from their natural food.

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



Today, however, I find them to be necessary in the flake and pellet foods that I feed my fish. Vitamin and mineral requirements are different for fish fry, 16- to 20-week-old fish, young adults, and breeders. The foods from Poland that I use include these supplements in their formulas. It is difficult to determine mineral requirements. If your discus water has calcium present, it may eliminate any need for a dietary source, but I would be certain that the diet does include thiamine (vitamin B1) and B12 vitamins.

Your climate is similar to ours, and I certainly would attempt to cultivate live mosquito larvae if you can keep the breeding situation under control. Don't allow the mosquitoes to develop past the pupae stage, as the next stage results in live, fully developed mosquitoes!

### Dear Jack,

I plan to purchase several small discus for a 40-gallon aquarium. Will you please provide me information that will allow me to succeed with their keeping? I do have enough experience to be able to keep my present tropical fish in very good condition. Thanks.

Jeff Young

Fargo, North Dakota

### Dear Jeff,

Where will you purchase your discus? It is generally better to purchase discus from a breeder or from a shop that specializes in discus. Many discus in aquarium or pet shops are not given the necessary care regarding water temperature, pH checks, proper tankmates, etc., to maintain good condition.

How many discus should one purchase at a time? Purchasing only two discus for the tank will more than likely be a mistake, even if both fish are the same size. The reason is that sooner or later (usually sooner), one of the two fish will exert its presence in the aquarium and totally dominate the second fish. In doing so, the discus will not allow its tankmate to feed or swim freely without being chased or harassed. If this persists for any extended period of time, the second fish will cease to grow normally and, in some cases, eventually die. For this reason, it is best to initially purchase at least five or six discus, in which case the dominant one will not take its aggression out on a single fish. And with four or five tankmates, there will be enough movement and confusion at feeding time to maintain control. But then, why not simply remove the dominant fish in the first place so the fish can settle down? In a group of five or six discus, the second most dominant fish would then take over. This is, of course, nothing more than the natural pecking order in nature establishing itself.



Andreas Gradin/Shutterstock

■ Keeping discus in groups will effectively disperse and minimize the aggression of dominant individuals.

For the novice discus hobbyist, it is wise to have a basic knowledge of freshwater fishkeeping before making the initial discus purchase. With that in hand, the best size to purchase would probably be approximately 2½ inches, for several reasons. At that size, they adjust quickly to their new surroundings, much more so than larger discus do, and they do not suffer the trauma or stress in the move from the dealer's tank to the hobbyist's tank. This is critical, especially if your discus have been bought from an out-of-state dealer and the fish have been shipped to you by air. We expect the young discus that we ship by air to be fully adjusting and eating on the same day they are placed in their new tank. In the home aquarium, your discus should be up to the front glass in the tank and actively looking for food when you enter the room.

Unlike most other tropical fish, discus are seldom seen in very large numbers in aquarium shops. If the hobbyist is in a position to personally select his discus from the dealer's tanks, there are several guidelines to follow. First, if the hobbyist selects the largest fish in the tank, will he end up with all males? Not necessarily. At 2½ inches, it is too early for the males to have developed into a larger size than the females, so I would definitely choose the largest, most robust fish in the tank. It is important to make sure that the dealer has not just fed the discus in that particular tank, as transferring any discus from one tank to another with a full stomach of food will most likely result in the fish becoming constipated.

The size of the eyes, in relation to the overall size of the fish, should give a clear indication of whether or not the fish have been given the

proper care during the crucial grow-out period. The eyes should be red or orange in color. Eyes that are dark gray or black in color or that are abnormally large more than likely indicate poor care or an existing disease.

In the dealer's tank, the young discus should be active and moving about assertively. If any are huddled in a back corner of the tank or are dark in color, this indicates they are probably sick. These discus are to be avoided as well as the healthy-looking ones that are in the same tank, as they are probably destined to become sick as well.

Many young discus manifest visible fin or gill deformities, which are nearly always attributed to either a genetic problem or a problem with the water. A fin deformity will usually show up as a malformed anal fin or malformed gill plates. There are times, however, when the fin deformity is caused by a bacterial problem in the water at the time the fry are very small and delicate. I have seen, on occasion, tanks of tiny discus with what was without a doubt a serious bacterial bloom in the water, in which case, all the fry were destined to develop deformed fins. When the gills on the fish are not properly formed, poor water quality or a genetic imbalance is generally the cause. When either of these deformities is caused by poor water quality, the young fish can still be used as future breeders, as the gill and fin problems will not be passed to the next generation as long as the bacterial problem has been resolved. Most of us, however, do not want to raise young deformed fish for eventual breeding. 🐟





# cichlid world

## Apistos: The Ideal Dwarf Cichlids

The smallest cichlids, generally those under 4 inches in total length, are known as dwarf cichlids, though as adults, they are actually quite normal in size for their species. Some of the Tanganyikan dwarf cichlids that live in shells, such as *Lamprologus meleagris*, could be imagined to be smaller versions of some of the larger species, such as *Lepidolamprologus elongatus*. But unlike miniature horses or Chihuahuas, the dwarf cichlids are not miniature versions of the same species. It is sort of astounding that, with all of the selective breeding of cichlids for strange colors and shapes, a nickel-sized discus or miniature Oscar has not yet entered the market.

Many hobbyists, including myself, got started with the dwarf cichlids, mainly because they do not require as large a tank as their larger cousins. Some of them are easy to keep and easy to breed, have interesting colors and behaviors, and make great parents. This is why the first cichlids many hobbyists start with are the convicts (*Amatitlania nigrofasciata*). Female convicts develop brilliant orange bellies when ready to spawn. They tolerate a wide range of water conditions, eat just about anything, and are, in general, not considered delicate. Convicts are sort of aggressive for their size, however, and

while they can be bred in a 15-gallon tank, an adult pair can easily take over a 55-gallon tank, kicking out all the other convicts and terrorizing any other tankmates.

### Caring for Apistos

At the other end of the scale in many ways are the dwarf cichlids in the genus *Apistogramma*, known commonly as apistos. This is currently a large genus, with over 60 described species, and as many as 200 species are estimated to live in the wild. The species have been divided into several lineages and further into groups, complexes, and subcomplexes, depending on the pattern of melanin, or black pigment, found on their bodies. Fin shape and color are not thought to be as diagnostic as to which group a species belongs.

Found mainly in the Amazon River Basin, apistos generally prefer soft and acidic water. They are happier in planted tanks and are not known to spend their time uprooting plants like their distant cousins, the convicts. They pretty much make the perfect cichlid for the planted tank enthusiast, but they are also very much at home with the standard hardy plant trio of *Anubias*, Java fern, and Java moss. When tied to

Eric Hanneman brought goldfish home in those white, waxy cardboard 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. For five years he owned and operated a tropical fish specialty store. He now works as the aquarist at the North Carolina Museum of Natural Sciences and is most interested in the cichlids of Guatemala.



eric hanneman



pieces of driftwood or stone, these plants anchor themselves with their roots and allow easy tank cleaning or fry catching by simply removing the wood with the plant attached. *Bolbitis* works the same way but is a little more difficult to grow, preferring some current. You can often find hornwort and duckweed floating around in my tanks too.

While apistos will accept flake and other prepared foods, they seem to do a lot better if some live food is included in their diet. I have often used baby brine shrimp, which is easy to hatch and, therefore, readily available. Though a small food item, baby brine shrimp is happily consumed by adult apistos and many other dwarf cichlids. If there are fry present, they can also get a meal. Additionally, microworms are good for the fry.

Whiteworms are another great live food for the adults. Whiteworms are easy to grow on some soggy white bread in a shoe box full of dirt, but they require cooler temperatures, so keep them on the floor of the basement or in a Styrofoam box containing a refreezable bag or frozen bottle of water to keep them cool. Tubifex worms (*Tubifex* spp.) are not considered safe by many hobbyists and could transmit some diseases to fish. Lately, I have been using the aquacultured blackworms, known scientifically as *Lumbriculus variegatus*, with some success. These worms still need to be kept cool and rinsed regularly to keep them alive and should be thrown out if the rinse water does not run clear or the worms fail to come together in balls. I keep mine in a spare tank with a box filter, and the tank gets a 10 percent water change every day through the automatic water-changing system. My fish do not seem to like them as much as whiteworms.

But back to the fish. Some apistos are easier to work with than others. There are some that seem to prefer the pH to be about 4. At this pH, nitrifying bacteria are not active. This means that all of the ammonia that the fish naturally produce has to be removed by plants or water changes, as it is toxic and not being converted into the less toxic nitrate by bacteria. If some apistos are not maintained and bred at the right pH and temperature, you may get fry of all one sex. Others will be unable to tolerate hard water as well. But some are a bit easier to work with.



Andrzej Zabawski

■ Redstripe apisto (*Apistogramma hongsloti*); apistos do best in tanks with soft and acidic water.



Andrzej Zabawski

■ Male cockatoo cichlids are differentiated by the first few rays in their dorsal fins, which are elongated.

## Cockatoo Cichlids

One of my favorite apistos is *A. cacatuoides*, sometimes called the cockatoo cichlid. Males have the first few rays of the dorsal fin elongated. The tail is squared off and elongated at the tips. The dorsal fin and the dorsal half of the caudal fin are reddish orange with many irregular black spots. A dark bar down the side, with thinner broken black bars below, can help identify *A. cacatuoides*. Small fish are difficult to sex. With wild-like color forms, usually only the males exhibit any color in the fins at all,

so those with color are male. Females are drab until they start to breed. They then turn an amazing canary yellow with a distinctive black spot on the side, a dark stripe extending from the eye to the base of the jaw, and black edges on the pelvic fins. Cockatoos are territorial, and males will fight. Like many of the apistos, cockatoos are harem spawners. I have heard stories that in the wild, they live in small streams that may be choked with leaves, and each leaf contains a female guarding eggs, so the territories are rather small. I once did



an experiment to see just how large a territory they would claim. I placed three pairs of *A. steindachneri* into a 6-foot-long, 100-gallon tank. It had some rocks and pots scattered around, but it was not a planted tank. The alpha male drove the other two males into the corners, and they were removed. He proceeded to spawn with each of the three females, one on each end and one in the middle. All three raised fry, but the female in the middle was constantly harassed by the females on the ends, who stole her

fry and took them to raise as their own. That was quite a large territory, though I am sure with more cover, there could have been more pairs in the tank.

Several color forms have been developed in the aquarium trade. The first was known as double red because it showed an increase in the red areas of the dorsal and caudal fins. Then came triple red, with the red and black blotching present in the anal fin as well. A sport known as red flash has no black pigment in the fins, but the unpaired

fins are a solid orange color. Another form known as gold has lost most of the black pigment in the body and has a gold overall color. Both reds and the orange flash have been combined with the gold form. When picking out pairs of double or triple reds, sometimes the females do have color in the fins, so look for yellowish bodies or the dark stripe under the eye or along the front edge of the pelvic fins. Females are often the smallest ones in the tank, so if they are all the same size and the same color, there are likely no females in the tank. If apistos are raised at too high of a pH, there may be only one sex among the fry. Temperature can also play a role in sex determination.

### Breeding Cockatoo Cichlid Varieties

I started breeding double reds in 15-gallon tanks with a sponge filter, with some plants tied to pieces of wood, small rocks and pieces of slate formed into caves, a half inch of sand in the bottom, and some small clay pots with openings just big enough for the fish



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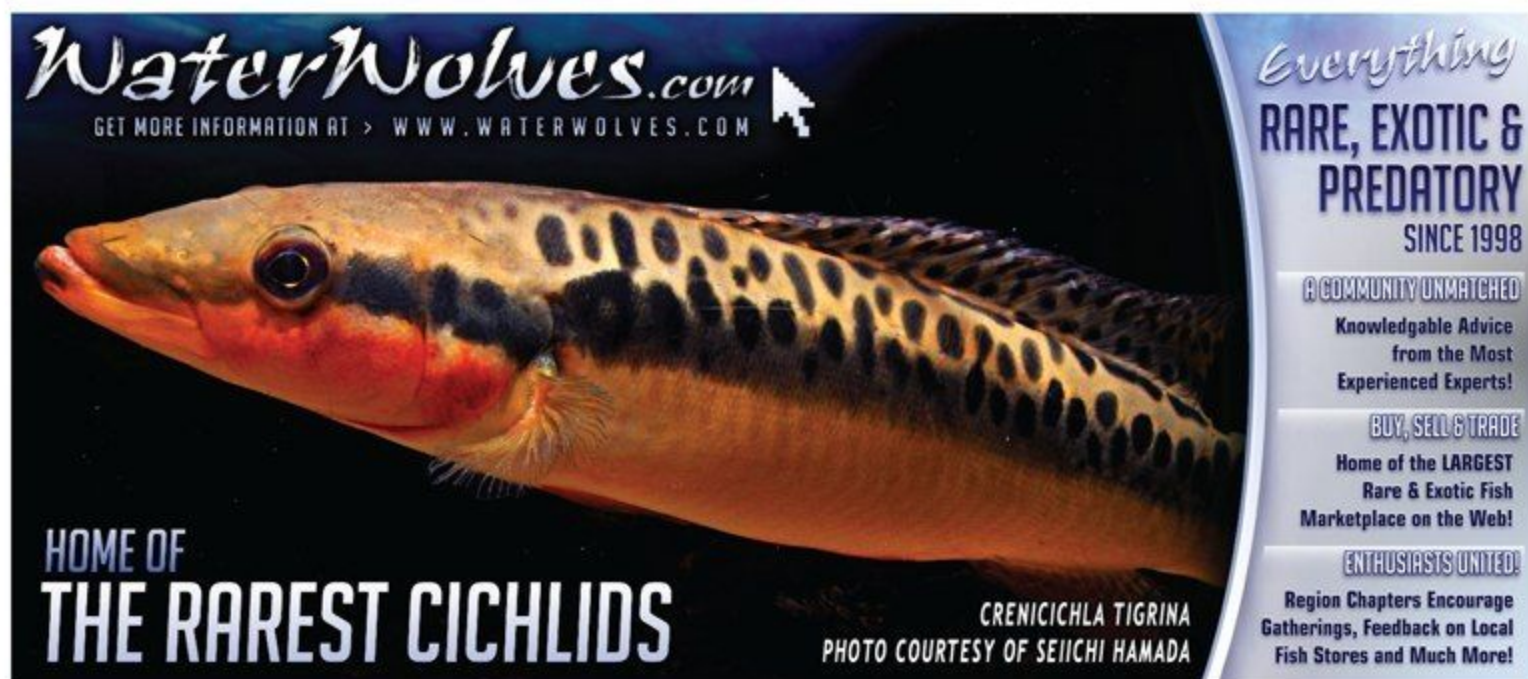
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Eric Hanneman

■ The double red color form of *A. cacaotoides* features intense red coloration in the dorsal and caudal fins.



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to fit through. An alternative to clay pots is to cut a coconut shell in half and notch out an opening in the edge. This allows you to pick up the shell and see if it contains eggs. Or you can attach the shell to a piece of slate with silicone sealant.

While cockatoos are known to be polygamous harem spawners, I found that a single pair was often fine together. I got hold of some orange flash and some golds and thought it would be neat to try to combine the two traits and make a gold orange flash. I took a male from a pair of orange flash and



a female from a gold strain and threw them together. This method works best if there are several places for them to choose as spawning sites and there is plenty of cover in the tank for the female to hide in if they do not get along at first. With plenty of live food, clean soft water, and a temperature of about 78°F, usually they can see a way to get down to business.

I raised these fry, the F<sub>1</sub>s, until I could tell males and females and then set up six breeding pairs. I was not sure how the two traits would combine but since they were both recessive, none of those F<sub>1</sub> fry showed either red flash or gold. I hoped that one-quarter of the F<sub>2</sub>s would give me the gold orange flash I desired. And it was true, and they were a lot of fun. I found that cockatoos generally make good parents, though I often removed the adults after the fry became free swimming. I kept track of individual fish, since some adults made better breeders than others.

Then one day I was in a different state and happened to walk into a local fish store, and there was a tank full of



Eric Hanneman

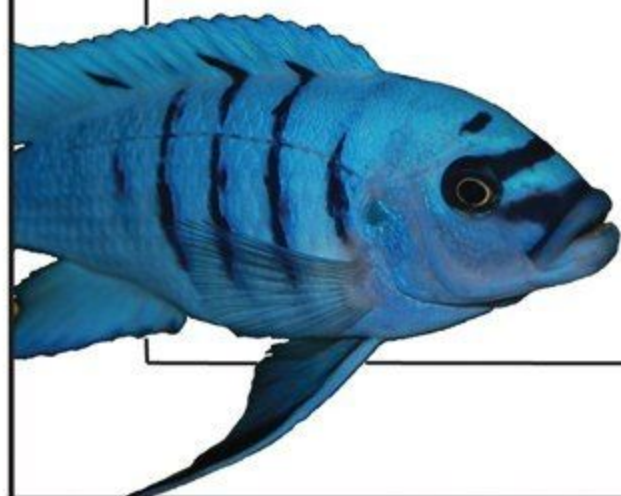
■ Viejita apisto (*A. viejita*); apistos should be provided some live food in their diet, such as whiteworms and baby brine shrimp.

gold orange flash cockatoos. Boy was I disappointed. I was not the only one to have that idea, and I evidently had it late. I kept that species around for quite a while, as it was one of the fish that

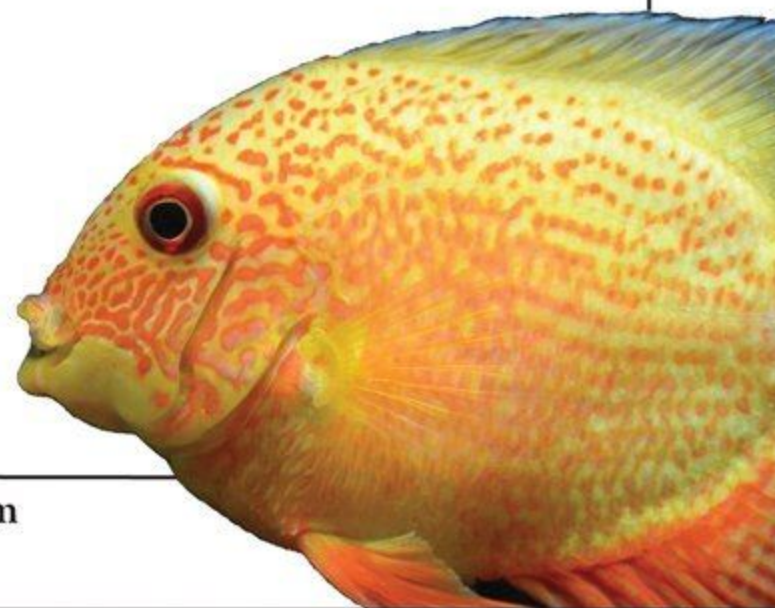
sold itself in the tropical fish store. But eventually they faded away.

Thus ended my breeding experiment—maybe next time I will work on a dwarf cockatoo. 🐟

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# the planted tank

## Evolution in the Hobby

I've always had a love of nature, and for some reason, I've always had a fascination with very small things. My childhood was filled with collecting insects and small animals, and I was always trying to make little miniature worlds for them to live in using the natural materials found around them.

In 1970, I got my first aquarium for my sixth birthday, and my hobby grew from there. At first, my mom helped me a lot with the tank, and I know that some of the fish and plants I enjoy the most are reminders of those early days. Guppies with black tails, albino corydoras, and neon tetras were some of the first fish I had. But while I still find these very appealing, I now prefer the cardinal tetras to the neons because I think they have better color.

Many people get their first aquariums either as children or as the parents of children. Getting an aquarium is a learning experience, and beginning hobbyists are often not equipped with the information they need to be successful in the hobby. There are often quite a few errors involved, and many beginning hobbyists become discouraged.

### Starting in the Hobby

My first aquarium evolved rapidly. The original tank was a 10-gallon, metal-framed tank with a matching metal incandescent hood. It had a heater and corner box filter with activated carbon and filter floss that bubbled away from the air pump connected to it. My father made a metal stand for

the tank, and it started life in our living room. The original decoration was a small ceramic piece made to look like a rock formation with two holes in it so the fish could swim through.

Soon, the tank was upgraded. The hood was brought into the local aquarium shop and converted to fluorescent lighting, and the tank was brought in to have a back painted on. During this time period, it was quite popular for aquarium backs to be painted with a crystallizing paint. Mine was done with a red and green starburst. My mom also took a red plastic bucket and cut it apart to make elevated sections in the aquarium. Two sections of the bucket were placed in the back corners at different levels, and each was filled with a different type of natural-looking gravel. The front section had a third type of natural-looking gravel. The ceramic rock went in the front section, and some small plants were added. Most didn't do that well. *Cabomba* and banana plants died; anacharis, hornwort, and duckweed were about the only successful plants.

It wasn't long before I took over the care of the tank. There was a library that shared a building with the fire department where I lived. It was a small town that would soon be encroached on and surrounded by a larger one. I was an avid reader and started reading the library's books on aquarium care. I also continued with my fascination with the natural world. One of my favorite things to do was go fishing, and my favorite lake had many different types of aquatic

Rhonda Wilson has a lifelong interest in all things aquatic and started keeping aquariums at age six. She has a fishroom with about 80 planted tanks. Rhonda has read TFH since the mid-70s, and she co-authored the TFH book *The Simple Guide to Planted Aquariums*. Active in local and national aquarium groups for over 16 years, including as the past chairman of the American Livebearer Association, she now maintains a forum on her website at <http://naturalaquariums.com>.



rhonda wilson  
photographs by the author



plants growing in it. I loved looking over the edge of our little motorboat and watching them go by under me.

## Growing with Aquariums

One aquarium turned into two when I acquired a 5-gallon aquarium, and they moved into my bedroom in our new house. This one I painted myself with blue and white paint, which did not turn out anything like a starburst. It was more like two curved stripes across the back. I had chosen this color scheme because I really wanted to breed zebra danios. I used blue and white gravel with a sparkly little decorative substance over the substrate. It was sold in little bags and was lightweight. I eventually figured out it was the pieces left over after buttons were stamped out of plastic sheets. This tank had a single incandescent bulb, and about the only plant that was interested in growing was duckweed. I didn't succeed in breeding danios then, though I found it relatively easy years later when I tried them again as an adult.

I started reading *TFH* in the 1970s and still have my first copies, though they went through an apartment fire and got wet from the fire hoses in 1985. As I read more and continued to expand the knowledge of my hobby, my aquariums became more successful and more numerous. When I was in high school in the early 1980s, I was trading black and black-and-white gerbils that I was breeding for aquarium supplies at a local pet store.

During this time, I added a few more plants to those that I could grow: *Vallisneria*, Amazon swords, and water sprite (*Ceratopteris cornuta*). Water sprite is actually a fern, and, like many plants that can grow under or above water, it can be quite variable. There has been some discussion as to whether or not there are two species in the hobby or one. I think the most commonly held belief at this point is that there are two: *C. cornuta*, which has wider oak-shaped leaves or fronds, and *C. thalictroides*, which has finer, more dissected fronds. I know that I have grown two very different *Ceratopteris*. *C. cornuta* tended to like life as a floating plant for me, meaning most of the plants I was growing were floating plants. At that point, I was still using some plastic plants in conjunction with the floating ones, since not much light was getting to the bottom and not many plants were really growing there.



■ The author's first fishroom.



■ Kiddie pools are a low-tech but effective means of maintaining plants outdoors.

My collection of aquariums really started growing when I moved to Arizona. I had a mobile home there and built special shelves around several aquariums and had quite a few others in windows. In Arizona, the sunlight is amazingly different than it is in Washington or Montana, where I'd lived previously. With very diffused lighting from the windows, I was growing all the previous plants listed, except the *C. cornuta*, which did not like the move to Arizona. *Rotala rotundifolia*, *Aponogeton* spp., *Saururus cernuus*, and mosses were some of the plants that were added to my growing collection. Over the years, I phased out heaters, which weren't really needed in Arizona, and most other filters and equipment. My tanks were basically

just aquariums with lighting, gravel, plants, fish, and snails.

I had also recently discovered the joys of the Internet and contacting other aquarium hobbyists around the country and even around the world. It was incredible for me to find others who shared my crazy aquarium obsession. I started joining aquarium groups and becoming involved in the hobby on a broader scale.

## Developing a Fishroom

When I finally moved to a home, I found one that had a room that would work well as a fishroom. It was about 22 feet long by 11 feet wide. In the 15 years I lived there, this was my fishroom. It started

out as an added-on room to the house. It had served the previous owners as a workroom. The door was more like a barn door and made with a southwestern, old ranch style with many holes between the stylish but impractical piece. I put plastic over the doors, and that's the way it stayed for the first several years. The room was eventually equipped with a real door, and it was incorporated into the house. There was a tall workbench that held some of my tanks, and some of the shelves from my mobile home were also moved over. More shelves were built with 2 x 4 and 2 x 6 lumber. Ted Judy lived in Arizona at the time and even came over and contributed a great deal of help and expertise in building some of my first shelves there.





■ This 10-gallon aquarium from the early 1990s included *Aponogeton*, *Rotala*, *Anubias*, and other plants.

I kept collecting more tanks and adding more lighting to the aquariums so I could keep growing more plants. I found many tanks and lighting at thrift stores and yard sales. More were bought from or given by other hobbyist friends, including a large set of shelves and tanks from Peter Unmack. These shelves were made of 2 x 4 lumber stacked on cement blocks. In the end, the last shelves I made in the room were of this kind. All wood shelves were nice in regard to being able to make them exactly the size wanted. The cement blocks also took up valuable space, but in the end, the ease of putting them up convinced me to use that style for the last shelves I had put into the room.

Over time, new techniques for growing aquarium plants came into practice and more plants became available to hobbyists. The beautiful *Nature Aquarium World* books by Takashi Amano were printed, and the planted aquarium hobby became a whole new world. I've tried several aquariums with various combinations of homemade and purchased substrates and substrate additives, fertilizers, and additional CO<sub>2</sub>.

At one point, I had over 90 aquariums in my home and fishroom, though most were in the fishroom. I decided that was too many and I wanted fewer but larger aquariums, so my fishroom slowly shrunk down to about 70 tanks. Over the years, I added many plants and fish to my

collection. I began trying every new plant, animal, or fish I could and then, over time, gradually became much more selective in what I would add to my collection. I am usually tempted by any new aquarium plant I find, though I also have old and new favorites that I often fall back on.

### My Hobby Today

I recently moved back to Washington State, where I'm from originally. I significantly reduced the number of aquariums I'm keeping for the move and plan on spending a lot more time with fewer tanks for the time being. I do intend to once again have a fishroom in the future, and I'm hoping to extend my hobby a bit more into the field of aquaponics. This is a practice of farming using a hydroponics-like system that runs the water through a tank of fish to fertilize the plants. The fish are usually also on the menu, but I'd like to try it with the small aquarium fish I've enjoyed so much over the years. I would also like to try growing semiaquatic edible plants, such as watercress and water chestnuts.

It's always best to be well informed as an aquarist, but mistakes happen, and time and experience are also important. First and sometimes multiple attempts are not always successful, but most reasonable aquarium goals are eventually attainable when self education and experience are combined. There are more successes over time, and many aquarists enjoy the challenge of trying new aspects of the hobby. 🐟

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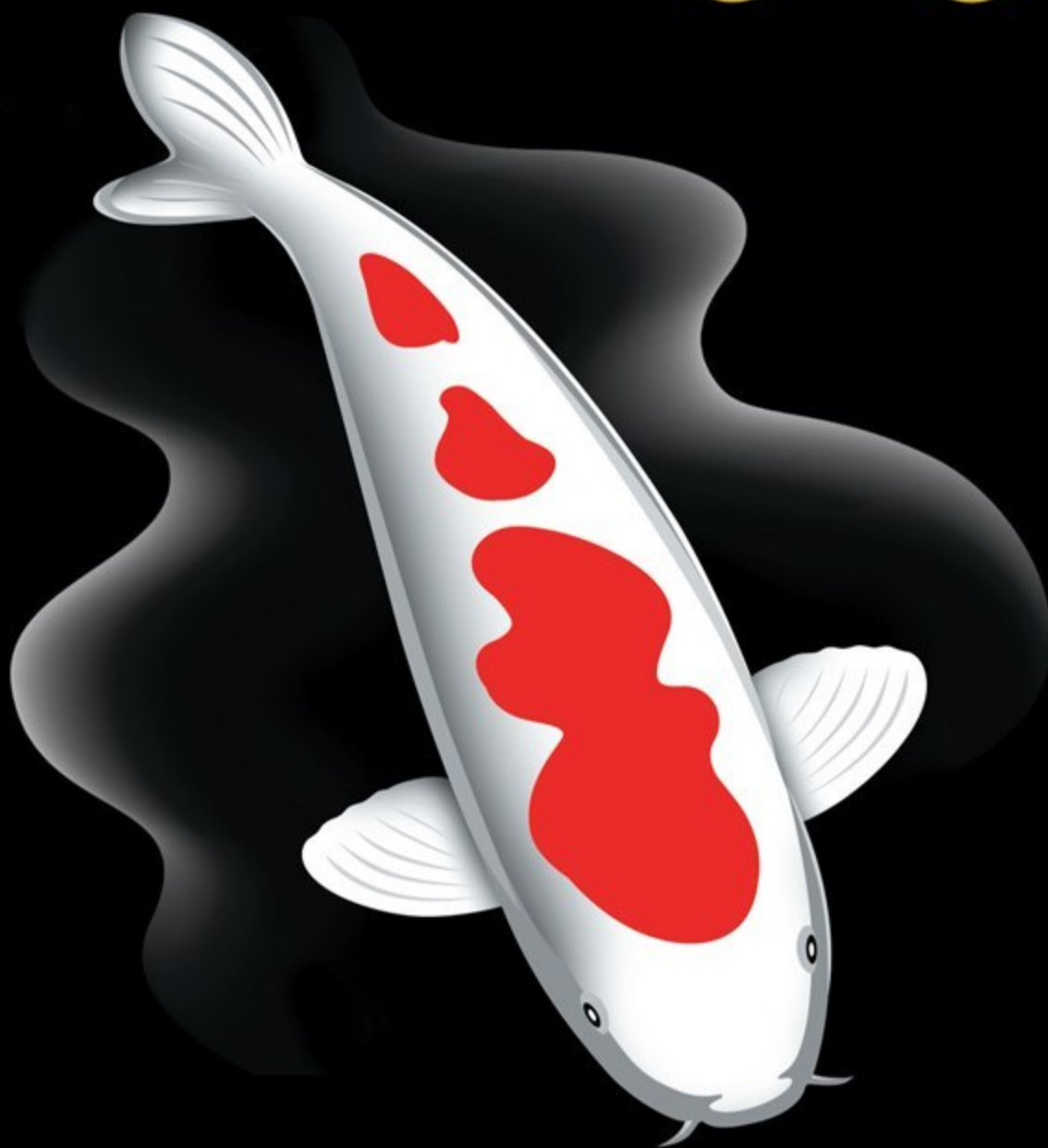


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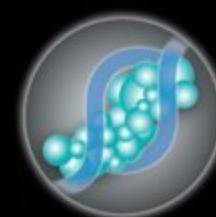




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# into the labyrinth

## Climbing Gouramis (*Anabas* spp.)

**W**hat is an anabantid? The term anabantid is used incorrectly by most hobbyists, even those with many years of experience, in what may be a case of “old habits die hard.” Most of the labyrinth fish were at one time considered to be members of the family Anabantidae, so aquarists correctly referred to them as anabantids, but due to the subsequent erection of more families, it's no longer accurate to do so. The family Anabantidae includes the genera *Anabas*, *Sandelia*, *Ctenopoma*, and *Microctenopoma*, but my focus this month will be on the genus *Anabas*.

Members of the genus *Anabas* may be the most primitive of the gouramis. I have always considered *A. testudineus* to be the prototypical anabantid. *A. testudineus* was described by Bloch in 1792 and is the type species of the genus. Many members of the genera *Ctenopoma*, *Microctenopoma*, and *Sandelia* were originally described as *Anabas* species before being moved to different genera.

### A Climbing Fish

The name “*Anabas*” means climber, which reflects the species' behavior and also leads to the common name of climbing perch or climbing gourami. *Anabas* can tolerate extremely poor water conditions, yet sometimes an individual will find it necessary to seek out new water sources—in fact, it has the ability to travel short distances over land to reach a new water source when necessary. Such travel generally takes place at night or in the early morning when the ground is wet or during heavy rains. These travels are generally done in groups. It is said that the climbing perch can travel up to several hundred meters and is capable of climbing over fallen tree trunks. Overland travel is propelled by the

tail or caudal peduncle, with the pelvic and pectoral fins acting as props. Because climbing perch are quite popular food fish throughout their range, discoveries of traveling groups are well received by the local populace, as this enables them to catch the fish easily and in quantity.

To aquarists, the common name should imply that a tight-fitting cover is a necessity. Due to the strength of this species, it may be necessary to put weights on the cover for larger specimens, as they can push right through a traditional aquarium hood.

The climbing perch ranges from Pakistan to the Wallace Line, which delineates the change in fauna from Asian-derived species to Australian species and runs through Indonesia, between Borneo and Sulawesi, and then through the Lombok Strait between Bali and Lombok.

With such broad distribution, one can only wonder if *A. testudineus* represents a single species or if it is a catch-all name for an assemblage of species. The likelihood is that there are a number of species, all of which are currently considered to be *A. testudineus*. Because this species has been widely introduced as a food fish, the almost inevitable escapes that follow such introductions have resulted in a hybrid gene pool that scientists may not be able to unravel. There are reports that some forms, i.e., fish from some locations, reach only 4 inches in length. Unfortunately, there is no way to know for sure what you are buying when you purchase young specimens, so the hobbyist should always plan for their specimens to potentially reach 10 inches in length.

In body shape, *A. testudineus* resembles a compressed sausage. As I already mentioned, it can grow up to 10 inches in length. The color is a uniform brown to gray, sometimes

Mark Denaro has been keeping freshwater aquariums since 1970 and marine aquariums since 1976. He currently operates Anubias Design ([www.anubiasdesign.com](http://www.anubiasdesign.com)), an aquarium and terrarium design, installation, and maintenance company serving southeastern Pennsylvania, and importer/online retailer of new, rare, and interesting freshwater fishes, invertebrates, and plants. A former president of the International Betta Congress, Mark's primary interests are anabantoids, cichlids, and planted aquariums.



mark denaro  
photographs by the author



with olive overtones, and there is a black ocellus on the caudal peduncle, a black spot on the operculum, and usually two stripes under the jaw. Vertical rows of spots may be present on the body. In some individuals, their presence seems to depend on mood. The relatively short fins are clear or can be the same color as the body. Overall, this is not a particularly attractive fish and its appeal to the aquarist is due to its behavior.

## Keeping the Climbing Gourami

It is most frequently exported from India and Thailand, though it may also reach the hobby from Vietnam or Indonesia. *A. testudineus* is an aggressive, territorial ambush predator that feeds primarily on shrimp and small fish, though it may also feed on plants. In a seeming contradiction, it is also a shy species, preferring to spend most of its time in vegetation or hiding among submersed trees. A single specimen can be kept in an aquarium as small as 30 gallons, but groups need a minimum of 75 gallons and will require larger tanks as they grow.

Decor should include some caves, and any plants included in the aquascape should be robust. *A. testudineus* will spend some time sitting on or hiding in plants, and some specimens have quite a taste for soft-leaved species. Appropriate choices would include *Anubias* spp., *Echinodorus* spp., or ferns of the genera *Bolbitis* and *Microsorium*. The addition of floating plants, such as water sprite (*Ceratopteris thalictroides*) or water lettuce (*Pistia stratiotes*), is also beneficial and will provide additional cover for the climbing perch. Lighting should be just bright enough to meet the needs of the plants.

*A. testudineus* should never be kept with fishes small enough to be swallowed. Ideally, tankmates should be as large as or larger than the climbing perch, or their body shape should be deep enough or broad enough that they cannot be swallowed. Most aggression will be targeted at conspecifics, but other fish may be bullied as well. Some other species of anabantoids make excellent tankmates, particularly the larger gouramies of the genus *Trichogaster* such as the pearl gourami (*T. leerii*), the moonlight gourami (*T. microlepis*), and the snakeskin gourami (*T. pectoralis*).

Similarly sized cichlids that are not overly aggressive can make good tankmates. The climbing perch will spend most of its time near the bottom, and this should be considered when choosing tankmates. Because cichlids will occupy the same area



■ Climbing perch (*Anabas testudineus*).



■ A suitable setup for climbing perch would include decor for refuge, such as driftwood.

of the aquarium, they should be carefully considered prior to purchase. If they are very territorial, they might not get along well with the climbing perch. Excellent choices in New World cichlids would include species such as *Paratheraps synspilus*, *Hoplarchus psittacus*, the various members of the *Heros severus* complex, and larger geophagines and acaras. Suitable tankmates among the Old World cichlids would include the various haps and peacocks from Lake Malawi and the larger chromides.

There are many schooling fishes that will help provide movement higher in the water column. Unfortunately, many of these are herbivorous and their inclusion will necessitate eliminating plants from the aquascape. Larger barbs, such as the various tinfoil types, work well but may eventually outgrow most home aquaria. Species like the redline torpedo barb (*Puntius denisonii*) and the bony lip barb (*Osteochilus vittatus*) are less likely to bother plants. The silver dollars are also good choices. They are peaceful and should cohabitate well with the climbing perch but will look at any plants as a salad bar. Smaller *Distichodus*

species are also acceptable.

The catfish provide practically unlimited choices, ranging from loricariids to doradids to pimelodids to mochokids to bagrids, and include a number of schooling fish as well as those best kept individually. Your choices are limited only by the suitably sized species available to you.

## Spawning *Anabas* spp.

Spawning *Anabas* spp. involves the typical anabantoid embrace, in which the male wraps his body around the female and fertilizes the eggs as they are produced. Unlike the vast majority of anabantoids, *Anabas* practices no brood care. In nature, the spawning season is tied to the rainy season and occurs from mid-April to mid-June. The eggs, which can easily number 5,000 to 20,000 or more in a single spawn, are buoyant and will float to the surface where they are ignored by the spawning pair. The eggs hatch in 24 to 48 hours, and the fry begin to feed on tiny live foods 24 hours or so afterward. First foods must be infusorians or similar live foods. They will not be large enough to accept even newly





■ *A. testudineus* has the remarkable ability of traveling over short distances on land.

hatched brine shrimp for approximately 10 days. Natural spawnings in the aquarium are still rare, and most spawns are induced by injection of hormones.

#### **A. COBOJIUS**

The other described member of the genus, *A. cobojius*, the Ganges perch, may occasionally be exported from India as *A.*

*testudineus*. It hails from India and Bangladesh and is deeper bodied than the more common and more widespread *A. testudineus*. Of course, it may not be a valid species in its own right and may represent a geographic variation of *A. testudineus* or a hybrid form of *Anabas*. Numerous other species have been described, but all have eventually been considered to be synonymous with *A.*

*testudineus*, with the exception of *A. oligolepis*, which is now regarded as a junior synonym of *A. cobojius*. Das described three subspecies of *A. testudineus* in 1966, but these are now considered invalid and regarded merely as *A. testudineus*. It is entirely possible that further work on these fish will result in some of these descriptions being resurrected or the naming of additional new species.

### **A Worthy Challenge**

The maintenance of *Anabas* species is still somewhat challenging in the aquarium, and breeding this species is one of the ultimate challenges for anabantoid keepers. Determination of ways to naturally trigger spawning is a project worthy of any advanced hobbyist. It might seem that keeping *Anabas* in a pond or water garden would provide them with the necessary spawning triggers, but this is a bad idea because they are extremely cold tolerant and their escape could result in the species establishing itself in much of the country. This is a risk the hobbyist cannot and must not take; these fish should be kept only in indoor aquariums. 🐟

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# going nano

## Going Wabi-Sabi

**L**ike so many planted tank hobbyists, I was eager to create a nature-style aquarium after discovering the works of Takashi Amano and seeing the prized, high-ranking aquariums in the contests held by the Aquatic Gardeners Association. But as I have yet to obtain the skills of such grand masters in planted aquaria and have somewhat less time to spend on manicuring tidy lawns of *Glossostigma* or *Hemianthus* and other shrubbery, I decided on something simpler for my new nano.

Having interest in both Buddhist philosophy and aquariums, I discovered the concept of wabi-sabi, a Japanese aesthetic that aims to express unique beauty derived from natural simplicity, transience, and imperfection. Though it can be said that many nature-style aquariums embody elements of this natural ideal, many are profoundly complex and require precise cultivation and fastidious maintenance to achieve the desired layout. These often aim to present a precise snapshot in time that, unfortunately, can be quickly ruined when plants mature past a certain point. I felt inclined to create a wabi-sabi layout, as it would show a simple, imperfect beauty and an ever-changing (though well-maintained) natural overgrowth. My goal was to produce a basic yet attractive aquascape that would not only be less demanding to maintain but also make for a lovely display, constantly reminding viewers of the transience and beautiful imperfection inherent in nature.

5-gallon) aquarium measuring 35½ x 21½ x 26 cm (14 x 8½ x 10½ inches). Lighting was provided with a black desk lamp, whose base and neck were hidden behind the tank. The long head supports a power compact fluorescent bulb of 4000K (which comes out a cool white color, although no PAR information was available). This is the best aesthetic in small lighting I could find for this tank, and given the small tank size and depth, the color and wattage were satisfactory for my needs. Filtration is provided by a small internal powerhead, with the head pointed against the rear glass to create some surface agitation and spread the flow down the glass and around the tank. As a bonus, it lessens the direct flow for my prize animal, a male *Betta splendens*. I have a small internal heater set to 26°C (78°F). I planned for both the filter and heater to be concealed by plant growth.

### The Design and Layout

Despite the aim of the wabi-sabi aquarium to look simple and imperfect, some careful design and planning was still needed to create a sense of balance and natural beauty. Indeed, while trying to create the impression of transience, letting too much time pass can result in an overgrown mess of plants, so forethought is important in planning a layout and a maintenance routine must be followed after it is created.

I decided to fill this nano with a lone piece of dramatic, interesting driftwood, one with many branches, twists, and crevices, but which would be easy to get around for trimming and not totally overwhelm the layout. It also needed to be large to create

Lea Maddocks is a long-time fish enthusiast and has been a scuba diver since age 15. A biologist, Lea is fascinated with aquarium science, including fish and invert husbandry, planted aquariums, reefs, and the art of aquascaping. Lea now operates Acumen Aquatics providing aquarium installs, assistance, and maintenance. She supplies her own FinSafe betta ornaments, is an active member of the Canberra District Aquarium Society, contributes to several fish and aquatic plant forums, and has written for the Australian RSPCA on the nitrogen cycle, goldfish, and betta care. Lea owns three planted tanks, and routinely maintains many freshwater tanks, a turtle tank, a marine reef, and is a volunteer worker at the National Zoo & Aquarium in Canberra, Australia—in the aquarium section of course!



lea maddocks

photographs by the author

### The Setup

For this aquascape, I chose a small, black-rimmed, 18-liter (approximately



a strong presence. The wood I finally chose had to be cut in several places to fit this look and the aquarium itself.

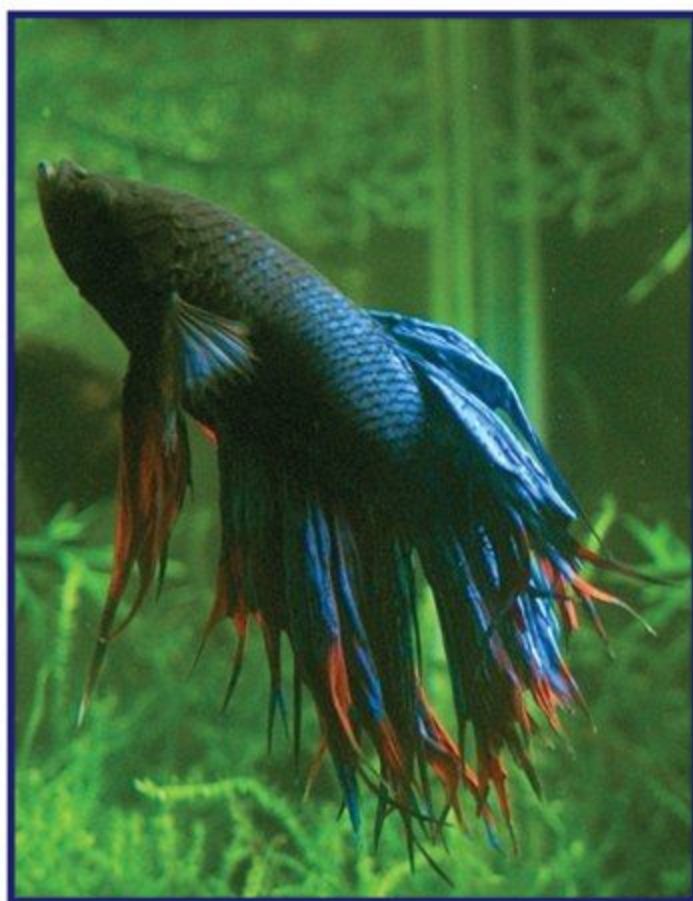
In keeping planting simple, I chose only two species of plants: lace fern, also known as water sprite (*Ceratopteris thalictroides*), and Java moss. These plants possess fine leaves to create a better sense of scale in a nano tank. Additionally, they are hardy and simple to grow. They can also create nice bushy effects, grow rapidly, and tend to grow over and engulf things.

I wanted both the moss and thicket of water sprite to look wild and as if they had, over time, captured the driftwood, thus conveying a passage of time and always presenting some degree of imperfect messiness. In terms of maintenance, both plants are also easy to trim and will forgive the occasional rough pruning. Their small, sprawling leaves will quickly cover trimmed areas and lend to the imperfection of the aquascape. However, considerable care is still required when trimming, as grossly uneven parts will look unnatural and disturb the overall impression.

My original idea was to have the water sprite as a thicket in the rear, possibly punctuated with Java fern, and the driftwood branches reaching down into the tank like roots into a river, with moss growing over them and across the substrate. After purchasing the driftwood and fiddling around with positioning the wood, moss, and plants, the layout just didn't seem to suit the piece of wood I'd purchased. It looked top heavy.

I changed tactics and oriented the wood in a position that seemed to complement its character, which seemed best with the trunk in the right corner and the branches reaching across the tank. To achieve a sense of balance, I placed the thicket of water sprite at the opposing corner so the branches would reach out and up into it (and also nicely conceal the heater and filter). The water sprite was just weighted down on the roots with some dark stones, as this plant does better with exposed roots in my experience, and then the roots and stones were covered loosely with moss. The placement for the remaining moss then became obvious, as a wild lawn across the substrate, covering the base of the water sprite and then reaching up and over the wood, becoming a bush to hide the origin of the trunk.

To prevent it from appearing too busy and chaotic, a patch of cleared substrate at



■ The author's nano includes a single but colorful, complementary male *Betta splendens*.



■ The Darwin red-nose shrimp looks great and does an effective job of cleaning algae.

the front between some branches that were placed on the substrate was maintained. This also seems to balance the thicket of fern diagonal to it and showcases the colors of the wood and plants against the substrate, which in this case was fine-grade, black-stone flakes of moon sand, as I had no plans to use it for properly rooted plants. The backing is also black, which I feel brings out the colors and makes them appear more dramatic.

## Livestock

The livestock for this aquarium is a lone male crowntail betta with deep-blue colors and fins that are edged in red and have a small amount of black on the edge. I think this color and tail morph match the

theme well as opposed to a more brightly colored specimen. His somewhat ragged tail (he's not a prize genetic specimen) also complements the sense of imperfection. He shares the tank with a colony of unusual Darwin red-nose shrimp, native to Darwin in north Australia. These small shrimp (adults measure just under an inch long) possess a clear body with a few white speckles and a long red rostrum. They are good algae eaters that constantly cruise the moss and are delightful to watch. There are also several small red ramshorn snails, which will be moved to another tank when they grow too large.

## Maintenance

I'd call this tank medium tech. It receives daily dosings of a liquid organic carbon supplement at 1½ times the recommended dosage, as there is so much plant matter in the tank and it has a very low bioload. It is also dosed every second day with two times the daily dose of liquid fertilizer containing trace elements and a nitrogen, phosphorous, and potassium analysis of 2.6 to 0 to 5. Providing additional nitrate is also essential for this tank because of the large plant mass and low bioload.

This aquarium receives weekly 30 percent water changes, with a gentle squeeze of the filter sponge in old tank water to remove any debris. As my local water has very low GH and KH, I add ½ teaspoon of aquarium salt per 10 liters (2½ gallons) to increase general hardness. Very small amounts of sodium bicarbonate are also added to buffer the pH from swings caused by daily plant respiration cycles. Parameters are kept at 5 dGH and 4 dKH, with a pH of 7.4 (this is the pH of my local water; I do not use pH chemicals). Temperature is 26°C (78°F). The lights are left on for eight hours per day, four hours in the morning and four hours at night so I can enjoy the tanks at home. The daytime siesta and mild overdose of organic carbon, accompanied by grazing shrimp, all seem to prevent any algae growth. Ammonia and nitrite are kept at 0 ppm, and nitrate is under 5 ppm.

Despite the wild look of this tank, it is carefully trimmed and pruned when required during water changes, as both of these plants can quickly overrun the tank and upset the balance of the aquascape. Dead and errant water sprite leaves are pulled out or removed with scissors, and Java moss is pressed into the lawn or bushes or trimmed when it grows too large.





■ The author's completed tank demonstrates a simplistic beauty, which is a fundamental aspect of the wabi-sabi aesthetic.

I have found plastic chopsticks useful for arranging the finer points in this tank and for fluffing up the water sprite leaves after a water change. The blunt end can also be used to push any large, adventitious

water sprite plantlets down into the moss where the roots anchor, becoming hidden, and the leaves create a thick undergrowth and proceed to grow up and out into the central thicket. As the substrate is

thin, being 2 cm (about  $\frac{2}{3}$  inch) thick, it does not appear to harbor many anaerobic spots, and by pushing bamboo skewers through the moss occasionally to stir it up, it remains healthy.

## Enjoying the Wabi-Sabi Aesthetic

This is probably the simplest aquarium aquascape I've ever done, but based on the simplicity, wild natural overtones, and how well the wood and plants came together, it might also be my favorite. Additionally, the betta in this tank has a lot of personality, constantly swimming through the plants and wood, observing the shrimp with interest, and watching me as I work. This aquarium makes time spent at my desk a pleasure, as I can frequently pause to admire my nice little nano and favorite pet fish. I'd recommend the wabi-sabi style layout to anyone with a new nano, as I believe a simple aquascape is easier to create in a small space, and this aesthetic is a fine way of keeping a relatively low maintenance nature-style aquarium while also achieving a sense of serenity and ever-changing, subtle natural beauty. 🐟

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### Thursday, May 24th

All day - Setup of Show & Convention  
- Refreshments provided.  
- Early Registration of Show Fish

### Friday, May 25th

9:00 AM - Registration Desk Opens  
- Show Fish Registration  
- Fish Sale Room Registration  
7:00 PM - 50 Years of the AKA with Tony Terceira & Charlie Nunziata  
9:00 PM - Hospitality Room Opens  
Refreshments & Food provided by the AKA.

### Saturday, May 26th

7:00 AM - Fish Show Judging Begins  
(No one except judging staff allowed

in the show room at this time.)

7:30 AM - Fish Sale Room - Round 1  
(This year, 10 people will be allowed in for 5 minutes at a time. One bag of fish per registered tag number.)

9:00 AM - Workshop #1 - *Fishroom Ideas & Dave's Octopus - The G1 Gang*

9:30 AM - Fish Sale Room - Round 2  
(Two bags of fish per registered tag number)

10:30 AM - Workshop #2 - *Live Foods - Mike Hellweg*

11:00 AM - Fish Sale Room - Round 3  
(Open Sales of remaining pairs. Buyers are restricted to 3 bags until paid in order to allow everyone a fair opportunity. Once paid, you may purchase another 3 bags.)

### Noon-1:00 PM- Lunch Break

1:00 PM - Seminar #1 - *Blue Eyes by Gary Lang*. (There will be a special Blue-Eye auction following the talk to benefit the George Maier Fund.)

2:30 PM - Seminar #2: *Collecting Native Killies - Tony Terceira and Charlie Nunziata*.

4:00 PM - Seminar #3: *Special Guest Speaker Dr. Glen Collier*. (Topic to be determined)

4:30 PM - Show Room Closed to Public. Special one hour viewing for photographers only.

5:00 PM - *Beginners Tour of the Fish Show with Kurt Zahrenger*

### Saturday Evening, May 26th

6:00 PM - Cocktail Hour.  
7:00 PM - Annual Banquet  
8:30 PM - Awards Ceremony  
9:00 PM - Banquet Speaker: *Holger Hengster: Collecting Nothos in Africa*  
Post Banquet: Hospitality Room Opens.  
Show Room Breakdown Begins

### Sunday, May 27th

7:00 AM - Show Room Breakdown Continues  
9:00 AM - Auction Registration Opens  
11:00 AM - AKA Auction Begins

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# adventures in aquascaping

## Mr. Saltwater Tank's 235-Gallon Reef Challenge, Part 2

**A**t long last, there it was. Three states, nearly 900 miles, one trailer loaded with worthless household junk (and no aquarium), and one old-but-game set of floor joists later, my beautiful 60 x 30 x 30-inch, 235-gallon saltwater tank was in place at my Nashville home.

It was leak tested. It was sturdy. It had all kinds of potential. But it was empty. And it was high time to fix that.

### Plumber, but...

The next step in getting the tank up and running was plumbing it. The tank—a rimless setup—was already drilled, so it was time for a hardware store run.

This is where I broke my own rules. On my website and in my guides for saltwater aquarium hobbyists, I always advocate buying more plumbing supplies than you should need. Think you'll use four 90-degree elbows? Buy eight. Think you'll use six sections of Schedule 80 PVC tubing? Buy 12. Think you'll use two bulkheads? Buy four. You can always return what you don't need (save those receipts!), but you almost always need more than you think. After all, stuff happens, and making multiple trips to the hardware store is no fun.

I plumbed my tank on a Saturday morning and leak tested again that evening. Everything was good except for one leaking return bulkhead. I gave it a quarter turn—the leak got worse. I gave it another half turn, and nothing happened. If anything, more water was coming out. There was no repairing this thing; it needed to be replaced.

Normally, I would have had a spare one-inch bulkhead on hand. But like I said, I broke my own rules. I only had as many bulkheads as I figured I'd need. And on a Saturday night, there was no running to the store to buy a new bulkhead. I was stuck with a leak and figured I would be for the rest of the weekend. The

only thing to do was wrap a towel around the faulty part, letting the water drip into the sump rather than onto the floor. This was backwoods plumbing, but it would get me through the next few days.

Lucky for me, I live in the age of Facebook and some friendly Tennessee neighbors came through. A follower saw my frustrated post and messaged me. He was opening an aquarium shop near my home and offered to hand deliver the needed bulkhead. Several hours later, he was at my front door holding a functional bulkhead—and a Schedule 80 double union ball valve that would replace the one glued to the faulty bulkhead. This guy was a saltwater aquarium knight in shining armor! He not only had the bulkhead I needed (did I mention he brought me spares?), but he also had Schedule 80 double union ball valves! Talk about service!

After the delivery, it was a matter of cutting out the old plumbing, installing the new return bulkhead, and tightening it down. I performed another leak test—success! Everything held. There was no water on the floor and nothing dripping off a towel and into the sump.

### The Right Equipment

With the tank ready to roll, it was time to start thinking in earnest about my equipment: circulation, lighting, and water processing. That meant choices to make and upgrades to perform.

### RO/DI UNIT

Since I'd be using dry rock and sand (more on that to come), I knew I'd be filling the new tank with RO/DI water. My standard reverse-osmosis, deionizing setup, capable of pushing out 75 gallons per day, had treated me well for years. But with a 235-gallon tank, it would have taken more than four days to fill—too long for my taste. Instead, I upgraded to a 150-gallon-per-day system, making it possible to fill my tank in less than two days.

Mark Callahan has loved (un-frozen) water since his childhood years in Tennessee. As a child, he spent eight months a year on a lake and traveled with his family to Maui each spring break. He learned to scuba dive there at the age of 12 and has been addicted to the ocean ever since. He owns and runs MrSaltwaterTank.com, the number one online resource for dedicated saltwater tank owners. He offers informative videos, articles, posts, and guides for marine and reef aquarium lovers.



mark callahan  
photographs by the author



## FILTRATION

For ongoing water processing, I went with a high-performance protein skimmer. I've used pinwheel skimmers in the past, but for this build, I decided to branch out and try a recirculating skimmer driven off my return pump. By using the return pump to drive the skimmer, I'd eliminate a pump in my setup, saving me electricity and money. Also on the continuous filtration side of my build is a dual media reactor with granular ferric oxide (GFO, a phosphate-binding medium) in the first chamber, activated carbon in the second, and three 100-micron filter socks. I've had much success with both GFO and activated carbon and chose to run them on my new tank.

## WATER CIRCULATION

Making up the heart of the tank's circulation system are three magnetically coupled, wireless pumps—two that are rated for 3,200 gallons per hour and one large powerhead rated for 7,500 gph. I used the two 3,200-gph pumps on my old 90-gallon build and was very happy with them, so I wanted to use the same pumps on my new build. The large powerhead provided the additional flow I needed for my 235-gallon tank. In time, I might add an additional 7,500-gph powerhead depending on the flow needs of my tank once I get it stocked with coral.

I'm picky about my pumps. I've seen too many builds where people spend all kinds of time and money keeping their protein skimmers and heaters out of sight, and then sitting in plain sight is a traditional pump with wires hanging in the water. That's jarring to the aesthetics, to say the least.

I much prefer the magnetically coupled, no-drill pumps. They provide all the power you need to create a proper gyre flow, they're reliable, and they keep their in-tank footprint down to a minimum. The big selling point for going with the magnetically coupled pumps was the lack of wires entering the tank. I couldn't see having a clean, rimless tank with wires hung over the tank. I wanted to see zero wires, which meant the magnetically coupled pumps were my answer.

Add on the wireless controllability, the battery backup capabilities, and the wireless syncing between pumps, and it's easy to see why I call these pumps "the Ferrari of water pumps."

## LIGHTING

In-tank circulation is important, and without lights, no reef tank will ever thrive. For my new build, I chose to go with a multiple-fixture LED system with high-efficiency, high-intensity LEDs. I'm not one for instantly jumping to



■ Dry, man-made rock was used to form two makeshift islands.



■ The author's refugium has ample room for high-performance skimmers and a powerful reverse-osmosis, deionizing unit.

new trends in the hobby, so after using halide fixtures for years, I wasn't immediately sold on LEDs. But I did an experiment with my old 90-gallon tank: LEDs over half and halides over half for three months.

The results were better than I expected. Coral growth under the LED lights was great, my corals kept their color, and I lost zero small-polyp stony coral colonies during the halide-to-LED switch. Plus, the LEDs offered all sorts of cool lighting modes (thunderstorms! sunsets!) and they even cut my power bill. I was sold—enough that I might eventually have as many as six LEDs over the new tank.

## Let There Be Life!

With my equipment chosen and up and running, it was time to get to the fun stuff: turning my tank into a full-fledged, livable aquarium.

I started with the bare essentials, sand and rock. As I said before, I went with dry for both.

Why not live? Although I know that there are sustainable sources of live rock, I still have some environmental concerns and therefore chose dry rock instead.

Plus, there's a good chance live rock can carry hitchhikers, since it came straight from the ocean. Pests in saltwater aquariums can wreak havoc on the tank and the livestock inside of it. The price for starting my tank with live rock was getting high.

Speaking of high prices, live rock can be prohibitively expensive. The rule of thumb is a pound of live rock per gallon of water. That can add up to four figures very quickly, as local fish stores sell rock for \$13 per pound! While there are hobbyists who have no problem with that, I'd rather invest that cash elsewhere in my setup.

For this tank, I went with a dry, man-made rock. I've used the same rock before with much success and wanted to use it in my new tank. After covering the bottom of the tank with a roughly inch-thick layer of dry sand, I used about 240 pounds of rock to create a two-island look with lots of caves, ledges and overhangs, as well as plenty of negative space. (Don't worry: There's plenty more aquascaping in the next installment!)

It was time to fill up the tank, and my newly upgraded 150-gallon-per-day RO/DI system made short work of the task. Since there was nothing alive yet, getting the water to the proper salinity was simple. Dump salt in the sump, test, repeat.



After getting the specific gravity (1.025) and temperature (77°F) right, the tank was ready for its next big step, cycling.

## Cycling: A Little Bit Different

I'm not a believer in the traditional method of cycling a saltwater aquarium, which amounts to tossing some live rock and hardy fish (like

*Dascyllus albisella*) into the tank and riding out spikes in ammonia and nitrite on the way to a comfortable nitrate level.

To me, this old style of cycling fails on several levels. First, it's inherently inefficient—since you're simply letting nature take its course, you can't put a good timeframe on it. It can take a few weeks or a few months. I see no good reason to let a perfectly good tank sit basically empty that

long. You spent the time and money getting it into your house; you want to enjoy it!

Then there's the matter of using living fish as long-term ammonia sources. Sure, damselfish can survive the ammonia and nitrite spikes. But is it right? You're essentially making them live in gill-burning toxic waste for as long as the cycle takes. That's simply cruel. Plus, damselfish are often aggressive in an aquarium environment—and good luck getting them out of your tank once they're in there. They're great swimmers, and they can live for years. Chances are, short of draining the aquarium and taking out all the rock so you can attempt to catch them, they're going to become permanent residents, whether you want them or not.

Over the years, I've become a big fan of bottled bacteria additives. Specifically, these are bacteria that are grown as a microbial community and on a microstructure instead of as free cells. I've used these products on four aquariums now, and I have countless emails of my viewers who have used it with much success. Every time I've used it, I've always had good luck setting up a biofilter within a week—and sometimes within 24 hours.

I started this tank's biofilter by adding a bottle of nitrifying bacteria and three blue-green chromis (*Chromis viridis*). The tank's ammonia, nitrite, and nitrate levels measured 0 parts per million (ppm), 6 ppb (that's parts per billion, very, very small), and 0 ppm, respectively. After one day, there was still zero ammonia in the tank, along with 5 ppb of nitrite and 7 ppm of nitrate. Day two saw zero ammonia, 4 ppb of nitrite, and 10 ppm of nitrate; and day three registered zero ammonia, 2 ppb of nitrite, and 7 ppm of nitrate.

By day one, the tank was clearly cycled because the nitrate had started to rise. Rising nitrate means the nitrifying bacteria have processed the ammonia into nitrite, then nitrite into nitrate. But for the sake of argument (and my website, MrSaltWaterTank.com), I kept taking measurements. On day four, after feeding the chromis a particularly heavy meal to encourage extra waste, the ammonia level was still at zero, nitrite was at 12 ppb, and nitrate was at 40 ppm. By day six, my nitrate level started to come down: zero ammonia, 10 ppb of nitrite, and 10 ppm of nitrate.

Those levels meant one thing: My tank was ready for more livestock. It had proper plumbing, filtration, circulation, and lighting. The salinity and temperature were right, the levels were perfect to support aquatic life, and the basics of an aquascape—sand and rock—were in place.

Check back next month, when we'll be adding livestock and corals. Then, we'll get the tank set up for long-term enjoyment and go through the basics of proper maintenance. 🐟

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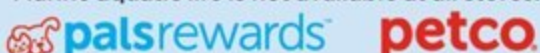
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# the salt mix

## My 55-Gallon Stony Coral Aquarium

I decided to set up a standard-size 55-gallon aquarium a while back, stocked primarily with small-polyp stony (SPS) corals, and I focused on using the least amount of equipment/electricity in the process. I thought I'd tell you about how easy it can be to have a great-looking reef aquarium that doesn't take up too much space and doesn't require very much equipment.

### What's in It

For the most part, I used specimens taken from one of my other aquariums that was more of a mixed tank, housing stony and soft corals. I wanted to change it to an all-softy tank, so I had plenty of stony corals to get the 55 filled up. At the beginning, I had over 50 specimens (mostly *Acropora* spp. and *Montipora* spp.), but that number has been reduced somewhat over time. There are three fishes in the aquarium: a yellow coris wrasse (*Halichoeres chrysus*), a firefish (*Nemateleotris magnifica*), and a black-ray/high-fin shrimp goby (*Stonogobiops nematodes*). A red-banded pistol shrimp (*Alpheus randalli*) lives with the goby.

I also have a couple of urchins in the aquarium that help keep the rocks clean, an emerald crab (*Mithraculus sculptus*) I added when some bubble algae showed up at one point, a few *Astraea* spp. and *Turbo* spp. snails that also help with cleaning, and a handful of blue-legged hermit crabs (*Clibanarius tricolor*) that do the same.

As far as the nonliving stuff goes, there's about 2 inches of oolitic aragonite sand

on the bottom and several pounds of what used to be dry base rock on top of it. No live rock was used in the aquarium, but now the base rock has become overgrown and encrusted with a good bit of coralline algae and sponge, so it looks just fine.

### Lighting

For lighting, I'm using a fixture that houses five 48-inch, 54-watt T5 fluorescent tubes. The fixture also includes an individual reflector for each of the bulbs, each of which has multiple bends and a little ridge right down the middle. After using a light meter to test several types of reflectors and bulbs a few years ago, I found that these really are the best type for sending the most light down into the tank.

However, after taking some light readings here and there in the aquarium, and going off the numbers I'd gotten in other healthy reef aquariums, I decided to remove the center bulb. For a tank that's only as wide as a 55-gallon, I didn't see any need for a fifth bulb, and using four has worked well. Even in the dimmest parts of the tank (the corners), light readings are still as high as they need to be to promote coral growth, and watching the corals continue to grow since making the change has verified this. This means that even at peak output, power consumption is still only 216 watts. There's certainly nothing wrong with using five bulbs over a tank this size, and some corals may grow faster than when using four bulbs. But, as I said, I've made it a point to reduce the electrical consumption

James Fatherree, MSc has had more than a quarter century's experience with aquariums of all kinds and has been deeply involved in the reef hobby for more than a decade. His background includes diving, collecting, and photography, and he has worked in the trade on both retail and wholesale levels. With all this experience, he has seen his share of aquarium disasters, both natural and manmade, making invaluable his insights on how to save your tank during a crisis.



james fatherree  
photographs by the author





■ The author's 55-gallon stony coral aquarium was set up to keep electrical consumption at a minimum.

of my aquariums, so four is the way to go for me.

In addition, I'm using two timers to control when the lights come on and go off. One turns on two 420-nm actinic bulbs for twelve hours in the winter and ten in the summer to help keep the water temperature down during the hottest Florida weather. The second timer turns on one 12,000 K bulb and one 460-nm one for ten hours in the winter and eight hours in the summer for the same reason.

As you can see in the photos, the corals' colors are still nice and bright. And, every coral in the aquarium is growing, albeit some much slower than others. I haven't been concerned with that, as this is something of an experiment anyway.

## Pumps and Filter

When I set the aquarium up, I started out with two submersible powerheads at the same end of the tank, positioned at the top of the tank and pointing toward the opposite end. This allowed the creation of a gyre effect, where water flow is directed across the top part of the tank toward the opposite end, goes down the far side of the tank, and then moves back across the bottom and up the other end, back to the pumps. When done right, you'd be surprised at how much flow can be generated this way, considering the pumps use only 12 watts of electricity each.

There really wasn't a thing wrong with this, but I'd never tried one of the newer

internal/external propeller-type pumps on one of my aquariums, so I figured I'd see how one did on this tank. For its power consumption, the flow was great, and it could really move some water. However, it slung water around the tank in such a way that I never could get the same gyre effect. I ended up putting one of the powerheads back into the tank. No matter how I arranged things, the flow wasn't as

good from end to end as it had been, so I went back to using the two powerheads. While the propeller pump certainly moved a lot of water for an 18-watt gadget, the powerheads still worked much better for an additional 6 watts of power consumption in this case.

Other than that, I also added a very small hang-on/box filter that consumes only 6 watts of power. It can hold several



■ The yellow coris wrasse (*Halichoeres chrysus*) is brightly colored, very active, and does not harm the author's invertebrates.





■ The corals have grown and covered the epoxy the author used to affix them in place, and their colors are looking good.

tablespoons of activated carbon and/or phosphate remover in a mesh bag, which is just what I needed. Before I added it, I also noticed a thin film building up on the water's surface, which I didn't like, but the water flowing out of the box filter and into the tank broke the water's surface and got rid of the film.

The aquarium has a very low fish load, and I don't add much fish food to it, so I never bothered to add a skimmer. While skimmers certainly have their place as part of some aquarium systems, mine didn't need one and everything has done fine without. Of course, the low fish load and good maintenance habits make this possible for the long term.

## Maintenance

Other than feeding the fishes and cleaning the glass on a regular basis, the biggest part of my maintenance routine is doing a monthly



■ Over 50 coral specimens were added to the pre-seeded aquarium over a period of just a couple of months.

water change. I use a quality salt mix and reverse-osmosis-filtered water, and change out about 25 to 30 percent of the tank's volume every month without exception. After many years of keeping reef aquariums, I can't emphasize enough how important this is for long-term success. The lack of a skimmer on this aquarium makes it even more important than normal.

Once a month, I change out the activated carbon and phosphate remover in the box filter. Using just a few tablespoons of each has worked well, and I haven't had any problems with unwanted algal growth that were any worse than what I've had in any other well-run aquariums.

A few times a year, I also put a hang-on cartridge filter on the tank and stir up the sand a bit. Detritus builds up in the sand bed

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■ A red-banded pistol shrimp lives with the black-ray goby.

over time no matter what I do, so I just run my fingers through the top part of the sand bed and swirl things around from end to end, letting the filter strip the detritus out of the water.

By doing this at least every other month or so, I've managed to keep buildup to a minimum. I just let the filter run overnight and then pull it off. I clean the paper filter cartridge out thoroughly after each use,

and by doing so, I've been able to use the same cartridge for many months before replacing it. An occasional soaking in a solution of fresh water and bleach also helps out, as long as I am always careful

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to make sure it is completely free of bleach before using one again.

Other than that, the only thing I do is add calcium. With so many stony corals in one aquarium, I have to add calcium at least two or three times a week to keep it in an optimal range of 380 to 450 ppm. I do this by using kalkwasser for the most part, but sometimes I use

a two-part additive. It all depends on how much water has evaporated from the tank. When adding kalkwasser, I use a one-gallon tub with a drip line attached to it, so there needs to be room in the tank for about a gallon of water. If there isn't room, I go to the two-part stuff, since it's a relatively low-volume addition.



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## Problems

Yes, there have been some problems, but nothing out of the ordinary, or at least unexpected. To start, it has been difficult to keep the calcium where it should be. Again, with this number of stony corals in the aquarium, I have to add a lot of calcium. Sometimes it seems like I can't get enough in no matter what I do, so I have to stay on it.

That being said, most of the corals have grown as well as can be expected, but some have not. Whether it's due to the use of only four bulbs in my lighting fixture or competition between different types of coral for calcium (or both), a few of the corals have grown very, very slowly. Like I mentioned above, this has been something of an experiment, though, as I've simply taken out most of the corals that haven't grown well over time. So, there has been a selection effect, the result of which has been the removal of corals that don't like it in the aquarium and the proliferation of those that do.

With the tank being as crowded as it has been, I've also had to do a good bit of pruning. Over time, many of the coral colonies have grown large enough to nearly come into contact with others. They then have to be trimmed with a pair of snips from time to time to avoid problems. Again, assuming I keep this aquarium running for the long term, I predict a further selection effect as the corals that grow fastest will come to dominate those that don't with regard to living space. I imagine that I'll end up with much less diversity over time, but being left with whatever wins out will be fine with me.

Lastly, temperature has been an issue in the summers. My air conditioner cools my house rather unevenly to some extent, and the room the aquarium is in heats up a bit more than some of the others when it's hot outside. That, and the addition of heat from the lights and pumps, has resulted in the aquarium staying in the 80° to 82°F range for part of the year, which is cutting it close. I start worrying when the water temperature in any aquarium passes 82°F, which means things have been just barely cool enough to keep me from tearing this aquarium down. Fortunately, it's only this hot for maybe three months out of the year, and so far I've gotten away with it without any problems.

And that's it! As you can see, it's certainly possible to have a tank full of stony corals under just a few T-5 fluorescent bulbs, using a minimal amount of equipment and with excellent results. 🐠



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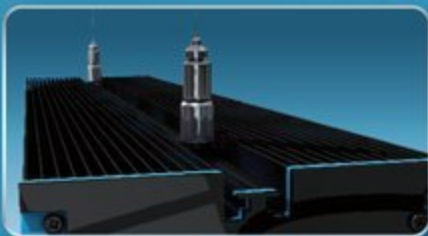
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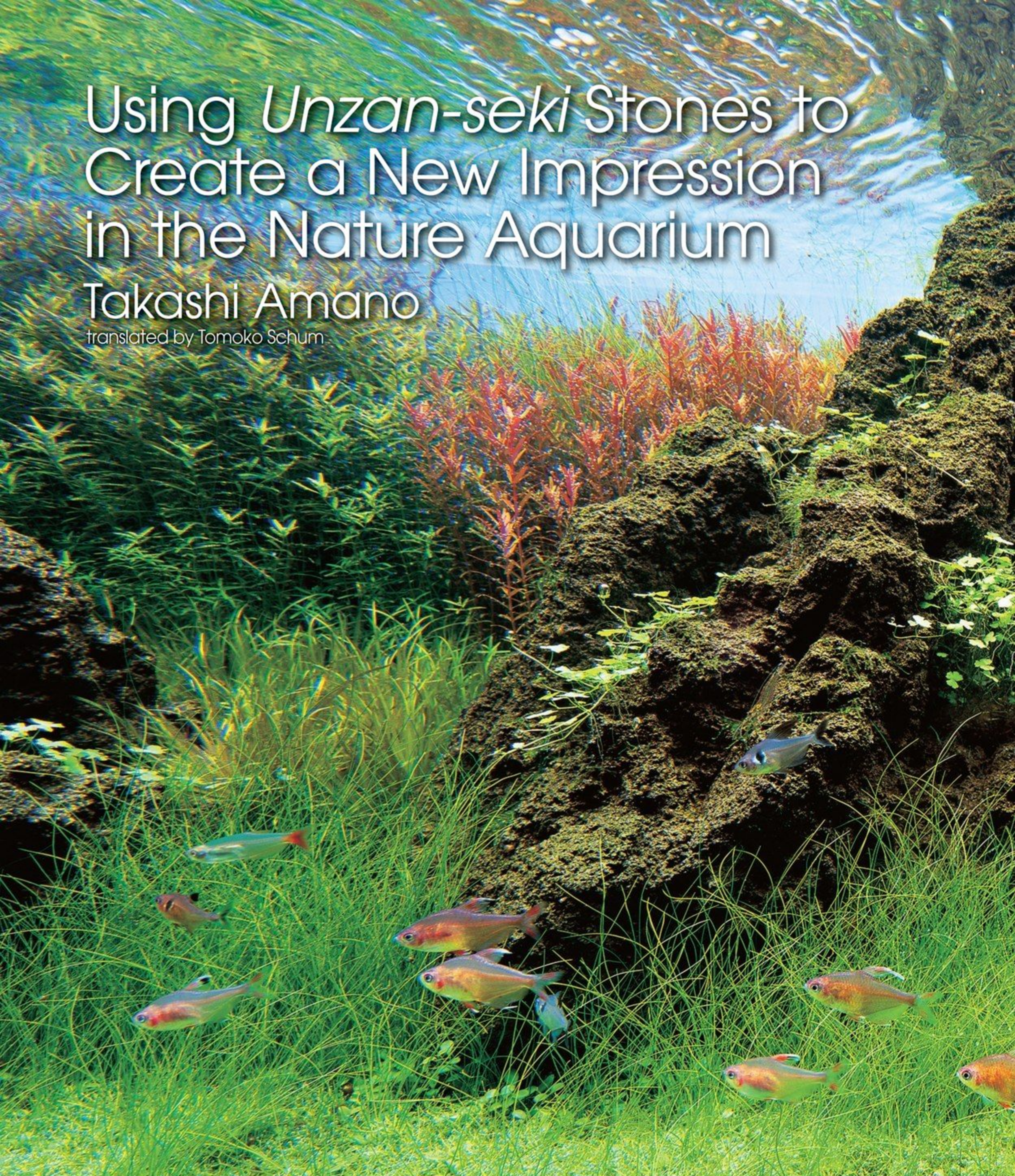
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# Using *Unzan-seki* Stones to Create a New Impression in the Nature Aquarium

Takashi Amano

translated by Tomoko Schum







■ A layout created with natural volcanic stones, *unzan-seki*, as a composition material. This layout has a U-shaped composition with stem plants planted in the left and right sides of the aquarium. The open space in the center creates a focal point in the composition.





■ The front view of the layout. A natural feel is rendered by attaching Australian *Hydrocotyle* and willow moss on the five *unzan-seki* arranged in the layout.

**T**he Nature Aquarium incorporates natural elements in an aquatic plant layout. The key characteristic of the Nature Aquarium is to combine various aquatic plants and use natural materials, such as stones and driftwood, in order to express natural scenery. While a different combination of aquatic plants can change the impression of a layout, the types and shapes of stones and driftwood that are used as composition materials can change the impression tremendously. Therefore, finding a new composition material can lead to expanding layout expressions. I have used various types of stones and driftwood in the Nature Aquarium up until now, and doing so has increased the number of layout variations.

## The Characteristics of Layout Materials

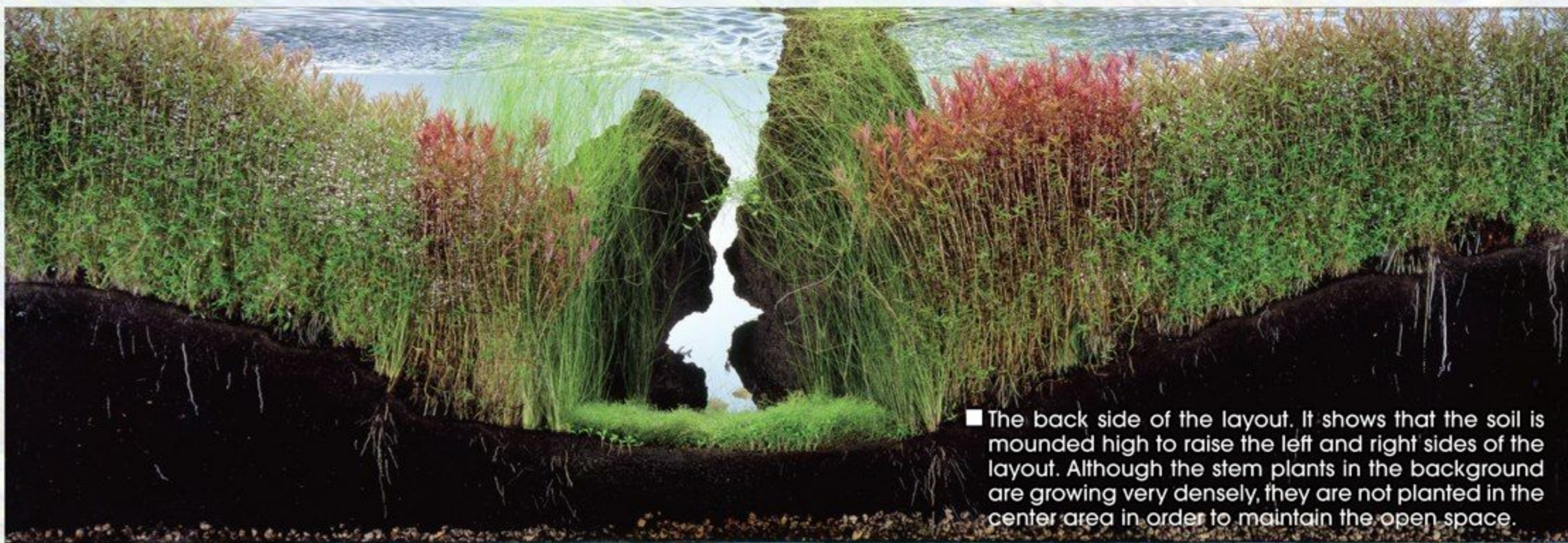
Branch wood, which I introduced in the previous two articles (*TFH* March and April 2012), is a relatively new type of driftwood. In addition, I have used other types of driftwood, such as horn wood and old black wood, in a lot of layouts. Although driftwood is often covered by mosses and aquatic plants and obscured from view, the texture and shape of an exposed surface of driftwood offer unique characteristics.

Similarly, I have used various stones in layouts. I created many simple *iwagumi* layouts using river stones, such as *hakkai* stones and *senmigawa* stones, and planted the layouts with a single variety of aquatic plant, such as *Echinodorus tenellus* or *Glossostigma*, in my early

years. The characteristic of rounded river stones often determined the impression of a layout. The impression of a layout changes drastically when the river stones are replaced with mountain stones, such as *manten-seki* and *ryuo-seki*. This is because the shapes and surface texture of river stones are completely different from those of mountain stones. *Unzan-seki* is the newest addition to the composition materials.

## Layouts Using *Unzan-seki*

*Unzan-seki* is a natural volcanic stone. It looks like tall, solidified lava that has spewed out of a volcano, reminiscent of a rugged mountain. When molten lava that spews out of a crater is cooled and solidified rapidly, the gas contained in the lava bubbles out and creates



■ The back side of the layout. It shows that the soil is mounded high to raise the left and right sides of the layout. Although the stem plants in the background are growing very densely, they are not planted in the center area in order to maintain the open space.

Takashi Amano





Takashi Amano

a lot of fine indentations on the surface of the stones. The general shape of the stone is quite rugged as well. The name *unzan-seki* comes from the unique, mountain-like appearance of this stone. *Unzan-seki* comes in various sizes.

In a small aquarium, just one stone can create the framework of a layout. In this article's layout, five *unzan-seki* were arranged, taking advantage of the panoramic aspect ratio of the 180-cm (70-inch) aquarium. The two *unzan-seki* in the center are the main features of the layout. The one on the left is large enough to protrude above the water surface. Another stone, which is almost as big as the left one, was arranged on the right side. The focal point of this layout was the space between these two stones.

Stem plants and *Eleocharis vivipara* were planted in the background behind the two *unzan-seki*. However, tall aquatic plants were kept out of the center of the background in order to maintain the open space between the two stones. The layout was planted with generally light-colored aquatic plants, such as *Glossostigma* and *Riccia*, in the foreground and hair grass and *Blyxa* short leaf in the midground. Since *unzan-seki* tend to give off a darker, heavy impression, the overall impression of the layout was adjusted with the colors of aquatic plants to keep the impression from getting too heavy. Additionally, Australian dwarf *Hydrocotyle* was planted in the depressions of the *unzan-seki* and willow moss was grown on the surface of the stones to render a natural feel.



Takashi Amano

■ The author chose to use a nutritive soil substrate. This photograph shows that aquatic plants have rooted well and their roots are growing deep into the substrate.

You can see the production process of this layout on the Aquatics Videos blog at [www.tfhmagazine.com](http://www.tfhmagazine.com). The way that the willow moss was attached to the surface of *unzan-seki* is quite unique. Willow moss was chopped into tiny pieces with a kitchen knife and rubbed on the surface of the *unzan-seki*. Chopped willow moss pieces will remain in the numerous depressions on the surface of *unzan-seki* and gradually attach themselves to the stones naturally.

## A Final Note About Stones for a Layout

An *unzan-seki* does not affect the growth of aquatic plants because it does not alter the quality of the water. Some types of stones can affect the water quality. If a stone is a

## DATA

**Aquarium:** Cube Garden W180 x D60 x H60 (cm)  
**Lighting:** Grand Solar I (NAG-150W-Green x 1, NA PC lamp 36W x 2) x 3 units, turned on for 10 hours per day  
**Filter:** Super Jet Filter ES-2400 (Bio Rio L, NA Carbon)  
**Substrate:** Aqua Soil Amazonia, Power Sand Special L, Bacter 100, Clear Super, Penac W/for Aquarium, Penac P, Tourmaline BC  
**Additives:** Brighty K, Green Brighty STEP2  
**CO<sub>2</sub>:** Pollen Glass Beetle 50, 6 bubbles per second via CO<sub>2</sub> Beetle Counter (using Tower)  
**Aeration:** For 14 hours after the light is turned off using Lily Pipe P-4  
**Water Change:** 1/3 once a week  
**Water Quality:** Temperature 25°C (77°F), pH 6.8, TH: 20 mg/l  
**Aquatic Plants:** *Rotala* sp. "Ceylon," *R. rotundifolia*, *Hydrocotyle* sp. "Australia," *Eleocharis vivipara*, *E. acicularis*, *Blyxa novoguineensis*, *Glossostigma elatinoide*, *Riccia fluitans*  
**Fish/Invertebrates:** *Hyphessobrycon rosaceus*, *H. megalopterus*, *Prionobrama filigera*, *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.]

type of limestone or a metamorphic rock, it will react with injected CO<sub>2</sub> in an aquarium and raise the pH, the carbonate hardness, and the total hardness levels of the water. Since some aquatic plants do not grow well in hard, alkaline water, if you wish to use a new stone that you have found yourself, you need to check its effect on the water quality before adding it to your layout. This does not mean that a type of stone that alters the water quality cannot be used in a layout. By changing the type of aquatic plants or by using a nutritive substrate that can lower the pH and carbonate hardness or a device to soften water, you can still create a beautiful layout with such stones. 🐟



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■ *Aphyosemion ogoense* "Gabon."



# African Plant-Spawning





**T**he term “killifish” describes a large group of fishes that are found everywhere except Australia and extreme southern and northern latitudes. They are divided into two major groups reflecting their reproductive strategies. The plant spawners inhabit permanent water and deposit their eggs in vegetation. For these types of fish, embryonic development is a continuous process. Soil spawners, the true annuals, inhabit temporary bodies of water and deposit eggs in the substrate. Embryonic development is episodic—the eggs go through a complex series of developmental steps.

# FISH

Charles Nunziata



The majority of killifish are plant spawners with hundreds of species, subspecies, distinct populations, and color phenotypes—too many for a single article. For this reason, I will cover only the African plant-spawning species.

Plant spawners do well within a general hardness range of 80 to 200 ppm and temperatures between 68° and 80°F. The breeding of some species requires a more acidic pH and lower hardness than others. Lower temperatures are well tolerated, but breeding activity in general declines. The plant spawners are not disease prone, requiring nothing more than regular water changes and good nutrition to remain healthy. To develop properly, their eggs must remain in water or be stored on damp media for one to three weeks. A small subgroup, the “switch spawners,” is known to deposit eggs in bottom vegetation or the substrate. Their eggs take longer to incubate, from three to six weeks.

The most popular plant-spawning species belong to the genera *Aphyosemion*,

## Aphyosemion Species

*Aphyosemion* species are among the most commonly kept killifish. This very large genus is divided into a number of formal and informal divisions that serve to identify mutual characteristics. Most *Aphyosemion* spp. are 2½ inches or less, and their eggs hatch in two to three weeks.

The subgenus *Chromaphyosemion*, known colloquially as the *bivittatum* group, consists of mostly small and easily bred killies that feature very colorful bodies and well-marked fins. For example, locations of *A. bitaeniatum* have long unpaired fins in various shades of yellow, red, blue, and green. *A. bitaeniatum* “Lagos” and the “Ijebu Ode” population are fine representatives of the group.

Members of the subgenus *Kathetys*, known as the *bualanum* or *elberti* group, are more robust, with deep blue or green bodies overlaid with thin, dark-red bars. Fins are large and similarly marked. The populations from N’dop and N’tui are particularly stunning.

inches in total length. The variation within this group is enormous. There is *A. australe*, with its elaborately extended fins, the elegant simplicity of *A. celiae*, with its sparsely marked orange body and dramatically edged caudal, and the garishly colored and exotically marked *A. ogoense* group.

The Congo Basin gives us the *elegans* group, represented by the *A. christyi* and *A. cognatum* complex. *A. christyi* are characterized by relatively long and elaborately marked bodies and unpaired fins that often extend into streamers. There is an *Aphyosemion* to satisfy every taste.

## Switch Spawners (*Fundulopanchax* spp.)

Reflecting their propensity to deposit eggs in both vegetation and the substrate, the switch spawners belong to the genus *Fundulopanchax*. Their eggs incubate in water or on damp media, hatching in three to six weeks. Many are large, exceeding 3 inches, but lack the variety in body and fin



Tony Terceira

■ *A. bitaeniatum* “Lagos”; *Aphyosemion* killies are noted for their dramatic finnage.

*Fundulopanchax*, and *Epiplatys*. Body length varies from barely an inch to more than 6 inches, but most are 2 to 3 inches total length. A few body plans are repeated among the genera, but fins vary from small and rounded to large and spectacular. Colors come in every conceivable combination of pale to vivid, and markings range from delicate to bold, incorporating stripes, bars, and spots.

The subgenus *Diapteron* includes arguably the most colorful of all killifish. Small (growing to less than 2 inches in length), each of the five species of *Diapteron* exhibit exquisitely beautiful bodies overlaid with brilliant spots, often extending into the fins. These cool-water jewels from the deep forest are not for the beginner.

The many species in the subgenus *Mesoaphyosemion* range from 2 to 2¾

inches in total length. The variation within this group is enormous. There is *A. australe*, with its elaborately extended fins, the elegant simplicity of *A. celiae*, with its sparsely marked orange body and dramatically edged caudal, and the garishly colored and exotically marked *A. ogoense* group.

The most popular subgenus, *Paraphyosemion*, includes the well-known *E. gardneri* group of species. They are well proportioned with elaborately patterned and colorful fins and bodies. In contrast to many *Aphyosemion* species, *E. gardneri*





Tony Terceira

■ *A. elberti* "N'uti"; killies in the *elberti* group are identifiable by their barred patterning.

are gregarious, vigorously exploring their habitat. They are often included in community tanks with similarly sized inhabitants. All are hardy, and most are quite easy to breed, making them ideal for people new to killifish.

### **Epiplatys Species**

Although colorful, *Epiplatys* species lack the dramatic finnage of *Aphyosemion* species. These surface-dwelling ambush predators have a pike-like appearance, accentuated by flattened heads and backs, and small dorsal fins placed well back on the body. The *fasciatus* types are large, often exceeding 3 inches at four or more years, and among the longest-lived killifish.

Members of the *sexfasciatus/infraciatus* group are moderately large, reaching up to 3 inches in length, and tend to be more colorful than the *fasciatus* types. The *baroi* population from Cameroon is a striking example of this group. The *multifasciatus* group is somewhat stockier, with muted colors but more dramatic body markings. Recent collections have found somewhat slimmer species with black on the flanks, a pattern not seen in any other *multifasciatus*. They are the only *Epiplatys* group considered difficult to propagate. *E. chevalieri* and the beautiful *E. ansorgii* "Massana" are available in the hobby.

There are several *Epiplatys* not closely associated with specific groups. One that often appears in literature is the diminutive *E. annulatus*, with its dramatic broad bars. Because its eggs are exceedingly small, this species is commonly maintained in

well-planted aquariums and the fry are periodically removed.

### **Lampeyes**

The group collectively known as "lampeyes," named for the bright, reflective silver, red, or blue regions around their eyes, ranges across all of sub-Saharan Africa. The best-known member is *Poropanchax normani*, a small killie with large, bright-blue eyes, and the larger *Procatopus aberrans*, featuring a deep, partially iridescent blue body. *Plataplochilus miltotaenia* is another exquisite lampeye, having an electric-blue, iridescent body, yellow highlights in the fins, and a dramatic carmine line along the flanks from the operculum to the caudal peduncle. Unfortunately, most of the numerous lampeye species are rarely seen in the hobby.

### **Other Plant Spawners**

There are a number of plant-spawning genera that are monotypic (only have one species) and also uncommon. One of note is as spectacular as it is unusual. Large at 6 inches in length and gorgeously colored, this decidedly minnow-like killie is found in enormous schools in Lake Tanganyika. The appropriately named *Lamprichthys tanganicus* is not difficult to breed but, due to its high oxygen requirement, is notoriously difficult to ship. They are worth the extra effort, however; a small school in a 6-foot aquarium is a sight one will never forget.

### **Breeding Plant Spawners**

Breeding plant spawners is a simple and straightforward process. Males don't waste

energy in complex prespawning displays. He approaches the female from the rear and side, aligns his body side by side, and, with the pair assuming an S-shaped formation, presses against her, pushing her against the plant. Both momentarily shimmer, and, with a jerk, the female releases her egg and he his sperm, in the same motion pressing the fertilized egg onto the plant. The eggs stay in place with a long adhesive filament, and depending on the species, may be placed anywhere or concentrated in a specific region of the plant.

Healthy, well-fed killifish spawn readily. Few require exotic conditions or specific diets to reproduce. Most species have preferences, and egg production increases if these preferences are known and effectively simulated. For wild imports, matching the water and temperature conditions of the natural environment may be important to success. If wild data is not available, data related to similar species is often used.

Successful breeding reports are more reliable than wild data for species that have been in the hobby for generations. In the more than 50 years that killifish breeding has been an organized specialty, killifish breeders have amassed an enormous library of breeding and maintenance information on all but the most recent importations. Much of this information is available on the Internet.

### **NATURAL SPAWNING METHOD**

There are several spawning methods employed by hobbyists. Many prefer the natural method, whereby killies are left to spawn and their eggs hatch in an established and densely planted aquarium. Males will





Tony Terceira

■ *A. bitaeniatum* "Ikorodu"; most *Aphyosemion* are small growing, which makes them easy to provide for.

drive females whether they have eggs or not, so sufficient plant cover is necessary to reduce stress on the girls. There are often multiple pairs or other fish in a permanent aquarium, and this will proportionally reduce the egg count, as unoccupied individuals eat eggs as they are spawned. Nonetheless, this minimal-labor method usually produces a number of fry to adulthood. More fry will survive if, when noticed, they are removed and reared in a separate tank.

### SPAWNING MOP METHOD

A more popular method employs a spawning mop, a device that mimics a plant cluster and allows the easy retrieval and controlled incubation of eggs. The

mop is constructed from nylon yarn, typically ¼ inch, in a dark color, green being the most popular. There are several construction methods that can be found on the Internet using the search term "killifish spawning mops." All methods produce a hundred or more strands of yarn that reach from a float to the bottom of the tank, simulating a rooted plant. If species preferences are not known, both a floating and a sunken mop are provided. The float from one of the mops is removed so it sinks to the bottom, simulating bottom vegetation. The mops should be placed in the region of the tank where the water is least disturbed so as not to unduly disrupt the spawning process.

### PAIR SPAWNING

The most productive method, and the one that stresses the female least, is to spawn one preconditioned pair in a small, dedicated spawning tank. Prepare the tank with live plants or, if the eggs are to be separately incubated, floating and sunken spawning mops. Since females cannot escape the driving males in these small confines, it is important to reduce the time they are together. This is accomplished by preconditioning the female for one week prior to spawning with generous feedings of live and other high-quality foods. When put with the male, spawning will quickly commence and continue more or less until she is depleted, generally within two to eight hours. The pair is then removed. More eggs are obtained with this method in the shortest amount of time and, most importantly, with minimal stress on the female, extending her productive life.

### Hatching Killifish Eggs

Because killifish eggs incorporate a strong acellular coat called a chorion, they can be handled without damage a few hours after being spawned, making artificial incubation methods feasible. To harvest the eggs, the mop is removed, squeezed of excess water, and laid on a paper towel. With the fingers, each egg is gently picked from the strands and stored in a small tray of water from an established aquarium. A newly fertilized egg is clear with one or more oil droplets within it. One a few days old will show some embryonic development. An unfertilized egg is white



Tony Terceira

■ Colorful and hardy, *Fundulopanchax gardneri* make ideal killies for beginners.





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■ *Epiplatys ansorgii* "Massana"; members of the *Epiplatys* genus have been observed to live longer than other killies.

or opaque or may show a white spot within an otherwise clear egg. Bad eggs are removed immediately to eliminate contamination of the healthy ones. The egg storage water should be changed daily or at least every other day, and if this regime is followed, antifungal chemicals are not needed.

A small microscope is helpful to observe embryo development and essential to determining whether an egg is fully embryonated. Look for a fully formed body, alert eyes that respond to changes in light level, and, in many species, pigmentation on the head and coloration around the eye. If a microscope is not at hand, a fully embryonated egg will appear quite black.

Eggs will hatch in two to six weeks depending on species and storage temperature. Not all fully embryonated eggs hatch at the same time. Some lag a few days, resulting in size mismatches among the fry. The late arrivals are at a disadvantage; they may be outcompeted for food or predated upon by their larger brethren. To avoid this, force hatch the embryonated eggs by placing them in a small vial partially filled with storage water. Exhale into the container, and quickly cap



Tony Terceira

■ *Procatopus nototaenia*; lampeyes are characterized by the reflective regions surrounding their eyes.

it. Shake it vigorously for a few seconds, and place it in a pocket. The high carbon dioxide and shaking about will force all the fully embryonated eggs to hatch within a few hours, greatly reducing size mismatches among fry.

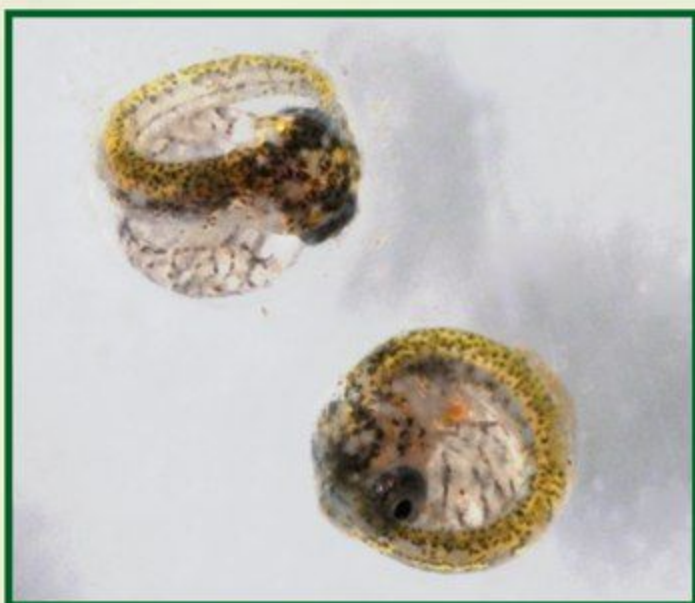
Remove the fry as soon as possible after hatching, and place them in a 1- or 2-gallon container. Add mild filtration or aeration and, to provide microorganisms for smaller fry, some plant matter from an established tank. Tri-weekly water changes are recommended the first two or three weeks, after which the fry can be moved to larger grow-out tanks where they can be weaned onto nonliving foods. Move to progressively larger containers as the fry grow, but avoid tanks of 10 gallons or more until they are at least ¼ inch long. Newly hatched brine shrimp can be fed from the first day through adulthood.

There is a method for those who do not want to pick eggs from mops. The mop is removed, squeezed of excess water, and placed in a polyethylene bag. Add a few teaspoons of water, and tie the bag off so the mop is in a bubble of air. Drops will form

inside the bag, indicating sufficient hydration. Examine the eggs periodically, and when a number appear embryonated, remove the mop from the bag, immerse it in the hatching container, and proceed as above. The fully embryonated eggs will begin to hatch in a few hours and the others over the course of several days. This method has the advantage that no time is spent maintaining eggs, yet many fry will hatch and do so at the same time. The disadvantage is that many eggs may be lost to fungus contamination because bad eggs are not regularly removed.

## Breed Your Own Plant-Spawning Killies

There you have it. Plant-spawning killifish provide the unique experience of being intimately involved with the reproductive process and observing fundamental biologic systems to a level not otherwise available to the hobbyist. With their small space requirements and astonishing array of different shapes, colors, and finnage, this group of animals provides a truly unique experience. Give a plant-spawning killifish a try; you won't be disappointed. 🐟



Tony Terceira

■ *A. australe* eggs.



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# The *Fundulus* of **Missouri** Mike Hellweg



■ Blackspotted topminnow (*Fundulus olivaceus*).







**M**ost American aquarium hobbyists keep fish that originate in the tropics, as we are attracted to the exotic beauty and interesting behavior of animals from far-away lands. Many, however, are unaware of the beauty and interesting behavior of fish that swim in the creeks, rivers, and lakes close by our own homes. Many of these fish make excellent aquarium residents, and many states allow the collection and keeping of a few non-game fish for private use in an aquarium.

### **Fundulus Killies**

My home state of Missouri is an interesting place, especially if you like fish. We are located almost in the middle of the United States, with the mighty Mississippi River rolling along and creating our eastern border. We are the confluence point of four major American aquatic habitats: the

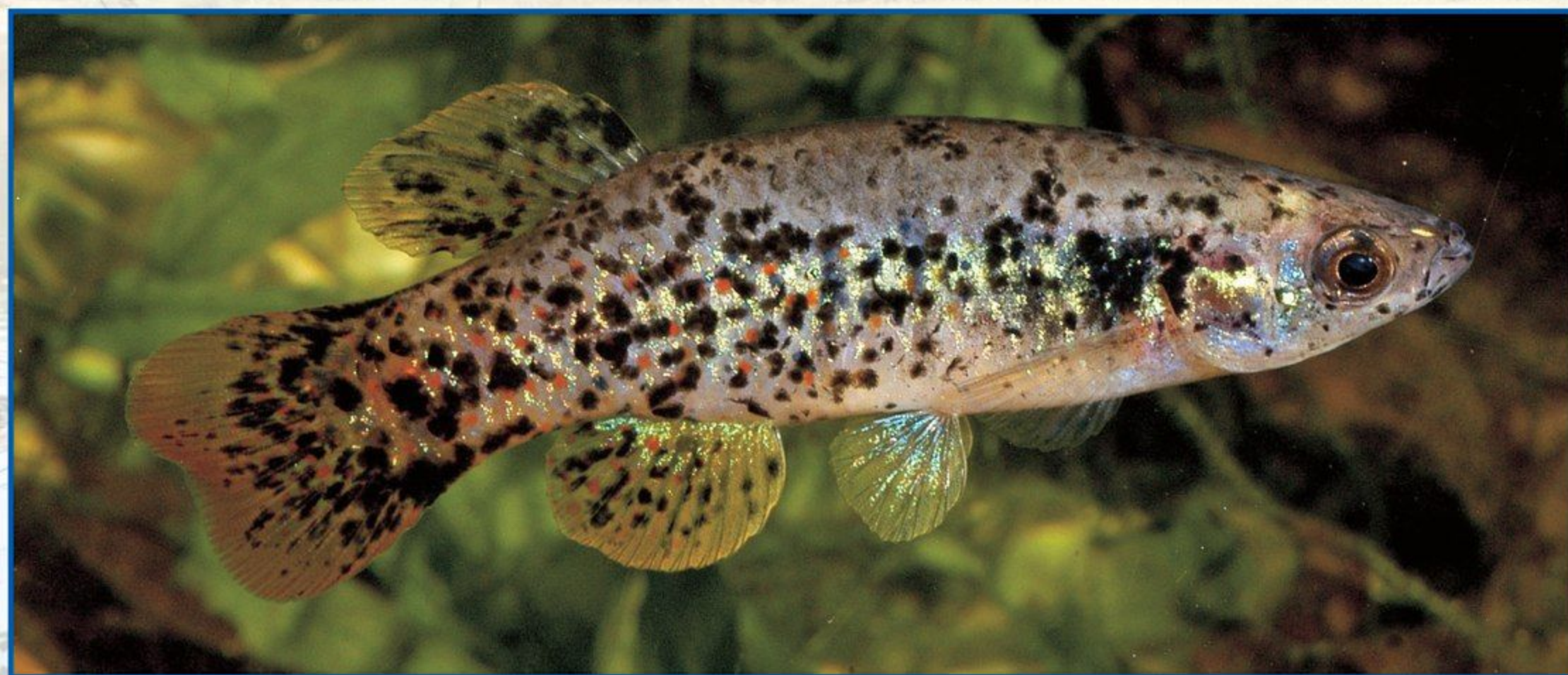
non-game fish make excellent aquarium residents. For most species, all that is required to collect and keep them in aquaria is a valid Missouri fishing license.

Killifish are very popular with aquarium hobbyists, yet few are aware that North America is home to more than four dozen species of native killifish. Most of these are members of the family Fundulidae. Of the 40-odd *Fundulus* species found in North America, seven have been recorded in Missouri. They each occupy unique habitats and have unique behavior, though members of our local aquarium society (the Missouri Aquarium Society, Inc.) have found at least three species (*Fundulus catenatus*, *F. olivaceus*, and *F. sciadicus*) living together in the same stretch of stream on a couple of occasions. The wild fish here spawn almost daily from April through September, though most young fish are found in June and July. They can live for up to five years in our aquaria, though most

collecting at all. Your local conservation agent or state fisheries department can guide you. In addition, some waters are open to collecting while other waters may be restricted.

Be a conscientious collector. Never take more fish than you can keep in your own aquaria, and never take fish that are threatened or endangered in your state. It is your responsibility to know these species in your local area. Fines can be large, and you may even lose your fishing privileges for a period of time. Most states do not allow people to collect fish for sale, so don't even think about doing that. There is no need to take as many fish as you can catch. Try to limit collections to no more than two young pairs or a group of eight to 10 young, unsexed fish from any area.

Second, once fish are introduced to your aquaria, that is where they must remain. Never, under any circumstances, release any fish kept in an aquarium into any body of



Tony Terceira

■ The melanistic variety of the golden topminnow (*F. chrysotus*) features a speckled pattern.

Great Prairie, the Big River, the Lowlands, and the Ozark Mountains. In our waters, you can find everything from diminutive pygmy sunfish to the true giants of North American waters, the big river catfish and alligator gar. There are over 200 species of fish found in our waters, including some real oddballs like the bizarre pirate perch and at least two species of amblyopsid cave fish (which are protected). Most of the families of freshwater fish found in North America have at least one representative living in Missouri waters, and most of our

fish live only to see their second or third breeding season in the wild.

## **Obtaining Specimens**

### **COLLECTING PRECAUTIONS**

Two caveats, I must stress up front, are critically important. First and foremost, you must know and follow all local laws regarding collecting and keeping fish from your home state. Some states require a fishing license, some want you to buy a special permit, and some do not allow

water. Don't even release natives back into the same body of water from which they were collected. Not only is this illegal in most areas, it is also incredibly unwise. While remote, there is the possibility of introducing an exotic disease against which the native species have no defense into the habitat. This is the last thing any conscientious hobbyist should ever want to do.

### **GO COLLECTING**

One of the easiest ways to obtain specimens is to go and collect your own. This is also



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usually the most fun! *Fundulus* are usually plentiful in the habitats where they are found, and on some of our collecting trips, they dominate the fish fauna that we collect at certain locations. They can be collected most easily by a group of people with a seine, but some species, especially large specimens of *F. catenatus*, can easily jump clear of the seine. Many species also use another interesting strategy to escape capture—they jump onto land and flip themselves into the brush, hiding for several minutes until things quiet down, and then they return to the water. This behavior is common enough that the banded water snake (*Nerodia sipedon*) has learned to catch *Fundulus* on land as adeptly as it does in water. We have witnessed this on several occasions on collecting trips. An individual banded water snake shadowed us most of the day, watching and waiting for food. On one collecting trip, we occasionally tossed a fish to a 3-foot banded water snake to watch it quickly grab and swallow the fish—on land!

up its figurative sleeve—it buries itself in the substrate when danger approaches, so you'll likely only get one or two casts of the net before you'll have to move on to another area to try and catch some.

After the fish are caught, it's a good idea to have a clear catch cup or other clear container and a small net so you can sort the fish you have caught. Return any unwanted fish to their home water immediately. It's best to keep juveniles or young adults. Admire the beauty of fully adult fish and then return them unharmed to their native habitat. Adult fish rarely make the transition to aquarium life, while juveniles make the transition easily. Hold any fish that you're going to keep in a covered cooler with water from the stream. Keep this cooler in the shade so it doesn't overheat. I also bring along a set of dip strips to test water parameters like pH, hardness, alkalinity, and a thermometer to test temperature. A GPS device and a TDS meter are other pieces of equipment that aren't necessary but might come in handy.

Then, if they are healthy and eating, they can go into a display tank.

## OTHER SOURCES

Another way to find these fish is to head to the local bait shop. Several species of killies are regularly used as baitfish. They're usually in rough shape, but since they are hardy fish, you can "rescue" a group of what are called "topminnows" or "studfish" for just a few bucks, and you don't even have to get your feet wet! After a few weeks of feeding and quarantine, they're usually as good as new.

## Feeding

The *Fundulus* of Missouri are primarily predators, with well over half of their diet being terrestrial arthropods (such as flies, spiders, and other insects) and the other half made up of aquatic insects, daphnia and other small crustaceans, and a bit of algae when prey is scarce. The majority of specimens of some of the *Fundulus*



Tony Terceira

■ The blackstripe topminnow (*F. notatus*) is characterized by a long black band that spans the length of its body.

Sometimes a large dip net with a long handle is sufficient, especially if you are going after juvenile fish. You can often stand on the bank and, with practice, catch several young fish in one or two quick swipes of the net through shallow water, moving from deeper water toward the bank. For species like *F. zebrinus*, a castnet is the easiest way to catch them. This takes a lot of practice, so it is a good idea to try it out several times before you go on your collecting trip. Otherwise, you'll spend the entire day untangling the net and likely never catch anything. *F. zebrinus* has another trick

## BRINGING THEM HOME

When you get the fish home, drip acclimate them into a quarantine tank. This tank and the container into which you are dripping the quarantine tank water should both be tightly covered, as the killies will be skittish and may jump (remember, this is one of their natural behaviors to escape a predator). The quarantine tank can be bare with a clump of floating plastic plants, a mature sponge filter or box filter, and a few pieces of PVC pipe so the fish have plenty of places to hide. Watch for signs of parasites or disease for at least three or four weeks.

species found in Missouri (*F. olivaceus*, *F. chrysotus*, *F. dispar*, and *F. notatus*) will take flakes and pellets right from the start, especially if they have other species to train them (guppies work well for this). Basically, they see the guppies eating those strange flat things floating on the surface and quickly learn those are food.

Of course, each fish is an individual, and certain individual fish will never take flakes. The two species we've found most reluctant to take flakes and pellets are adult *F. catenatus* and *F. sciadicus*. For these species, live foods work best. Try foods like daphnia, flour beetles, fruit flies,



blackworms, and, for larger *F. catenatus*, earthworms. Frozen bloodworms and frozen brine shrimp are taken eagerly by all seven species. One of our club members, Dave Rush, has noticed that you can get juvenile *F. catenatus* to take flakes if you keep them with other species that feed on flakes. They then grow to adulthood on this diet and will take it even as full-grown adults. Those introduced to flakes as adults will never take them. We haven't yet tried this with *F. sciadicus*.

## Aquarium Care

All of the species found in Missouri, except *F. chrysotus* and *F. zebrinus*, are fairly widespread, and some, like *F. olivaceus*, *F. notatus*, and *F. catenatus*, are actually extending their ranges. Due to most species' wide ranges, they are quite adaptable and water parameters are not very important. Dechlorinated tap water in most parts of the country should be fine. They do appreciate clean water, so

aquarium, but aren't entirely necessary. A nice aquascape reminiscent of their stream homes can be designed with driftwood and rocks. For substrate, choose larger gravel, such as pea gravel, which will serve double duty as a decorative substrate and also as a spawning site, since many of these fish will lay their eggs in the gravel.

## Breeding

All seven species are daily spawners and egg placers. They can also be spawned like other egg layers, where the sexes are separated and conditioned for a week to 10 days and fed heavily with high-quality live and frozen foods. When the pair is put together, instead of laying just a few eggs as they would during daily spawning, they lay up to a couple hundred. The advantage to this is that the fry will all hatch out at about the same time and be about the same size.

Males, especially *F. catenatus* and *F. sciadicus*, can be fairly aggressive with

displaying in the wild. If she is receptive, she allows the male to sidle up next to her and they go off to lay their eggs.

They will swim parallel, occasionally touching one another. They will swim down to the bottom and lay from one to several eggs, quivering together for a moment, then breaking off and swimming away with a swirl of their tails that serves to both mix their reproductive products and scatter the eggs, which will fall into the interstices of the gravel. If there are acrylic spawning mops in the tank, those will often be the target of their spawning activities.

After spawning is complete, the parents provide no further care to the eggs or the resulting fry. The eggs have a series of filaments on one area that allow them to catch onto plants, branches, rocks, and other debris in the wild, providing them with some security while they develop. These filaments will also allow them to stick to mops.



Tony Terceira

■ Plains topminnow (*F. sciadicus*); based on their penchant for aggression, male plains topminnows should be kept within a larger group of females.

large, regular water changes and a well-maintained filter are important.

Surface area is more important than total depth, so select a long or breeder-type aquarium over a high or show-type aquarium of the same volume. Most of the species mentioned will do well in a 20-gallon long. These native North American fish do not need a heater and may actually benefit from seasonal fluctuations in temperature in their aquarium. Generally, if you're comfortable in the room, they will be too.

Plants can give the fish a sense of security, especially when newly introduced to your

one another. They display head to head and side to side, thrashing against each other and occasionally biting one another, especially if the thrashing indicates they are evenly matched. If there isn't enough room in the tank, the dominant male can kill his weaker rivals. For breeding, it is best to have only one male per tank. Otherwise, the males will be spending so much time sparring that they may never get around to breeding. The male displays for the female, doing a short dance and showing his best colors. This is often accompanied by head bobbing, which reminds me of male lizards I've seen

The eggs are tough and can be handled safely. Eggs laid in the gravel can be removed with a gravel cleaner (run into a bucket!) or by swirling a fine-mesh net in a figure-eight pattern through the tank. Mops can simply be removed. Many breeders will pick the individual eggs and put them in shallow dishes for hatching, but I prefer to leave the eggs in the tank and remove the adults. The eggs will hatch out in 10 days to two weeks depending on temperature and species. Fry are large and will take newly hatched brine shrimp and microworms right from the start. In the





Tony Terceira

■ The red finnage and zebra-like stripes of the plains killifish (*F. zebrinus*) make it especially unique among Missouri killies.



Tony Terceira

■ The northern studfish (*F. catenatus*), the largest of all killifish, will do best in a 75-gallon or larger tank.

wild, they are ready to spawn in their second summer, and in our aquaria, most are ready to spawn in five to six months, which is well before they reach full adult size.

## Fundulus Species

### THE NORTHERN STUDFISH (*F. CATENATUS*)

The northern studfish (*F. catenatus*) is the largest of all killifish and the largest in the state of Missouri. It is found in the southern half of the state below the Missouri River throughout the Ozarks, though there are now some populations above the Missouri too. Big males can

reach 7 inches and are truly striking fish. They are also aggressive among themselves, so they should be given a large tank—at least 55 gallons, but preferably 75 gallons or more. It is best to keep adults in groups of one male and five or six females. Juveniles can be kept in mixed groups with other species until they reach maturity. *F. catenatus* rarely takes prepared foods but will thrive on a diet of frozen bloodworms with the occasional small earthworm. This species is primarily a gravel spawner.

### THE GOLDEN TOPMINNOW (*F. CHRYSOTUS*)

The boot heel of Missouri marks the extreme northern edge of the golden

topminnow's (*F. chrysotus*) range. This green and gold lowland beauty usually tops out at about 2½ inches, though some older specimens might push 3 inches. It will lay eggs in mops. A 20-gallon tank is ideal for a breeding group of golden topminnows.

### THE STARHEAD TOPMINNOW (*F. DISPAR*)

The starhead topminnow (*F. dispar*) is also found in the southeastern part of the state but is more widespread than the golden topminnow, being in the transitional area between the lowland and the Ozark Mountains. As its common name suggests, this species is easy to spot in the water by the bright golden star or spot on top of its head, which can be seen even in turbid water. Males have a series of bands along their flanks that differ by collection location. These guys seem to top out at about 2½ inches. *F. dispar* is not a schooling fish, usually hanging out alone or in pairs. A small, mixed-sex group of six to eight fish can be kept in a 10- or 15-gallon tank. This species will spawn on mops.

### THE BLACKSTRIPE TOPMINNOW (*F. NOTATUS*)

The blackstripe topminnow (*F. notatus*) is fairly widespread and reaches about 2½ inches in length. It is characterized by a wide black stripe that runs from the mouth through the eye to the base of the caudal fin. There are no spots on the flanks or





Tony Terceira

■ Female (top) and male (bottom) *F. olivaceus*; blackspotted topminnows are reminiscent of blackstripe topminnows but usually grow much larger in size.

back above the black stripe. Blackstripe topminnows are usually found in more slow-flowing, turbid waters and can tolerate higher temperatures than other Missouri killies. This is an Ozark fish with a range that extends into the Great Prairie. *F. notatus* will lay eggs in mops or gravel. A 10- or 15-gallon tank is perfect for a mixed-sex group of six to eight or so specimens. Males are considerably larger than females.

### THE BLACKSPOTTED TOPMINNOW (*F. OLIVACEUS*)

Though the blackspotted topminnow (*F. olivaceus*) looks similar to its cousin, the blackstripe topminnow, it is much larger, often reaching nearly 4 inches. It is also much more widespread and probably the most numerous killifish in terms of the quantity of specimens in the state. It is found in all four areas, though it is not common in the northern part of the state. We encounter this species almost everywhere we try to collect. The blackspotted topminnow is characterized by a wide black stripe along its flanks from the mouth to the base of the caudal fin (and sometimes extending slightly into the caudal fin) and by a series of black spots above this black line. It prefers clear, flowing water with vegetation close

by. Like the blackstripe topminnow, it too will spawn in mops or in gravel. Due to its larger size, a 20-gallon long should be the minimum size tank considered for a group of six or eight fish.

### THE PLAINS TOPMINNOW (*F. SCIADICUS*)

The plains topminnow (*F. sciadicus*) is a dusky gray-green killie that tops out at about 2½ inches. It is found in the central part of the state in clear-flowing creeks and rivers of the Ozarks. While the plains topminnow's habitat is a bit scattered, it is often the most numerous species wherever it is found. In one location, we seined several hundred specimens in a single seine run. The males are rather aggressive, not only among conspecifics, but also with other species. If collecting males during spawning season, it is a good idea to give each male its own container for the trip home. It is best to keep one male to a group of six or eight females in a 30-gallon or larger tank. This species is a mop spawner.

### THE PLAINS KILLIFISH (*F. ZEBRINUS*)

In Missouri, the plains killifish (*F. zebrinus*) is limited to a few saline creeks north of the Missouri River in the Great

Plains area. It grows to a little over 2 inches and has a dozen or so narrow stripes on its flanks, often with red or orange in its unpaired fins. *F. zebrinus* seems to prefer areas with very hard, alkaline, and even salty water, and its numbers are reported to fluctuate from year to year with it being more abundant in years when the climate is drier and less abundant when there is more rain. It has the previously described habit of diving into the substrate for cover when threatened, both in the wild and in aquaria. It is reputed to eat plants as well as critters. Eggs are buried in the substrate, which is often sand, silt, or soft mud in the wild.

### Find Your Own *Fundulus*

While your state may not have all of the beautiful *Fundulus* that Missouri does, you should still be able to find something of wonder and beauty to admire in your state's native waters, assuming it is legal to do so. Since they are not available in the trade, you have to either collect your own or trade with others (again, where legal) to obtain specimens. Most species are easy to raise and breed, so once you get a few specimens, you should be set for years of enjoyment. 🐟



# THE LATEST BUZZ: FRESHWATER BEE SHRIMP

AMANDA WENGER

Nou (Nick) Xyong

■ Crystal red shrimp (*Caridina* cf. *cantonensis*).



## Freshwater dwarf shrimp

of the order Atyidae have exploded onto the hobby scene in recent years. Starting in the early 2000s with the global introduction of the red cherry shrimp (*Neocaridina heteropoda* var. "red"), breeders and importers all over the world have been bringing new and exciting species and color morphs to the market, with new strains now appearing on a near-monthly basis.

Of the many available species of shrimp, the bee shrimp (*Caridina* cf. *cantonensis*) is currently one of the most diversified, with over a dozen variants on the market today. The widespread popularity of this particular species is somewhat peculiar in that it thrives in a far narrower range of conditions than its more adaptable cousins in the genus *Neocaridina* (including the aforementioned red cherry shrimp).

### Basic Care

Bees are not shrimp for the beginning invert keeper. New hobbyists who have done their research often start with commonly available *Neocaridina* species or Amano shrimp (*Caridina japonica*) and move on to bee shrimp only after they've had success in keeping the easier species. Apart from being less forgiving, bee shrimp generally carry a heftier price tag, which is reason enough to have some experience before investing in them.

Shrimp in general require very clean water, as they're far more sensitive to toxins than fish. The bioload in the tank should accordingly be kept low, which is not as difficult as it may sound, since shrimp have a low impact on bioload. Only the smallest of fish, such as *Otocinclus* spp. catfish or least killifish (*Heterandria formosa*), are suitable as tankmates. For breeding purposes, however, shrimp should be kept in species tanks.

Since they are typically prey animals, shrimp like to have readily available hiding places. The addition of live plants provides shelter and helps remove ammonia from the water. Low-light aquatic mosses, such as Java moss, are wonderful additions to shrimp tanks. Another source of shelter the shrimp enjoy is cholla wood, the dried-out husks of the cholla cactus (often sold in pet stores for use with hermit crabs).

There is a general consensus among shrimp breeders that bee shrimp need cooler waters that do not exceed approximately 74°F. This is more or less true. Bee shrimp do thrive in cooler temperatures, but their failure to thrive in warmer environments most likely has just as much to do with oxygen



Amanda Wenger

■ Out of all shrimp species available in the hobby today, none are as diversified as bee shrimp, which include over a dozen variants.



Amanda Wenger

■ Tiger shrimp and other wild bee shrimp variants can be identified by their dark striping.

saturation as the heat itself. Oxygen dissolves much better in cool water, and bee shrimp need well-oxygenated water. Keeping them in temperatures above 76° will require the addition of an extra airstone or air-operated filter. Even so, it's not a good idea to keep them in temperatures above 78°. As such, a heater is unnecessary in all but the coldest environments. I've had plenty of success with these shrimp in temperatures as low as 65°.

### Water Parameters

Temperature aside, bee shrimp also like their water soft and just slightly acidic, with a pH of 6.5 or so. Many breeders use reverse osmosis (RO) water to give the shrimp an ideal environment. However, pure RO water is deficient in minerals (particularly calcium) that

are vital to shrimp exoskeletons. The addition of a mineral rock or a shrimp-specific GH booster will help replace the missing minerals without adding more than what is necessary. Another option is using a partial mix of RO and tap water. A GH of 4 to 6 with a carbonate hardness of approximately 2 is ideal.

Personally speaking, I use tap water combined with a pH-lowering substrate (such as the myriad of substrates designed for planted tanks) and a pinch of montmorillonite clay to provide calcium. Depending on your local parameters, this approach may or may not work for you.

### Wild Variants

The wild bee shrimp, native to China and Japan, has a rough pattern of broad, brown-





Amanda Wenger

■ The orange-eyed blue tiger shrimp, a unique tiger shrimp strain, was recently introduced in the hobby.



Amanda Wenger

■ A number of interesting crystal bee shrimp variants have emerged from Taiwan, such as black King Kong shrimp.

black and white stripes on a clear body. A variant wild shrimp with a transparent body and thin dark bands, known as the tiger shrimp, also exists. All of the other strains of bee shrimp were derived from these two shrimp populations. Because these wild types are also the least inbred and fairly inexpensive, they make good first choices for a first-time keeper of bee shrimp.

### Bring on the Colors

In the mid-1990s, a bee shrimp breeder in Japan by the name of Hisayasu Suzuki noticed that a handful of specimens in his wild-type population displayed slightly reddish coloration. Over the course of several years, selective breeding produced the first crystal red shrimp. Once these crystal red shrimp hit the market, other breeders refined the strain to improve the

brightness of their color, delineation of their pattern, and overall coverage of the white stripes on the shrimp.

Today, a lettered grading system has been developed to describe the quality of the patterning on crystal red shrimp, ranging from C (the original red bee shrimp) to SSS (also known as *mosura*) grade. Oddly enough, despite being called a crystal red shrimp, the quality of the shrimp is determined by the amount of white it possesses, with the highest grades being almost entirely white. The grading system is also applied to the refined versions of the wild-type black coloration, known as crystal black shrimp.

A very recent addition to the hobby is the crystal white shrimp, which has thin, white stripes on a clear body. The most notable features of this shrimp are the eggs

and ovaries of the females, which are an unusual minty, blue-green color. Crystal white shrimp have only started making their way to the United States in the past year or so. These new shrimp are not to be confused with the solid-white to yellow-white bee shrimp variety known as the golden bee, which has been around for several years now and a likely source of the increasing white coverage in higher-grade crystal red shrimp and crystal black shrimp.

The tiger shrimp, on the other hand, have mostly been bred to become darker. A strain with a blue body and orange eyes—appropriately called the orange-eyed blue tiger shrimp—was introduced to the hobby a few years ago. A combination of the dark blue body and increased coverage of the black stripes produced a near-black version of the shrimp, referred to as the black diamond or black tiger shrimp. Other breeders have focused on the coloration of the stripes, producing red-striped shrimp known (unsurprisingly) as red tigers.

### Meanwhile, in Taiwan

In Taiwan, a group of highly selected strains of crystal bee shrimp, apparently all caused by the same mutation, have been introduced to the hobby in the past couple of years, carrying such creative names as red ruby, blue bolt, and black King Kong shrimp. Collectively, these variants are referred to as Taiwan bee shrimp, a reference to the location where breeders first developed the mutation.

Taiwan bee shrimp are the rarest and most fragile variants of the species. Being highly inbred, they are also prone to genetic defects and deformities and tend to be smaller than their wild-type counterparts. Because of the difficulties they present, they also command the highest price among bee shrimp, often in the hundreds of (US) dollars for high-quality specimens. Hopefully, with a few generations of outcrossing and stabilizing, these breeds will become less specialized and more readily available in coming years.

### Crossing Conundrums

The other difficulty with bee shrimp, and shrimp in general, is keeping track of what variations can be kept together without hybridizing or muddling the genes of two different strains. The easiest solution to the problem is to just give each type of shrimp its own tank, but this, of course, is not feasible for most hobbyists, so who can be with whom?





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Amanda Wenger

■ Crystal black shrimp; the quality of a shrimp's patterning is determined by the amount of white on its body.



Amanda Wenger

■ Aside from a red carapace, mosura-grade shrimp feature fully white bodies.

Since the bee shrimp discussed are all the same species, *Caridina* cf. *cantonensis*, crossing strains does not technically result in a hybrid shrimp. However, it can undo all the careful selective breeding and produce a shrimp that is not nearly as attractive as either of its parents. Crystal variants, including the golden bee and Taiwan bee shrimp, can be kept together without fear of corrupting the appearance of future generations. The Taiwan gene is recessive to normal crystal appearance, whereas golden bee genes tend to merely increase the white coverage in the shrimp, a desirable trait. Tiger shrimp, however, cannot be kept with crystals—crossing crystal black shrimp and tigers will produce a kind of vaguely striped, splotchy result known in slang as a *tibee*. Since the crystal white shrimp is so new to the hobby, it's not yet

clear what other, if any, bee shrimp it's compatible with.

As a member of the genus *Caridina*, the bee shrimp can also be kept with a colony of a strain from the genus *Neocaridina* (for example, blue pearl or red cherry shrimp) and/or a member of the genus *Paracaridina* (which are less readily available to hobbyists).

Other members of the genus *Caridina*, such as the bumblebee shrimp (*C. brevata*) and *C. hodgarti*, should not be kept with bee shrimp to avoid hybridization. However, *Caridina* species that do not breed in fresh water, also known as low-order breeders, are acceptable tankmates. Examples of low-order shrimp include Amano shrimp and ninja shrimp (*C. serratirostris*).

## Breeding Bees

Breeding bee shrimp is not much more

difficult than keeping them alive and happy and, of course, having shrimp of both sexes. Females are more robust, having more convex underbellies and being slightly larger than males. In non-opaque varieties, they can also be determined by the presence of their saddle-shaped ovaries, located just behind the head of the shrimp.

Assuming both sexes of shrimp are present, when the female has just molted and is fertile, she produces pheromones that cause the male shrimp to swim in frenzied circuits around the tank, seeking her out. After their eggs are laid and fertilized, the females carefully stick them to their pleopods (swimmerets), located on the underside of the tail. A female with fertile eggs is referred to as "berried" due to the berry-like appearance of the egg clusters. The female proceeds to carry the eggs for the next month, diligently fanning her swimmerets to ensure a flow of oxygenated water, until they hatch.

On hatching, baby bee shrimp are miniature replicas of their parents and are left to fend for themselves. Since adult bee shrimp do not bother their babies, a species-only tank ensures a lack of predation on the shrimplets. Combined with clean water and ample food, a high survival rate is not difficult to achieve.

## Where to Start

Should you decide to try keeping bee shrimp, start with the basics. Wild-type and early strains, such as low-grade crystal reds or crystal blacks, are the best choices. Start with a group of ten to a dozen and see how they do—once you've got a knack for keeping these shrimp happy, you can begin exploring the more costly strains if you so choose.

Since almost all dwarf shrimp find their way to the US from Asian exporters and are fairly new to the hobby, they are still far more readily available on the Pacific Coast than on the Atlantic. The most common bee shrimp to appear in local fish stores are the crystal reds. Procuring more exotic variants is still most easily accomplished through Internet retailers. You may also want to check with your local aquarium club to see if a freshwater invert breeder is in the area.

Bee shrimp are a diverse and fascinating group of invertebrates well worth keeping if you're up to the challenge. For hobbyists who want to move beyond the basics, these shrimp are a great place to look. 🐼



# Poly Bio Marine

## Filtration 103

### Filtration Problems due to Van der Waal Forces

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If Van der Waal force limitations are exceeded, tunneling through the media, surface coating of the media plus collapse of the attractive charge on the media, all contribute to rapid failure of the media's ability to adsorb contaminants / pollutants.

So what's the best way to address your tank and tap water filtration needs in light of Van Der Waal limitations?

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# MOSQUITO LARVAE

PETER JEKEL

■ Mosquito larvae are an excellent live food for fish that can be grown during warmer seasons.





*I see myself as a roving mosquito, choosing its target.*  
-Kenneth Williams, Actor

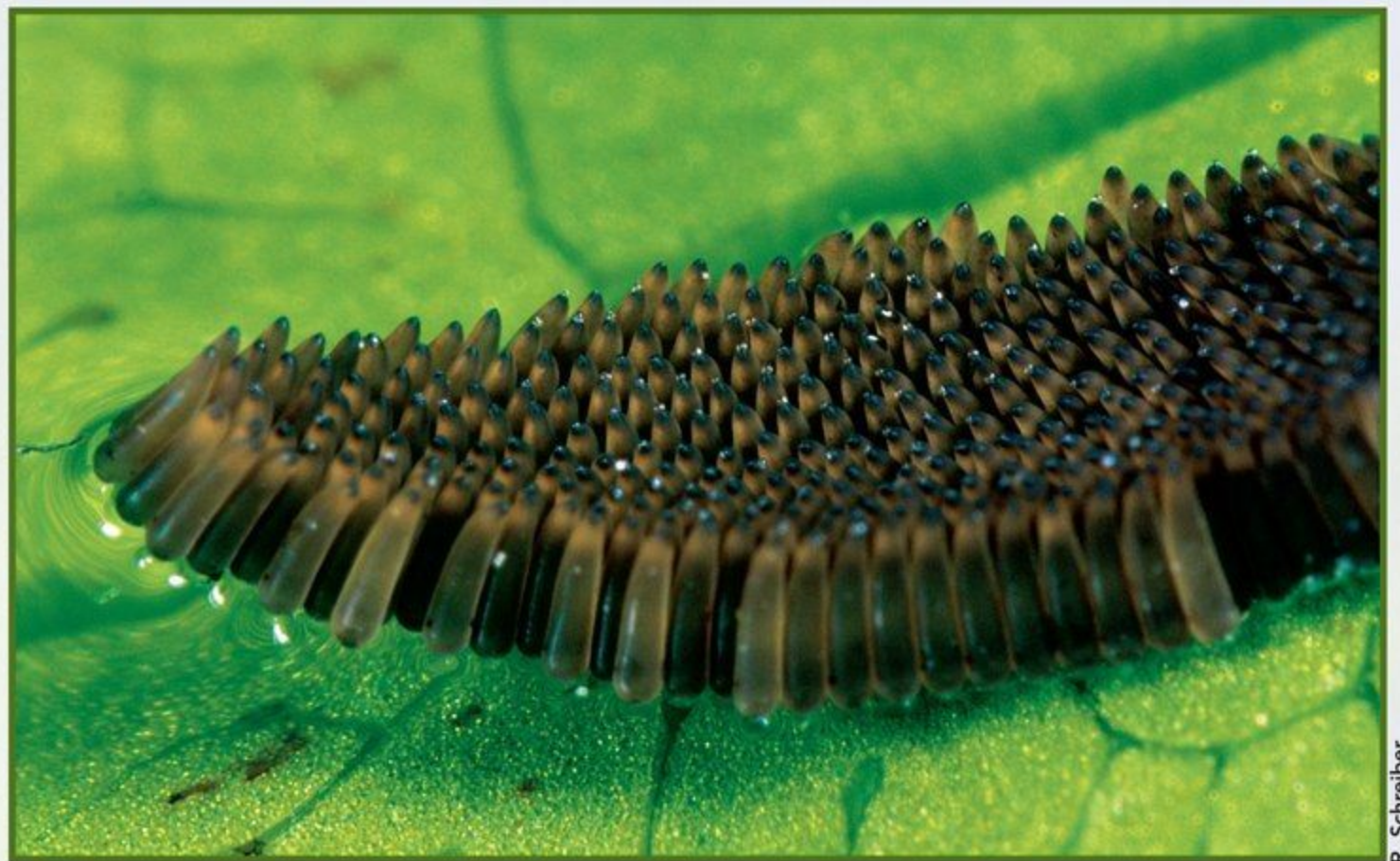
**The lowly mosquito.** Its larvae will grow in wading pools, gutters that need cleaning, abandoned tires, old tin cans—anywhere that water is allowed to accumulate.

But did you know that this very habit of the female mosquito laying eggs in standing bodies of water can actually be a boon for the tropical fish hobbyist? We all know that live food is important in fish rearing, not just for nutritional value, but also for awakening the primal need in many fish to hunt for food. Many of us may produce live food by purchasing brine shrimp eggs at a local pet store and hatching them, but brine shrimp, though relatively easy to raise, have certain limitations. They require a certain salinity, temperature, and aeration to thrive. They often, depending on conditions, take up to three weeks to mature. But with mosquito larvae, we have a ready supply of live food that is high in protein, quick and easy to grow, and free for the taking.

## Mosquito Biology

Mosquitoes are holometabolous insects. Much like butterflies, they go through very distinctive growth phases, including egg, larva, pupa, and adult stages. Depending on the temperature of the air (ideally above 64°F in the morning and evening), it takes about a week for the full cycle to happen. However, it is the larvae that the fish hobbyist is interested in.

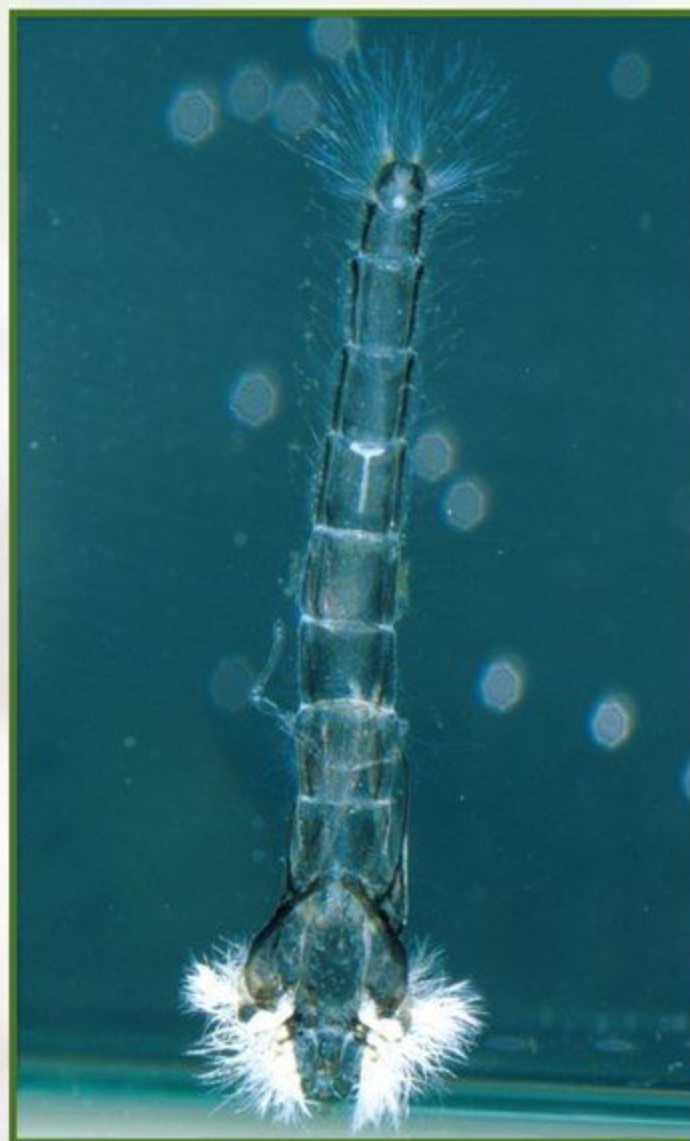
To reproduce, the female mosquito requires a blood meal, which she acquires by plunging her long proboscis into an unsuspecting victim. As she feeds, the female mosquito injects her saliva into the body of the victim, which contains an anticoagulant that allows the blood to flow freely. It is the reaction of the body to the anticoagulant that causes itching. The amount of blood drawn from the victim is negligible, but at the same time, it is the process of drawing blood that makes the mosquito dangerous. As the mosquito injects its saliva and anticoagulant concoction to draw its blood meal, it has the potential to spread disease. For instance, if it has fed on someone with, say, malaria, it will inject the protozoans that cause this illness into the new, unsuspecting victim.



■ A raft of mosquito eggs.

In other cases, the disease may be dengue fever or West Nile virus. The list goes on and on, and it is highly species dependent. Many mosquito species, however, spread no disease at all.

The eggs are laid by the female mosquito in rafts. When the larvae hatch, they are often called wrigglers due to their unusual body movements. They have a soft body, a hard head, and a siphon for breathing.



■ In the larval stage, mosquitoes have worm-like bodies and remain near water surfaces for air.

Mosquito larvae, despite living in water, must breathe air. Within about two days, depending on air temperature, the larvae will reach a pupal stage, where they look like a comma and are often referred to as “tumblers.” Once the ungainly pupa matures, a true wonder of nature emerges: an adult mosquito with its long legs, proboscis, and a pair of transparent wings. Despite its pesky feeding habit, it truly is a wonder of engineering for its ability to land on an unsuspecting victim and draw its blood without being noticed.

## Building Your Larvae Farm

You will need very little equipment to take advantage of this highly nutritious food. Place a 5-gallon bucket outside in the sun. Other sizes of buckets, an old aquarium, or a fish bowl will do as well. It is entirely dependent on how many larvae you require to feed your fish. If you use a plastic bucket, it should be made of food-grade plastic, which can be purchased at a restaurant supply store. You can even use a container that had food in it as long as it is properly cleaned out. Under no circumstances, though, should buckets that once had chemicals be used, as there may be residual material in them even after cleaning that can not only inhibit larval growth but potentially poison your fish.

Fill the bucket with water. You can either wait for it to rain or use water from a garden hose. If you are using municipal water, there will be chlorine in the water,





TFH Archives

■ The wriggling movements of mosquito larvae help stimulate the natural feeding behaviors in fish.



TFH Archives

■ Be sure to harvest your mosquito larvae before they mature into adults.

which can inhibit larval development. But remember that bright sunshine and heat will quickly dissipate the chlorine from the water. A dechlorinator is not required.

Place the bucket in the sun so that it heats up quickly. Once the temperature of the water reaches around 80°F, which you can verify with a thermometer, move the bucket into a partially shaded area. This will prevent overheating of the water, which will inhibit larval growth, but still allow enough light for the development of algae, which is an essential food for your growing brood.

Check the water after a couple of days. Under no circumstances should you forget about your project. You do not want to be the source of a major mosquito-borne disease outbreak in your neighborhood or create conditions that make summer

evenings unbearable. You should see tiny brown rafts of dark eggs on the surface of the water. Here, you have a choice. You can either scoop them out with a fine-meshed net (e.g., a brine shrimp net) and place them in your aquarium or let them hatch in your bucket.

If you choose the former, the egg rafts will hatch directly in your aquarium and the fish will greedily gobble them up before they reach adulthood (usually within 48 hours).

With the other option, you will let them mature as larvae in your bucket. Be sure to scoop them out by the time you see some of the comma-shaped pupae at the surface, as they will soon mature into adults. This, of course, is something that should be avoided. Not only are adult mosquitoes notorious annoyances, spoiling many

summer barbeques, but, as I've already mentioned, they can also spread disease.

## Warnings

If you decide to go the route of growing your own mosquito larvae, there are several considerations that must be addressed. One that cannot be stressed enough is, again, the fact that mosquitoes can spread disease when they feed.

As a result of the severe public health problems associated with these insects, most jurisdictions have restrictions against standing water to prevent mosquito development. In some areas, there is an active presence of public health officials who will order the cleanup of any standing water, regardless of whether mosquito larvae are present or not. In other cases, orders are issued only if there are complaints. In some areas of the world, where mosquito-borne diseases take a toll on local populations, the punishments can be severe. Check with your local municipality to make sure you understand the restrictions in your area. In most cases, these are specifically focused on preventing the maturation of mosquitoes. With some diligence, this should not be a problem, as our interest lies only in the larvae.

## Working with the System

So how do we prevent the larvae from maturing into adults? A simple and chemical-free way to prevent mosquito larvae from maturing into adults is to set up two buckets. When the first bucket develops the mosquito larvae, merely strain the larvae by dumping the water through a fine-mesh net into the second bucket, where you can await another population of larvae to develop. If you are going away for a few days, remember to turn the buckets over to prevent rainwater from collecting and providing an ideal mosquito-breeding environment. When you return home, just start the process all over again.

## A Summer Treat for Your Fish

With mosquito larvae, you have a free and easily bred live food for your fish right outside your door. They can even be grown on an apartment balcony if you are not too high up. Mosquito larvae not only make an excellent protein treat, but their active wriggling movements stimulate the natural feeding behaviors in fish. Just be aware of their potential for disease, which can easily be prevented through proper maintenance of your larval farm. 🐟



Jack  
Wattley

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# Father's Day in the Ozarks

Ted Judy

**T**he best Father's Day ever featured two boys, nets, snorkels, water shoes, and lots of crayfish.

I learned a long time ago that forcing my boys to do things I like usually results in having to deal with a couple of grouchy kids. My hope is that they, Matthew (who was 7 at the time) and Thomas (who was 11), will someday embrace the aquarium hobby, but other than the obligatory aquarium in the bedroom (which I maintain), I have made little progress toward the goal of creating a new generation of fish geeks. Fortunately, my children are not lazy and have inherited a love of being outdoors, so I took a chance on having a very trying weekend, piling the boys in the truck for the 12-hour drive from Wisconsin to southern Missouri on a fish-collecting trip.

Southern Missouri and northern Arkansas encompass a very unique area known as the Ozarks. The region comprises steep limestone hills with narrow valleys, dense deciduous forests, and abundant fast-flowing stony rivers and streams. The biodiversity of the Ozarks is amazing, especially in the number and variety of aquatic organisms. The area has long been a destination for native fish enthusiasts. I started traveling to the area in 2007 to net fish and crayfish with my friends from the area, Kevin Mouser and Michael Gaines. They introduced me to native fish collecting and, even more enjoyable, stream snorkeling. Water, nets, snorkels, fish, and crayfish, all in the great outdoor paradise of the Ozarks—young boys have

■ From left to right: Matthew Judy, Makenzie Meyer, and Corey Meyer prepare their nets for what lies beneath Ozark's waters.





Ted Judy

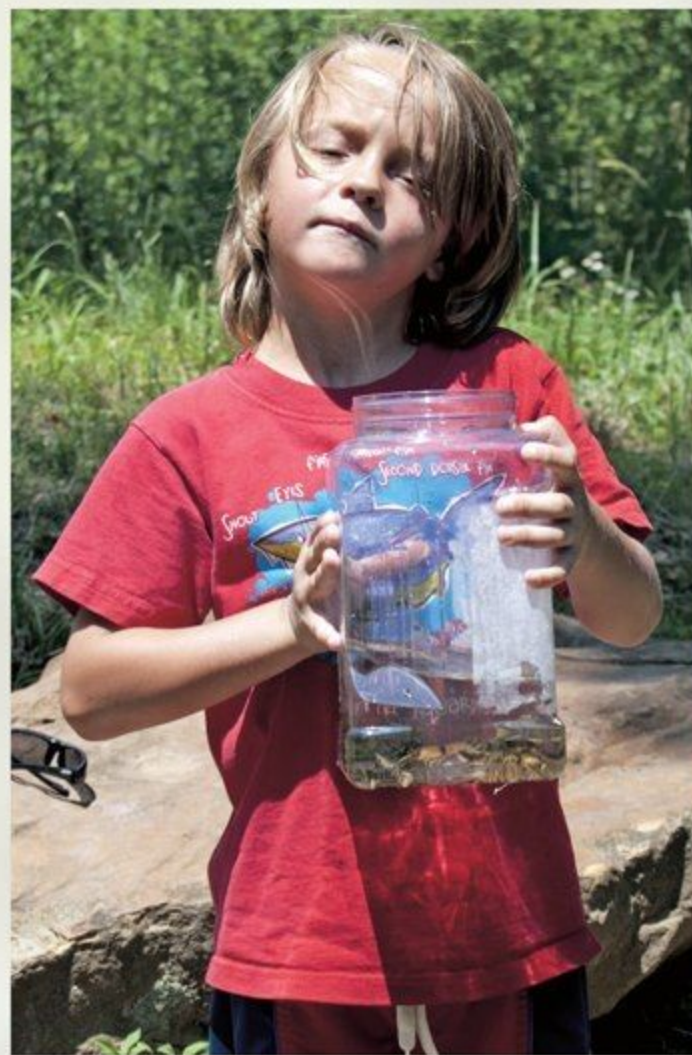
■ Corey Meyer (left) and Matthew Judy (right) seine the waters for fish and other aquatic life.

When we planned the trip, I made sure that Kevin knew that the goal was for the kids to have fun. And Kevin, being a teacher, knows that the best way to ensure that kids have fun is to make sure there are other kids, so he invited a few other families. We totaled ten people, five of whom were kids under the age of 12. The stage was set for chaos. To the stream!

## Crayfish in the Sugar River

Our first stop was in the headwaters of the Sugar River drainage near the town of Monett, Missouri, which we visit and collect from every year. The stream is small but routinely offers many fish species, such as darters, chubs, log perch, stone rollers, various shiners, livebearers, and even rainbow trout that escape from a fish farm upstream. There are also crayfish. We found three species in the same stream, one of which is the smallest Missouri species: the Neosho midget crayfish (*Orconectes macrus*). We also found the ubiquitous northern crayfish (*O. virilis*) and the beautiful and voraciously predatory ringed crayfish (*O. neglectus*).

Boys like to catch crayfish. I made the mistake of mentioning to Kevin that I might like to take some of the Neosho midgets home for an aquarium. An innocent statement of interest between fellow aquarists becomes license to reap in the minds of adolescent boys with buckets and nets. It took only 30 minutes for my sons to catch a couple dozen Neosho midgets. I was so proud.



Ted Judy

■ The author's son, Matthew Judy, holds a jar with crayfish caught near Neosho, Missouri.

The Neosho midget is not a fish predator and does well in an aquarium. Unlike most crayfish, it is not particularly destructive to plants either. It will do a good job of killing snails, however, and I have seen a 1½-inch crayfish destroy and devour a 1-inch mystery snail. Neosho midgets will even crush and eat small Malaysian trumpet snails, though the larger Malaysians are too hard for the crays to handle.

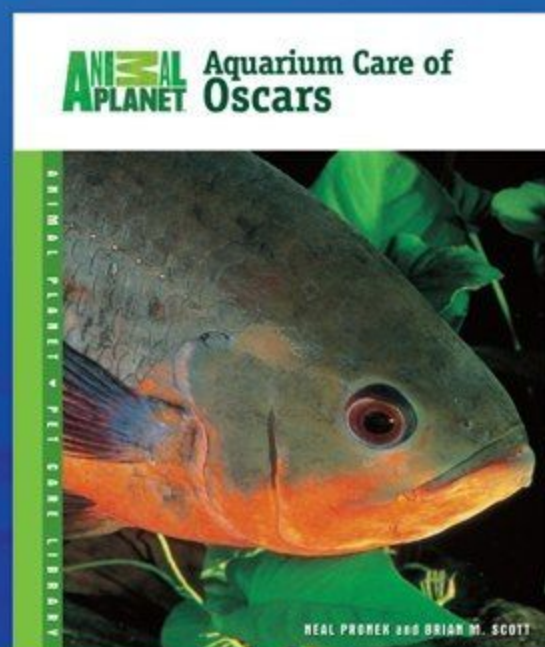
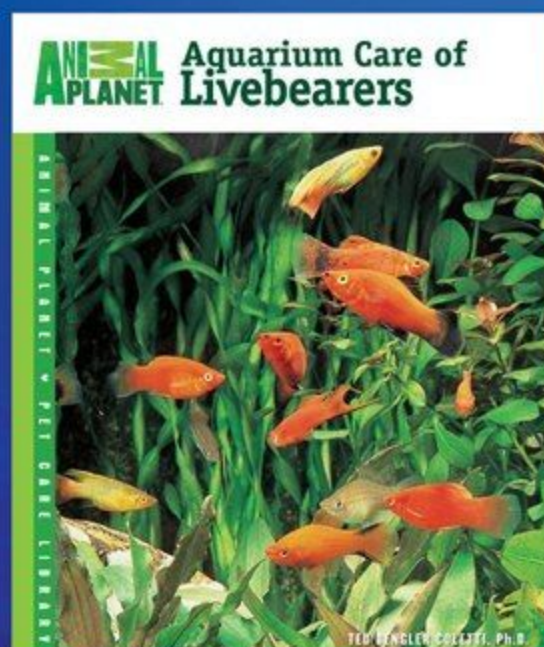
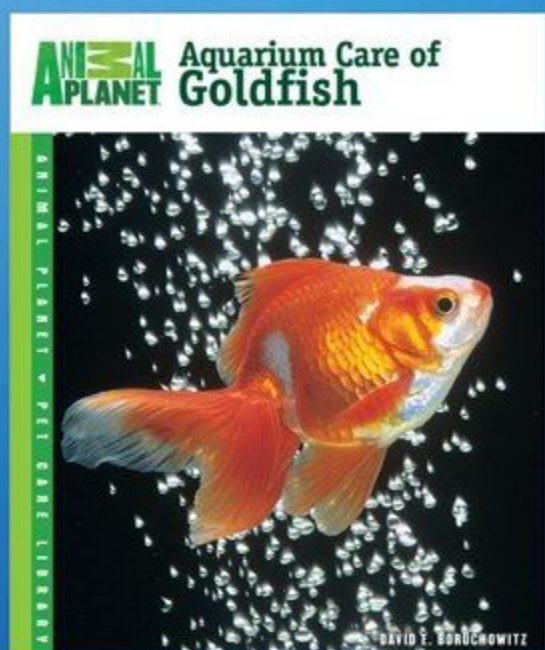
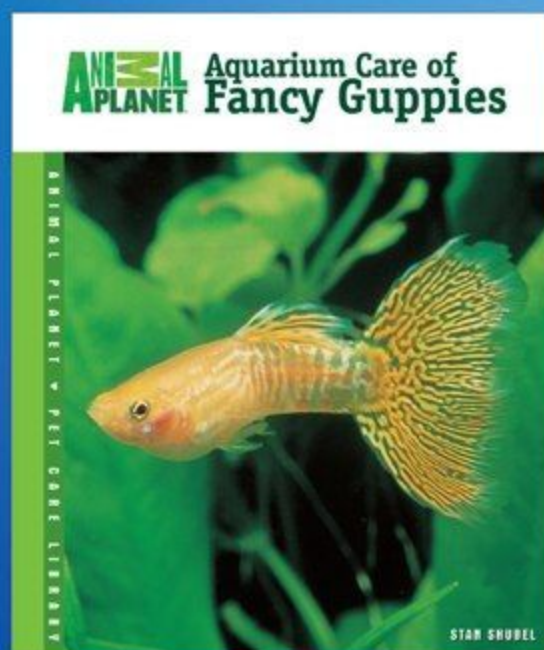
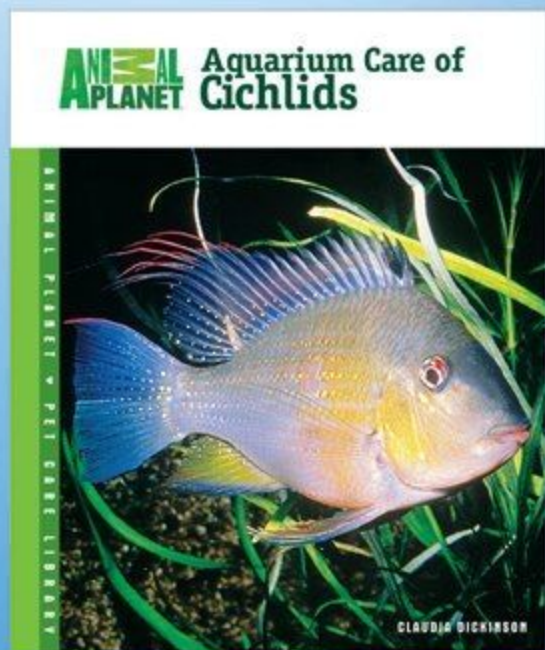
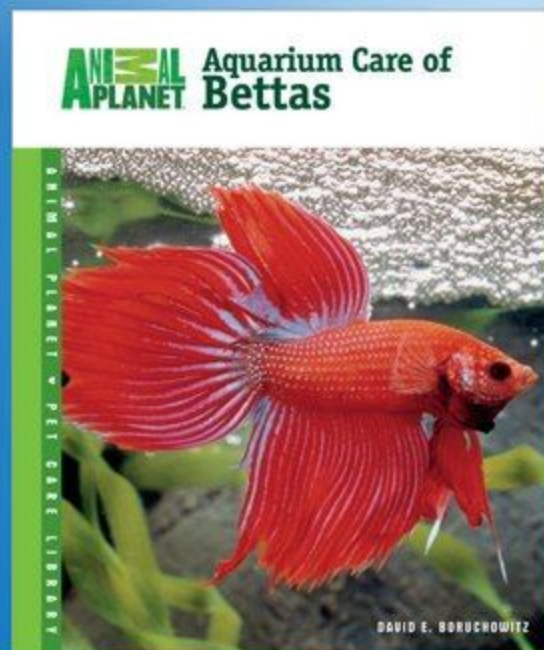
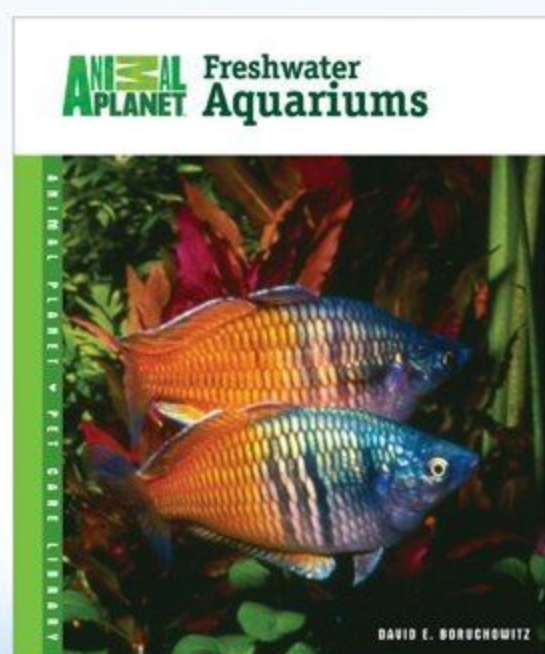
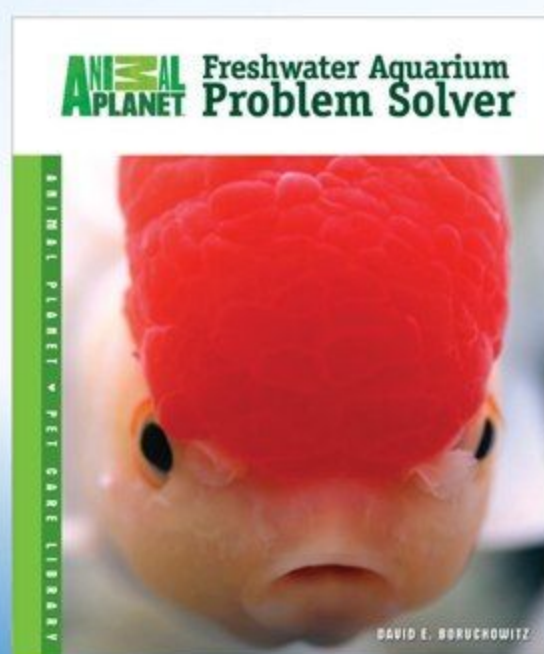
Collecting fish and crayfish for transport to an aquarium is permitted in Missouri with a fishing license. There are special regulations on certain species and specific bodies of water, however, so if you intend to collect fish or invertebrates, it is important that you learn the laws first.

## Snorkeling in the White River

Kevin chose a different river system, the White River, for our second stop of the day. One of the goals for this location was to find the largest crayfish species in Missouri, the long-pincer crayfish (*O. longidigitus*). Compared to the Neosho midget, this crayfish is a beautiful monster. It is not as common as other crayfish in the same river (which includes a very yellow variety of the ringed crayfish), and it is somewhat solitary. The microhabitat where the long-pincer cray is found is as unique as the animal. It prefers open rock shelves without gravel, punctuated by larger stones under which it can find shelter. These niches make up only a small portion of the stream, so we were able to concentrate our search. We were able to locate two young adult long-pincer crayfish. Thomas and Matthew were very impressed. Apparently a step up from finding lots of crayfish is finding a really *big* crayfish.

The section of the White River drainage we were in is large enough for swimming and snorkeling. Shiners, darters, and sculpin are abundant in the faster waters, while the slower and deeper pools hold suckers, bluegill,





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Ted Judy

■ The long-pincered crayfish (*Orconectes longidigitus*) is the largest crayfish species in Missouri.

smallmouth bass, and the spectacular longear sunfish (*Lepomis megalotis*). *L. megalotis* is one of the most colorful and variable species of fish in North America. It has a wide distribution, and many streams have color varieties that are subtly different from other areas. A mature male in full breeding colors rivals even the most spectacular discus. Longear sunfish do very well in an aquarium, although they are very aggressive and need a lot of space if the intention is to keep a pair and spawn them.

## Back to the Sugar River

Our last stop on Father's Day was back in the Sugar River system in a larger stream



Ted Judy

■ A number of interesting darters were found during the collection trip, such as this rainbow darter (*Etheostoma caeruleum*) caught near Neosho.



Ted Judy

■ Banded sculpin (*Cottus carolinae*) were encountered in a section of the White River drainage.

near the town of Pineville, Missouri. This area is a community recreational area, and there were a lot of local people out enjoying the first official day of summer with a dip in the cool stream. The river here consists of long, deep pools separated by stretches of riffles that flow rapidly over thick beds of 2- to 3-inch pebbles. Kevin netted a small slender madtom catfish (*Noturus exilis*) in a riffle and mentioned that he rarely caught them in this location. Thomas must have taken that as a challenge, as he managed to catch about a dozen of the madtoms in about 20 minutes. Matthew, in the meantime, discovered a rope swing over a deeper pool and lost all interest in netting fish and crays.

The boys rated day one as "excellent." Thomas ranked the White River system as the best area of the day, while Matthew proclaimed that no crayfish, large or small or in any number, could surpass the rope swing. Neither boy made it back to the hotel awake.

## A Second Day of Collecting

Day two started with a two-hour drive south from Missouri into the Buffalo National River Park in northwest Arkansas. The park is the oldest national river in the country and slices through 135 miles of some of the most spectacular and pristine Ozark geography. Our host and guide for the day was Michael Gaines. The Buffalo River is big water compared to the streams we visited in Missouri and boasts 64 species of fish.

We went to two locations in the Ponca Wilderness area, located near the western end of the park. The first stop was at Kyles Landing, a campground area with canoe access. The water here is excellent for



snorkeling. We saw a lot of interesting species of fish in the riffles, including dusky shiners, stone rollers, hog suckers, and huge white-tail shiners (*Cyprinella galactura*). Game fish were abundant in the deeper water and included many longear sunfish and both largemouth and smallmouth bass. We even found a small Ouachita map turtle (*Graptemys ouachitensis*).

The last stop of the day was upstream at the Ponca access point. The Buffalo River in this location is faster, with large areas of gravel and pebbles under only a few inches of water. These shallow areas are full of darters of several species, including the large Arkansas saddle darter (*Etheostoma euzonum*). Along the edges of the river are places where the rock outcroppings reach the water, and the current during runoff has carved out deep holes with larger boulders. These lairs hold larger game fish, including the Ozark bass (*Ambloplites constellatus*), a secretive species unique to the Ozarks. Shallower areas along the shoreline have areas of flooded emergent plants, in which we found northern studfish (*Fundulus catenatus*), a killifish that forms harem groups



■ Ouachita map turtle (*Graptomys ouachitensis*).



■ The Buffalo River was host to even more darter species, such as the saddled darter (*Etheostoma euzonum*).

of a dominant male and several females. This species is very hard to catch.

While wading, we found a smallmouth bass (*Micropterus dolomieu*) driving away any fish that got near its breeding nest. The boys were able to swim right up to the edge of the nest with snorkels for a close-up view. The depression in the gravel at the base of a large rock was full of bass larvae, the life stage of the species between the eggs hatching and the fry becoming free swimming. The parent bass tolerated the human interruption but had no mercy for any of the small sunfish that got too close. A longear sunfish was also nesting less than 10 feet away from the bass, but on the opposite side of the large rock. Observing so much fish behavior in the wild is a rare privilege.

## A Father's Day Delight

Having Thomas and Matthew go with me to explore native fish in the Ozarks was the best Father's Day gift they could have given me. Enjoying it was the icing on the cake. I am looking forward to more fish adventures closer to home, and farther away. My boys will soon be old enough to travel on more exotic collecting trips to places like Central America or Africa, but getting them interested in collecting locally is the right way to ease them into this more hardcore aspect of the aquarium hobby. Get some nets and take your kids down to the creek—you will be glad you did! 🐟



■ The Ozark bass (*Ambloplites constellatus*) is a large game fish unique to the area.





■ Various zoanthids (left) with a red and green *Micromussa* (right); a properly cared-for nano can be just as spectacular as a larger setup.

David Bell

**W**hen the buzz about nano reefs began several years ago, my immediate thought was, “Why would anyone want to have a small aquarium when they can have a large one? I want a tank as big as a small Pacific island, bigger if I can still find a place to put all my other stuff!” In retrospect, that conveys a hint of pretentious thinking and snobbery to me and, undoubtedly, to those who have already successfully achieved beautiful results in nano-reef creativity, husbandry, and management. I have seen

some gorgeous nano-reef systems that seem perpetually healthy and thriving.

I assure you my reluctance had as much to do with the odds of attaining success while reducing high-risk factors than with size alone. A nano reef just seemed to demand too much restraint and self discipline to suit my taste. Could I possibly be satisfied with the results or even succeed?

There were two simple reasons that caused me to overcome my aversions and take a second look at this facet of aquarium keeping. The first may sound familiar—I had all this equipment sitting around,

including a small tank, which could be put to better use. And the second, which I know sounds familiar—my habit is insatiable! There are so many fishes and corals I would love to have, but I do not have the places to put them all!

A well planned and properly maintained smaller tank can be just as spectacular as a large one, impressively reflecting the successful culmination of aquarium science and art in miniature form. With that success comes a desire to build upon the achievement, to become more advanced and determine just how successful the



venture can be. Done right, the nano-reef aquarium becomes the role model of a project perfectly tuned.

## The Challenge

The nano system inherently comes with limitations and requires exacting system maintenance, but if this is done properly, risk is minimized. However, to compromise or circumvent any aspect of nano-reef management is a formula for rapid breakdown and complete disaster. Total water volume is the primary concern; it influences so many other parameters in all aquaria, especially in any small system. Small water volumes are unstable and constraining as opposed to large ones and are particularly volatile in response to numerous external factors.

A beginner looking upon a dazzling nano-reef aquarium may be overcome by the beauty packed in such an unimposing volume and say, "I can do that!" They may buy into the belief that it is a good starting point. Many fish stores will display such systems accompanied with an all-inclusive price tag for the hardware, water, inhabitants, delivery, and setup. But experience in the saltwater hobby is needed to overcome the challenges presented by nano reefs.

I still do not manage an aquarium as large as a small Pacific isle, but with several years of experience and a reasonable degree of knowledge in successfully building and maintaining medium- to large-sized aquaria, I believe I have developed the abilities paramount to achieving success in the nano realm.

## Basic Precepts

To begin with, I knew that my diligence (or lack thereof) with my 135-gallon tank must be more than doubled to achieve the same rate of success or better in my nano tank. This meant weekly or biweekly water tests would be sorely insufficient. Water testing at least once a day would be more like it, especially in the setup stage, before the system was stabilized. I have even conducted a full range of water tests twice in a day's time because parameters can and do change that quickly. Second, I was determined to do things by the book. For the most part, the basic tenets of this approach have remained intact throughout setup.

Assume there is no margin for error in building a nano-reef system. If this is your first attempt at building such a small



David Bell

■ Zoanthids with purplish-red acanth (lower right) provide a psychedelic mix of interesting colors.

system, put experiments and unproven methods aside, at least until enough experience is acquired to gain the ability to decide that risks will not prove irreversible or disastrous.

I had a plan that included everything from identifying hardware components to developing a timeline from setup to stocking the aquarium with fishes and invertebrates. I often identify necessary tweaks and changes once I see the entire scope of things laid out before me. But any plan starts with wants, and I certainly have those.

## The Setup

The tank I already had available is a simple one—a 30-gallon measuring 36 x 12 x 16 inches. I did not go with a prepackaged kit because I like the flexibility of determining my own components and selectively beefing up those I believe are most important. The 30-gallon tank is generally the upper maximum of volume to be considered a nano-reef system. For my purposes, it is large enough to house the fishes and invertebrates intended but not so small as to further increase risk exponentially, which is involved with even smaller water volumes.

## WATER QUALITY

I use only RO/DI water for mixing synthetic seawater and top-offs and use a high-quality sea salt mix to produce seawater for all of my tanks. I would not consider using water that has not been purified to this degree, since even minor

traces of impurities may have significant impact in small water volumes. I keep at least 10 gallons of mixed seawater stored and circulating at all times, which is specifically dedicated to this 30-gallon system, and I change at least 5 gallons every week. I perform all water adjustments, such as applying buffers and other additives, to the pre-mixed salt water only and then check the water parameters again in case I have made an error. I *never* apply additives directly in the tank, as the impact is too abrupt to fishes and especially invertebrates and any mistake in dosing can prove lethal. In fact, other than adjusting for proper calcium levels, alkalinity, and pH, I tend to avoid additives and allow a premium salt mix to provide balance.

## SUBSTRATE

I used dry aragonitic reef sand to achieve a substrate depth of over 3 inches. It was combined with a few cups of live sand from another reef tank. The mineral/element content from a high grade of true reef sand will aid in stabilizing calcium and alkalinity levels while helping prevent large drops in pH, all parameters that must be monitored closely in all reef applications where sudden or large fluctuations in water chemistry can prove fatal to delicate invertebrates. The grain size ranges from 0.25 to 0.75 mm. A finer, rather than coarser, material promotes microbial activity in the sand bed while reducing the potential for anaerobic areas and provides cover for a variety of reef animals that live, browse, burrow, or hide in its depths.





David Bell

■ *Ricordea* mushrooms (center) and green zoanthid polyps (rear) really pop with their tentacles.

I also incorporated a small amount of coarser substrate material that comprises the upper layer of substrate across the front of the tank, extending about halfway to the back (finer sand particles will work their way down and leave coarser material on top). This provides a firmer base for certain corals, such as plate and brain corals, which do not appreciate frequent sedimentation on their surfaces, as they may be unable to easily shed such matter. The coarser material inhibits the dispersal of fine sand into the water column, which produces cloudy water conditions and raining particulates that could adversely affect such corals and other organisms.

### LIVE ROCK

The live rock for this system came from three sources: the local fish store, an existing reef system, and a FOWLR (fish-only-with-live-rock) system. The new rock has introduced a greater variety of living organisms while all of the rock had extensive coralline algae coverage and significant color and species diversity.

### SKIMMING, WATER MOVEMENT, AND FILTRATION

I believe in at least doubling the

recommended skimming ratios in my systems. In this case, I went even further and purchased a top-grade protein skimmer rated for up to 100 gallons. It does an excellent job and seems to be more efficient on this tank than skimmers on my larger systems, which is a matter of great importance as far as I'm concerned. I want to remove as much organic matter and nutrients as quickly as possible, since waste can rapidly promote deleterious conditions in a very small system.

Only a few months after start up, there is very little detritus visible in my nano tank, and what is there doesn't remain long. I aim to keep it that way, primarily through frequent water changes and the use of devices that ensure superb water motion throughout all parts of the system. Secondarily, I rely upon scavenging animals—fishes and invertebrates—to keep the accumulation to a bare minimum.

I use a diffusing powerhead rated at 620 gallons per hour (gph) for primary water movement. The skimmer provides another 295 gph. I also installed a hang-on filter rated at 280 gph. Since I have not yet completed installation of a sump or

refugium on this system, the mechanical filter currently provides additional water flow and a location for a 100-micron filter pad to remove particulate matter, as well as high-grade carbon and an absorbent polymer to further remove organics and polish the water. I service this unit (along with the skimmer) and change filter media once a week to reduce nitrate introduction, which can easily result from allowing these filters to turn into dirt traps. On paper, the total system circulation is around 1,820 gph, or 61 times the total water volume per hour, but other factors reduce that number.

### LIGHTING

As for lighting, I utilized a spare 36-inch, fan-equipped, dual power-compact fixture totaling 192 watts of output. I prefer a bulb combination of 420- to 460-watt actinic and a 96-watt, 10,000K daylight that provides a very pleasing and natural look. The corals fluoresce quite well under this combination of mixed actinics when the daylight bulb is off. I run the actinics for 12 hours and run the daylight for six to eight hours. Two small LED lunar light units (with five lights each) illuminate the tank for two additional hours after the actinics go off and prior to the actinics coming back on.

The main lighting system produces a strong 6.4 watts per gallon, meaning the light that reaches the substrate is bright. I have successfully maintained various hard corals, such as *Duncanopsammia axifuga*, *Caulastrea furcata*, *C. curvata*, *Fungia* spp., *Favites* spp., *Blastomussa* spp., *Trachyphyllia* spp., and *Cynarina* spp., under this same lighting fixture in a tank as deep as 18 inches. This nano system also has not been prone to abnormal temperature fluctuations under this lighting regimen; my temperature has consistently remained between 78° and 80°F, exactly where I want it. Aside from this basic hardware, the only other equipment I currently use is a 100-watt heater set at 72°.

### FUTURE PLANS

My plans call for the addition of a sump/refugium underneath the main system. Aside from an increase in water volume by approximately 30 to 50 percent and an improvement in total circulation, this addition will incorporate a deep sand bed and live rock/coral rubble to enhance the biological filtration, serve as a source of food, provide an area for filtration media, and accommodate the heater and skimmer.





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Another item on the to-do list is the eventual replacement of the power-compact lighting fixture with a T5 high-output unit with at least a four-bulb configuration. I like flexibility, and there are a wide variety of bulb colors and temperatures available in the T5 format, which I believe would be a positive enhancement both aesthetically and physiologically to reef inhabitants. T5 bulb life is also significantly longer than that of power compacts.

## The Process

At initial setup, pre-mixed RO/DI seawater was adjusted to the following specifications before being added to the tank with substrate material already in place: temperature 78°F, specific gravity 1.026, salinity 35 ppt, pH 8.2, alkalinity 8 dKH, and calcium 450 ppm. These parameters were monitored daily and recorded during the first three weeks, then three times per week thereafter as well as before each introduction of live rock, fishes, or invertebrates.

The mechanical filter was run during the first week with double 100-micron filter pads of inert material and double carbon-filter inserts (all changed once during the first week) to clear particulate matter and any existing impurities. At the end of one week, the pads and inserts were changed again in preparation for introduction of the live rock, and water parameters were again tested and adjusted as necessary before the live rock was added.

Live rock was introduced from all three sources concurrently. The final design reflected a low-profile, open structure with various territories, which a 3-foot tank allowed.

With the introduction of live rock, water parameters were checked daily and adjusted as necessary with additives being mixed and introduced with RO/DI top-off water or with water changes. I began moderate water changes even at this early stage, assuming that there could be some die-off from the rock. However, there were no spikes or detectable ammonia or nitrite levels subsequent to adding live rock.

The system was run for four weeks after it was cycled with no life being introduced. The only devices that were utilized during this period were one 620-gph powerhead, the mechanical filter with carbon and inert filter pads, lighting (cycled on/off for full schedule by timers), and a heater.

A skimmer was not installed until the end of the tenth week. At this stage, I



■ A rich mix of hard and soft corals surrounds a *Favites* sp. brain coral.

David Bell

believe that the biological filter should be allowed to develop unimpeded and without the intentional or unintentional excessive removal of any beneficial organisms or nutrients from the system via the skimmer. Organisms introduced with the live rock proliferated greatly during this period.

With a fully functioning, healthy biological filter, the tank was actually cycled by the end of the second day from the point of introduction of the live rock. Ammonia and nitrites have been measured at 0 since that time, and neither of these compounds ever reached more than barely detectable levels during the first two days. Nitrate levels were undetectable for the first four weeks and remained under 5 ppm during the next three weeks. By the tenth week, nitrate reached its highest reading of 20 ppm. At this point, I installed the new skimmer to the system, which immediately began producing skimmate. Within two days, nitrate levels dropped to about 7 ppm, and they still remain between 5 and 10 ppm.

Four weeks after cycling, I began introducing one or two fishes at a time in addition to a few small zoanthid colonies, corallimorphs, and octocorals. Some were purchased while others were transferred from other reef systems. The fishes are thriving, and the corals are responding naturally and showing growth. I have since added several hard corals that are thriving as well.

I continue to monitor and record system water parameters and perform all routine maintenance activities on a strict schedule.

## The Early Results

I have to confess, this nano-reef system thus far is the healthiest and least problematic of any system that I have set up or currently maintain. I have three other tanks in my home, yet this one seems to provide the greatest pleasure, although it does require the most attention to ongoing maintenance.

Although this tank is already heavily stocked, nitrates have remained low and accumulations of detritus are almost nonexistent. Good water motion, heavy skimming, low organics, a healthy biological filter, and clean-up organisms have kept nuisance algae virtually undetectable at this early stage. I also believe that the rapid stocking of filter-feeding invertebrates has helped to consume nutrients that could otherwise cause problems. Coralline algae growth is exceptional, and corals are expanding and feeding well and showing new growth even as the system is in development.

All fishes are extremely healthy and eating a wide range of foods offered in combination with vitamins, fatty and amino acids, and garlic additives. Corals are being fed a wide variety as well and receive zooplankton, phytoplankton, an oyster egg formula, and various frozen seafood preparations incidentally with the fish feedings. Corals that need it are directly fed two or three times weekly. The heaviest stony-coral feedings are given in the early morning under lunar lighting, when tentacles seem fully extended.

Problems or unexpected challenges have been extremely negligible. Alkalinity and pH are the variables that have been the most unstable. I use a two-part alkalinity/calcium additive to maintain both readings at optimal levels, and I have found that this adjustment must be performed two to three times weekly, but alkalinity and pH typically drop faster than calcium levels.

That's about it! With attention to details and regular maintenance, this system runs like clockwork. I mostly just enjoy it. Before attempting a nano-reef aquarium, I didn't think I would say those words. Next month, I'll talk about my livestock choices and how the reef is progressing. 🐠



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■ The Passages of the Deep exhibit is popular for its sharks and other large fish.

# Exploring the Oregon Coast Aquarium

## Kenneth Wingerter

**L**ike so many of the small Pacific Coast communities that dot the northern stretch of US Highway 101, Newport, Oregon has much to offer visitors in the way of scenic landscapes, a mild climate, and genuinely friendly people. Newport is especially appealing to those with a keen interest in marine life. Aside from its proximity to some of the finest beachcombing and tidepooling locales on the continent, the city boasts a number of marine-themed public attractions. Of these, the premier attraction is undoubtedly the Oregon Coast Aquarium.

Built in 1992, the Oregon Coast Aquarium occupies 39 acres along beautiful Yaquina Bay near the Pacific Ocean. This public, not-for-profit facility is unaffiliated with the nearby Aquarium Village, a sizable complex that features aquarium- and marine-themed shops and restaurants.

The Oregon Coast Aquarium is recognized internationally for the first-rate construction and interpretation of its exhibits. The focus of the aquarium's diverse collection is on the fauna and flora of the Northeast Pacific Ocean.

Backdrops for these exhibits include man-made structures, such as pier pilings and sunken ships, as well as more naturalistic aquascapes. The panoramic presentations of some of the more sizable tanks on the premises are balanced with up-close views of select creatures housed in clusters of small tanks.

### The Oregon Coast Aquarium Collection

Permanent galleries in the main building include Sandy Shores, Rocky Shores, and Coastal Waters. Each progressively



showcases inshore biota that inhabits beaches and estuaries to offshore biota that inhabits kelp forests and rocky reefs. A large indoor touch pool is situated at the hub of these galleries.

In an adjacent building is Passages of the Deep, the Oregon Coast Aquarium's largest and grandest display. This 1.32 million-gallon exhibit, consisting mainly of a series of massive acrylic tubes (200 feet in all), is organized into three sections: Orford Reef, Halibut Flats, and Open Sea. These showcase biota (over 5,000 specimens in all) that inhabits deepwater and pelagic habitats. Orford Reef primarily houses smaller fish species, such as rockfish. Halibut Flats houses larger fish species, such as rays and lingcod. Open Sea houses large schools of small fish as well as very large fish, such as the sevengill shark.

Passages of the Deep is the former home of killer whale Keiko, who earned considerable fame for his role in the film *Free Willy*. The current exhibit (with its appreciable diversity of creatures) is a strong contrast to its former self (with the previous lone, giant inhabitant).

The aquarium frequently rotates extraordinary temporary exhibits that touch upon subjects as wide ranging as seahorses of the world and swampland reptiles.

One-third of the Oregon Coast Aquarium's exhibits are outdoors. These are interconnected by corridors of rocky crevasses made out of gunite. A large outdoor touch pool is situated near the center of the courtyard. Many of the outdoor exhibits house seabirds, such as auklets, murre, and puffins, as well as marine mammals, such as harbor seals, sea lions, and sea otters.

### Notes for Visitors

It should be noted that tobacco is prohibited throughout the facility, inside and out. However, there are some very nice, covered picnic areas near the aquarium with great views of the bay. Parking is free, plentiful, and very close to the entrance. The Oregon Coast Aquarium is ADA accessible; wheelchairs are available in the main lobby. While pets are not allowed on the aquarium grounds, service animals (as defined by the ADA) are welcomed.



Cindy Hanson, Oregon Coast Aquarium

■ The aquarium offers a massive seal and sea lion exhibit in addition to its many fish and invert displays.



Kenneth Wingerter

■ Elegant, white-spotted rose, and painted anemones.





Cindy Hanson, Oregon Coast Aquarium

■ The Orford Reef exhibit showcases rockfish and other stunning species.



Cindy Hanson, Oregon Coast Aquarium

■ Special events called "Animal Encounters" allow guests to get up close and personal with a variety of marine life.

The typical length of a visit is about one and a half to two hours, but a stay of three or more hours can afford visitors ample time to observe the many fascinating details and subtleties in the exhibits. Visitors who plan ahead can be present during scheduled feeding times or even obtain special tickets for hands-on octopus or sea lion encounters. For ticket prices and a list of upcoming special events, visit <http://aquarium.org>. 🐠



Cindy Hanson, Oregon Coast Aquarium

■ Anemones and starfish; visitors are exposed to the intricacies of sea life through a number of displays.

## Oregon Coast Aquarium

2820 SE Ferry Slip Rd, Newport, Oregon

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# Behind the Brand: Dainichi

**Dainichi**  
FISH FOOD

Life can be full of unexpected twists, and it was one of those surprises that led to the development of Dainichi fish food.

## The Trip of a Lifetime

Theia de Aenlle, owner of Dainichi, had little experience caring for fish other than watching her father, Roland, turn his passion for koi into a thriving koi import business. Fresh out of law school in Boston, Theia accompanied Roland on one of his regular visits to meet Japan's top breeders. During this 1997 excursion she met master breeder Minoru Mano of Dainichi Yoriyo, who lamented about the lack of quality in many commercially available fish foods.

After a lengthy conversation about nutrition and food quality, Mano-san slipped out of the room and returned with a compilation of recipes from his private files. He handed them to Theia, telling her that she was a smart girl who should consider entering the fish food business.



■ Theia de Aenlle (right) and her husband, cichlid breeder Darius Bozek (left).

Theia gave the notion little thought at the time—it was not an obvious career move for someone with a law degree—but a chance encounter with an old friend persuaded her to think again. Her friend had a background in the human food industry. She showed him some fish food pellets and asked how difficult it would be to produce her own brand. He happened to have the right equipment gathering dust in a warehouse, and he told her: “Come to California and I’ll help start your business.”

## Dainichi Is Born

Three months later Theia did just that, moving back to California and working on translating the Japanese recipes, consulting fish nutritionists, and studying the industry.

Theia says, “We learned early on that stockpiling ingredients (fishmeal, shrimp meal, krill meal) was an industry norm, and concluded that we could do better by using only the freshest premium ingredients and eliminating potentially harmful chemical preservatives.

“Beyond making the freshest food, to stand out from our competition, we decided to incorporate a revolutionary, low-heat encapsulation process that involves coating pellets with heat-sensitive ingredients like digestive enzymes, pre-biotics, natural color enhancers, garlic, vitamins, and minerals that are often destroyed in conventional manufacturing processes.”

Her koi food quickly gained popularity, and within a few years people were asking Theia if she could make a smaller pellet for cichlids. Although she knew nothing about cichlids at the time, she knew some hobbyists were already using her koi food formulas on them. She then expanded into food for indoor aquarium fish.

One of her first opportunities to market Dainichi's new line was at the 2001 American Cichlid Association Convention. A cichlid breeder with an extensive background in aquatic biology, Darius Bozek, started chatting with Theia. The encounter proved particularly fruitful; he joined her in California to help with the business, which turned out to be just the start of the relationship. Theia and



■ Darius diligently tests and ensures the quality of all of Dainichi's fish foods.

Darius are married, have two children, and run Dainichi together. There have been many changes since Dainichi was founded, but the focus on quality has been constant.

“Darius tests everything that comes off our line,” she said. “He goes to the fish tanks and drops in different kinds of food to see how they like it. It’s run that way because we’re very close to our product.”



■ Dainichi utilizes a low-heat encapsulation process that coats pellets.

## Looking to the Future

As their brand grew more popular, marine keepers asked them to develop a formula for their fish. Like Dainichi's other lines, this one has done well worldwide. Recently, they were asked to develop a micropellet for smaller tropicals such as tetras, guppies, and bettas. This summer, Theia and Darius are responding by launching a line of micropellets that have the same ingredients as the larger pellets.

“One of the things that Mano-san taught us is that to have good fish, you need three things: good breeding, good food, and good water.” Theia recalls him saying that “if you have two out of three, you can do pretty well because even if you don’t have good breeding, you can make the fish you have the best they can be.”

For more information on Dainichi Fish Food, visit <http://www.dainichi.com>. “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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# meeting place

## events

### May 25-27 • St. Louis, Missouri

The 2012 American Killifish Association (AKA) Convention will be held in St. Louis, Missouri. This year's event will include a range of speakers and workshops that cover topics such as collecting natives and live foods. Tony Terceira, Mike Hellweg, Charlie Nunziata, and other killie experts will be attending. For more information, visit [www.aka.org/convention/2012](http://www.aka.org/convention/2012).

### June 21-24 • Atlanta, Georgia

The 2012 North American Discus Association Discus Show will be held at the Sheraton Gateway Hotel in Atlanta, Georgia. The show will include a variety of classes for showing fish, such as solid, spotted, and wild. Andrew Soh, Dick Au, Dieter Uttergasser, and other speakers will also be present. For more information, visit <http://nadaatlanta2012.com>.

### July 11-15 • Indianapolis, Indiana

The 2012 American Cichlid Association (ACA) Convention will be held in Indianapolis, Indiana. Headlining the event will be a lineup of speakers that includes Ad Konings and Dr. Paul Loiselle. Events include a fish show, Sunday auction, and much more. For registration and event updates, visit [www.aca2012indy.com](http://www.aca2012indy.com).

## clubs

### REGIONAL

#### American Cichlid Association

Come join in the largest and most distinguished national organization of the cichlid hobby! Your membership in the American Cichlid Association (ACA) entitles you to six issues per year of our highly acclaimed Buntbarsche Bulletin and access to our online Trading Post, and each July the ACA hosts a fabulous convention not to be missed! Your membership in the ACA will offer so much more, such as participation in the Paul V. Loiselle Conservation Fund, cichlid research through the Guy D. Jordan Endowment Fund, hands-on cichlid conservation through ACA C.A.R.E.S., a speaker program, a Club Liaison Program, special awards, and an up-to-date, informative ACA website at [www.cichlid.org](http://www.cichlid.org)

#### American Killifish Association

The American Killifish Association (AKA) is dedicated to the propagation, study, and conservation of killifish. Enjoy the benefits as a member. Membership is \$26 per year and includes six issues of the Journal of the American Killifish Association and monthly issues of the Business Newsletter, which gives members the opportunity to obtain and sell killifish. Members are also given access to the members-only section of the website. The AKA hosts many events during the year, including the big Memorial Day Weekend convention and affiliate club shows, which occur all year long. Log on to [www.aka.org](http://www.aka.org) for more information.

#### American Livebearer Association

The American Livebearer Association (ALA) offers bi-monthly publications, species maintenance programs, access to various types of livebearers, an annual convention, special publications, slides, and more. For more information, visit [www.livebearers.org](http://www.livebearers.org)

#### The Angelfish Society

The Angelfish Society (TAS) is a collection of angelfish enthusiasts, hobbyists, and breeders who are interested in the advancement of our hobby through improvements in the quality of the fish we keep and breed by employing the standard which this society will develop. TAS is dedicated to the enhancement of the angelfish through high-quality breeding programs using standards established by the society. Informative online chatroom meeting schedules can be found at [www.theangelfishsociety.org](http://www.theangelfishsociety.org). Membership is \$5 annually, which includes the quarterly FinTASTic newsletter.

#### Aquatic Gardener Association

Membership in the Aquatic Gardeners Association (AGA) includes a quarterly journal with informative articles for beginners and advanced hobbyists alike. Dues are \$20 per year (US, Canada, Mexico), \$33 all other countries (multiyear discounts available). For more information see our website, [www.aquatic-gardeners.org](http://www.aquatic-gardeners.org). For a sample copy of The Aquatic Gardener, please send \$6 (US, Canada, Mexico—shipping extra elsewhere) to AGA Bookstore, 2303 Mt. Sinai Road, Chapel Hill, NC 27514, USA.

#### The Canadian Association of Aquarium Clubs

The Canadian Association of Aquarium Clubs (CAOAC) is a non-profit association of aquarium, herptile, and pond clubs from across Canada and New York State. Some of the things we offer are: a national awards program to honor those in member clubs who have achieved success in breeding, plant propagation, or other endeavors related to the hobby; a Fish Rescue Program to help those hobbyists with large or unwanted fish to find new homes for them; and a chance to become involved with people who share similar interests. Please visit our website at [www.caoac.ca](http://www.caoac.ca) for more information.

#### East Coast Aquarium Society

The East Coast Aquarium Society is the largest and fastest-growing aquarium club in Atlantic Canada. ECAS actively promotes and encourages aquatic education of freshwater and marine aquaria, aquatic plants, and other related livestock in a fun and informative learning environment. Benefits and privileges of joining include discounts from sponsors and local vendors, auctions and fish shows, and shopping nights at local fish stores. Members also join programs such as the Breeders Award Program (BAP) and the Horticulturalist Award Program (HAP), which offer hobbyists rewards for species breeding and plant propagation. Also held are monthly socials and chat nights. For more information, visit [www.eastcoastaquariumsociety.ca](http://www.eastcoastaquariumsociety.ca)

#### East Coast Cichlids

East Coast Cichlids is an active and friendly group of hobbyists who support each other in the breeding, raising, and care of all fish (not just cichlids). Fun, monthly events are held and online support is always available. Come see what the "buzz" is about! FREE membership! Join us for fish, fun, and friendship! [www.eastcoastcichlids.org](http://www.eastcoastcichlids.org)

#### Great Lakes Cichlid Society

Join one of the Midwest's top cichlid clubs now celebrating its 20th year in progress. Members come from all states surrounding the Great Lakes area and throughout the nation. The club meets on the fourth Friday of every month, excluding July, 8 p.m. at the Masters Church (771 east 260th St. Euclid, Ohio, 10 minutes east of downtown Cleveland). There are local and national speakers monthly, raffles, breeder award programs, refreshments, and great fish talk. For more information visit [www.GreatLakesCichlidSociety.net](http://www.GreatLakesCichlidSociety.net)

#### International Betta Congress

Founded in 1966, the International Betta Congress (IBC) is a nonprofit worldwide organization promoting the breeding, raising, and study of bettas. IBC actively promotes the selective breeding of various color and finnage strains of bettas through the Sanctioned Show program, where fish are exhibited and

judged in pre-defined classes. Our bi-monthly bulletin FLARE! contains articles written by our members and is geared toward the beginner as well as the advanced hobbyist. We have a June Annual Convention hosted by one or more IBC chapters (smaller local groups of betta hobbyists within IBC). As a member of IBC you can join our members-only forum, a free service where you can send and receive group messages, share photos, access IBC-related files, and much more. For further information visit the IBC official website, [www.ibcbettas.org](http://www.ibcbettas.org)

#### International Fancy Guppy Association

The International Fancy Guppy Association (IFGA) is an organization for guppy breeders and hobbyists interested in breeding and showing fancy guppies. A monthly publication is available and many shows with over 40 color/tail-shape classes are held throughout the country yearly. For more information visit [www.ifga.org](http://www.ifga.org)

#### Mid-Atlantic Cichlid Keepers

The Mid-Atlantic Cichlid Keepers (M.A.C.K.) is a group of amateur aquarists whose main interest is the breeding, raising, and management of cichlids. Monthly meetings are held from September to May on the 3rd Friday of each month, at 8 p.m. (doors open at 7:30 p.m.), in the Springfield Town Hall building, 50 Powell Road Springfield, PA 19064. For further information, email [membership@mackattack.org](mailto:membership@mackattack.org) or visit [www.mackattack.org](http://www.mackattack.org)

#### Mid-Atlantic Koi Club

An active and friendly club for people who are interested in the study and enjoyment of koi, goldfish, and outdoor ponds. Monthly meetings provide a variety of activities, including lectures, pond tours and koi shows, as well as an opportunity to meet other enthusiasts. For information email [members@makc.com](mailto:members@makc.com) or visit [www.makc.com](http://www.makc.com)

#### The Midwest Cichlid Association

The Midwest Cichlid Association (MCA) is a new and exciting organization, dedicated to the promotion of keeping, breeding, and specialization of the cichlid fish hobby. We eat, sleep, and breathe cichlids! If you would like more information about The Midwest Cichlid Association, please email us at [Contact@MidwestCichlid.com](mailto:Contact@MidwestCichlid.com) or visit [www.midwestcichlid.com](http://www.midwestcichlid.com)

#### North American Discus Association

The North American Discus Association (NADA) is a non-profit organization of discus enthusiasts, hobbyists, and breeders. Our goal is to educate the general public, encourage new members, provide information on the hobby, and promote discus at fish shows. We offer a quarterly newsletter. Please visit our website at [www.discusnada.org](http://www.discusnada.org) for more information.

#### The North American Native Fishes Association

The North American Native Fishes Association (NANFA) is a not-for-profit, tax-exempt corporation dedicated to the appreciation, study, and conservation of the continent's native fishes. The organization seeks to increase and disseminate knowledge about North America's native fishes and their habitats, and to promote the conservation of native fishes and the protection/restoration of natural habitats. It also looks to advance the captive husbandry of North America's native fishes for the educational, scientific, and conservation benefits it affords. For more information, visit [www.nanfa.org](http://www.nanfa.org)

#### Northeast Council of Aquarium Societies

The Northeast Council of Aquarium Societies is a group of aquarium societies in the northeast, where we share information about running an aquarium society and generally bring all members of each of our clubs together. The NEC sponsors an annual general tropical fish convention in March or April each year. [www.northeastcouncil.org/nec/](http://www.northeastcouncil.org/nec/)

#### Northwest Killies Club

The Northwest Killies Club (NWK) is an affiliate club of the American Killifish Association. Our intent is to represent the interests of killifish keepers of the Pacific Northwest and beyond. Membership is open to all. Our members are widely scattered, living in various parts of Oregon, Washington, and as far away as Utah. For that reason, we call ourselves a "virtual club," using e-mail to keep in regular contact and meeting physically only four times a year. We also publish a quarterly newsletter. For more information, visit <http://nwk.aka.org>

#### The Pacific Coast Cichlid Association

Now celebrating its 20th year, the Pacific Coast Cichlid Association (PCCA) meets in San Jose, CA the second Saturday of each month. Meetings feature a presentation (past speakers have included Dr. Paul V. Loiselle and Ad Konings) with an auction and raffle following. For more information, write to: PCCA P.O. Box 28145t, San Jose, CA 95159-8145 or visit [www.cichlidworld.com](http://www.cichlidworld.com)

#### Quad City Fish Keepers

Serving the Mississippi Valley region of Eastern Iowa and Western Illinois. All are welcome from the beginner to the advanced hobbyist, fresh or salt [www.qcfishkeepers.com](http://www.qcfishkeepers.com)

### ARIZONA

#### Arizona Aquatic Plant Enthusiasts

Meets every third Sunday of the month. See forum for additional details. [www.azaquaticplants.com](http://www.azaquaticplants.com)

#### Arizona Rivulin Keepers

Meets monthly (usually on the second Saturday), 7:00 p.m., Denny's Restaurant, 4403 S. Rural Road, Tempe, AZ. [www.ark.aka.org](http://www.ark.aka.org)

#### Dry Wash Aquarium Society

Meets the second Thursday of the month, American Legion Post 105 at 3534 W. Calaver Rd. in Phoenix, AZ at 7 p.m. [www.drywashaquarium.org](http://www.drywashaquarium.org)

### ARKANSAS

#### NE Arkansas Reef Club

Meets irregularly, but always available for online support, especially for beginners, and to share wealth of reefkeeping knowledge. [www.nea-reefkeeping.com](http://www.nea-reefkeeping.com)

#### Northwest Arkansas Aquarium Society (NWAAS)

Contact: (479) 359-0088 - Meets the second Saturday of each month, 7 p.m., at the Rogers Police Department Community Room in Rogers, AR. General interest club, everyone welcome! <http://nwaas.com>

### CALIFORNIA

#### California Betta Society

Afternoon meetings on the fourth Saturday of each month. Check website for location and contact information. [www.csbettas.org](http://www.csbettas.org)

#### COAST Club

Meets 1 to 5 p.m., the first Sunday of each month, the Costa Mesa Neighborhood Community Center, Victoria Room, 1845 Park Avenue, Costa Mesa, CA. [www.coastfishclub.com](http://www.coastfishclub.com)

#### Golden State Bettas

Meets bimonthly at various locations throughout Southern California. Visit the website for more information. [www.goldenstatebettas.com](http://www.goldenstatebettas.com)

#### LA Fish Fanatics

This freshwater fish club meets in the San Fernando Valley, the last Sunday of each month. Contact: 818-370-6930 or email [lafishfanatics@hotmail.com](mailto:lafishfanatics@hotmail.com)



### **The Marine Aquarium Society of Los Angeles County**

Meets the second Friday of every month, Denny's Restaurant, 3060 San Fernando Road in the Los Angeles area, 7 p.m. [www.maslac.org](http://www.maslac.org)

### **Sacramento Aquarium Society (SAS)**

Meets on the first Saturday of each month at 7 p.m. at Round Table Pizza (9500 Greenback Lane) in Folsom. [www.sacramentoaquariumsociety.org](http://www.sacramentoaquariumsociety.org)

### **San Diego Marine Aquarium Society**

Monthly meetings are held on the second Wednesday of every month. Visit the website for locations. [www.sdmass.com](http://www.sdmass.com)

### **San Diego Tropical Fish Society**

Meetings the second Sunday of every month, 7 p.m., Room 101 of Casa del Prado, Balboa Park. [www.sandiegotropicalfish.com](http://www.sandiegotropicalfish.com)

### **San Francisco Aquarium Society**

Meetings are 6:30 p.m., the first Friday of every month, and are free and open to everyone. [www.sfaquarium.org](http://www.sfaquarium.org)

### **Silicon Valley Aquarium Society**

Meets every first Saturday, 6:30 p.m., Round Table Pizza, 4302 Moorpark Ave., San Jose, CA (Rt. 280 & Saratoga Ave.). <http://siliconvalleyaquariumsociety.com>

### **Southern California Reef Keepers**

Meets at 2642 Cherry Ave. in Long Beach every 3rd Sunday of the month from 6 to 9 p.m. Contact Tana Hsu at 310-930-5537 or visit [www.scrk.org](http://www.scrk.org)

## **COLORADO**

### **The Colorado Aquarium Society**

General meetings the first Friday of each month, 7:30 p.m., St. James Episcopal Church, 8235 W. 44th Ave., Wheat Ridge, CO.

### **Rocky Mountain Cichlid Association**

Meets September through June, 6 p.m., the second Sunday of the month, the Englewood Recreation Center, 1155 W. Oxford Ave., Denver, CO (1/2 mile south of Hampden and one block east of Santa Fe Ave.). [www.rmcichlid.org](http://www.rmcichlid.org)

## **CONNECTICUT**

### **Connecticut Area Reef Society**

Meets monthly at various spots throughout the state, typically the third or fourth Sunday of the month. [www.ctars.org](http://www.ctars.org)

### **Greater Hartford Aquarium Society**

Meets 7:30 p.m. on the fourth Tuesday of every month at the Lutz Children's Museum, 247 South Main Street, Manchester, CT. [www.ghasct.org](http://www.ghasct.org)

### **The Norwalk Aquarium Society**

Meets the third Thursday of every month (except July and December), Earthplace, 10 Woodside Lane, Westport, CT. [www.NorwalkAS.org](http://www.NorwalkAS.org)

## **DELAWARE**

### **Delaware Reef Club**

Meets the third Monday of every month, 7:00 p.m., at the William Penn High School's main cafeteria in New Castle, DE. [www.delreefclub.org](http://www.delreefclub.org)

### **Diamond State Aquarium Society**

Meets on the second Monday of each month of the school year, September thru May, at 7:30 p.m. at William Penn High School, 713 E. Basin Road, New Castle, DE 19720. <http://dsas.topcities.com>

## **FLORIDA**

### **Coastal Aquarium Society**

Meets at the Pritzker Marine Biology Research Center at the New College of Florida the first Wednesday of

each month at 7:30 p.m. For more information, visit <http://coastalaquariumsociety.com>.

### **Gold Coast Aquarium Society of South Florida**

Monthly meetings with presentations, raffles, and auctions. Details and forum at website. [www.goldcoastaquarium.org](http://www.goldcoastaquarium.org)

### **Southwest Florida Marine Aquarium Society**

Meets on the third Saturday of each month at 3:30 p.m. at The Imaginarium, 2000 Cranford Avenue, Fort Myers, FL (unless otherwise noted on the club website). [www.swfmas.com](http://www.swfmas.com)

### **Space Coast Reef Club**

Meets the first Wednesday of each month at 7 p.m. at the Space Coast of Florida. [www.spacecoastreelfclub.com](http://www.spacecoastreelfclub.com)

### **Tampa Bay Aquarium Society**

Meets the 2nd Monday of every month at the Florida Aquarium, 701 Channelside Drive, Tampa, FL. Doors open at 7:00 p.m., and the meeting starts at 7:30 p.m. [www.tbas1.com](http://www.tbas1.com)

## **GEORGIA**

### **Atlanta Area Aquarium Association**

Meets the first Sunday of every month at 1:30 p.m. in Room 101 of White Hall on the campus of Emory University. [www.atlantaaquarium.com](http://www.atlantaaquarium.com)

### **Southeast Georgia Reef Club**

Meets on third Tuesday of the month at Shoney's Restaurant in Waycross, Georgia at 7 p.m. [www.sgreelfclub.com](http://www.sgreelfclub.com)

## **HAWAII**

### **The Big Island Aquarium Society**

Meets the first Friday of every month, the Komohana Agricultural Complex, Hilo, HI, 7 p.m. Contact: Ricky K. Ogata, P.O. Box 6807, Hilo, HI 96720, [kazuor@interpac.net](mailto:kazuor@interpac.net)

### **The Honolulu Aquarium Society**

Meets the first Friday (except holidays) of each month, 7p.m., the Kuhio Elementary School Cafetorium, 2759 South King Street, Honolulu, HI. [www.honoluluaquariumsociety.org](http://www.honoluluaquariumsociety.org)

## **ILLINOIS**

### **Central Illinois Tropical Aquarium Club**

Meets the second Sunday of each month. Please visit the centralillinoistac Yahoo! Group or email [david@davidzink.com](mailto:david@davidzink.com) for more information.

### **Champaign Area Fish Exchange**

Meets the first Saturday of the month (second Saturday for holiday weekends, and no meeting in January or July) at 1125 Plant Sciences Laboratory, 1201 S. Dornier Drive Urbana, IL 61801. For more info, contact Jerry Montgomery at 217-359-6707 or email [champaignfishguy1@yahoo.com](mailto:champaignfishguy1@yahoo.com).

### **Chicago Killifish Association**

Meets the third Saturday bimonthly at the Holiday Inn Select, 1801 N. Naper Blvd., Naperville, at 2 p.m. [www.aka.org/chika](http://www.aka.org/chika)

### **The Chicagoland Marine Aquarium Society**

Meets the second Saturday of each month, 1 p.m., Devry University, 1221 N. Swift Rd., Addison, IL (unless otherwise noted). [www.cmas.net](http://www.cmas.net)

### **Greater Chicago Cichlid Association**

Meets 7 p.m., the second Sunday of each month, the Holiday Inn Rolling Meadows, close to I-90 & I-290/53. [www.gcca.net](http://www.gcca.net)

### **The Green Water Aquarist Society of Chicagoland**

Meets the first Friday of each month (except July and December), 7:30 p.m., the Alsip Village Hall, 4500 W. 123rd Street, Alsip, IL. [www.gwasoc.org](http://www.gwasoc.org)

## **INDIANA**

### **Circle City Aquarium Club**

Meets the first Thursday of each month at 7:30 p.m. at Stonegate Early College High School, 2855 N. Franklin Road, Indianapolis, Indiana. For more information, call Hedy at 317-255-0121, email [ranchu2@juno.co](mailto:ranchu2@juno.co)

### **Indy Cichlid Club**

The ICC holds monthly meetings where members can meet and discuss the latest information in the hobby. Contact [indycichlidclub@gmail.com](mailto:indycichlidclub@gmail.com). [www.indycichlidclub.com](http://www.indycichlidclub.com)

### **Michiana Aquarium Society**

Meetings the third Sunday of each month, Jan.-Nov. (second Sunday in June), 6 p.m., the Roseland Town Hall, 200 Independence Dr., Roseland, IN. [www.michianaaquariumsociety.org](http://www.michianaaquariumsociety.org)

## **IOWA**

### **Greater Iowa Reef Society**

Reefkeepers' club sharing years of knowledge for success! Monthly meetings include conferences, tank tours, DIY workshops, coral trading, group discounts, guest speakers, and raffles. Save money and find success! [www.greateriowareefsociety.org](http://www.greateriowareefsociety.org)

### **Iowa Aquaria Association**

Meets quarterly, the first Saturday of February, May, August, and November. [www.iowa-aquaria.com](http://www.iowa-aquaria.com)

## **KANSAS**

### **The Heart of America Aquarium Society**

See the Heart of America Aquarium Society listing under Missouri.

### **Wichita Aquarium Club**

Please visit the website for meeting information. [www.wichitaaquariumclub.com](http://www.wichitaaquariumclub.com)

## **KENTUCKY**

### **Louisville Marine Aquarium Society**

Meetings usually the third Sunday evening of the month. [www.LMAS.org](http://www.LMAS.org)

## **LOUISIANA**

### **Southeast Louisiana Aquarium Society**

Check our website for meeting times and locations. [www.selas.us](http://www.selas.us)

## **MARYLAND**

### **The Capital Cichlid Association**

Meetings the second Saturday of every month, 2 to 4 p.m. [www.capitalcichlids.org](http://www.capitalcichlids.org)

## **MASSACHUSETTS**

### **The Boston Aquarium Society**

Meets the third Monday of each month, 7:30 p.m., New England Aquarium, The Exploration Center, Central Wharf, Boston, MA. [www.bostonaquariumsociety.org](http://www.bostonaquariumsociety.org)

### **New England Fancy Guppy Association**

Typically meets the third Sunday of the month at 1 p.m. Email [laurasminskins@comcast.net](mailto:laurasminskins@comcast.net) or check the website for more information. [www.newenglandguppies.org](http://www.newenglandguppies.org)

### **The Pioneer Valley Aquarium Society**

Meets the first Tuesday of each month from September through June, the Captain Charles Leonard House, 663 Main Street, Agawam, MA, 7 p.m. [www.pvas.net](http://www.pvas.net)

## **MICHIGAN**

### **Grand Valley Aquarium Club**

Located in Grand Rapids, MI. Meets the second Saturday of each month, 7 p.m., after a half-hour social period, the Holiday Inn Express, 6569 Clay

Ave SW, just off Highway 131, at the 68th street exit. [www.grandvalleyaquariumclub.org](http://www.grandvalleyaquariumclub.org)

### **The Greater Detroit Aquarium Society**

Meets the fourth Wednesday of every month (unless otherwise noted), the Good Shepherd Lutheran Church, 814 North Campbell Road, halfway between 11 and 12 Mile Road, Royal Oak, MI, 8 p.m. <http://greaterdetroitaquariumsociety.org>

### **Michigan Aquatic Plant Group**

Check forum for meeting times and locations. [www.miapg.com](http://www.miapg.com)

### **Motor City Aquarium Society**

Meets the second Thursday of every month, St. Gertrude's Religious Education Building, 28839 Jefferson St., Clair Shores, MI, north of Martin Rd. (11 1/2 Mile Rd.) near the Blue Goose Restaurant. Enter from the back of the building. Doors open 7:30 p.m. [www.motorcityaquariumsociety.com](http://www.motorcityaquariumsociety.com)

### **Southwestern Michigan Aquarium Society**

Meets at 8 p.m. on the first Friday of each month at Kalamazoo Valley Community College's Advanced Technology Center, at 6767 West "O" Avenue in room 5830, in Kalamazoo, MI. [www.swmas.org](http://www.swmas.org)

## **MINNESOTA**

### **Minnesota Aquarium Society**

Meets the first Thursday of every month (except July) at King of Kings Lutheran Church at 2330 N. Dale St., Roseville, MN 55113. Meetings begin promptly at 7:30 p.m. [www.aquarium.mn](http://www.aquarium.mn)

## **MISSOURI**

### **Heart of America Aquarium Society of Kansas City**

Meets the second Saturday of the month at Bridge View Hall in North Kansas City. <http://kcfishclub.org>.

### **The Missouri Aquarium Society**

Meets the third Thursday of each month, 7:30 p.m., the Dorsett Village Baptist Church, 2240 Bennington Place, Maryland Heights, MO 63043. [www.missouriaquariumsociety.org](http://www.missouriaquariumsociety.org)

### **Saint Louis Area Saltwater Hobbyists**

See website for meeting dates and time. [www.slashclub.org](http://www.slashclub.org)

## **NEW HAMPSHIRE**

### **The New Hampshire Aquarium Society**

Meets the second Wednesday of every month, September through June, 7 p.m., Somersworth, NH High School/Vocational School. [www.nhaquariumsociety.com](http://www.nhaquariumsociety.com)

## **NEW JERSEY**

### **Jersey Shore Aquarium Society**

Meetings the second Monday of the month, Knights of Columbus Hall, 70 E. Main St. (Rt. 537), Freehold, NJ, around 8 p.m. [www.jerseyshoreas.org](http://www.jerseyshoreas.org)

### **The Metropolitan Area Killifish Association**

Meets the fourth Wednesday of the month (third Wednesday in November and December), the Meadowlands Environment Center, Lyndhurst, NJ. [www.aka.org/maka](http://www.aka.org/maka)

### **New Jersey Tri-State Tropical Fish Association**

Meets monthly, 7 p.m., the Barrington Municipal Building, 229 Trenton Avenue, Barrington, NJ. Contact: Bill Farrell, President, at 856-428-1431 or [fish4thought0321@aol.com](mailto:fish4thought0321@aol.com)

### **North Jersey Aquarium Society**

Meets every third Thursday of the month (except August and December) at the Lyndhurst Elks Club, 251 Park Avenue, Lyndhurst, NJ 07071. Doors open at 7:00 p.m.; meeting starts promptly at 7:45 p.m. [www.njas.net](http://www.njas.net)



### The South Jersey Guppy Group

Meets the third Sunday of each month, 1 p.m., the Griggstown Firehouse in Princeton, NJ. Contact: Dave Polunas at 732-329-9597 or email [daveguppy@aol.com](mailto:daveguppy@aol.com)

## NEW YORK

### Brooklyn Aquarium Society

Meets the second Friday of the month, 7:30 p.m., the New York Aquarium's Education Hall, Coney Island, Surf Ave. and West 8th St., Brooklyn, NY. [www.brooklyn-aquarium-society.org](http://www.brooklyn-aquarium-society.org)

### Capital District Marine Aquarist Society

Meetings are informal and held once per month at a volunteering member's home. [www.cdmas.org](http://www.cdmas.org)

### Central New York Aquarium Society

Meets 7 p.m., the third Wednesday of every month (except July and August), at the Dewitt Community Center, 148 Sanders Creek Pkwy, East Syracuse, NY. [www.anyas.org](http://www.anyas.org)

### Danbury Aquarium Society

Meets the fourth Friday of each month (except July and December), 8 p.m., the Carmel Ambulance Corps, Vink Road, Carmel, NY. [www.northeastcouncil.org/daas](http://www.northeastcouncil.org/daas)

### The Greater City Aquarium Society

Meets the first Wednesday of each month (except January and February), the Queens Botanical Garden, Queens, NY 7:30 p.m. [www.greatercity.org](http://www.greatercity.org)

### Hudson Valley Reefkeepers

Group meets monthly at a member's home. Visit the events section of the website for more information. [www.hvreef.org](http://www.hvreef.org)

### Long Island Aquarium Society

Meetings are the third Friday of every month (except July and August) at 8 p.m. at Stony Brook University. [www.liasonline.org](http://www.liasonline.org)

### Long Island Reef Association

Meets the first Friday of the month. See website for location and speaker. [www.longislandreef.org](http://www.longislandreef.org)

### Nassau County Aquarium Society

Meets the second Tuesday of the month (except July & August). [www.ncasweb.org](http://www.ncasweb.org)

## NORTH CAROLINA

### Raleigh Aquarium Society

Meets the first Thursday of each month, the North Carolina State University School of Veterinary Medicine; downstairs, across from the library; 7:30 p.m. [www.raleighaquariumsociety.org](http://www.raleighaquariumsociety.org)

### Reef Aquarium Society of Charlotte

Meets every third Saturday of the month, 2 to 4 p.m. [www.rasoc.org](http://www.rasoc.org)

### Western North Carolina Aquarium Society

Meets from 7 to 9 p.m. on the third Thursday of every month in the Aquarium & Planetarium Building at the Catawba Science Center, located at 243 3rd Ave. NE in Hickory, NC 28603. Freshwater and saltwater aquarium enthusiasts welcome. Contact: Scott Arney at [cichlidz1@aol.com](mailto:cichlidz1@aol.com)

## OHIO

### The Cleveland Aquarium Society

Meets the first Tuesday of the month, the Cleveland Zoo educational building, just inside the main gate, 8 p.m. [www.clevelandaquariumsociety.org](http://www.clevelandaquariumsociety.org)

### Columbus Area Fish Enthusiasts (CAFE)

Meets bimonthly in Columbus, OH. [www.columbusfishclub.org](http://www.columbusfishclub.org)

### The Greater Akron Aquarium Society

Meets the first Thursday of each month, the

Tallmadge Community Center, 80 Community Drive, Tallmadge, OH. [www.gaas-fish.net](http://www.gaas-fish.net)

### The Greater Cincinnati Aquarium Society

Meetings the last Sunday of the month (may vary with speaker and event schedules), 7:30 p.m., the Winton Woods Visitor's Center, 10245 Winton Road, Cincinnati, OH 45231. [www.gcas.org](http://www.gcas.org)

### Medina County Aquarium Society

An all-species club located in Medina, OH. See website for meeting dates and times. [www.mcas-fish.net](http://www.mcas-fish.net)

### The Ohio Cichlid Association

Meets the first Friday of every month (except July, because of the ACA convention), the Old Oak Bible Church, 7575 Old Oak Blvd., Middleburg Hts., OH (north of Fowles Road). Doors open 7:30 p.m., meeting promptly at 8 p.m. [www.ohiocichlid.com](http://www.ohiocichlid.com)

### Stark County Aqua Life Enthusiasts Society

Meets the third Sunday of every month at the Perry Grange Hall, 6300 Richville Dr. SW., Massillon, OH 44646. Meetings are from 5 p.m. to 7:30 p.m. For more information, contact John or Theresa Baad at 330-452-9027, or visit the website. [www.scalesclub.com](http://www.scalesclub.com)

### Youngstown Area Tropical Fish Society

Meetings the third Friday of each month, the Presbyterian Church, Mineral Ridge, OH, 7:30 pm. [www.yatfs.com](http://www.yatfs.com)

## OKLAHOMA

### Oklahoma Aquarium Association

Statewide organization with chapters in Tulsa, Stillwater, and Oklahoma City. Meets monthly. For more details, call 405-263-4769 or visit the website. [www.theokaa.org](http://www.theokaa.org)

## OREGON

### The Greater Portland Aquarium Society

Meets the fourth Tuesday of each month, 7 p.m., the Fellowship Masonic Center, the corner of 57th and Sandy, Portland, OR. [www.gpas.org](http://www.gpas.org)

## PENNSYLVANIA

### The Aquarium Club of Lancaster County

Meets the third Saturday of each month except July and August. For more information, visit [www.aclcpa.org](http://www.aclcpa.org).

### The Bucks County Aquarium Society

Meets the first Thursday of every month, the Churchville Nature Center, Churchville, PA, 7:30 p.m., doors open 7 p.m. [www.bcasonline.com](http://www.bcasonline.com)

### The Delaware County Aquarium Society

Meets the first Friday of every month, except July and August, the Springfield Municipal Building, Springfield (Delaware County), PA. Doors open 7:30 p.m., meeting at 8 p.m. [www.dcas.us](http://www.dcas.us)

### Erie Aquarium Society of Erie Pennsylvania

Contact: Erie Aquarium Society, P.O. Box 8025, Erie, PA 16505. Meets 7:30 p.m., the second Wednesday of each month, the West Ridge Fire Station, 3142 West 26th Street (Route 20) & Homer Avenue, Erie, PA 16506. <http://groups.yahoo.com/group/erieaquariumsociety>

### Greater Pittsburgh Aquarium Society

Regular meetings usually the last Friday of the month, the Phipps Garden Center, corner of Fifth Ave. and Shady Ave. (Mellon Park). Doors open 7 p.m., meeting at 7:30 p.m. [www.gpasi.org/index.html](http://www.gpasi.org/index.html)

### Mason Dixon Reef Club

Also serving Maryland; all meetings open to public. Check our website for times and locations. [www.mdreefclub.com](http://www.mdreefclub.com)

### Pennsylvania Fish Culturist Association

Meets the second Thursday of every month (except July and August), 7:30 p.m., Lawncrest

Recreation Center, 6000 Rising Sun Avenue, Philadelphia, PA 19111. Contact: Bill: 856-428-1431, or e-mail: [farfish403@aol.com](mailto:farfish403@aol.com)

### The Philadelphia Area Reef Club

Meetings the first Wednesday of each month, the Katherine Drexel Library, 11099 Knights Rd., Philadelphia, PA 19154. Contact: [p.a.r.c@home.com](mailto:p.a.r.c@home.com)

### Pittsburgh Area Planted Aquarium Society

Dedicated to planted aquaria. Meetings are typically held at 2:00 p.m. on the first Sunday of the month at A and B Oddball Pets and Aquariums, 262 Joseph St., Pittsburgh, PA. [www.homeofpapas.org](http://www.homeofpapas.org)

## RHODE ISLAND

### Tropical Fish Society of Rhode Island

Meetings are the third Wednesday of the month at 7:30 p.m. (no meeting in December). Meetings are held at the Rhode Island Society for the Prevention of Cruelty to Animals (RISPCA) at 186 Amaral St., Riverside, RI 02915. [www.tfsri.net](http://www.tfsri.net)

## SOUTH CAROLINA

### Columbia Marine Aquarium Club

For location and meeting times, visit the website. [www.columbiamac.org](http://www.columbiamac.org)

### Palmetto Marine Aquarium Club

For meeting times and location, visit [www.palmettomac.com](http://www.palmettomac.com).

## TEXAS

### Dallas Marine Aquarium Society

Meetings are held on the second Saturday of each month. Visit the website for more information. [www.dallasmas.org](http://www.dallasmas.org)

### Dallas-Ft. Worth Marine Aquarium Society

Meetings every third Wednesday of the month, around the DFW Metroplex. [www.DFWMAS.com](http://www.DFWMAS.com)

### Dallas Killifish Association

Meets the first Saturday of the month at 6 p.m. Check website for date and location. [www.dallaskillifish.com](http://www.dallaskillifish.com)

### Greater Houston Aquarium Club

Meets at a member's home on the third weekend of each month. Visit the website for time and location, or contact [stevecgg@myghac.org](mailto:stevecgg@myghac.org). [www.myghac.org](http://www.myghac.org)

### The Hill Country Cichlid Club

Serving the I-35 corridor including Austin, San Antonio, and the rest of the Texas Hill Country. [www.hillcountrycichlidclub.com](http://www.hillcountrycichlidclub.com)

### Houston Aquarium Society

Meets the fourth week of the month, varying locations. [www.houstonaquariumsociety.org](http://www.houstonaquariumsociety.org)

### Texas Cichlid Association

Meetings the third Saturday evening of each month. [www.flash.net/~tcichlid](http://www.flash.net/~tcichlid)

## UTAH

### The Great Salt Lake Aquarium Society

Meets the second Thursday of each month at the Garden Center, Sugarhouse Park, 1601 E. 2100 Street, Salt Lake City, UT. Doors open 7 p.m., programs, 7:30 p.m. [www.gslas.com](http://www.gslas.com)

### Utah Marine Aquarium Society

Meetings held at the Living Planet Aquarium on the third Thursday of every month. [www.utmas.com](http://www.utmas.com)

### Wasatch Marine Aquarium Society

Meetings the first Thursday of each month. [www.utahreefs.com](http://www.utahreefs.com)

## VERMONT

### Otter Valley Aquarium Society

Meets the second Tuesday of the month at 7:30 p.m. (except July & August) at the Maclure Library in Pittsford, Route 7 North. [jtoddybas@aol.com](mailto:jtoddybas@aol.com)

### Tropical Fish Club of Burlington, VT

Meets monthly September through June, the second Thursday of the month, at the VFW, 73 Pearl St, Essex Junction, VT. [www.tfcv.org](http://www.tfcv.org)

### Vermont Marine Aquarists

Meets quarterly when there is interest. Contract [erik.engstrom@gmail.com](mailto:erik.engstrom@gmail.com) for more information. [www.saltwatervt.org](http://www.saltwatervt.org)

## VIRGINIA

### Potomac Valley Aquarium Society

Meets the first Saturday of each month at the Green Acres School, 4401 Sideburn Road, Fairfax, VA. Doors open 12:30 p.m., meeting begins at 1:00 p.m. [www.pvas.com](http://www.pvas.com)

### Shenandoah Valley Aquarium Club

Meetings are held on the last Sunday of each month from 4 p.m. until 5 p.m. at the Burger King in Verona, VA. For more information, check [www.svac.co](http://www.svac.co) and our Facebook page (Shenandoah Valley Aquarium Enthusiasts).

## WASHINGTON

### Greater Seattle Aquarium Society

Meets the second Tuesday of every month, except July and August. Plant auction in February, big auction in April. [www.gsas.org](http://www.gsas.org)

### Inland Northwest Aquarium Society

Meets the first Wednesday of every month, 7 p.m., Aquarium Solutions, 9516 E. Montgomery Ave, Ste. 18, Spokane Valley, WA. [www.inwas.org](http://www.inwas.org)

### Seattle Saltwater Fish Association

Meets biweekly in west Seattle, Washington. Contact: Kristine at 206-935-3212 or email [kvillager@gmail.com](mailto:kvillager@gmail.com)

## WASHINGTON D.C.

### The Chesapeake Marine Aquaria Society

Meets monthly in the Greater Washington/ Baltimore area. See website for more details. <http://www.cmas-md.org>

## WISCONSIN

### Central Wisconsin Aquarium Society

Meets at least once monthly, and auctions (spring and fall), shows (before fall auction), and other outings are held. [www.cwas.org](http://www.cwas.org)

### Green Bay Aquarium Society

Meets the second Wednesday of each month at the home of a club member. <http://www.gbasonline.org>

### Madison Area Aquatic Hobbyists

Meets monthly on the third Saturday of the month. <http://madisonaquatic hobby.com>

### The Milwaukee Aquarium Society

Meets the third Friday of every month (except July and December), Hoffer's Tropic Life Pets, 7323 N. 76th St., Milwaukee, WI. [www.milwaukeeaquariumsociety.com](http://www.milwaukeeaquariumsociety.com)

### Sheboygan Aquatics Society

Meets the second Wednesday of each month. For more information, visit [www.sheboygan-aquaticsociety.org](http://www.sheboygan-aquaticsociety.org).

## AUSTRALIA

### Australia New Guinea Fishes Association

Contact: [membership@angfa.org.au](mailto:membership@angfa.org.au), PO Box 673, Ringwood Vic 3134, Australia. [www.angfa.org.au](http://www.angfa.org.au)



## CANADA

### The Aquarium Society of Winnipeg

Meets every third Sunday, September through June, theatre 100 at St. Paul's College, University of Manitoba, 70 Dysart Road. [www.asw.ca](http://www.asw.ca)

### Association Regionale des Aquariophiles de Quebec

Meets 7:30 p.m. on the second Monday of every month at 2125 Louis-Joliet, Quebec, QC. [www.araq.org](http://www.araq.org)

### Brant Aquarium Society

Monthly meetings are held on the second Wednesday of each month, September to June, at TB Costain Community Centre at 12 Morrell St., Brantford, Ontario. [www.brantaquariumsociety.ca](http://www.brantaquariumsociety.ca)

### Calgary Aquarium Society

Meets the second Tuesday of each month. Visit the website for time and location. [www.calgaryaquariumsociety.com](http://www.calgaryaquariumsociety.com)

### Canadian Killifish Association

Meets monthly, the second Sunday, 1 p.m. Location changes month to month. [www.cka.org](http://www.cka.org)

**The Canadian Rift Lake Cichlid Association**  
Quarterly meetings, the University of Guelph, Arboretum Nature Centre in Guelph, Ontario. [www.crlca.com](http://www.crlca.com)

### Durham Region Aquarium Society

Monthly meetings, the second Tuesday of each month, 7:30 p.m., Anderson Collegiate, 400 Anderson St., Whitby, Ontario. [www.dras.ca](http://www.dras.ca)

### East Coast Aquarium Society

Based in Halifax, Nova Scotia. Monthly meetings from September to June. [www.EastCoastAquariumSociety.ca](http://www.EastCoastAquariumSociety.ca)

### Hamilton & District Aquarium Society

Meets on the second Thursday of every month at 7:30 p.m. (except July and August) at the Church of the Resurrection, located at 435 Mohawk Road West, Hamilton, Ontario. [www.hdas.ca](http://www.hdas.ca)

### Kitchener Waterloo Aquarium Society

Meets the first Tuesday of every month (except July and August). [www.kwas.ca](http://www.kwas.ca)

### The London Aquaria Society

Based in London, Ontario, Canada. Meetings the second Tuesday of every month, 7:30 p.m., except July and August. [www.londonaquariasociety.com](http://www.londonaquariasociety.com)

### Montreal Aquarium Society

Meets the second Wednesday of each month, except in July and August. [www.montrealaquariumsociety.com](http://www.montrealaquariumsociety.com)

### Ottawa Valley Aquarium Society

Meetings are the fourth Monday of every month (except July, August, and December) at 7 p.m. at the Mel Baker Hall of J.A. Dulude Arena at 941 Clyde Avenue, Ottawa, Ontario. [www.ovas.ca](http://www.ovas.ca)

### Peel Regional Aquarium Club

Meetings the third Thursday of the month, September to June, 7 p.m., Turner Fenton Secondary School, 7935 Kennedy Road South. [www.peelaquariumclub.org](http://www.peelaquariumclub.org)

### Saskatoon Aquarium Society

Meets at the Calvin-Goforth Presbyterian Church at 1602 Sommerfeld Ave. (corner of 3rd and Sommerfeld) on the last Sunday of each month at 1:30 p.m. [www.saskatoonaquarium.com](http://www.saskatoonaquarium.com)

### The St. Catharines & Area Aquarium Society

Meets every third Thursday of the month

(except August and December) at The Seafarers and Teamsters Union Hall, 70 St. David's Rd. E., Thorold, ON. Doors open at 7:00 p.m.; meeting starts promptly at 7:45 p.m. Visit us at our website or call 732-541-1392. [www.scaas.info](http://www.scaas.info)

### Sarnia Aquarium Society

Meets 7:30 p.m., the second Tuesday of each month, the British Canadian Club, 375 Vidal Street South., Sarnia, Ontario, Canada. [www.sarniaaquariumsociety.com](http://www.sarniaaquariumsociety.com)

### Société d'Aquariophilie de Montréal (S.A.M.)

Meetings are on every third Tuesday of the month, except July and August, held at 75 Sir Georges-Etienne Cartier in Montreal, Canada; events include conferences, breeder awards, and auctions. [www.aquasam.qc.ca](http://www.aquasam.qc.ca)

### Toronto Willowdale Aquarium Society (TWAS)

Serving the megacity of Toronto. For more information, email us at [info@torontoaquarium.org](mailto:info@torontoaquarium.org) or visit [www.torontoaquarium.org](http://www.torontoaquarium.org)

### Vancouver Aquatic Hobbyist Society

See website for meeting times and contact information. <http://vahs.ca>

### Wet Coast Aquarium Society

Meets the second Monday of the month at 7:30 p.m. at The University of British Columbia. <http://wetcoastaquariumsociety.ca>

## INDIA

### Indian Aquarium Hobbyist Portal

Dedicated to aquarists of India, bringing them together, addressing lack of specific information in the hobby and providing useful

resources. [www.iah.in](http://www.iah.in) or visit us at our website [www.indianaquariumhobbyist.com](http://www.indianaquariumhobbyist.com)

## ITALY

### Club Ittiologico Romano "Giancarlo Iocca"

Meets the last Thursday of each month. Visit the website for time and location. [www.cir.roma.it](http://www.cir.roma.it)

### The Gruppo Acquariofilo Salentino

Please visit website for meeting times and other information. <http://www.gas-online.org>

## MEXICO

### Comunidad Acuariófila Regiomontana

An association dedicated to the study, conservation, and propagation of all fishes, plants, and other aquatic life. Located in Monterrey, Nuevo León, Mexico. Annual membership is \$15. Meets every second Saturday of each month at 3:00 p.m. Mail us at [info@carac.com.mx](mailto:info@carac.com.mx) for additional information or visit [www.carac.com.mx](http://www.carac.com.mx)

## PUERTO RICO

### Aquarists Metro East of Puerto Rico

Meets in San Juan, every first Saturday, 1:30 p.m., Interamerican University Metro, 426. [www.amepr.org](http://www.amepr.org)

### Asociación de Acuaristas de Aguadilla

Meets every second Sunday at 1:30 p.m. at Esc. Esther Feliciano de Mendoza, Ramey Base, Aguadilla, PR. Contact: [camatos99@yahoo.com](mailto:camatos99@yahoo.com) [www.aaapr.org](http://www.aaapr.org)

If your club would like to be included in "Meeting Place," please contact Tsing Mui at [tmui@tfh.com](mailto:tmui@tfh.com)

# aquarium society news

Rhonda Wilson

## The Northeast Council of Aquarium Societies Convention

I had never been to the Northeast Council of Aquarium Societies (NEC) Convention before and was excited because Leslie Dick asked me to speak at this year's event during *TFH's* live chat on the *TFH* Forum.

It's a long flight between the west and east coast, and between buses, planes, and rides, it was almost a full day from the time I left home until I got to Connecticut. I was very surprised at the view of deciduous forests this early in spring, with no leaves on the trees and few evergreens.

After checking into the hotel and bringing my things to my room, I was able to go down and look at the vendor room while it was being set up and greet some of my old aquarium friends while meeting new ones. Several displays were already in progress, with merchandise and some aquariums being set up.

When I went to the restaurant for dinner, I quickly found a table of fish fanatics to sit with and had a nice meal and get-together afterward, where I was fortunate to meet the first and long-time convention chairs Penny and Al Faul and Janine and David Banks, who chaired the conventions



The NEC Convention attracted many hobbyists from all over the area.

after Penny and Al until this year. I was also happy to meet fellow speaker Klaus Steinhaus, the Conservation, Awareness, Recognition, Encouragement, and Support (C.A.R.E.S.) Canadian Ambassador, and the Saturday night keynote speaker Spencer Jack.

The evening presentation was on the family Loricariidae in the Rio Xingu, given by Hans-Georg Evers. It not only illustrated the plight of these plecos in their native environment, but also the lives of the local people who make

a living catching these plecos for the aquarium trade.

I was very happy to finally meet Ted Coletti in person on Saturday. We originally met on the Fishnet on Compuserve years ago. It was nice to finally be able to meet him in real life after almost 20 years of knowing him only from the computer and written correspondence.

The Connecticut Aquatic Plant Enthusiasts (CAPE) had several nice little tanks set up: a small tank with emergent plants, another small glass art bowl with tiny plants, and a large tank with several new and rare potted aquarium plants.

There were several competitions at the convention. There were four categories in the Article Competition: Breeder, Humor, Open, and Continuing. The first place humor article was called "With a Little Help" by Dan Radebaugh. The article featured multiple photos of his cat helping in the care of his aquariums, with a written description of how to enlist your cat's help in the fishroom.

My day on Saturday was mostly filled by doing three talks on aquarium plants and pond invertebrates. Other speakers included Patrick Donston on fish health, Scott Fellman on nano aquariums and marine biotopes, Bob Lewis on show guppies, Ken Normandin on *Rivulus* spp. and collecting in Panama, and Tony Terceira who did a photography workshop.

Spencer Jack was the speaker for the big banquet dinner and provided a very amusing talk, "Confessions of a Cichlaholic," while providing alternative entertainment for the non-aquarium enthusiasts who accompanied friends and family members to the convention.

On the last day, I could no longer resist the temptation to look at the creek behind the hotel. I had brought only a pair of inappropriate shoes for climbing around in forests, but I didn't let that stop me, though I did have to clean them when I was done. There were no plants in the water, but it was interesting looking through a deciduous forest because I hadn't had the opportunity to do so before, and it was quite interesting after seeing them from the plane.

The auction was huge. Not only convention guests but members of the public from all over the area came to the auction, which was still going strong when I had to go to the airport for my return journey. Everyone was incredibly nice at the convention, and I arrived home invigorated and ready to start working on my aquariums again.



Several new and rare plant varieties were on display.



The William T. Innes Competition included a number of splendid fish entries.

Rhonda Wilson

Rhonda Wilson

Rhonda Wilson



# classifieds

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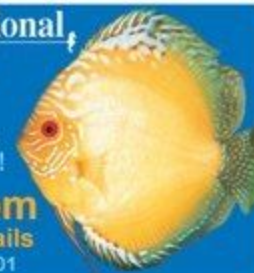
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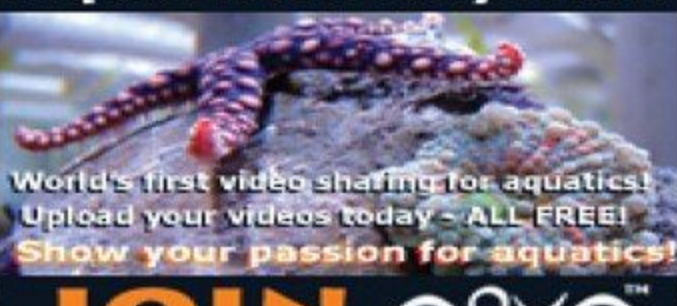


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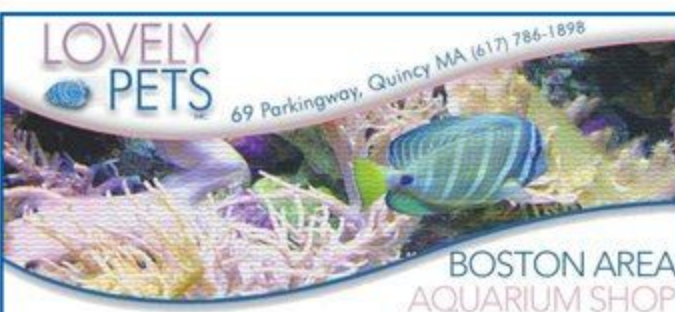
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# Product Spotlight



## Aquarium Filters

**Hagen** introduces the Fluval 06 Series Filters. This new lineup helps make aquarium keeping as easy and worry-free as possible by providing a remarkable range of convenient features that include patented Aqua-Stop Valves for easy hose disconnections, single-motion lift-lock clamps for simple cleaning and maintenance, and multiple removable filtration baskets that are already packed with mechanical, chemical, and biological media. In addition, Fluval's unique square-shaped canister design holds 35 to 50 percent more water than round canister filters of similar size, allowing superior flow through a complex cleansing process that allows maximum contact time with filtration media. The Fluval 06 Series Filters are available in four sizes—106, 206, 306, 406—designed for a wide range of small to midsize home or commercial aquariums. For more information, visit [www.hagen.com](http://www.hagen.com).

## SPS Coral Food

**First Bite** presents SPS Coral Food, a revolutionary food that has been micronized to a nanoplankton particle size of 2-20 microns, the perfect size range for feeding small-polyp stony corals. These particles are combined with organic metabolic pigments, which are building blocks used by SPS coral species. Other ingredients include enhancing carotenoids, marine proteins, and other unique feeding triggers that make the food irresistible to SPS corals. Experience a more rapid coral growth and enhanced polyp extension with First Bite SPS Coral Food. Available in a 5g aluminum can, complete with feeding equipment and instructions. For more information, visit <http://food4fish.co.uk>.



## Titanium Heater

**Commodity Axis** introduces the ViaAqua Titanium Heater. Incorporating the best technology and electrical components to date, this heating element is manufactured of pure titanium that will not crack like conventional glass heaters. The titanium heating probe is virtually unbreakable. An adjustable remote LCD thermostat and a remote temperature probe ensure a consistent temperature throughout the whole aquarium. The remote thermostat allows you to alter the temperature without getting your hands wet. With a visible LCD temperature readout on the front of the heater, setting the optimum temperature for your aquarium is as simple as pressing a button. Our titanium heater is safe and reliable in both saltwater and freshwater aquatic environments. For more information, visit [www.viaaquaocceanpure.com](http://www.viaaquaocceanpure.com).

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# in next month's issue...

## impressive cichlids

A group that includes some of the most well-recognized and popular fish in the freshwater aquarium hobby, cichlids are renowned for their interactive personalities, fascinating behaviors, and great looks. Cichlids also come in all shapes, sizes, and difficulty levels, meaning their appeal never wanes. Our July issue celebrates these amazing animals with articles on everything from conservation to breeding and much more!



Mo Devlin

## rascally wrasses

Brash, colorful, and packed with personality, many of the larger wrasse species can be real show-stoppers in home aquaria. Given suitable swimming space, tankmates, aquascaping, and nutrition, they can make fascinating and hardy aquarium residents. Check out our July issue to learn how you can enjoy one of these boisterous beauties in your own home.



Ed Wong

## caring for koi

With the weather warming up, allowing people to spend more time outdoors, it is a great time to take your hobby outside. Koi are the quintessential pond fish, and they can be relatively easy to care for if you have a large enough space and know what they need. Learn all about these hobby staples in the July issue of *TFH*.



Amanda Flagg

Read About All This and Much, Much More  
in the July 2012 Issue of *TFH*!

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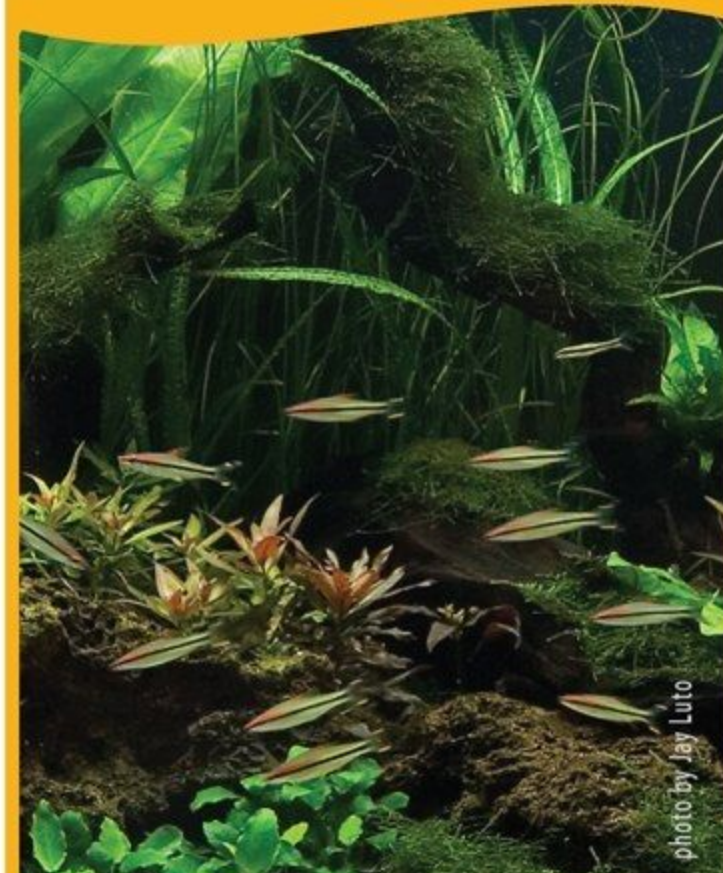


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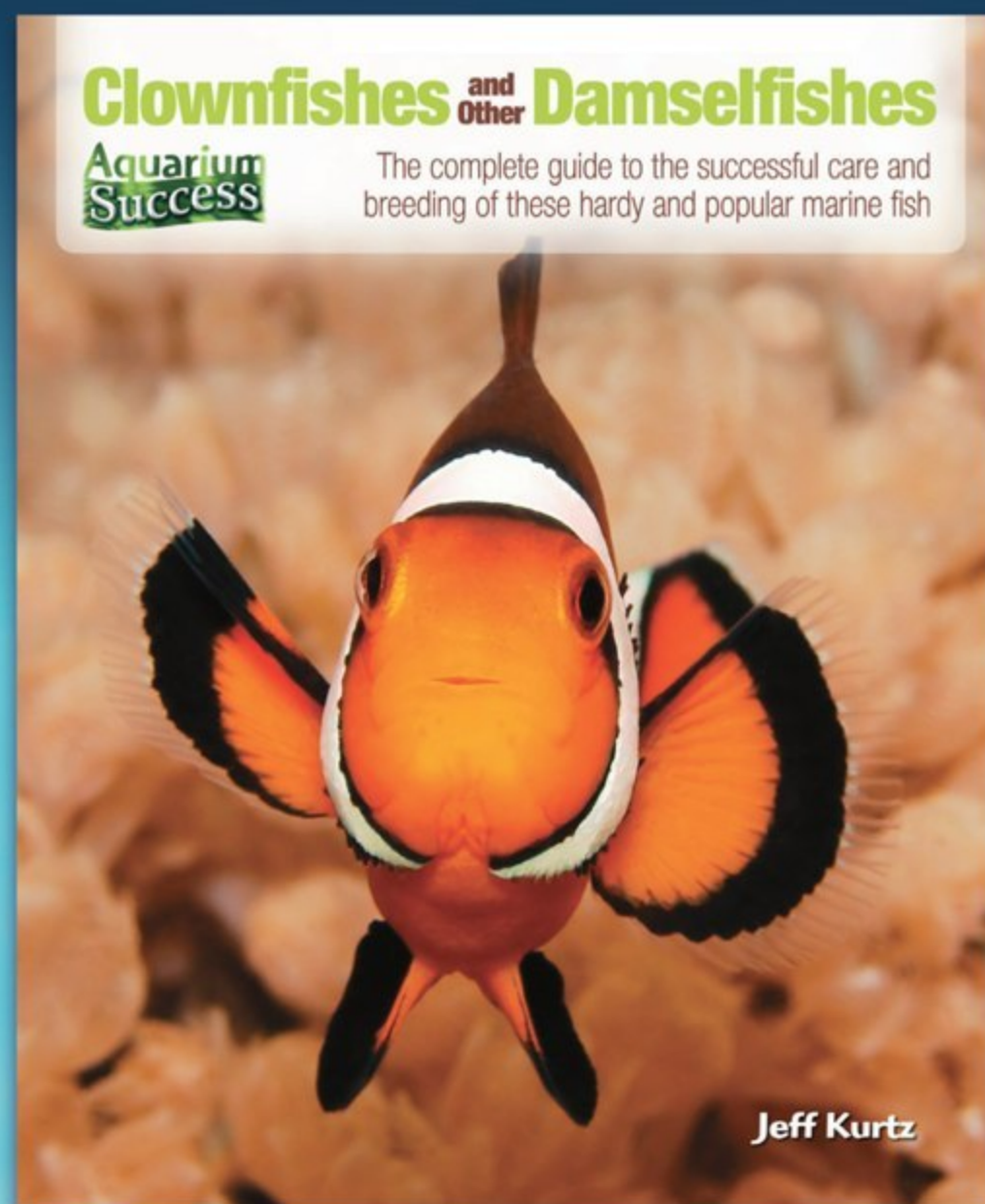
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# PARTING SHOT

Photo: Stanley Bysshe

## yellow- headed jawfish

*Opistognathus aurifrons*

**Y**ellow-headed jawfish (*Opistognathus aurifrons*) make fascinating marine aquarium residents. Upon entering an aquarium, they will dig a burrow (if one is not already available) and hover above it looking for food. They must be provided a deep substrate and rubble to make burrows that are both large and stable. Since they will not venture too far from their burrow, they must

be target fed and not be kept with species that will outcompete them for food.

In general, yellow-headed jawfish make hardy aquarium residents that tend to be resistant to disease. If you have a large-enough aquarium and sufficient available bottom space, you can keep more than one in the same system. *O. aurifrons* can even be bred successfully in captivity.





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