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ON THE COVER

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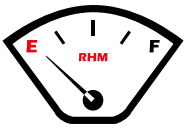

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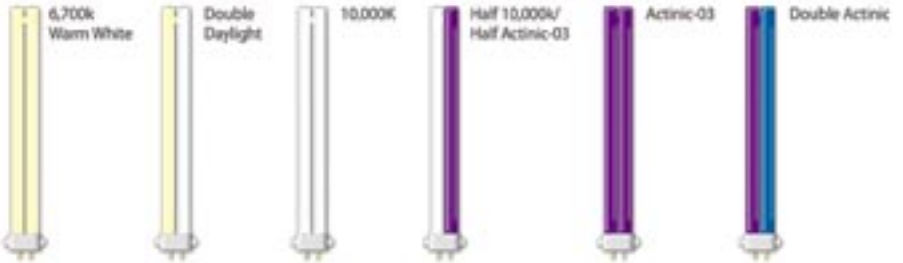

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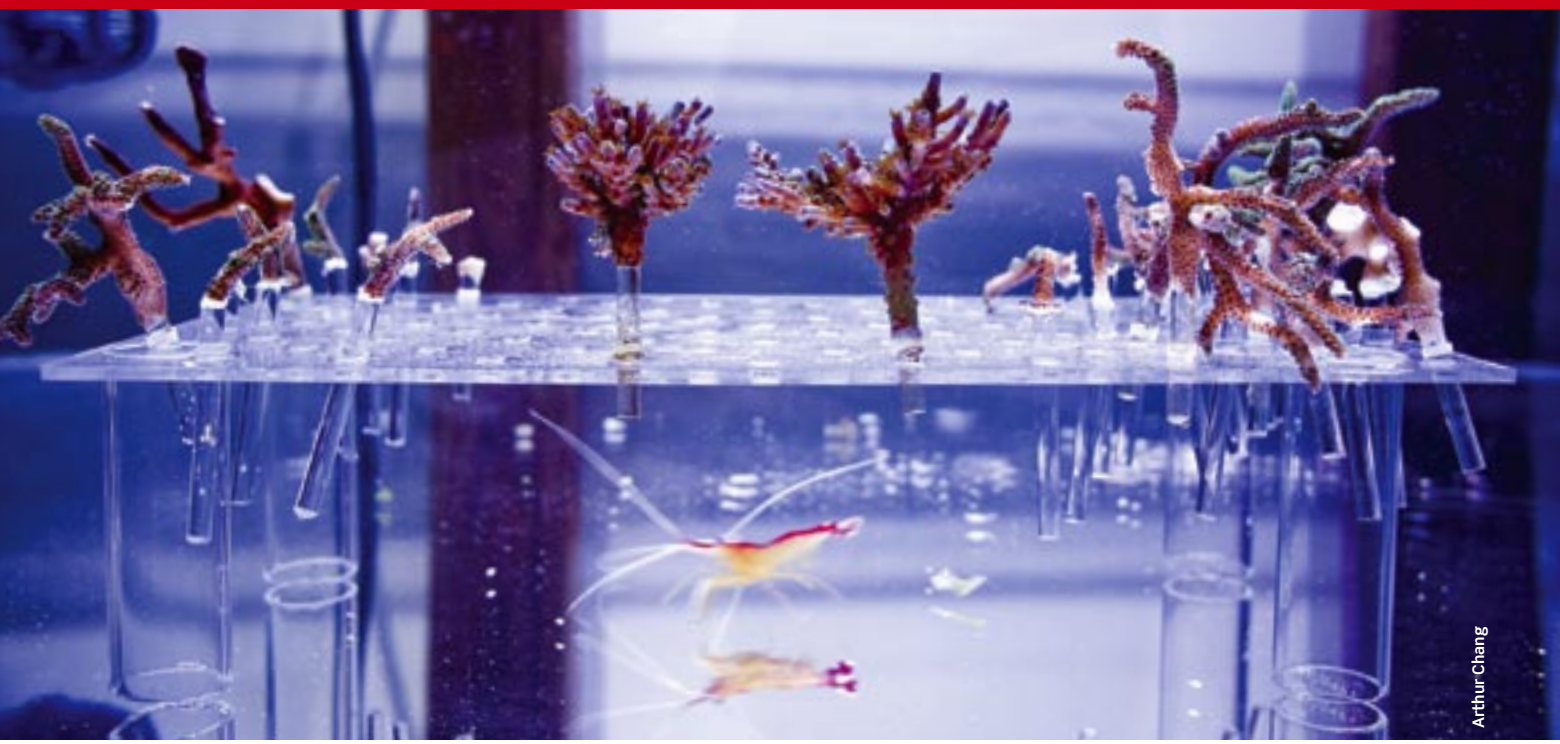

REFINED CULTURE: An Acrylic System

Article By Jim Adelberg
Images By Author except as noted

Here at Reef Hobbyist Magazine, we believe that a free and open exchange of information amongst hobbyists enriches the hobby for everyone. With that in mind, I'd like to offer up a propagation system I developed and have been using successfully for many years. Feel free to use this system as is, or adapt any part of it to meet your specific needs.

I've been farming coral for (what seems like) a long time now and it continually surprises me that after all these years, the basic 'frag plug' has remained more or less the same. Made from ceramic, or some kind of aragacrete mixture, they serve their basic purpose but, with apologies to my friends who produce frag plugs, they're ugly. And these ugly little mounds, capped with our beautiful little corals are then proudly displayed on what?...Egg crate! Perhaps the most aesthetically challenged material I can imagine. And so began my search for an economical, efficient, and beautiful (or at least unobtrusive) coral propagation system.

Sometimes new designs are conceived out of thin air but often they're just a reaction to deficiencies in the old designs. Here are the issues I tried to address with the new system:

Egg crate racks – ugly, block light, block flow, hair algae magnets (especially the corners), break easily, hard to clean and reuse.

Frag plugs – ugly, not easily secured in place, block light, easily colonized by nuisance algae, not great for flow, shape encourages sediment to collect directly around the growing edge of the coral, may require weeks of curing, creates an ugly, unnaturally regular bump in the display tank when fully encrusted.

So I started by designing, building and testing a whole series of acrylic racks. Luckily, most plastic shops will have a "scraps" bin where cut-offs can be purchased quite cheaply. I soon found that clear, smooth acrylic provided the least impediment to water flow and the most aesthetic presentation. I also tried some different leg designs for the stands and found that using round legs allowed me to maintain the highest flow rates beneath the racks. This observation would come into play again later.

Satisfied that any more work on the racks would have to be specific to the frag mounts, I began considering the available options. Material selection was a limiting factor. It would have to be inert in saltwater, cheap, easy to handle, quick to cure and easy for corals to encrust

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on. Also, it would be nice if it somehow kept sediment from settling around the growing base of the coral. I knew that if I could keep the coral up above the rack surface, I'd have an easier time moving the detritus along. And I remembered that the round legs on the stands had shown the least resistance to flow, so the idea of growing coral on round acrylic rods was born. Another visit to the plastic store revealed 3/16" clear acrylic rod at $0.70 per six foot length. The final piece of the puzzle was that standard 'airline tubing' with an interior diameter of slightly less than 3/16" and can be cut to make collars to keep the rods from falling through the holes in the rack.

By the way, this is a great use for all those six inch scraps of airline tubing you could never bring yourself to throw away! And I'd like to point out that my Yankee ancestors would be proud that I've kept the cost under 2 cents per frag mount.

I now use clear, flat, acrylic sheet racks which I drill with 7/32" holes to accommodate the 3/16" rods. And while I have personally farmed SPS at a density of 200 of these rods per square foot (yes, you read that right), I find it's more manageable in the 160-170 per square foot density. I'll also go on record here as recommending offset rows of rods. Sure, it's not quite as visually cool as straight rows but it'll give your herbivores better access around all of the coral and offsetting the holes will help maintain even flow across the entire rack.

I knew that the round rods would allow for both good flow and good herbivore access, and I knew this would go a long way in helping me keep the racks clean. What I didn't fully appreciate in advance was the fact that the snails and grazing fish seem to have a very easy time scraping algae off this diameter rod and even after months in culture, no algae to speak of grows on the rods. This came as a welcome relief because, once nuisance algae gets a toehold on traditional frag plugs, it can be quite frustrating to say the least! It also seems that this acrylic surface allows for very rapid encrusting growth. Many acropora frags will grow more than 1/4" down the rod below the glue point in under 2 weeks.

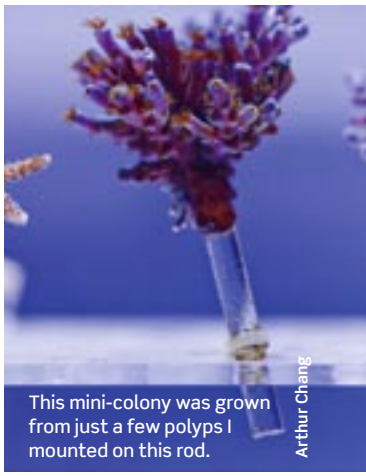
There are a few other nice bonuses to this propagation system that are worth mentioning. First is that any pests are quite easy to spot and eradicate. Since you're only looking at clear acrylic and live coral, macro pests like aiptasia and majano don't stand a chance of reproducing unnoticed. And since you'll only be mounting living tissue in your propagation tank, there should be less chance of bringing in the pests that live on tissue/skeleton boundaries like the montipora-eating nudibranch. Red bugs and flatworms are of course in no way excluded by this system but I believe that with each coral discretely mounted and separated by clean, acrylic rack and rod, the likelihood of these pests spreading is reduced.

And I think this is a fairly 'green' system both because of the minimal materials used per coral and also because it allows us to grow more individual coral, in a smaller area than ever before possible. For example, over 200 frags can be comfortably housed in a standard 10 gallon tank using this method. When compared to the carbon footprint of making and curing your own aragacrete plugs, or buying plugs readymade, I think this system is a winner hands down.

There were many different experiments with rack legs. These are made from syringe plungers.

This is the same rack in use.

Reuse your old airline tubing to make these collars.



This mini-colony was grown from just a few polyps I mounted on this rod.

Arthur Chang

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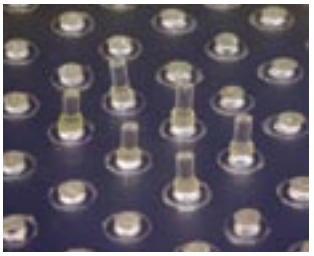
Here are the materials required for a go rod rack. My Go board in the background is the template.

Here's a larger acrylic rack with room for 181 rods.



Reuse your old airline tubing to make these collars.

Arthur Chang

Rods are held upright and single drops of super glue gel are applied to the tops.

Arthur Chang

Once the gel has cured for a minute, the frags are mounted on the rod tips.

Arthur Chang

Using this method, very small frags can be successfully grown.

Arthur Chang

Fresh frags being placed into the go rod rack.

Because all the surfaces involved are either smooth and flat, or smooth and round, flow around the coral is enhanced, allowing for better gas exchange, waste removal, and access to available food. This process is also aided by the fact that the coral is sticking up into the water column, away from any surfaces that could inhibit flow. And whichever planktonic food you're using, it'll stay in suspension longer with no rough surfaces to slow it down and make it settle out of suspension.

And there's more! I've found that there is plenty of light and flow under the racks to grow lower light montis and various LPS and palythoa. This represents a considerable gain in efficiently using the available space.

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Intensive SPS culture using acrylic rods.

The last material consideration was in regard to the adaptability of this mounting system to traditional reef systems. I mentioned earlier the unsightly bumps and bulges that can result from traditional frag plugs and I wanted a mounting system that would completely disappear once in a 'naturalistic' environment like a reef tank with live rock. Luckily, most live rock has holes or crevices where the rods can be secured out of sight with epoxy or super glue gel. For other mounting options, the rod can be cut with a wire cutter and the coral glued directly to any desired surface.

But in the end, my favorite part of this system is the aesthetic leap this approach invites. Separated from live rock, sand and anything even suggesting a natural environment, the coral is more easily seen and appreciated, the structure can be viewed in finer detail and the subtlety of color is more pronounced.

To date I have used this method with great success for all manner of SPS, stoloniferous softies (like clavularia), and zoanthids. This system is not designed for growing LPS. For LPS propagation, I still use traditional frag plugs.

The details of this acropora are easily observed.

Arthur Chang

Once again, feel free to use what you can of this method and contact me through the magazine if you have any questions (jim@rhmag.com). And if you have a propagation technique you'd like to share, send it to us and maybe we can share it with the world! You could be famous!

As always, thanks to Scott Clark and Truvu and Johnny Rodriguez and Seachem for sponsoring my tank.

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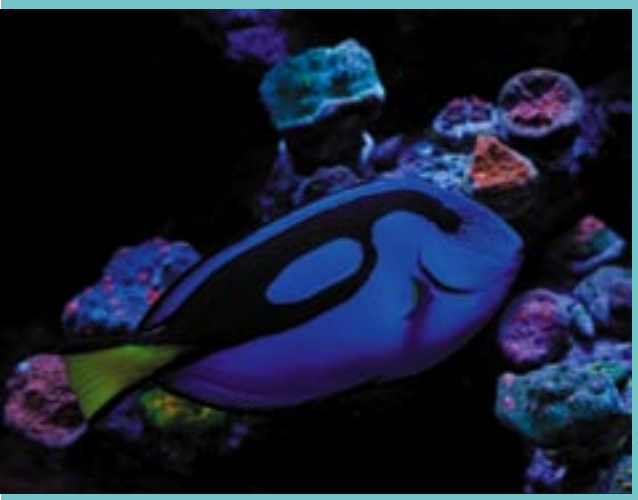
Paracanthurus hepatus (Pacific Blue Tang)

Family: Acanthuridae

Article By Peggy Nelson



Lou Schiavo

Greg Rothschild

Greg Rothschild

There aren't many of us involved with saltwater who are not familiar with the simply stunning Paracanthurus hepatus, or Pacific Blue Tang (not to be confused with the Atlantic Blue Tang, Acanthurus coeruleus). The Pacific Blue Tang is the only member of the genus Paracanthurus. This beauty has many common names, including Pacific Blue Tang, Hippo Tang, Regal Tang, Palette Tang, and a list of others. It is widespread throughout the Indo-Pacific and has become one of the mainstays of marine ornamentals in the aquarium trade for obvious reasons. A healthy Pacific Blue Tang sports a rich, almost deep sky blue body color that is unmatched by any other fish you'll see. The black "palette" marking against the rich blue body and contrasting yellow pectoral and caudal fins makes for one amazing fish that brings the "oohs and awes" out of anyone setting eyes on it for the first time!

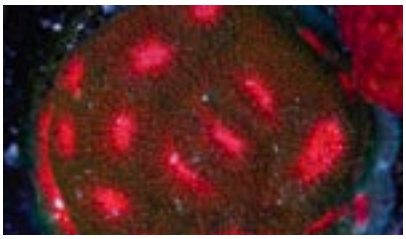
The Pacific Blue Tang is an omnivore, feeding primarily on zooplankton in the wild and also on algae. It feeds heavily on "greens" in captivity and should be provided Nori and other suitable algae on a daily basis. The Blue Tang is reef-safe and makes a great addition to a reef environment. It's a voracious feeder and will take just about any aquarium fare offered. A wide and varied diet, including Nori and other macro algae, will keep a nice fat belly on this beautiful fish, maintain its amazing color, and also bolster its immune system. Keep in mind that, along with room to move, and a varied diet including lots of greens, excellent water quality is paramount for the Pacific Blue. In the wild, the Blue Tang will grow to approximately one foot but in captivity seldom reaches such a large size. Do, however, plan a tank that has plenty of swimming room for this beauty as it is an active and busy Tang!

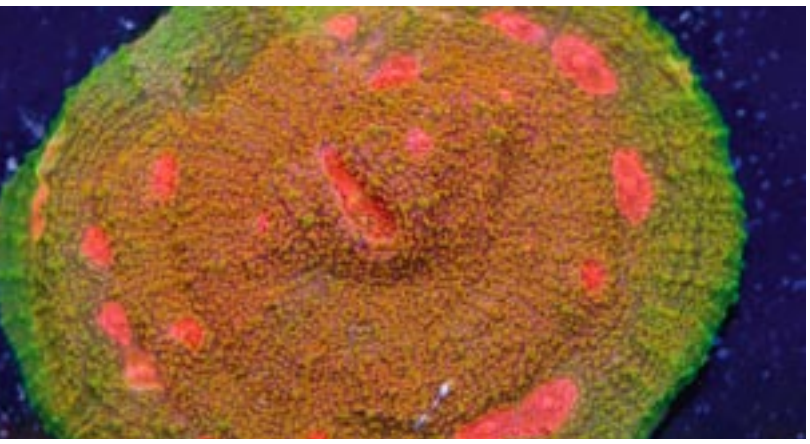
This one of a kind Tang is not only reef-safe but also makes a good community fish. It will "pal" around with other Tangs, Clowns, etc., and has a somewhat needy personality. It typically is non-aggressive and has no interest in corals, clams, inverts, etc. Its worst offense may be periodic nipping while constantly in search of macro algae and food sources to satisfy its never-ending appetite! It also can be humorous to watch as it will poke its head in a crevice in an attempt to hide, and because it then can't see you, it assumes you cannot see it! We have a 6" Blue Tang in our store that cracks us up because if someone he doesn't know approaches his tank, he hides his head and assumes he's out of sight when in fact his entire body is out in the open. He's a store resident we've had since he was only about an inch, and we're all very attached to him!

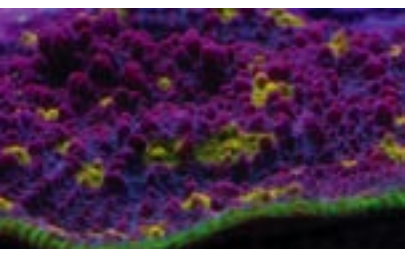
There are some who believe the Pacific Blue Tang is a difficult fish to maintain in an aquarium, citing reasons and/or experiences that include problems with Hole in the Head, recurring Cryptocaryon irritans (Ich/White Spot Disease), color fade, and other maladies. As is true with any fish or animal to be kept in a closed system, the Pacific Blue has its specific needs as set out above which should be known to the purchaser before acquiring the fish, and these needs can be and are easily met. So take care to provide the necessary environment to keep this beautiful fish in excellent health, and it will provide you with years of enjoyment! We highly recommend this amazing fish and give it a blue thumbs up!

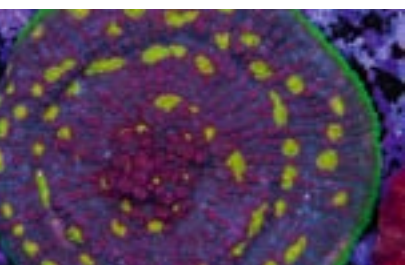
Top Down Photography – Shooting Amazing Pictures

Article & Images by Ian Iwane









Have you ever wondered how some of the most vibrant and colorful pictures of coral are taken? The answer is top down photography. Coral fluoresces in a different fashion when viewed from the top. I have discovered that shooting from the top down creates a different perspective and produces a high quality image that I prefer over traditional techniques. In this article we will explore how these pictures are taken. I will also give some tips I have learned over the last couple of years.

Recommended Equipment

Top down photo box (as pictured)
Basic five sided box made out of acrylic (I prefer four sides of the box to be black), with a hole for the camera mount.

DSLR camera
Important to be able to have control over some manual settings. I will touch on this later in the tutorial.

Macro lens w/auto focus
I recommend either a Canon 100mm 2.8, Nikon 105mm 2.8, Sigma 105mm 2.8, Nikon 60mm 2.8, Canon 60mm 2.8, or a Tamron 90mm 2.8.

Photo processing program
Adobe Lightroom 2, Adobe Photoshop, etc.

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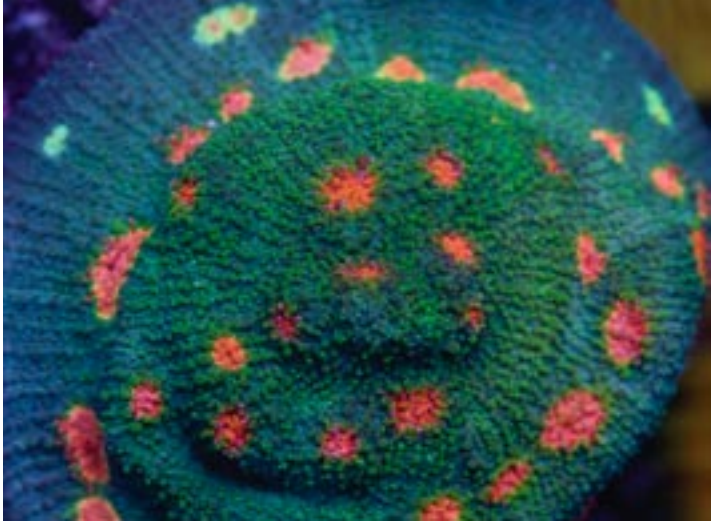
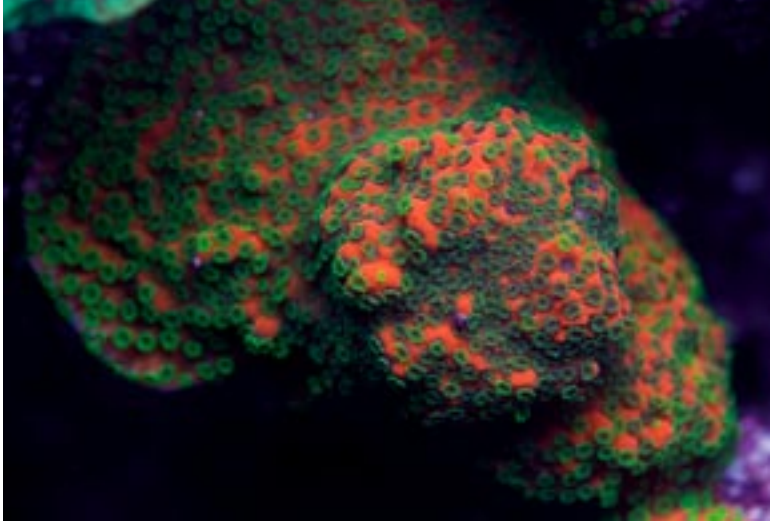
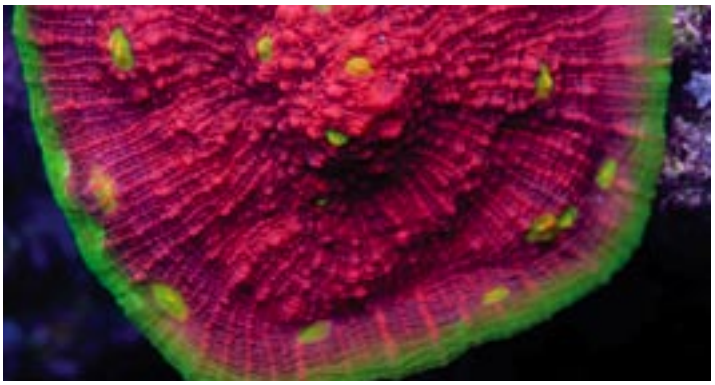
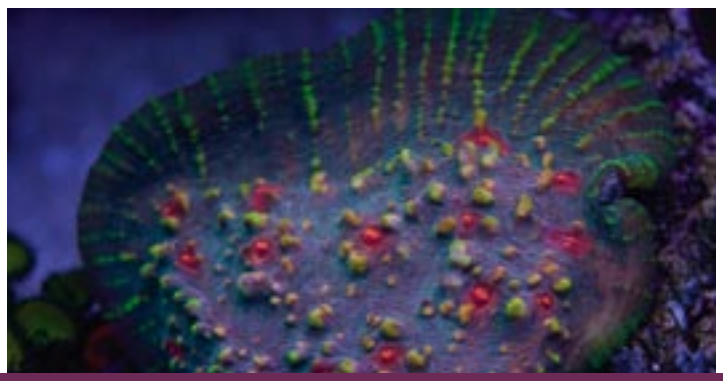


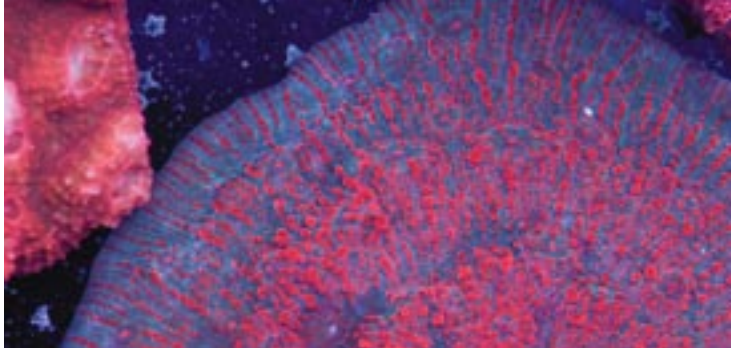
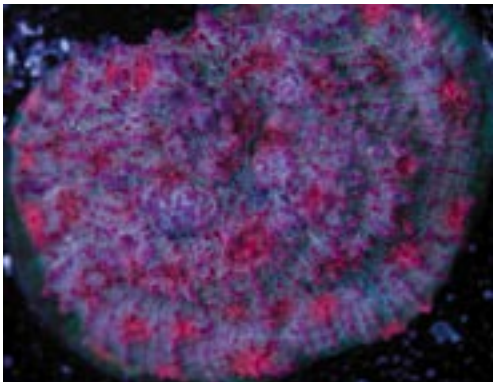
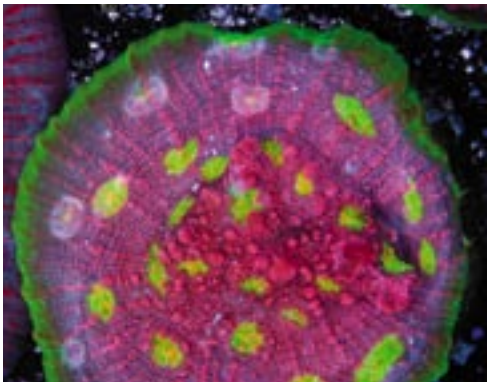


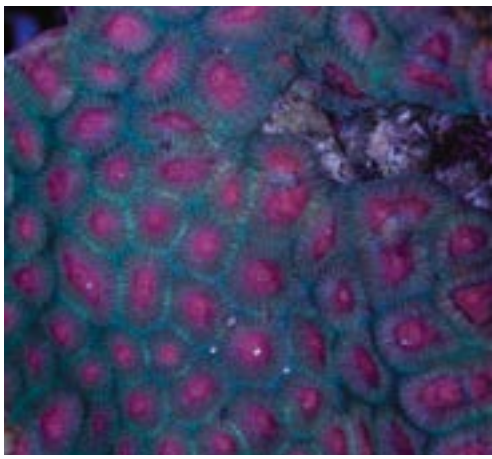
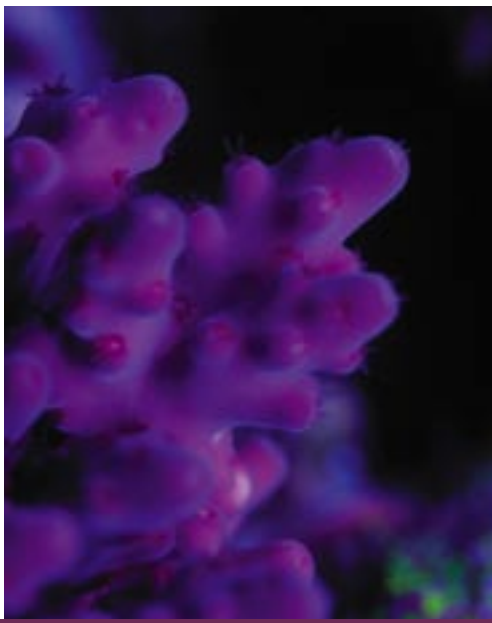




Once you have all of the above you will be ready to take some amazing photographs. Here are some tips on how to do so. First, turn on your auto focus and set your white balance to the appropriate level. If your camera has a manual setting, choose the highest Kelvin setting (e.g. for the Nikon D300 it's 10,000k). If your camera does not have a manual setting, choose the setting for shooting on a cloudy day. Most of our reef tanks have an overall 14,000k to 20,000k appearance. Adjusting the white balance on the camera will allow for fairly accurate color renditions without post processing. Second, always shoot in RAW mode. RAW files have the greatest latitude for post processing out of any of the file types.

I prefer to shoot in aperture priority. In this mode I have manual control over just the aperture (F-stop). A low f-stop equates to a large aperture. A large aperture allows for quicker shutter speeds but a smaller depth of field. A high f-stop equates to a small aperture. A small aperture allows for a greater depth of field but a slow shutter speed. The key is to come to a compromise between the aperture and shutter speed. Ideally I like to shoot with a f-stop of about 8 and a shutter speed that is at least 1/(the length of the lens I am shooting * the crop factor). In my case it's 1/(90 * 1.5) = 135 of a sec. If your shutter speed is too slow you

will get image blur in your pictures. Typically I have to adjust my ISO level to 800 to get both f-stop and shutter speed to my liking. A higher ISO also allows for a faster shutter speed, however, it also introduces more noise (graininess) into your pictures.

Once you get all the settings to your liking, turn off all pumps/power heads connected to your tank. Next, brace your arms on the top of the tank to steady the shot, look through the view finder and start snapping away. Some DSLRs like the D300 have a feature called Live View. This feature allows you to focus and preview your shot through the LCD screen rather than the view finder. Live View is a nice feature because looking through the view finder can put you in some very awkward positions. Next, take as many shots as you can. When starting out you may find that you may only take one good shot out of every ten pictures. This will improve over time.

Finally, break out your favorite photo processing program. I like Adobe Lightroom 2 for its speed and ease of use. My basic post processing steps include the following:

- Adjust the exposure
- Adjust the white balance
- Adjust the darkness if needed

These simple steps will have you taking the most amazing photographs you've ever shot. I encourage everyone that has access to a DSLR to try top down photography. It is not as difficult as you may think and you will love the results.

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Red Sea

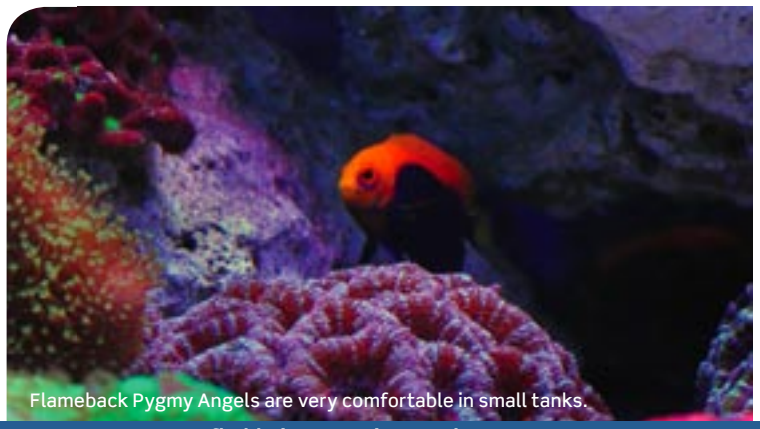
Hot Nano Fish, Episode 2

Pygmy Angelfish

Article & Images By Adam Mullins
Resplendent Angel Images By Peter Schmiedel

In this series installment, I will continue to showcase some of my favorite "Hot Nano Fish". This second installment will feature a few different species from an unlikely 'nano' family, the Angelfish. When most people think of Angelfish, they conjure up images of fairly large, vividly colored fish. Angelfish were some of the first and most highly desired fish to be obtained for the marine aquarium trade. This was due to their beauty, personality, and most notably, size. Many Angelfish reach adult sizes of eighteen inches or more. This, of course, makes them too large for most aquaria, and their hefty appetites for ornamental invertebrates makes them unsuitable for most mixed reef tanks. Nonetheless, their beauty, grace, and overall interesting personalities have made them very popular aquarium fish.

Luckily for us, there is an entire subfamily of Angels perfect for most home aquaria. These are known as the "Dwarf" or "Pygmy" Angelfish, though their attitude is anything but small. Pygmy Angelfish are for the most part very hardy and adapt well to captivity, with the exception of a few harder to keep species such as the Potter's Angel (C. potteri) from Hawaii. There are a few of these pint sized Pomacanthids which exhibit many of the popular traits of their larger cousins, but in a size suitable for most "nano" reef aquariums. A small or medium sized tank is a perfect way to showcase Pygmy Angels, which otherwise might be unnoticed in larger displays with more aggressive and larger fish such as tangs. Though the term "nano" is loosely used to describe tanks below thirty to forty gallons, all fish tanks are relatively "nano" in comparison to natural habitats. Thankfully, there are Dwarf Angelfish that are entirely suitable for tanks as small as twenty gallons.



Flameback Pygmy Angels are very comfortable in small tanks.

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The two Dwarf Angel types that have the most relevance for this 'Hot Nano Fish" series are the Cherub (Centropyge argi) and Flameback (C. acanthops & C. aurantonotus) Angels. Both are similar in size and coloration, not reaching more than three inches, and are closer in size to Damselfish than they are to most Angelfish. These Dwarf Angels do very well in tanks as small as twenty gallons. They hail from the Atlantic Ocean, making them fairly unique in the hobby as most fish in the trade originate on reefs in the Indo-Pacific Oceans. Another small Angel in similar shades/colors is the elusive Resplendent Angel, also from the Atlantic.

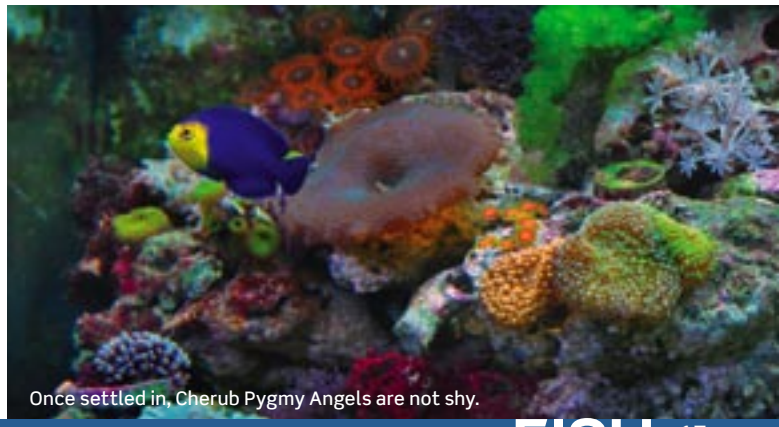
The Resplendent Angel has all the qualities of a 'Hot Nano Fish', however, due to its VERY restricted trade, they are extremely difficult to find and command high prices when available. Their scarcity comes from the fact that they are indigenous only to Ascension Island in the middle of the Atlantic and are banned from collection. The International Union for the Conservation of Nature (IUCN) has placed the Resplendent Angel on its Red List of Threatened Animals, making it the only marine Angelfish on the list. There was a time when these Angels were being collected and distributed, but that's another story. There have been a few successful captive breedings of these Angels. Unfortunately, like the aquaculture of other marine Angelfish, commercial production has not kept up with demand. However, there are whispers of tank raised Flame Angels (C. loricula) available in the not too distant future, and of course I will keep you updated as to when they become available.

The Cherub Angelfish sports a contrasting yellow face on a deep purple-blue body. The Flameback's bright orange extends from the "face" along the length of its elongate dorsal fin. The Cherub is found in the western Atlantic, with a wild range from Florida and the Gulf of Mexico throughout the Caribbean. This Angel can be found among the overhangs and in the rubble zones of reefs foraging for food, always within safe distance of a hiding place, and is commonly found at depths of sixty five to one hundred feet.

I remember the first time I saw a tiny Cherub Angelfish and knew immediately that it would be a great addition to a mini reef. While not the most brightly colored fish available, it's gorgeous none the less. To me, it's more about the whole package, and the personality and charm of Angelfish seem to set them apart. My Cherub Angel is one of my customers' favorite fish in The Mystic Reef nano tank (maybe because it's one of the few they actually see on a regular basis).

There are two varieties of Flamebacks available from opposite ends of the Atlantic: the Brazilian Flameback (C. aurantonotus) and the African Flameback (C. acanthops). They sport nearly identical coloration patterns, with characteristic "orange flame backs"


The Cherub Pygmy Angelfish is a vivid and active nano reef fish.


Once settled in, Cherub Pygmy Angels are not shy.

dressing a purple/blue body. On the Brazilian fish, the caudal fin is the same color as the body, while on the African morph, the caudal fin is a clear yellow color. Brazilian Flamebacks have acquired the reputation of being a bit more aggressive than their African cousins, so care should be taken when adding them. The African Flameback is usually a bit more expensive due to the extra shipping costs.

Pygmy Angels are generally regarded as "reef safe", however, they may nip at fleshy LPS corals and clam mantles in their constant picking. This habit of nipping coral seems to be a trait of certain individual fish and cannot be generalized across the species. Tank raised Angels seem less likely to exhibit this behavior. I house a Cherub Angel in a twenty four gallon Aquapod and it has left most of the other livestock alone, including some ornamental macroalgae.

The only coral I ever noticed it nibbling was a green Tubipora fragment I recently added (and recently removed)! While Pygmy Angels have the reputation of being aggressive, I feel that they are not the perpetual bullies that some other fish are, such as damsels. They rarely chase other fish, besides conspecifics, and I've housed them with clownfish, gobies, butterflies, and even pipefish. Angelfish form very interesting social hierarchies in nature, and keeping more than one Angel is possible in home aquariums. Angelfish are born females, so it is fairly easy to pair juveniles. After a little aggressive socializing, the more dominant one will become the male. This is similar to pairing clownfish but in clownfish pairs, the female fish is dominant. Pairing fish is truly worth it in the long run and you will be able to observe much richer social behavior. I believe all fish should be kept in pairs or groups, when possible. It's best to provide a Pygmy Angel pair with a medium sized aquarium of at least fifty gallons to allow each fish to claim a few hiding spots. This will help to prevent stress related problems such as Ich breakouts. Angelfish establish natural territories, and even small ones require at least a few square feet of reef on which to feed and to provide hiding spots. Angels, and especially Dwarf Angels, can be likened to Tangs in feeding behaviors, scouring the substrate of the reef for food, making them very active in home aquaria. These little Pygmy Angels, like their much larger counterparts, are voracious omnivores. In their scavenging, they will rasp algae from the live rock along with small crustaceans such as copepods and mysid. Their diet in captivity should reflect their natural feeding habits, with plenty of enriched foods offered such as frozen Spirulina enriched mysis shrimp. I also supplement their diets with regular additions of foods like Cyclop-eeze, Spectrum Pellets and Reef Nutrition's Arcti-Pods and Fuzzy-Phytes, to round things out. Pygmies tend to prefer softer algae and leave many harder macroalgae alone.

A tank set up with a decent amount of live rock, caves and crevices will help Pygmy Angels adjust to tank life. They normally do not venture far from rocky overhangs or coral heads in nature. You will be able to witness the confidence these angels possess once they feel secure, as they dart about the tank, rasping algae from the live rock. Their behavior makes them perfect for fish watchers as

This Pygmy Angel is clearly reef safe.

A Cherub Pygmy Angel.

Plenty of live rock and rubble will make Cherub Pygmy Angels feel at home.

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they are in constant motion, almost like a hummingbird darting from flower to flower. Algae control was the reason I added the Cherub to my Aquapod in the first place. I feel they are much more attractive than and not nearly as aggressive as a lawnmower blenny.

Pygmy Angels are perfect for fish watchers.

Many fish of suitable size for nano tanks are fairly small and cryptic in nature. Even the flamboyant Flaming Prawn Goby, while extremely colorful, can be very hard to find even when right in front of you. Angels on the other hand, once acclimated to their new environment, will constantly be out feeding on rock surfaces.

If you've been looking for a great open water swimmer for your nano, don't overlook the Pygmy Angels. They are great additions to tanks over twenty gallons, and are far more suitable than a baby Purple Tang in the same size tank. There is a Pygmy for everyone, from the casual aquarist to the rare fish collector. You can expect to see pricing from $25-$35 for a Cherub, which is about half the cost of a Flameback. African Flamebacks will generally cost $10-$15 more than their Brazilian counterparts.

I would like to thank Peter Schmiedel, whose company, Reef Safe (www.reefsafe.com), continues to produce desirable and exotic tank raised fish for the European Market and Eric Cohen of SDC. I'd love to hear any questions or comments from our readers. Feel free to e-mail me at sales@themysticreef.com. Get ready for the third installment in the "Hot Nano Fish" series: Tank Raised Nano Fish, with plenty of surprises!!

The Resplendent Angels: How They Got Here & Why They're Gone

Article By Adam Mullins
Images By Peter Schmiedel

This Angelfish is so uncommon in the hobby that even trying to track down photos of a Resplendent Angelfish to accompany this article proved to be a challenge. Sure the article would have sufficed without them, but I thought being able to compare all these very similar Pygmy Angel species would be beneficial. What is so special about Resplendent Angels anyway? Why do they cost so much, and, why are people willing to pay so much for them? After all, aren't they nothing more than a dressed up Flameback? To some, perhaps, but for others, it's much more than that. Maybe a history on their background will help you understand why private collectors were willing to travel to the middle of the Atlantic, and spend thousands of dollars getting there, for just the chance to try and catch some. To accomplish this, I needed photos.

After a lengthy, unsuccessful search for photos, I decided to ask Vince Rado of O.R.A. if he knew anyone who could help. Although he didn't know anyone with photos, he did tell me how he used to get these fish when they were first brought in during the late 80's and 90's, while he was working at a Florida wholesaler.

It was here I found a story that has to be shared. Many dedicated hobbyists have heard the lore of these fish. How they briefly became available from Ascension Island, their only natural habitat, and then vanished. Much like the Clarion Angel, once they ceased coming, everyone was left looking back regretting they didn't buy one.

Well, apparently, Ascension Island in the middle of the Atlantic was an emergency remote landing area for the space shuttle. Anytime they would launch the shuttle, they would dispatch a crew of men to the island to be prepared to receive the shuttle in an emergency situation. Corpsmen that departed from a base near Cape Canaveral would be on the island for a week or two at a time and there wasn't much to do except wait around in case of emergency. Some savvy young recruits decided to go diving, and try to catch these gorgeous little "Blue Angels". And that's exactly what they did. The waters around Ascension Island are filled with these fish. Their placement on the IUCN Red List in 1996 has nothing to do with their population size; there is no major threat against them. While common in Ascension's coastal waters, its population is considered vulnerable because of its extremely limited natural distribution, similar to Banggai Cardinals, Clarion and Clipperton Angels, as well as many other island-endemic fish.

Vince told me they would capture dozens of these little Angels and transport them back to mainland Florida on military transports, then sell them to local marine wholesalers and collectors for the staggering sum of $10 a piece. It became so routine, they pretty much knew every time the space shuttle was launched, they would be receiving a shipment of Resplendents in the near future. Unfortunately, once the military caught wind, the Corpsmen ceased their involvement in the rare fish trade.

Resplendents haven't been seen in the industry in at least a few years, and can truly be classified as a rare fish. Ascension Island is officially a British Territory and has since banned collection of all marine life around their waters. Numerous well respected fish collectors and divers have petitioned the government for years to be able to collect a few, with no luck. Sadly for collectors and hobbyists everywhere, even if collection were possible, it would still cost thousands of dollars in travel expenses just to reach the island, stacking up to enormous

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end costs, just like other fish from exotic locales like the amazing Wrought Iron Butterfly. Now I knew how they originated in the hobby. I just needed some proof they existed.

Finally, I was able to procure some photographs from noted breeder Peter Schmiedel in Europe, who at one time had 8 Resplendents. Sadly, his brood stock was lost. It's heartbreaking to think the success Peter could have had with these rare fish (he had one of the first Breeding Latezonatus Clownfish pairs outside Australia, amongst other reef rarities), but that's just how it goes sometimes. I'd like to thank Vince Rado for sharing with us his firsthand experiences with these fish, as well as Jim Stime and Peter Schmiedel. These little exotics are sure not to be forgotten anytime soon, and we can only hope work continues to be done on the captive breeding of these fish. While they are perfect candidates, these gems are far too scarce to be responsibly recommended as Hot Nano Fish. It is very easy to write articles touting the attributes of the rarest and most expensive fish, though not necessarily most beautiful. However, the point of this series is to try to shed light on great fish you may or may not have heard of, within a reasonable price range and available to a broad range of aquarists.

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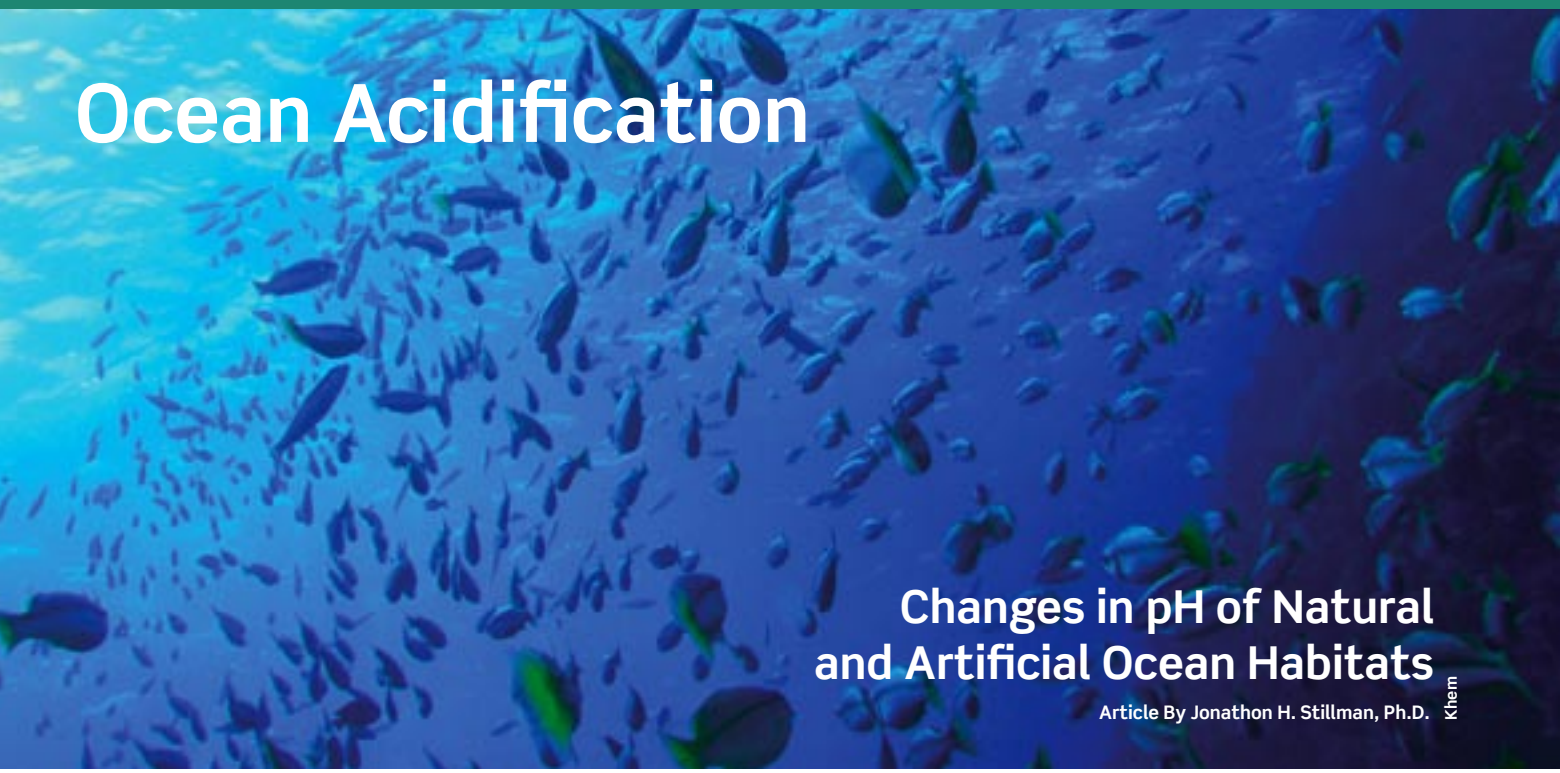
Ocean Acidification



Changes in pH of Natural and Artificial Ocean Habitats

Article By Jonathon H. Stillman, Ph.D.

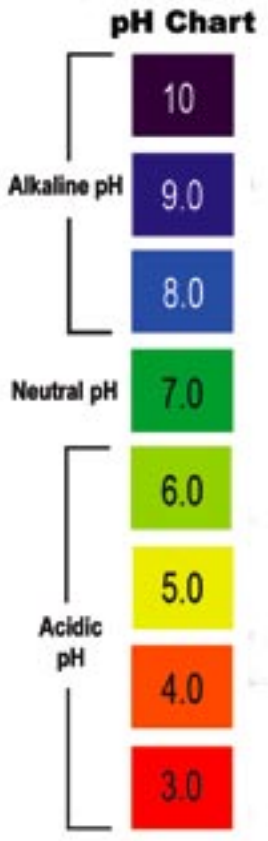
Khem

Aquarium hobbyists and professional aquarists alike spend a lot of time and energy to ensure that the parameters of their tank's water are stable and in a range good for the health of their tank inhabitants. Humanity is not doing such a good job with the World's oceans though, and through the burning of fossil fuels and the release of greenhouse gases, we are changing the parameters of the ocean waters, making them warmer and more acidic. The warming and acidification will be more extreme in polar waters, but since many tropical organisms, including corals, are presently experiencing environmental conditions that are very close to their physiological tolerance thresholds, small changes in environmental factors may have a large impact on tropical organisms. Many scientists predict that in 50-100 years, changes in water chemistry and temperature may impact corals to the point where they are no longer able to calcify.

In this article, I will address why burning fossil fuels is causing the oceans to become acidified, what the predicted consequences of ocean acidification are on calcifying organisms, and how you can control acidification to ensure the health of the organisms in your reef aquarium. You, as a reef hobbyist, may be able to control appropriate chemical parameters in your own tanks so that conditions are better for corals than they would be for corals in the wild. In that context, where coral reefs have a better chance of surviving in captivity than in the wild, captive propagation and responsible reefkeeping efforts are more important than ever before.

One of the critical water chemistry "balancing acts" in the aquarium is the control of pH through the interaction of dissolved carbon dioxide (CO_2) and total alkalinity. In this article, I will avoid the use of chemical equations and mathematical relationships as much as I can since I do not wish to lose readers that are put off by technical speak (I have provided some references for more detailed treatments of the subject). However, it will be necessary to at least name some chemical compounds.

1. pH: This is a measure of the concentration of protons (otherwise known as hydrogen, or H+ ions) in a solution. pH is inversely correlated with the logarithm of proton concentration. If the concentration of protons increases, pH decreases. If the concentration of protons decreases, pH increases. We term pH=7 as neutral, any pH that is lower than 7 as acidic, and any pH that is higher than 7 as basic. The pH scale is a relative one so that while a solution of pH=8 is ten times more acidic than a solution of pH=9, both are basic.



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2.Carbon Dioxide (CO2):
This is the gas that is released by burning any organic chemical compound. CO2 is released when we burn gasoline in our cars or coal in a power plant. But fossil fuel burning devices are not the only things that release CO2, as it is also the gas that we (and every other animal) release to the environment as a result of normal metabolic processes. In the cycle of carbon by the Earth, CO2 is captured from the atmosphere by photosynthetic organisms (plants, algae, and many unicellular organisms) using energy from the Sun to "fix" the carbon into organic compounds (such as carbohydrates (=carbon + water)). For all life on the planet that lives in the euphotic zone where enough light is available for photosynthesis to occur, those organic compounds transfer energy from the sun to the energy in food that we eat and fuel that we burn. When we eat that food or burn that fuel, we oxidize the organic compounds by burning them with oxygen, extracting the energy of the sun and releasing the CO2 back into the atmosphere. Sometimes the organic compounds produced by photosynthesis are not eaten or burned but rather get buried deep in the earth and, over millions of years, eventually become fossil fuels (e.g., coal, oil and natural gas). Since the start of the industrial revolution, humanity has both recycled the new photosynthetically-derived carbon dioxide back to the atmosphere (for example when we eat an apple) but has also released additional CO2 into the atmosphere (for example, we drive our gasoline powered car to the store to buy the apple). Thus, the amount of CO2 in the atmosphere has been increasing over the past century. In the 1800's, atmospheric CO2 levels were at about 0.028% of all of the gases (this value is generally expressed in terms of parts per million or ppm; 0.028% = 280ppm). Today, atmospheric CO2 concentration has reached 370 ppm, and climate models predict that by the year 2100, atmospheric CO2 will reach between 750 and 1,000 ppm. The modeled increases in CO2 are dependent on different scenarios of human activity, with the 1,000ppm value reached in the "business as usual" scenario where people continue burning fossil fuels at the present rate. The lower value is from a scenario where additional CO2 input into the atmosphere from fossil fuels is dramatically reduced. The fact that even in the reduced emissions scenario, atmospheric CO2 concentration will continue to increase represents a largely unavoidable consequence of human activity. Even if 100% of fossil fuel use were ended globally today, atmospheric CO2 would still rise over the next century to about 500 ppm. So a future increase in CO2 is unavoidable.

3. Alkalinity: Alkalinity is a term used to describe the ability of a solution to absorb additional protons and thus avoid changes in pH. If a proton is released into a solution, it can be bound by another molecule with a net result that the proton is no longer in solution, and thus doesn't affect pH. In chemistry, we call such proton-binding molecules "buffers", and in the ocean or marine aquarium we also have buffering molecules that in total are referred to as "Alkalinity". In ocean water, the primary buffering molecules are the carbonate and bicarbonate anions, which are about an order of magnitude more concentrated than the next most abundant buffering anions such as bromide and borate anions. Aquarium salts contain a much higher percentage of borate anions than natural seawater, which gives the artificial salt mixes a greater alkalinity. Reef aquarium 2-part mixes to raise calcium and alkalinity also contain a greater amount of carbonate ions than in natural seawater to provide additional alkalinity in the reef aquarium.

When ocean water is in contact with the atmosphere (air), CO2 from the air dissolves into the water. The amount of CO2 that dissolves is dependent on the CO2 concentration in the air. Dissolved CO2 reacts with water to form carbonic acid (H2CO3). This acid dissociates into a bicarbonate anion (HCO3-) (an anion is a negatively charged ion) and a proton, and the bicarbonate anion further dissociates into a carbonate ion (CO32-) and releases an additional proton. These reactions are driven by equilibrium states between dissolved CO2, carbonic acid, bicarbonate ion and carbonate ion concentrations. Increased dissolved CO2 concentration results in increased formation of bicarbonate and carbonate anion species, and thus drives a reduction in pH since formation of those anions is accompanied by release of protons.

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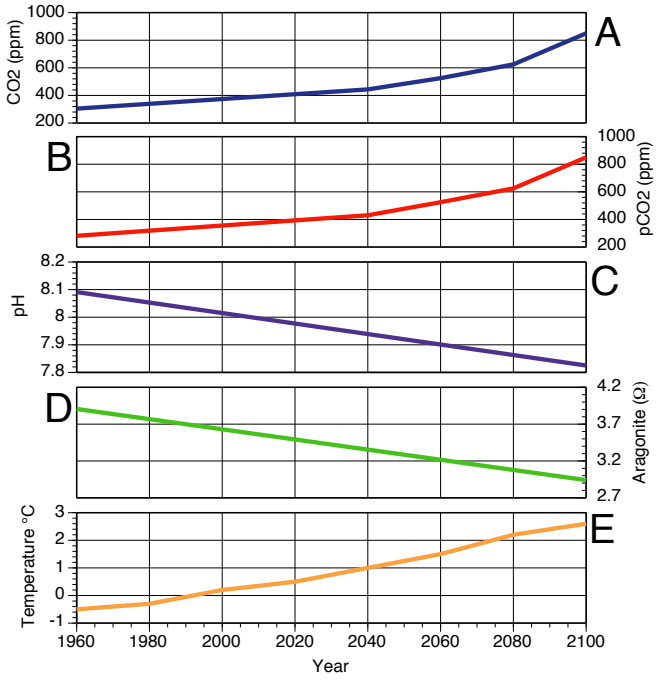
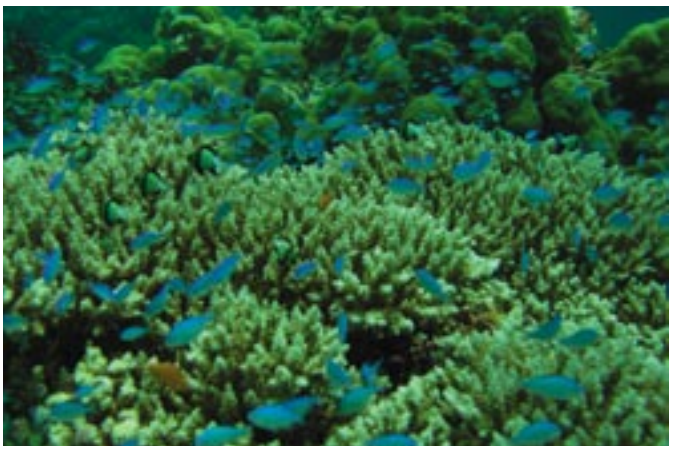


Although those carbonate anions are buffers that increase alkalinity, their formation from carbonic acid also causes the release of protons (unlike the addition of carbonate ions in aquarium 2-part buffers, which have a high pH). So, with increasing atmospheric CO2 and without additional sources of buffers in seawater, the pH of seawater will decrease and become acidified.

What are the consequences of ocean acidification on marine organisms? The answers to that question are presently being hotly pursued by researchers around the globe. It is likely that acidification will impact organisms in multiple ways, including both impacts on calcification and impacts on physiological energetics for both calcifying and non-calcifying organisms. Calcification is the process by which organisms deposit calcium cations and carbonate anions together in the mineral calcium carbonate. This process, also termed biomineralization, is complex and not yet fully understood. What is known is that the formation of calcium carbonate is directed by specific proteins and occurs within specialized cellular compartments. Organisms use energy both to make the specific proteins and to increase the concentration of calcium and carbonate ions in the specialized cellular compartments so that biomineralization occurs. Calcium carbonate mineral crystals are formed into two different predominant structures: aragonite and calcite. Although the chemical composition of aragonite and calcite are the same, because of differences in their physical structure, aragonite is less stable than calcite and will dissolve in seawater if that water is naturally low in calcium cations or carbonate anions. Calcite will also dissolve in seawater, but because it has a physical structure that is more stable, calcite structures will not dissolve in seawater that is corrosive to aragonite structures.

Most calcifying organisms biomineralize calcium carbonate to calcite, but corals make aragonite, and thus coral skeletons are likely to be impacted by smaller changes in water chemistry. The term “aragonite saturation” is a measure of how corrosive the seawater will be to aragonite calcium carbonate, and basically is an index of the calcium and carbonate ion content of the water. High aragonite saturation will prevent aragonite dissolution, whereas aragonite structures, such as coral skeletons, will dissolve in low aragonite saturation water. Aragonite saturation is also dependent on water temperature and water depth (= pressure) as both of those factors relate to the ability of calcium and carbonate ions to exist together in a dissolved state. Increased atmospheric CO2 will drive the aragonite saturation state lower because of the fact that 2 protons are released for every one carbonate ion formed, and thus the available carbonate alkalinity will be exhausted binding those protons and forming bicarbonate ion. Lower aragonite saturation state means that it may be harder for corals to form skeletons, and may result in the net erosion of coral reefs.

Some scientists hypothesize that coral reefs may be extinct by the end of the 21st century as a direct result of ocean acidification. However, as mentioned previously, the biomineralization process is not well understood and also occurs in specialized structures covered by biological tissues. If corals can make physiological adjustments or adaptations to increase ion pumping rates to favor biomineralization, and are not limited by energy availability to power that ion pumping, then they may be able to maintain aragonite skeletons under living tissue so that the skeleton is not directly bathed in seawater. For corals, much of their energy comes from Symbiodinium (zooxanthellae) photosynthate, and rising temperatures that result in bleaching reduce that energy supply.
So, corals may face a double whammy of increasing temperature AND acidification, and that double whammy may be the death knell for coral reefs in the wild as we presently know them. But, because in reef aquaria we can do a better job of managing water chemistry to be as favorable as possible for corals, reef aquarists, both professional and hobbyist alike, will play an increasingly important role in the protection and preservation of coral biodiversity.



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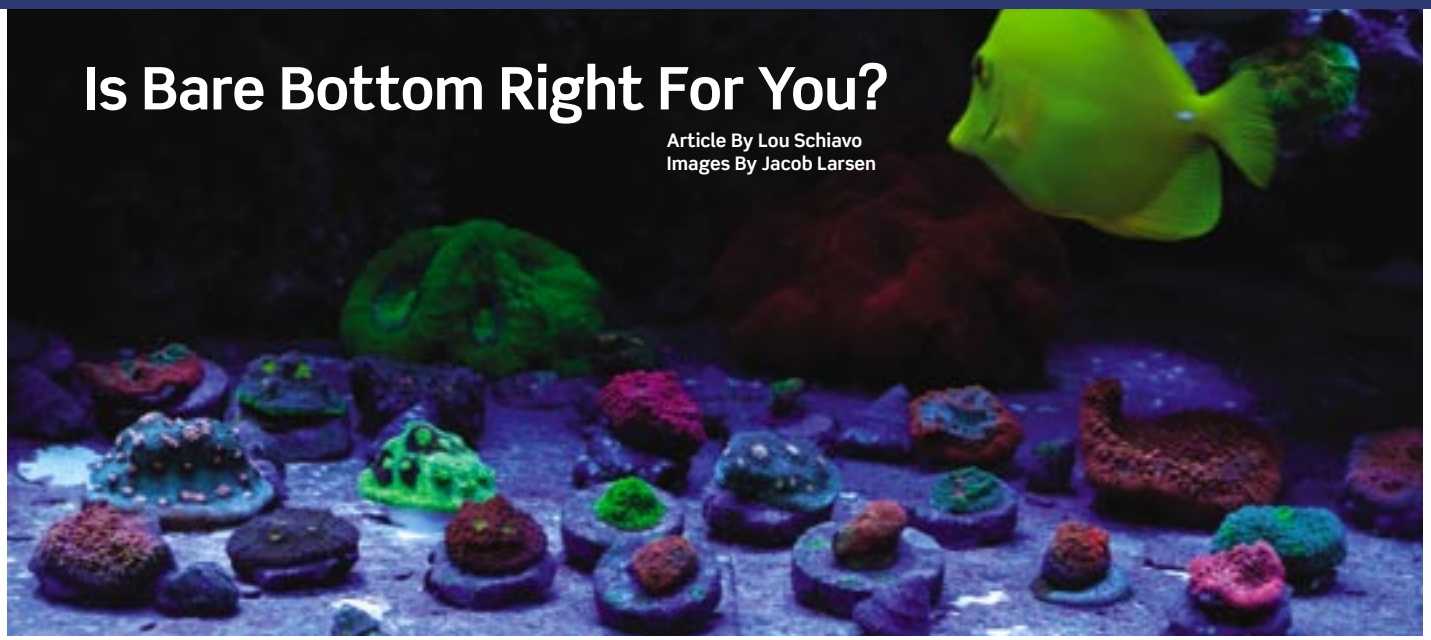
Is Bare Bottom Right For You?

Article By Lou Schiavo
Images By Jacob Larsen



I want to start this article off by stating that running a bare bottom aquarium is not any better or worse than running an aquarium with a sand bed. I wrote this article with the intent to provide enough information for the reader to make a conscious decision on what is best for their aquarium. Every person has their own wants, needs and desires. In our store, we run over 4,000 gallons of reef tanks without the use of sand beds and have incredibly healthy, vibrant and thriving aquariums. Our aquariums achieve some of the most amazing coral coloration we've ever seen from a closed system.

Before delving into bare bottom methodology, let's review the most popular tank bottom options so that you, the reader, can make an informed decision on which method is best for you. Here are the three most popular choices: (1) Deep Sand Bed ('DSB'), which is generally considered to be a substrate with a depth of at least 3 inches, (2) Shallow Sand Bed ('SSB'), generally 1 to 3 inches of substrate depth, and (3) Bare Bottom ('BB'), in which no substrate material is used at all, and is the focus of this article.

Deep Sand Beds are usually 3 to 6 inches deep and are often composed of 'sugar fine', round, calcareous sand. Sand sifting organisms will keep the top few inches stirred and will help allow water circulation to penetrate to the deeper parts of the sand bed. Some examples include fighting conch, nassarius snails, sand sifting gobies, starfish and sea cucumbers. It is very difficult to deliver high flow in an aquarium with a deep sand bed without disturbing the substrate. DSB's can become quite biologically 'rich' over time and there is good reason for concern if old, deep sand beds are suddenly disturbed. The resultant release of nutrients and various chemicals can easily compromise water quality in an established tank.

Shallow Sand Beds are generally composed of fine sand or the more course aragonite, and are usually 1 to 3 inches deep and just like the DSB, the substrate will have a tendency to blow around in a high flow aquarium. This factor alone is something to consider before deciding on any type of sand bottom aquarium.

Bare Bottom (BB) aquariums use no substrate and provide hobbyists with greater control over the nutrient level in the aquarium. Remember that all but the shallowest sand beds are capable of storing large amounts of organics. Bare Bottom systems facilitate the physical removal of waste, enhance the flow in the tank, and

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remove the danger of sand blowing around the tank (and perhaps settling on your coral). Additionally, some aquarists simply prefer the clean look of a Bare Bottom aquarium.

There are a few things to consider when choosing to set up a Bare Bottom aquarium. First, it may be difficult or impossible to sustain sand dwelling and sand sifting fish and invertebrates. If you have your mind set on these types of fish and invertebrates in your aquarium, then a Bare Bottom system may not be for you. Another thing to consider is COMMITMENT to your aquarium, especially when first setting up a Bare Bottom system. If you use live rock, you will probably be siphoning out piles of sand and detritus from the bottom of your aquarium over the course of the first few months. Also, you must commit to purchasing the essential equipment for your aquarium including a powerful protein skimmer and enough power heads to create a high level of water flow in your tank. It is also a good idea to invest in power heads that have the capability of being driven by a controllable wave maker. Your corals and fish will love the random flow! You will also want to blast any silt off of your rocks regularly with a power head. This will allow the detritus shed by your rocks to be moved up into the water column where the flow will take it down to the mechanical filtration in the sump to be removed. Over time, blasting the rockwork will become less necessary. You may also want to consider using a Berlin style sump with filter socks for mechanical filtration to trap particulate matter. Remember to clean the filter socks regularly to avoid any nitrate build up in the system. I feel that heavy, wet skimming (tea colored light brown or green) is one of the keys to success for a Bare Bottom system. The Bare Bottom concept revolves around high flow rates to keep the waste and detritus off of the bottom of your tank, accompanied by heavy, wet skimming and physical filtration to eliminate the waste and detritus from your system.

A large clean-up crew is also recommended so you may want to stock up on invertebrates like snails and hermit crabs. We recommend one of each per gallon.

If your aquarium is made of acrylic, it can be run as a Bare Bottom tank without the use of any bottom protection. If your aquarium is glass, however, you should consider using a sheet of Starboard as a protective buffer for the glass on the bottom of the tank. Starboard is a marine grade polymer that is resistant to saltwater. It was created to be used on boats in the marine boating industry and you may be most familiar with this material in its use for kitchen cutting boards. In a glass aquarium, it will protect the glass in case of a collapse of your rock structure. Starboard comes in different colors but once the system gets going, it will probably end up covered in purple coralline algae. Coral are quite capable of encrusting onto this material as well. Starboard is available in many different sizes and thicknesses. We are partial to using a 1⁄2 inch thickness which is easily enough to protect the glass bottom of the aquarium. Starboard is available on line or you can find it locally through a plastic company or marine boating center.

PREPARING AND CUTTING STARBOARD FOR AN AQUARIUM

Step 1

It is very important to make an accurate template before you start cutting. Get a big enough piece of cardboard to cover the entire top of the aquarium. Lay the cardboard over the top of the aquarium.

Step 2

Secure the cardboard so that it does not move or shift while you outline the aquarium. We use painter masking tape since it is strong and easy to remove without leaving behind residue. Make sure your outline is as accurate as possible to avoid a costly cutting mistake. Upon finishing the outline, you can use a utility knife to cut off the excess cardboard. By now you should have a completed template.

Step 3

Once you have the template ready to go, relocate outside to begin cutting. Starboard is easy to work with and cut but is a little messy. Once you match your cardboard template with the Starboard, you want to outline the template with a marker so that you will have the guidelines to follow for your cut.

Step 4

Once you have marked an outline on your Starboard and you are sure it is as accurate as possible, you can proceed to cut. We have found a jig saw (as seen in this picture) to be the best tool for cutting Starboard, especially when cutting bow fronts, and around overflow boxes.

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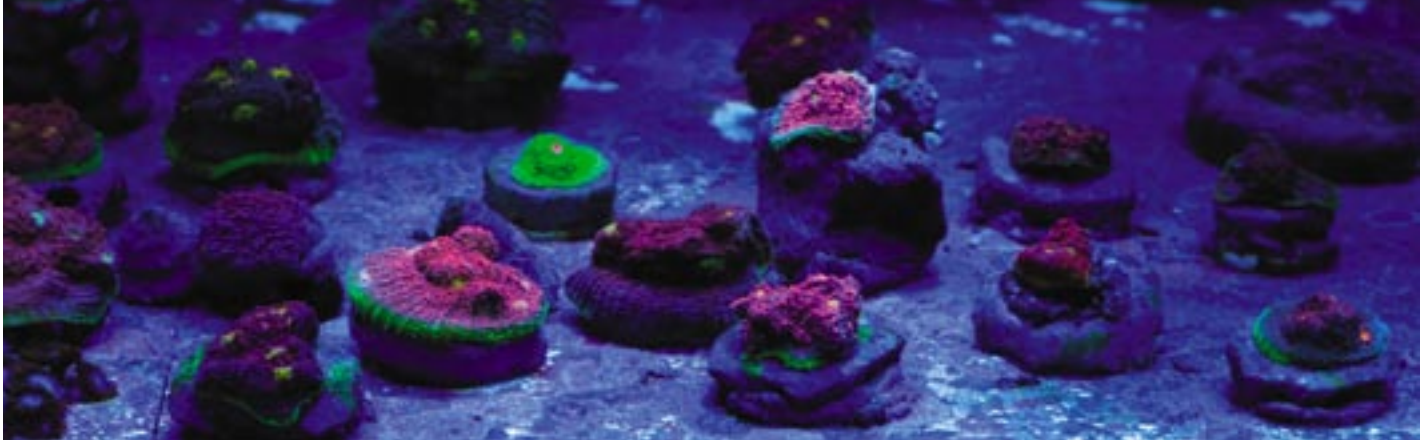

Another consideration in setting up a Bare Bottom system concerns the rock you are planning to use in the tank. If your rock has been established in your system for several years, then you may want to simply give it a good dunking and a vigorous shake in a bucket of saltwater. This will loosen and remove some of the less impacted sediment that has built up on the surfaces of the live rock. Another technique many people have used and which has proven to be successful is "Cooking" the live rock. "Cooking" rock entails removing the rock from the display and placing it into a holding tank or barrel. The rock is kept in total darkness for a period of time. This will retard the algae growth on the rocks and eventually kill off all the algae plus minimize the debris and "shed off" that usually occurs in the initial stages of a Bare Bottom system.

To sum it all up, it is up to you to choose what method is best for your needs and the amount of time you will invest in your aquarium. Each system has its advantages and disadvantages. Any of these methods can be successful as long as you provide the proper set up and maintenance needed in order for your aquarium to succeed. The choice is yours and ultimately a large part of the success of your aquarium will depend on decision making based on solid information. I hope some of what I presented here is helpful as you make these decisions for your system.

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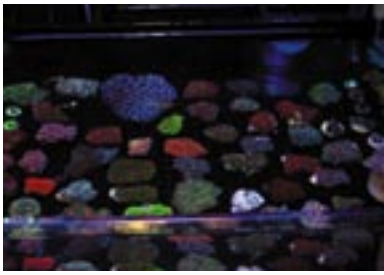
Reef-A-Palooza

Images by Leo Chen

Reef Hobbyist Magazine would like to congratulate Reef-A-Palooza on a successful 6th year as the preeminent reefing show in the west coast. The booths were filled with some of the most innovative farmers and manufacturers in the industry and the aisles were packed with attendees.

This past October, Greg Carroll and the Southern California Marine Aquarium Society, the group behind Reef-A-Palooza, dazzled us with over 85 exhibitors (almost half were livestock booths!) and over 2,000 attendees showed up for this massive event! What will Reef-A-Palooza bring us this year? You're sure to hear it first in Reef Hobbyist Magazine, Reef-A-Palooza's official sponsor, so stay tuned! (reefapalooza.org)



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