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George Bell has been diving for close to 30 years and has been active in diving positions at aquariums for 15 years. Few people ever dive in a 200,000-gallon reef tank, but George does and tells us about it here.



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Richard Aspinall is a freelance writer and photographer from Yorkshire, England. Many dwarf angels are attractive, but Richard explains why the ubiquitous Coral Beauty is ideal.



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Gordon Greenley is a veteran marine aquarist and experienced marine breeder. Gordon knows you have a problem with nuisance algae and provides solutions here.



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KOMODO: AN AMAZING REEF!

Sabine Penisson is a professional reef-life photographer and RHM's photo advisor. Join Sabine on her wondrous dive expedition to chronicle the reef life of the Komodo coast.

Ecsenius bathi by Sabine Penisson.



ANNOUNCEMENTS

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RHM-SPONSORED EVENTS

(latest issue available at these events)

- **Reef-A-Palooza California:** October 10-11, Costa Mesa, CA – reefapaloozashow.net
- **Mid-Atlantic Marine Aquarium Expo:** October 17, Virginia Beach, VA – midatlanticmas.org/mamax-2015/
- **Aquatic Experience:** November 6-8, Chicago, IL – aquaticexperience.org
- **Cincy Reef Frag Swap:** November 7, West Chester, OH – cincyreef.com
- **Reef Currents:** March 19, 2016, Houston, TX – reefcurrents.org

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Let's Start A Story



STEINHART'S 212,000-GALLON REEF: A DIVE BEHIND THE SCENES

G.A. BELL
Images by Will Love.

As one of the world's largest indoor coral reef tanks, the California Academy of Sciences' Philippine Coral Reef exhibit gives viewers a great look at a coral reef ecosystem.



The author prepares to drop into the tank for a dive show. The heads of broccoli are placed in holders in the tank and provide both nourishment and environmental enrichment for the fish.

The fascination of observing colorful fish and their behaviors, the satisfaction that comes from watching corals thrive, and the contemplative calm of tank maintenance—every reef hobbyist knows these feelings. I get to have them too, but I don't own a fish tank. Actually, I'm not a reef hobbyist either. Come to think of it, I'm not even close to what I'd call a "fish person."

And to be sure, my relationship with fish tanks comes from a different perspective than that of most reef hobbyists, too: inside the tanks—big tanks.

I'm a volunteer scuba diver at the California Academy of Sciences in San Francisco. This approximately 160-year-old institution, showcased in a 21st century museum, is the home of the Steinhart Aquarium and its numerous exhibits of aquatic life.

The aquarium's most prominent feature is the Philippine Coral Reef exhibit. This 212,000-gallon tank reflects the Academy's 40+ years of research in that 7,000-island archipelago, with approximately 1,200 Philippine fishes of 110 species and 500 specimens of 70 coral species. Visitors view all of this through five acrylic windows, the largest of which is 15 feet high by 30 feet wide.

Any reefer well knows that a tank like this is going to need some care. Imagine a 50-gallon tank and multiply that 4,240 times. And that's only one of three tanks that the Academy's 60 volunteer divers routinely service.

We do most of the day-to-day cleaning, as well as other tasks assigned by the biologists who manage the exhibits and who also dive in the tanks regularly. We interact with guests during twice-daily underwater dive shows as well as through numerous chance encounters throughout the building. I have yet to hear anyone—diver, non-diver, volunteer, or visitor—disagree when I claim we have the best jobs in the building!

We spend a lot of time doing the same things reefers do, but on a larger scale: scrubbing algae off the windows, picking up debris, siphoning detritus from the tank bottom, and clearing filter intakes. At times, we hand or target feed animals such as anemones, or assist with fish-herding tasks, such as helping to remove fish for medical care or relocation. No water changes for us though; there's a dedicated staff that takes care of the Academy's 100+ life-support water systems.

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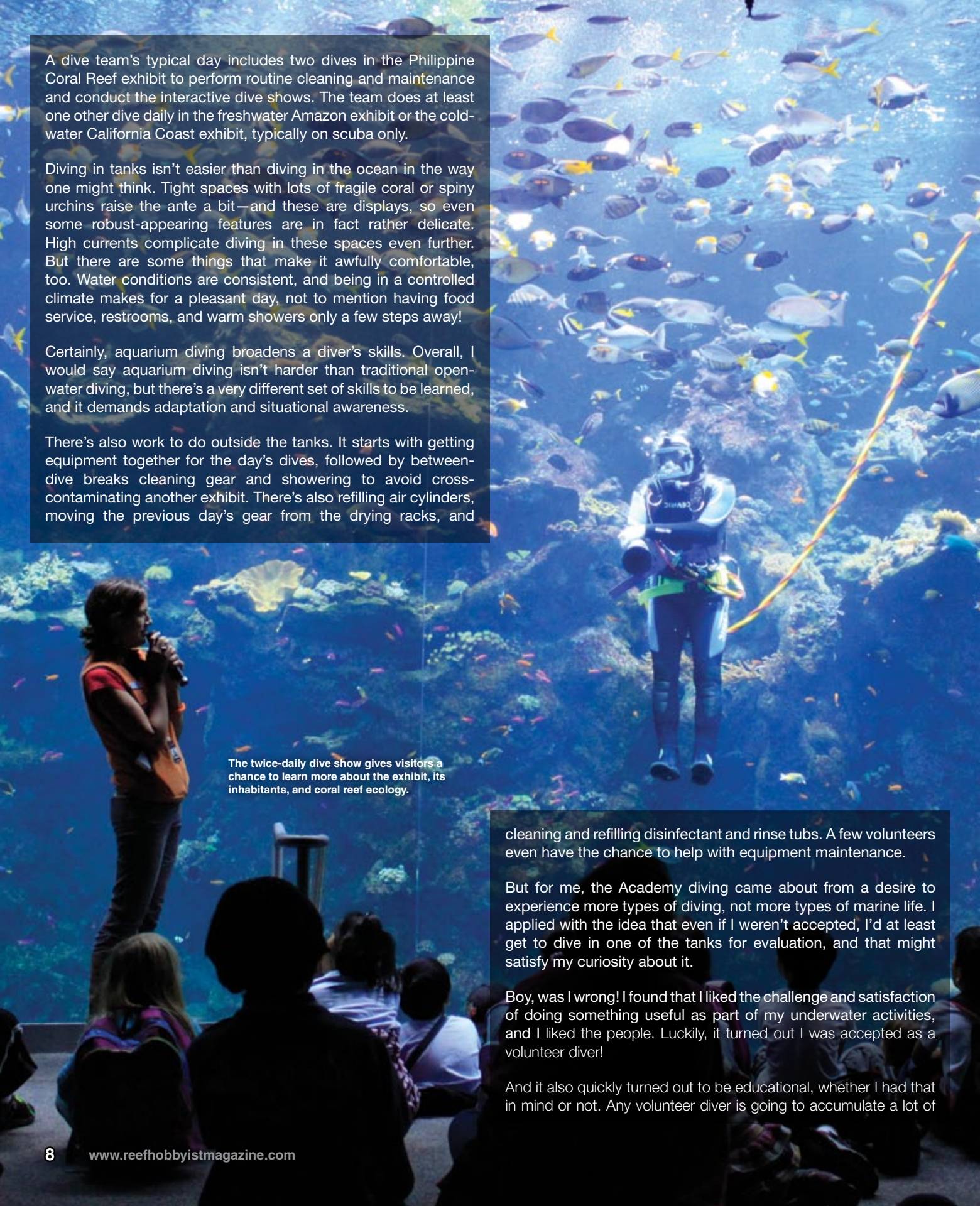
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A large underwater scene with a diver in the center, surrounded by many colorful fish. The diver is wearing a blue wetsuit and a mask, and is holding a yellow and orange rope. The background is a vibrant blue with various species of fish swimming around. The overall scene is bright and clear, suggesting a well-maintained aquarium environment.

A dive team's typical day includes two dives in the Philippine Coral Reef exhibit to perform routine cleaning and maintenance and conduct the interactive dive shows. The team does at least one other dive daily in the freshwater Amazon exhibit or the cold-water California Coast exhibit, typically on scuba only.

Diving in tanks isn't easier than diving in the ocean in the way one might think. Tight spaces with lots of fragile coral or spiny urchins raise the ante a bit—and these are displays, so even some robust-appearing features are in fact rather delicate. High currents complicate diving in these spaces even further. But there are some things that make it awfully comfortable, too. Water conditions are consistent, and being in a controlled climate makes for a pleasant day, not to mention having food service, restrooms, and warm showers only a few steps away!

Certainly, aquarium diving broadens a diver's skills. Overall, I would say aquarium diving isn't harder than traditional open-water diving, but there's a very different set of skills to be learned, and it demands adaptation and situational awareness.

There's also work to do outside the tanks. It starts with getting equipment together for the day's dives, followed by between-dive breaks cleaning gear and showering to avoid cross-contaminating another exhibit. There's also refilling air cylinders, moving the previous day's gear from the drying racks, and

A woman in an orange vest is standing and speaking into a microphone. She is addressing a group of people who are sitting on the floor in front of a large aquarium tank. The tank is filled with colorful fish and coral. The scene is well-lit, and the atmosphere appears to be an educational or interactive session.

The twice-daily dive show gives visitors a chance to learn more about the exhibit, its inhabitants, and coral reef ecology.

cleaning and refilling disinfectant and rinse tubs. A few volunteers even have the chance to help with equipment maintenance.

But for me, the Academy diving came about from a desire to experience more types of diving, not more types of marine life. I applied with the idea that even if I weren't accepted, I'd at least get to dive in one of the tanks for evaluation, and that might satisfy my curiosity about it.

Boy, was I wrong! I found that I liked the challenge and satisfaction of doing something useful as part of my underwater activities, and I liked the people. Luckily, it turned out I was accepted as a volunteer diver!

And it also quickly turned out to be educational, whether I had that in mind or not. Any volunteer diver is going to accumulate a lot of

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Not all of the Philippine Coral Reef tank is at diving depth; this shelf area at the top of the exhibit offers a close-up view of life in the shallows.

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new knowledge. For a reefer, it's a wealth of new perspectives. For someone like me, it's horizon-broadening exposure to things I'd never really thought about.

There's no way to dive in the tanks regularly without starting to identify individual fish—not just species. A diver starts noticing certain fish behaviors as well, reinforced by seeing these fish regularly rather than momentarily. We learn individual fish behaviors, territories, and personalities. I might add, too, that the fish also learn about the divers—or they at least become comfortable with us in a manner they wouldn't be in the wild.

One of the ways this accumulated knowledge comes in handy and grows is through public contact. The tops of the Academy's largest tanks are in full public view and ripe for over-the-railing conversation, so divers field a lot of questions and comments as they prepare for and exit from dives or transit the public floor.


And that goes to yet a further dimension in the Philippine Coral Reef tank. It's in this tank that the Academy features twice-daily dive shows in which a diver—yes, usually one of the volunteers—uses a diving system with built-in communications. The diver discusses the Philippine reef system, coral reefs in general, and marine ecology and conservation through a microphone-wielding presenter who does the direct audience engagement, including passing questions on to the diver.


We're truly part of the public experience, so it's a great chance to not just enjoy the diving, but to pass on one's love for the oceans and their animals. We get to share messages on issues affecting ocean health with folks who might otherwise not be exposed to this information. And maybe, just maybe, we can start someone else on the path to caring about and even having passion for the marine environment.

Did I say love and passion? That's not like me—I'm not a fish person.

But whatever sort of person a diver might be, there's no doubt diving at the Academy is a great gig, be it for the knowledgeable reef hobbyist or someone who simply loves diving itself. The education has been the part that'll have the longest-lasting impact on me, but it's fun every day too, and even cathartic. Like all volunteers, I have an outside life—and like all people, there are times I bring some residual worry or aggravation with me to the Academy. What's significant, though, is that no matter what's on my mind when I walk in the door, I always feel better when I walk out. That's another thing you can't say for many jobs!

And I must add, that even for someone who's not a fish person, the awareness and interest I've gained through my years at the Academy is rubbing off a bit. My seven-year-old daughter has developed her own passion for the ocean and ocean life. She loves visiting the Academy or any aquarium we can visit, not to mention any days we can get at the shore.

Now she wants a pet. And I think we all know that children's pets are as much the ward of the parent as of the child, so we're working on an idea we both like: We're looking into setting up a fish tank. 



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Centropyge bispinosa

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RICHARD ASPINALL





Dwarf angels are understandably one of the most popular genera of fish in the marine aquarium hobby. They are also one of my overall favorite groups of fishes. Dwarf angels reside in the *Centropyge* genus, which is contained within the family Pomacanthidae.

This family contains a further six genera populated with species that can be thought of as the dwarf angels' distant relatives. Looking at the Pomacanthids reveals a group with species that are not always easy to maintain in captivity. Many, such as those in the genus *Pomacanthus*, are large fish with boisterous natures. Others can be difficult to acclimate to aquarium life. The monotypic Regal Angelfish (*Pygoplites diacanthus*) is a good example of this. In my opinion, of all the angels, the best are the dwarfs—the good old *Centropyge*.

Before looking at the Coral Beauty (*Centropyge bispinosa*), it's worth quickly noting some of the other beautiful fish from this genus. As I understand it, there are 33 species in the genus *Centropyge*. Many are mainstays in the trade, such as the Flame Angel (*C. loriculus*) and the Lemonpeel (*C. flavissimus*). Some are a little rarer and not considered practical for those without lots of experience (for example, *C. bicolor*). Other dwarf angels from limited geographical ranges that are not commonly imported (such as *C. jocularis*) command high prices and are often destined for the wealthiest fish collectors. On occasion, species with overlapping geographical ranges produce hybrid offspring that sometimes find their way into dealers' tanks. I particularly like hybrids between the Half Black and Lemonpeel Angelfish (*C. vrolikii* × *C. flavissimus*), and these hybrids seem to be fairly common in U.K. stores.

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Half Black Angelfish usually don't nip corals.



Lemonpeels are well known to nip corals.

I've chosen to look at the Coral Beauty because in my experience, it is one of the most readily available of the genus, is easy to feed, and adapts to aquarium life with ease. The Coral Beauty is perhaps the ideal beginner's angel. Having said that, do not think to buy one without making sure your tank is ready. While these fish are considered relatively easy to care for, they are not disposable and deserve the very best of care.



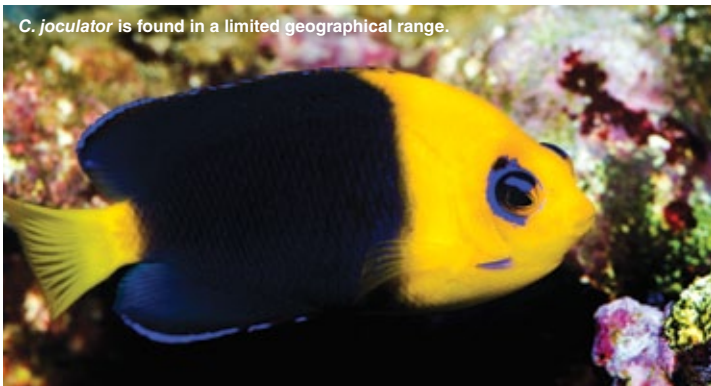
This is a Half Black x Lemonpeel hybrid.

extent as they mature. That's not the case with this gem. With its rich amber body overlain with blue and purple—and of course the stunning electric blue margins on its fins—this fish is dressed to impress. We might be used to seeing this common fish in the stores, and we may drool over a rare *C. interruptus* while walking past the Coral Beauty, but take a moment and really look at any specimen—they are truly gorgeous.

In the wild, these fish are found throughout suitable habitats in the central Pacific Ocean and across Indonesia in relatively shallow waters of 15 meters or less—ideal for easy catching without the stress caused by raising a fish from depth, as is the case with some rarer angels. Various morphs can be found across their range with some fish being almost entirely purple and others with far more orange. I have read that color variants may also relate to depth of collection, but I cannot personally attest to that. It's worth noting though, that the Coral Beauty stays a beauty as it matures. So many other fish seem to lose their colors to a greater or lesser

DWARF ANGELS IN THE AQUARIUM

Let's cut right to the chase here; dwarf angels do have a reputation for being coral nippers, and when I say that, I should add that it's not just corals, but clam mantles, gorgonians, and in the case of one specimen I owned, even xenia! *Centropyge* angels vary though in their propensity to nip. Lemonpeels are universally nippers, whereas Flame Angels may or may not be. My experience suggests that just as with Half Black Dwarf Angels (*C. vrolikii*) and Cherubs (*C. argi*), Coral Beauties usually don't nip, but on occasion might



C. jocularis is found in a limited geographical range.



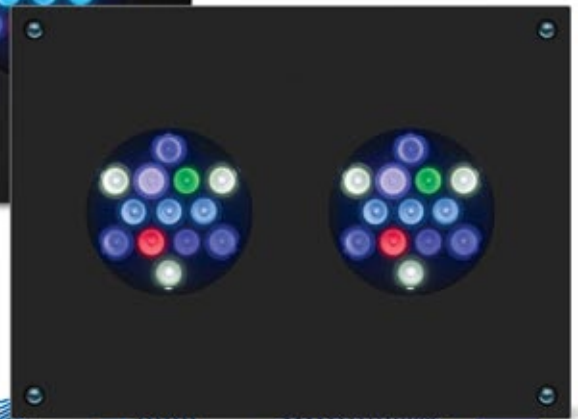
Flame Angels may or may not be coral nippers.

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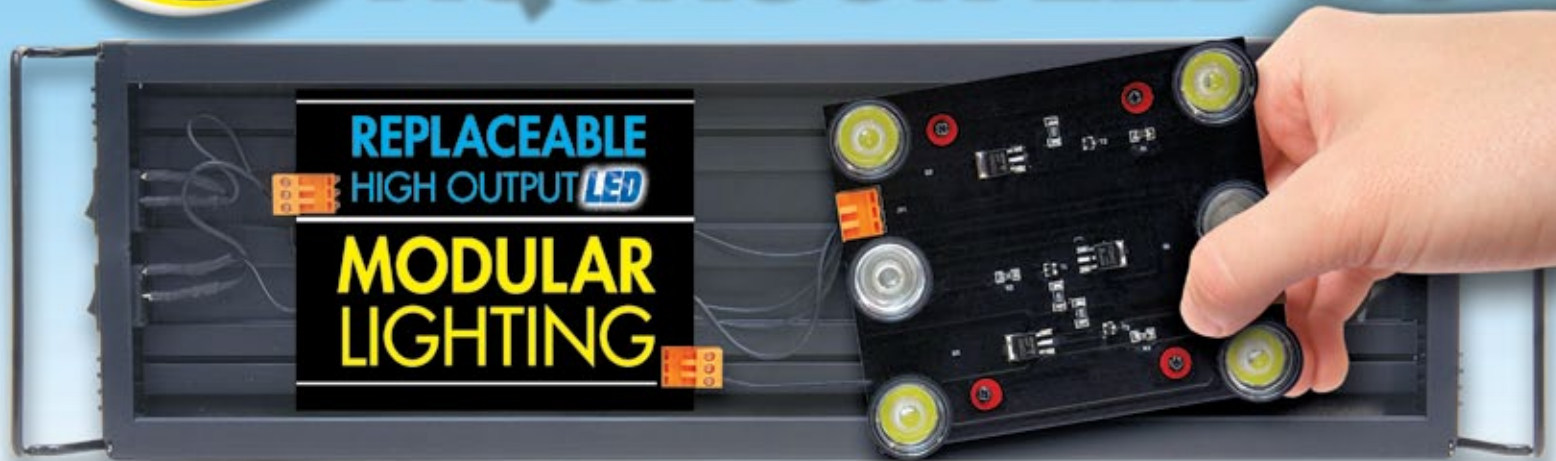
if the temptation is strong enough and the individual fish is so inclined. Basically, all *Centropyge* may nip your corals, but of them all, I think the least likely to do so is the Coral Beauty. The only way to be absolutely sure that nothing will ever get nipped is to avoid the genus entirely or enjoy a fish-only aquarium.

All Coral Beauties start out as females, and like many other marine fish, a dominant fish in a group of young will transition to a male and a harem of three to seven or so fish will be formed. In the closed habitat of an aquarium, the pecking order established in a harem will often result in a concentration of aggression and the eventual death of the lowest-ranked fish, so think twice about keeping multiple Coral Beauties together. It can be done in large tanks, especially when the fish are added together as juveniles, but it's not advisable.

The Coral Beauty, once acclimated to a tank, is a very active fish and will welcome complicated rockwork structures that it can explore looking for morsels of food. In the wild, they are seen picking at the substrate almost constantly, often around growths of algae, but they are not solely vegetarian and also enjoy more meaty foods. I always offered my angelfish a mix of foods, including prepared flake foods containing vegetable matter, frozen *Mysis* shrimp, Cyclopeeze, and sheets of nori. I have also had success with dried food especially prepared for dwarf angels. All were taken with relish, and Beauty, as my fish became known, grew chubby and happy and lived in harmony with several larger tangs and a range of unrelated smaller fish that were happily ignored. I should note, however, that some individuals can be aggressive to newly added fish that they take exception to. I've known some Coral Beauties that have bullied



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damsels and even clownfish on occasion while ignoring other tankmates. So be aware that they are generally classified as semi-aggressive and stock them after smaller and more timid fish.

Choosing a Coral Beauty is fairly straightforward. These alert and active fish should exhibit these same characteristics in a dealer's tank and should react to you and their surroundings. Look also for specimens with a good amount of body fat. Shrunken bellies and hollows behind the gill covers are a sure sign of ill health. Be sure to buy from high-quality vendors and avoid shopping for the cheapest price instead of the healthiest specimen. Lastly, ask the dealer to show you the fish eating; it's always a good sign. Overall though, I would say these are quite robust fish that if treated well will easily survive the shipping process and go on to be quite long-lived (up to a decade or even more) residents in your aquarium.

I don't believe that captive-bred Coral Beauties are available to buy from stores yet, and given the relative ease of collection of this fish, I'm not sure if breeders will shift from focusing on the higher-value Pomacanthids at any point soon, though I would always urge everyone to seek captive-bred fish over wild stock.

CLOSING

The Coral Beauty is one of those fish that most marine aquarists will own at some point in their fishkeeping careers and for good reason. It is attractive, relatively well mannered, rarely a coral nipper, and robust. Isn't this everything you want in a fish? 

DID YOU KNOW?



C. bispinosa is so-called for the prominent preopercular, or cheek, spines the fish displays. While cheek spines are commonplace in the Pomacanthids, I suspect that since this fish was classified in the mid-1800s, it was the first to attract the name. There are, after all, plenty of fish in the genus with two spines. I'd be interested to know if this theory holds up or if it is the result of ill-informed speculation. The species is on occasion referred to as the Two-spined Angelfish.



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A Guide to Common Nuisance Algae: Prevention, Control, and Elimination



Bryopsis sp.

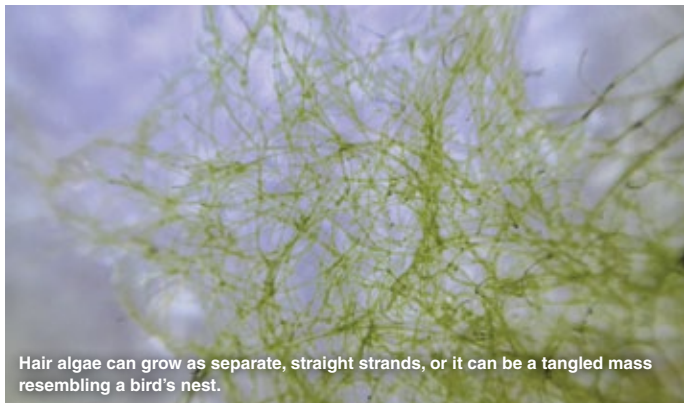
Images by Miguel Tolosa and Gordon Greenley.
GORDON GREENLEY

The algae-free aquarium is a myth. Algae play an integral role in the natural marine environment. They are found all over the world, in the open ocean, on every reef, and in all lagoons; they are also found in every aquarium. Given the proper conditions, some species of algae can quickly overrun an entire aquarium system and can outcompete and overgrow all other inhabitants. As an aquarist, it is important to understand why excess algal growth occurs and master some useful and simple techniques for regaining control of an infested system. The main objectives of efficient algae control are prevention, identification, and eradication. This article will cover the basic information needed to prevent excess algal growth and provide identification and eradication techniques for three of the most commonly encountered species of invasive algae in the marine aquarium.

Algae require three things to live and reproduce—water, light, and nutrients. If an aquarium has all three, then it contains algae. What is critical in battling nuisance algae is knowing how to prevent the algae from experiencing explosive growth. There are many different factors that can cause explosive growth in algal populations.

Although excessive light is often blamed, it is more often excess nutrients that are responsible. Algae are photosynthetic plants, and like terrestrial plants, they utilize nitrate and phosphate for growth. Since nitrate and phosphate can build up in aquariums, they can lead to undesirable (but avoidable) algal growth. The three easiest ways to avoid a build-up of nitrate and phosphate in an aquarium are to feed only as much food as the inhabitants can consume at one time, increase water-change volume and frequency, and add nutritional supplements sparingly. There are also several different types of filter media that can be used to remove nitrate and phosphate. However, if the underlying cause of the excess is not addressed, the problem will persist.

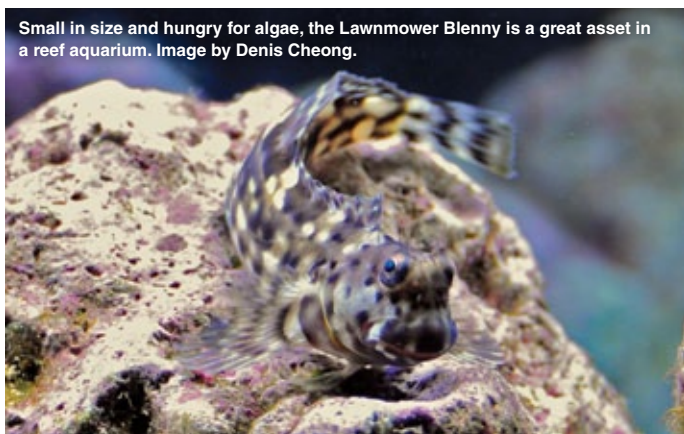
Another way to minimize the chances of invasive algae taking over is to avoid bringing them into the aquarium in the first place. While there is no way to completely prevent introducing algae into an aquarium, it is good practice to examine any new additions for obvious algal growth and attempt to physically remove any that are found. New rocks can be boiled to kill any algae that are too well attached to be removed manually, and some corals, such as zoanthids, can be dipped in a solution of five parts saltwater to one part hydrogen peroxide prior to adding them to the aquarium.



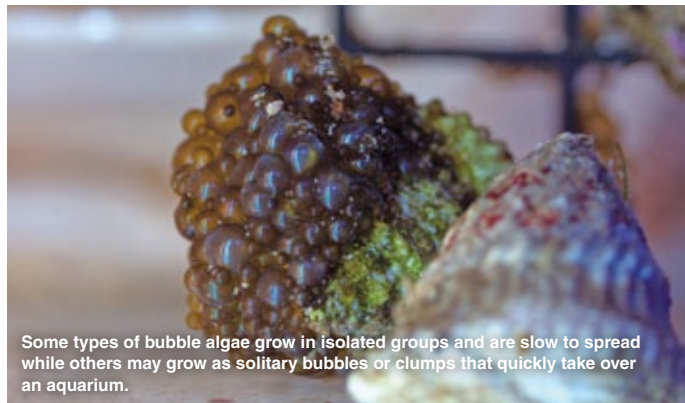
Hair algae can grow as separate, straight strands, or it can be a tangled mass resembling a bird's nest.

One of the most commonly encountered types of nuisance algae found in aquariums is green hair algae. Green hair algae comprise several different species of green algae and are easily identified as somewhat delicate filamentous algae with thin strands. They can grow as small tufts confined to certain locations or extend into large, grassy mats covering entire rough or smooth surfaces. Luckily, green hair algae are some of the easiest to eliminate and are eaten by numerous fish, snails, and crustaceans. Turbo snails, numerous types of hermit crabs, lettuce nudibranchs, and urchins are great grazers to keep in an aquarium and will help prevent green hair algae from growing out of control. Fish such as Lawnmower Blennies (*Salarias fasciatus*) and surgeonfish will also graze on green hair algae, but make sure the aquarium is properly sized for fish such as surgeonfish. If the infestation of green hair algae is too advanced for grazers to tackle, the algae can be siphoned out manually and then starved by removing any excess nutrients in the system.

Another frequently encountered type of invasive algae is green bubble algae (*Valonia* spp.). Like the name suggests, this type of algae generally looks like shiny, green bubbles. The bubbles can be as small as a grain of sand or larger than a golf ball, and they can be found in bunches or as a single bubble. Since this type of algae is so easy to see and identify, one of the simplest ways to avoid having issues with it is to visually inspect new additions for the bubbles. If they are found, depending on their size, tweezers or fingers can be used to gently pull them off the surface where they're attached. If a system already has a large population of bubble algae, manual



Small in size and hungry for algae, the Lawnmower Blenny is a great asset in a reef aquarium. Image by Denis Cheong.



Some types of bubble algae grow in isolated groups and are slow to spread while others may grow as solitary bubbles or clumps that quickly take over an aquarium.

removal is the most effective solution. A siphon hose can be used to gently detach the bubbles from a surface and suck them out of the tank during a water change. Popping the bubbles can lead to the release of spores, which will only spread the problem. Emerald Crabs are known to eat bubble algae. However, they do so by popping the bubbles. Therefore, using Emerald Crabs alone may not solve the problem.

A much harder to eliminate, but commonly found genus of nuisance algae, is *Bryopsis* (*Bryopsis pennata* and *Bryopsis plumosa*). *B. pennata* and *B. plumosa* are green, feather-shaped algae that grow in mats on rocks and sand. They may look similar to some types of

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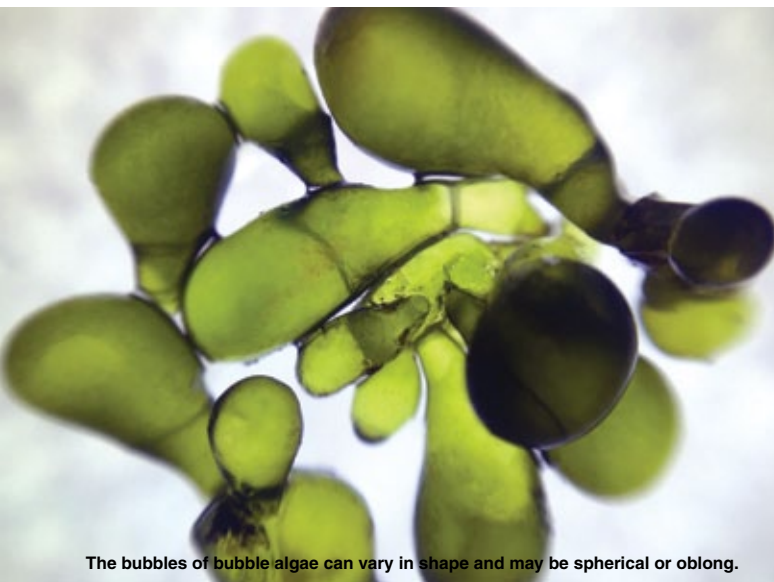


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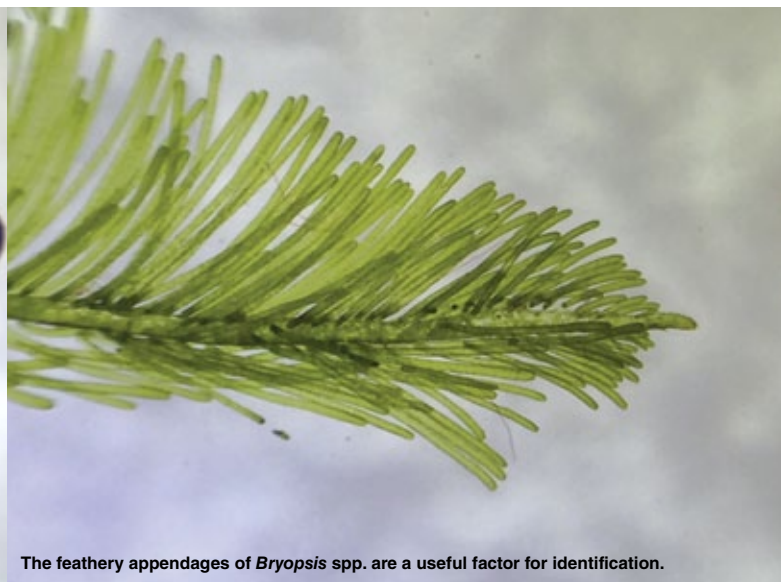
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The bubbles of bubble algae can vary in shape and may be spherical or oblong.



The feathery appendages of *Bryopsis* spp. are a useful factor for identification.

green hair algae, but they are much harder to completely eradicate. This is because they have root-like holdfast systems that are able to take a firm hold on rocks, and if the holdfasts are not destroyed, the algae will grow back. In the best-case scenario, if *Bryopsis* is found on a single rock, the rock can be removed, boiled, and placed in the dark for several weeks. These algae are not to be underestimated. It is imperative to act swiftly and aggressively to prevent them from spreading.

If the rock or surface cannot be removed or the algae has already taken over the entire system, raising the magnesium level 100 ppm every day for 3 or 4 days and keeping it elevated for several days thereafter may kill *Bryopsis*. It is generally accepted that only one specific magnesium supplement, Kent Tech-M by Kent Marine, is capable of killing *Bryopsis* at elevated levels. It is not fully understood why only this product seems to work. Unfortunately, depending on the type of *Bryopsis*, the magnesium method may not work. In my own fight with *Bryopsis*, I have raised the magnesium level to about 2800 ppm out of desperation and found it had no effect. Typically, raising the magnesium level by no more than 100 ppm per day does not harm any of the other organisms in the aquarium, but it is important to approach this method with caution and use a reliable test kit throughout any attempted treatment.

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A lesser-known method that works well for removing patches of *Bryopsis* is to directly apply a pure liquid magnesium supplement to the *Bryopsis* patch with a syringe. To do this, all pumps must be turned off and the water must be very still. Since the magnesium will sink, it can be carefully draped on the algae using the syringe. When using this method, be sure to get the magnesium down into the base of the algae and all over the top. Then let it sit for about 5 to 10 minutes and turn the flow back on in the system. After a few hours, there should be a noticeable color change in the algae, and after a day or two, the algae should be completely gone. I have successfully used this method with Brightwell Magnesium by Brightwell Aquatics. It is important to only do one or two small patches at a time to avoid spiking the magnesium concentration in the system. Also take care not to get any pure magnesium on any corals.

Confronting nuisance algae is something that every aquarist will deal with at some point in their aquarium-keeping career. With some basic understanding of what makes nuisance algae flourish, it is easy to proactively prevent algae from taking hold in an aquarium. Learning to cope with nuisance-algae problems and overcoming their grasp can take the casual aquarist to a new level of aquatic mastery. 

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WHAT A DIFFERENCE A YEAR MAKES

MARCO PARDUN



My name is Marco Pardun, and I am from Dortmund, Germany. As a small boy, my family always had an aquarium at home. My father was a freshwater hobbyist, so I had a freshwater aquarium at a very early age. But for me, marine aquariums were always very fascinating, and I had always wanted one. It wasn't until four years ago that I finally got my chance.

As I write this article, my latest aquarium, named KingsLand, is 12 months old. I started it on June 19, 2014, with the idea that this tank would be a room divider. However, I didn't want the tank to be too big, so I settled on a length of 5 feet.

When I started planning this set-up, a clean and uncluttered look was extremely important to me. I did not want my overflow to be visible inside the display, so I employed an external overflow on the rear of the tank. The life support technology for my system consists of only a handful of components: a Royal Exclusiv Red Dragon 3 return pump, an EcoTech MP40, a Bubble Magus Curve 7 skimmer, a heater, and two media reactors—one to remove phosphate and one to run activated carbon with.

In terms of lighting, I didn't really like any of the fixtures available in the market at the time, so I decided to build my own. The main objective of building my own fixture was not to save money. Instead, I wanted to create a very good lamp design and build it using the best available technology and components. The lamp I





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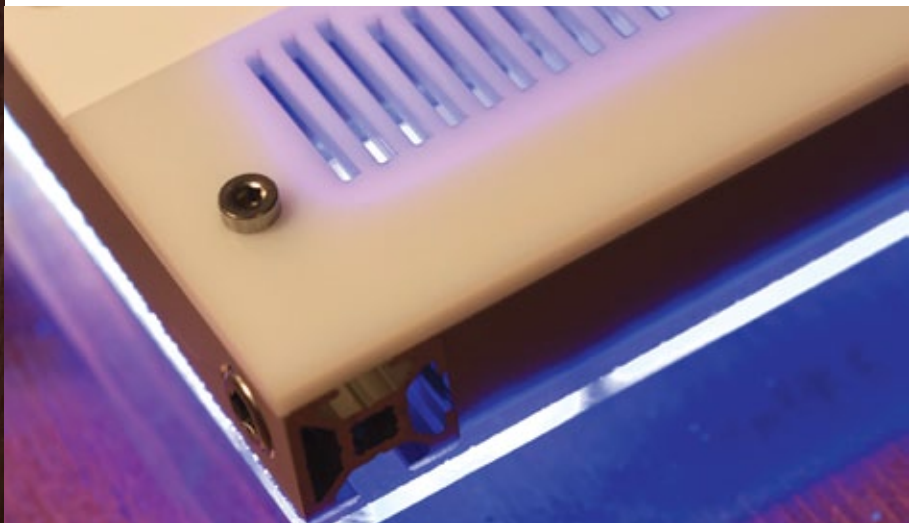
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built does not employ reflectors, but the LED fixture effectively lights up the entire aquascape. Like T5s, the distribution of light is very even. The array is controlled by a BlueTWILED 2.x controller and powered with a 320-watt Netzteil/MEANWELL HLG-320H-24B power supply.

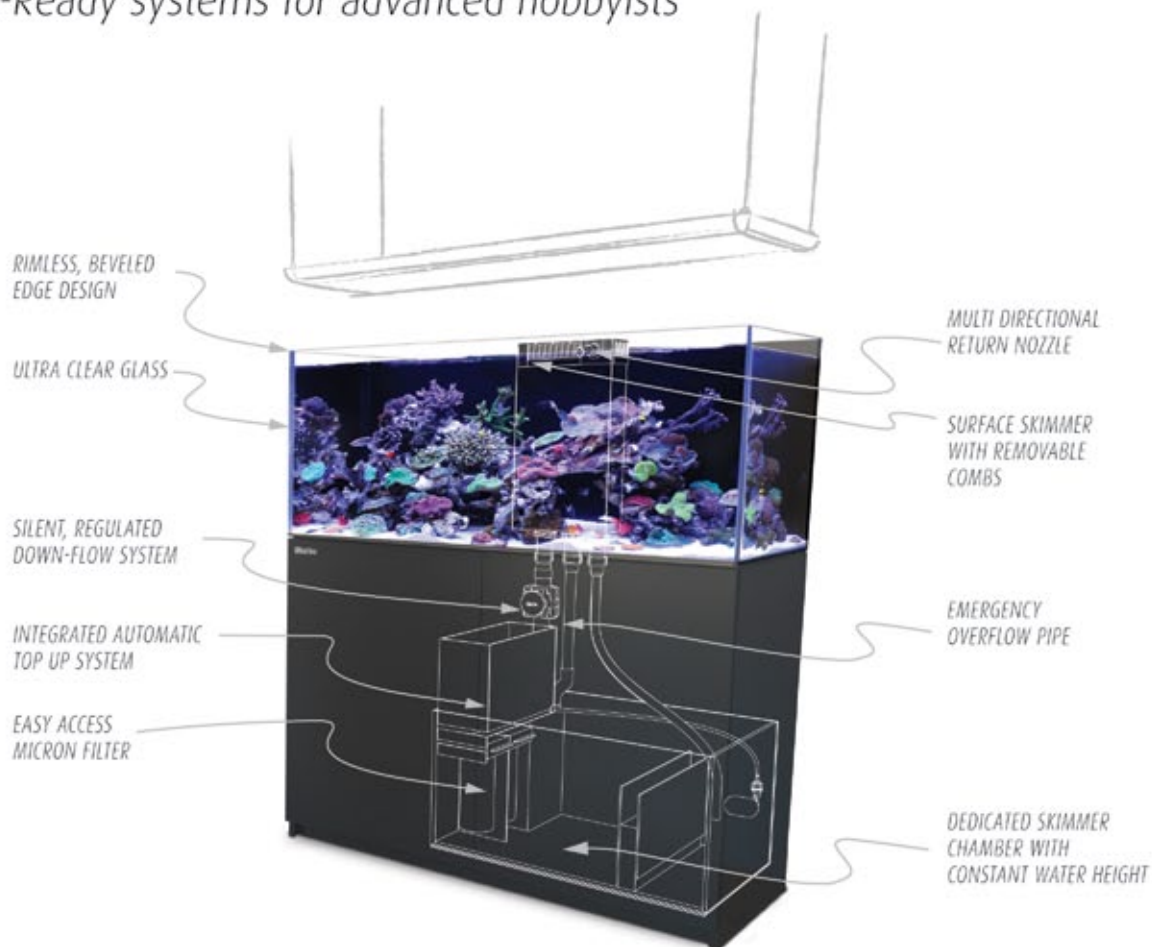
LED COMBINATION

- (28) XM-L T6 Star - 800mA
- (12) arctic blue (430nm) - 500mA
- (20) Cree XT-E Royal Blue - 600mA
- (40) Cree XP-E Blue K2 - 600mA
- (6) deep red (645nm) - 500mA



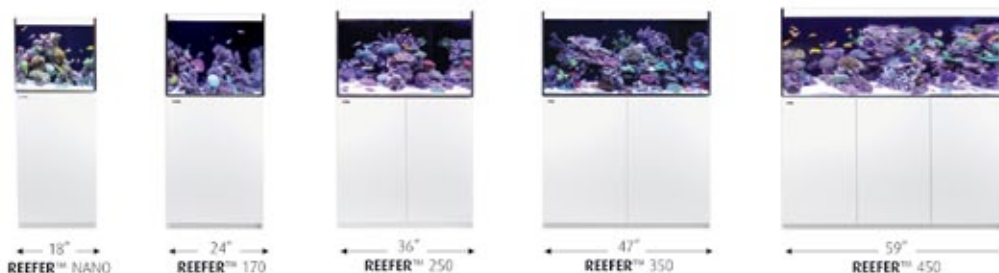
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The tank is maintained using the Triton method, and there has been no other additional dosing outside of what the Triton process dictates. So far, no water changes have been required. Every 3 months, a lab analysis of the water is performed at the Triton lab. With this information, I am able to program my doser to tune my tank's water parameters. Once or twice each week, I feed the corals Nyos Instant Plankton and Nyos PhytoMaxx or live plankton that a friend of mine breeds.

TANK SPECS

- Display: 60 in x 20 in x 20 in (approximately 100 gallons)
- Sump: 35 in x 17 in x 17 in (approximately 40 gallons)

EQUIPMENT

- DIY LED Lamp
- Red Dragon 3 Super Silence pump
- EcoTech MP40 Quiet Drive
- Bubble Magus Curve 7 skimmer
- DIY media reactors
- Eheim heater

SYSTEM PARAMETERS

- Nitrate: 3-5 ppm
- Phosphate: 0.02-0.03 ppm

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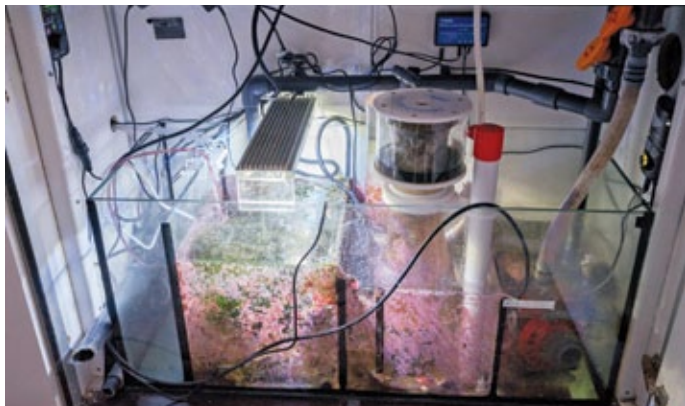
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- Calcium: 430 ppm
- Magnesium: 1350 ppm
- dKH: 7.5–8.0

The tank walls are cleaned daily. Every 4 to 6 weeks, I change the carbon filter, which runs continuously. In addition, I run a reactor to remove phosphate, which I recharge when the phosphate value begins to rise. For this reactor, I use Triton AI99 and ROWaphos media. The Triton method is great because it makes maintenance so simple that I have more time to concentrate on the corals and fish.

FISH & SHRIMP

- (8) Resplendent Anthias (*Pseudanthias pulcherrimus*)
- (8) Chromis (*Chromis caerulea*)
- (2) Flame Hawkfish (*Neocirrhites armatus*)
- (2) Red Saddleback Clownfish (*Amphiprion ephippium*)
- (2) Skunk Cleaner Shrimp (*Lysmata amboinensis*)
- (1) Copperband Butterfly (*Chelmon rostratus*)
- (1) Yellow Tang (*Zebrasoma flavescens*)
- (1) Bluestreak Cleaner Wrasse (*Labroides dimidiatus*)

Over the last few years, I have had the opportunity to get to know a lot of really great people in this hobby who have become very good friends. We are a close-knit community, and when someone sets up a new aquarium, everybody helps. This feeling of camaraderie and community is the most special part of the hobby for me, the part that makes it so worthwhile! 



Whoa!
Bazinga!
Cowabunga!
Holy Smokes!
Shazam!
Zowie!
Wow!

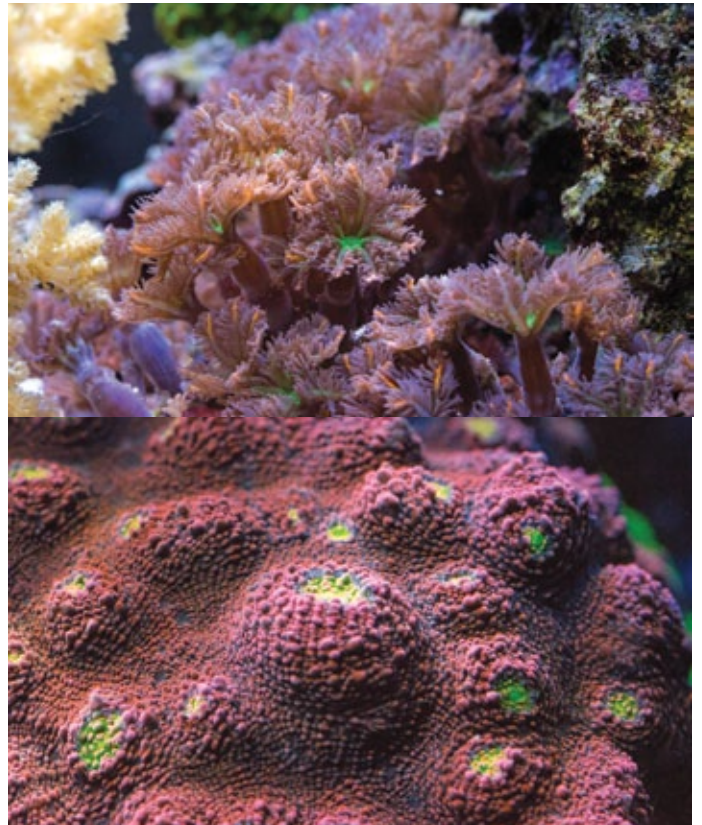
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Astraea snail



Nassarius snail

CHOOSING THE RIGHT SNAILS FOR YOUR REEF

JIM ADELBERG
Images by Eli Fleishauer/Quality Marine.

As responsible reef hobbyists, we need to be quick studies in a variety of skills and topics. Electrical, plumbing, mechanical engineering, and chemistry are all topics that come into play when creating a home reef tank, and that's all before your first trip to the store to acquire livestock. As we begin stocking our tanks, we also must become familiar with our livestock's basic requirements for space, terrain, and particularly, food. These considerations are important for our ornamental charges but equally critical for the clean-up crew that we hope will do the lion's share of surface cleaning and scavenging in our tanks.

Bear in mind that no snail will appreciate poor or fluctuating water quality or any copper-based medications whatsoever. When shopping for snails, pass by any tanks with more than one or two dead snails as that group of individuals may be compromised. Also remember that snails are sometimes mislabeled, and it's your job to be the expert, know what snails you want for which job, and what they look like. Now let's review some of the snails typically offered in stores for your consideration.

ASTRAEA SNAIL (*Astraea tecta*) Also referred to as star snails, these snails are largely herbivores, but will also scavenge moderate amounts of meaty leftovers. They are probably the most common Caribbean snail sold in the hobby and tend to be readily available (more so on the East Coast than here on the West Coast). They are fairly flexible in terms of algae eating and will consume diatoms, hair algae, and to a lesser extent, turf algae and cyano. These are what I'd call a mid-sized snail with adult shell sizes a little over an inch in height. Think twice if you have a nanoreef with delicate corals since these snails can be a bit clumsy. The other issue is that if they fall

on their backs, it's your job to rescue them; they don't have a large enough foot to flip themselves back upright.

CERITH SNAIL (*Cerithium* spp.) Ceriths are often purchased as detritivores to help maintain sandbeds in aquaria, which they do both by consuming uneaten food and through their movement within the sandbed itself. This is a group of snails sourced mainly from the Caribbean and Mexico where they are easily collected in shallow water. Although they are great for sandbed maintenance, they are somewhat flexible and will also keep the rockwork in your tank free of diatoms and other soft algae. They are not particularly useful for the more challenging hair and turf algae though. These are small snails and thus a good choice for a nano with a sandbed if they aren't relied upon solely to keep nuisance algae at bay.

NASSARIUS SNAIL (*Nassarius* spp.) Even more specialized than the Cerith, the Nassarius snail is almost strictly a sandbed dweller and shouldn't be considered for bare-bottomed tanks. They are also one of the most efficient detritivores available for our tanks. The species that is usually sold is *Nassarius vibex*, and these are sourced from the Atlantic, Caribbean, and Mexico. These snails aren't going to do much for the algae on your rocks and glass, but they will keep your sandbed clean and free of uneaten fish food.

STROMBUS SNAIL (*Columbellidae* family) Strombus snails represent a group within the family that includes true conches, and while most of them are grazers, they get rather large. Luckily for us, most snails sold under this name are in fact Dove Snails, which are perfect additions to our tanks. These snails are found



Cerith snail



Strombus snail




Turbo snail

worldwide in shallow tropical waters and are wonderful grazers. Dove Snails stay small, are able to get into the tightest corners of our reefs, and are happy to eat diatoms, soft and leafy algae, some hair algae, and even a bit of unconsumed fish food from time to time. They typically stay off the substrate and do well cleaning rocks and glass-tank walls. They make a good combination with the Nassarius mentioned above.

TURBO SNAIL (*Turbo spp.*) Turbo snails are largish and clumsy, but they do consume a broad variety of nuisance algae and so remain very popular. They hail from the Caribbean and the Gulf of Mexico and are really one of the only choices to keep nuisance

algae from becoming a problem. I'd like to recommend that if you do want to include these snails in your clean-up crew that you purchase a small number early on. The strategy of buying a whole bunch late in the game to handle entrenched nuisance algae is not really a strategy; it's more like an act of desperation. Unfortunately, this is another group of snails that cannot right themselves when flipped, so vigilance on your part is required to make the occasional rescue.

So in summary, know your snails, what they eat, and how they behave in a tank. You'll save yourself a lot of cleaning and aggravation down the line. 

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Image by Tim Wong.

BREEDING THE RINGED PIPEFISH

(*Dunkerocampus dactyliophorus*)

I have been lucky enough to work as a biologist at the California Academy of Sciences for more than 4 years now, and in that time, I have been involved in caring for some amazing animals. From maintaining undescribed octopuses to working on one of the largest living coral reef tanks in the world, I would say I have a pretty sweet day job. I work primarily on tropical saltwater husbandry, although in my early days as an aquarist, I cared for mostly temperate and cold-water animals. My interests have continued to change throughout my husbandry career, and lately I have gravitated toward syngnathids.

The Syngnathidae are a family of fish that includes seahorses, pipefish, and sea dragons, among others. We have a few species of syngnathids at the Academy, and one of my tanks happens to be dedicated to the display of pipefish. When I was first setting up the tank, I wanted to keep only a couple of species of pipefish in it, knowing that the tank is fairly small and that these fish have a tendency to be very aggressive. I also wanted to choose species that weren't going to outgrow the exhibit and would, of course, be pretty to look at and make themselves visible in the tank. The display is a 50-gallon tropical-reef tank with a variety of corals, and it is also home to two Citron Gobies, a Redlip Blenny, and a Bluestripe Pipefish. The system is kept between 78°F and 80°F.

ACQUISITION AND QUARANTINE

In December of 2014, I acquired six captive-bred Ringed Pipefish (*Dunkerocampus dactyliophorus*) from Senior Biologist Janet Monday of the Long Beach Aquarium of the Pacific. The animals

were shipped two to a bag in three bags. The Academy had limited quarantine space at the time, so I decided to leave them in the pairs as they were shipped and quarantine them in some small cube tanks that were connected to a larger system. I was nervous about the possibility of them fighting in their new, cramped quarters. These pipefish have a tendency to fight over mates if they're kept in anything other than a mated pair. After asking Janet how to sex them, I decided it didn't really matter at that time because they were just becoming sexually mature, and it would've been hard to sex them this young anyway. I just hoped these pipefish would get along well enough for their 30-day stay in the cubes so that I could attempt to divide them into breeding pairs once they were a little bigger.

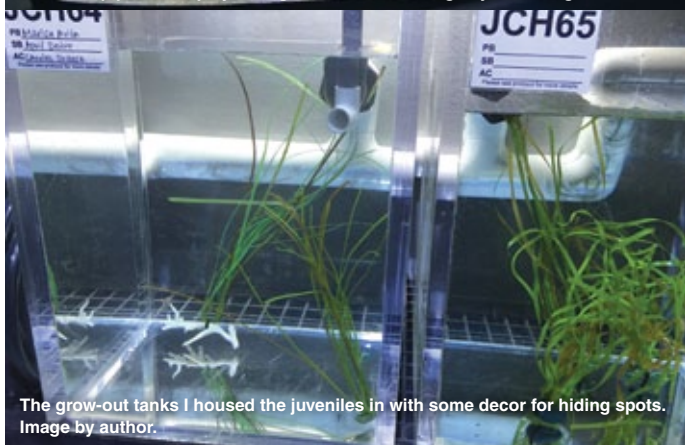
To my surprise, I came in one morning to find that the fish had done my job for me; males in two of the cubes were holding eggs! This was very exciting for me because I had never raised this species of pipefish before, and I figured they wouldn't even start breeding until they were placed in their ultimate display tanks that would be larger and more comfortable. Janet was nice enough to share with me the general care protocol she used at Long Beach, so that is what I based my initial set-up and feeding choices on.

GESTATION AND HATCHING

The gestation period for the eggs was about 12–14 days. I observed the eggs every day as closely as I could, and when I started to see eye spots, I began to plan for how I was going to collect the larvae. I knew I was going to keep them in a small, undecorated kreisel that



The main pipefish display, a 50-gallon reef tank. Image by Tim Wong.



The grow-out tanks I housed the juveniles in with some decor for hiding spots. Image by author.

I had already set up. I just wasn't sure if I wanted to move the male into the kreisel when it looked like the eggs were ready to hatch or if I wanted to use a turkey baster to suck the larvae out of the tank post-hatching. If I couldn't isolate the male, it would be important to remove the larvae immediately after hatching since they could be sucked out of the tank by the filtration system or eaten by any of the other conspecifics in the tank.

This time, I decided to move the male into the kreisel and allow the larvae to hatch there, which seemed to work just fine. The eggs hatch in the morning, so I like to look in my tank as early in the day as possible when I know they're getting close. The male did drop a few eggs prematurely, most likely from the stress of the move, but overall it was a successful hatch.

When I moved him back in with his mate, the two immediately started breeding again. About a week and a half later, I tried sucking the next batch of larvae out of the water column with a turkey baster and putting them in a second kreisel for grow out.

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Close-up of newly hatched larvae with *Artemia* nauplii. Twenty-four-hour nauplii are a good starter food for babies. Image by author.

This method also seemed to work out fine. Since I had the gravid males in almost bare aquarium set-ups, it was easy to do the male transfer method, but in an actual reef tank set-up with live rock and hiding places, I would think the best way would be to remove larvae post-hatching.

LARVAL REARING

The larvae are very tiny upon hatching, about 4–5 mm, and they're ready to begin feeding almost immediately. For the first few weeks, I gave the fry enriched 24- to 48-hour-old *Artemia* nauplii and adult *Parvocalanus crassirostris* copepods purchased from Reed Mariculture. I offered the baby pipefish rotifers too, but I didn't see them targeting those much, if at all; I stopped adding them after the first week and a half. I think the *Parvocalanus* were very helpful in raising the larvae, although I know they can be reared without them. These copepods provide a good intermediate food size, and they are a high-quality food as far as nutritional value. As with any batch of fish larvae, some will be better eaters than others, so expect to lose a few babies here and there. Like other members of the

Syngnathidae family, pipefish lack true stomachs, so they need to eat at least two to three times a day.

For a couple of months, I continued feeding *Parvocalanus* and also began feeding Tigger-Pods (also from Reed), 48-hour and



P. crassirostris. Image by Jim Welsh, courtesy of Reed Mariculture.

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Tigriopus californicus (Tigger-Pods).
Image by Waldo Nell, courtesy of Reed Mariculture.



Syngnathid-rearing rack in our jelly-culture room. Image by Tim Wong.

older *Artemia* nauplii, and Cyclopeeze. When the pipefish turned 3 months old, I discontinued the Parvo because I noticed that the pipefish seemed to mostly be consuming the other food options. They especially liked the Tigger-Pods and 72-hour or older *Artemia* nauplii. I should also mention that siphoning out uneaten food is an absolute requirement when feeding so frequently and in such great quantity.

GROW-OUT

The larvae were growing rapidly and needed a larger home as soon as possible. Fortunately, we had just completed a new holding system specifically designed for raising syngnathid larvae. The

system is about 125 total gallons and is comprised of two kreisels; two black, round tubs for larvae; and three medium-sized holding tanks for grow-out. The kreisels are each about 1 gallon, the black, round tubs are about 7 gallons, and the grow-out tanks are 20 gallons and 55 gallons. All the tanks in the system are connected, but the entire system itself can be switched between temperate and tropical-temperature schemes depending on the species we are working with at the time.

After 4 months, I had 12 pipefish larvae still going strong, and now I just needed to grow them to an appropriate shipping size so I could share them with the aquarium community. I kept up with the 72-hour or older *Artemia*, the Tigger-Pods, the Cyclopeeze, and of



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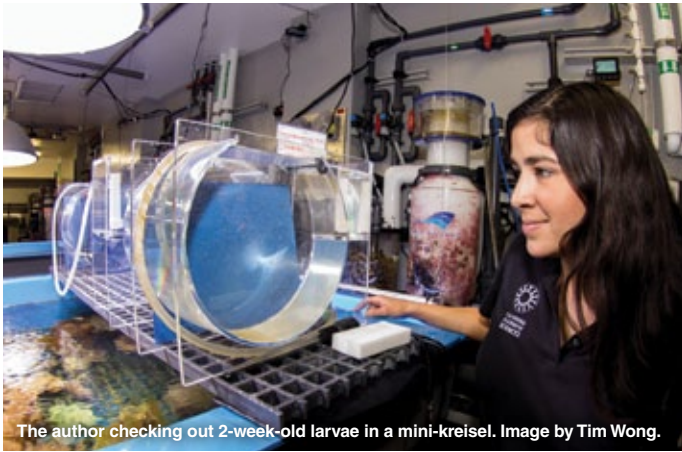
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The author checking out 2-week-old larvae in a mini-kreisel. Image by Tim Wong.




Pipefish pair on display. Image by Tim Wong.

course the daily siphoning. At this point, the juvenile pipefish were still fairly peaceful in groups, but it seemed a good time to give them some artificial plants and other types of structure for them to retreat to. I eventually was able to ship out all of the juveniles to another institution, so my captive breeding adventure was sadly at its end.

SUMMARY

Overall, *Dunckerocampus dactyliophorus* is a relatively easy species to raise, and it's possible to get nearly continuous breeding from paired adults with hatches every couple of weeks. As far as sexing goes, it can be difficult to determine their gender, but it's been

suggested that you can tell by looking at the thickness of the stripes (males have thicker stripes) and the shape of their bellies (males tend to have flatter bellies while females are more rounded). Just make sure to have adequate food and tank space for the larvae. These pipefish are a great display species, although they can be a little shy and may tend to hide out underneath any overhangs in your tank until they feel comfortable. I have this species in the aforementioned pipefish display and also in a 300-gallon reef tank that's connected to the same system. I have even put them in our 2,500-gallon shallow reef exhibit at the Academy. They are a great addition to a variety of tanks, and I recommend them to anyone who is looking for a beautiful new fish for their medium- to large-sized reef tank. 

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Indonesia is a country blessed by nature with incredible beauty and an abundance of scenic terrestrial and marine landscapes. Forest hikes, volcano-ascending treks, and visits to traditional villages are just some of the terrestrial activities to be enjoyed when visiting Indonesia. The natural environment is magical, and the people will amaze you with their kindness and legendary generosity.

Diving in Indonesia is also world renowned. The Lesser Sunda Islands are among the nicest dive spots in the world. For this dive trip, however, we chose Flores for its diversity and comparatively easy access—the airport of Labuan Bajo hosts a flight several times a week from Bali. We decided to stay on Labuan Bajo even though the village, nestled around a small fishing harbor and a long dirt track, is far from civilization.

Three well-established dive centers are located in the village. Each one offers very professional services that can be reviewed and booked online, making it easy to plan the trip in advance. Staying in Labuan Bajo allows you to explore the nearby reefs that stretch between the north of Rinca, the west coast of Flores, and the eastern shores of Komodo. Countless islets are scattered over this part of the world and represent a huge number of reef slopes to be enjoyed.

If you do not choose a live-aboard cruise, it certainly limits your range of possible exploration, because at the end of every day, you need to come back to base. But the tremendous richness of the reefs around these islands is such that, within a month, one

could dive every day in a different and splendid place without being further than 50 km from the village.

The rather strong sea currents around the Wallacea chain of islands foster an impressive biodiversity, from the big deep-sea fish to the swarming multitudes of smaller reef organisms. Whether you are a micro-critter lover or demand the adrenaline rush of seeing large sea creatures, there's a dive for every taste.

In Flores, we dove with the Dive Komodo team. Greg and Frans, who are in charge of this dive center, put together a program tailored to our dive preferences and the species we wanted to see. We chose to make two to three dives per day on spots between a half-hour and a two-hour boat ride from the harbor of Labuan Bajo. The boat is rather big—about 15 meters—and provides basic but hospitable comfort.

On the first day, we jump in the water around an islet named Sabolon Island. From the first moment of descent, we come face to face with a huge Bumphead Parrotfish (*Bolbometopon muricatum*) about a meter long. We go down until we're at 27.5 meters depth where we meet a school of Garden Eels (*Heteroconger enigmaticus*). They are as intriguing as always, with their waving heads and their sudden and perfect retraction into burrows one by one as we approach. A Bluespotted Ribbontail Ray (*Taeniura lymma*) passes by. A big Titan Triggerfish (*Balistoides viridescens*) rubs his sides against the sand bottom below. If there is a fish I fear, it's this one! My very first contact with one of its cousins in the Red Sea was violent enough



A school of Garden Eels capturing zooplankton.



In my opinion, the Titan Triggerfish is the scariest fish on the tropical reef.



The Graceful Anemone Shrimp is a magnificent example of the hidden beauty of the wild.

to ingrain the word “caution” in my mind when my path crosses a large trigger. I think they are fascinating fish, but from a distance!

As we continue on, the reefscape spreads out in front of us, and it is time to begin to pay attention to the small critters. Gobies, blennies, featherduster worms, feather stars, and sea squirts; everything is in superb abundance. Pretty Chocolate Surgeonfish (*Acanthurus pyroferus*), Orangespot Surgeonfish (*A. olivaceus*), a couple of Moorish Idols (*Zanclus cornutus*), and some tobies (*Canthigaster valentini*) forage between the coral. And next, here is the eternal symbol of the tropical reef: a pair of Ocellaris Clownfish (*Amphiprion ocellaris*) tucked inside their anemone. Corals here display excellent health; the reef is free of the impact of humanity, a real unspoiled marvel.

After an energetic lunch break, we dive again a short distance from the morning’s dive spot. We explore a rather shallow reef, a paradise for the macro photographer. Under a huge clump of Hammer Coral (*Euphyllia ancora*), a group of transparent Graceful Anemone Shrimp (*Ancylomenes venustus*) fidgets. Nearby, a Magnificent Anemone (*Heteractis magnifica*) is transformed into a true community dwelling. It shelters a trio of Ocellaris Clownfish, a group of Glass Anemone Shrimp (*Periclimenes brevicarpalis*), and a couple of Porcelain Crabs (*Neopetrolisthes ohshima*). All in this small world attend to their business, seemingly indifferent to their neighbors.

Pink and purple colonies of *Acropora*, neon blue and yellow Ox Heart Ascidian (*Polycarpa aurata*)...colors are flashing everywhere.




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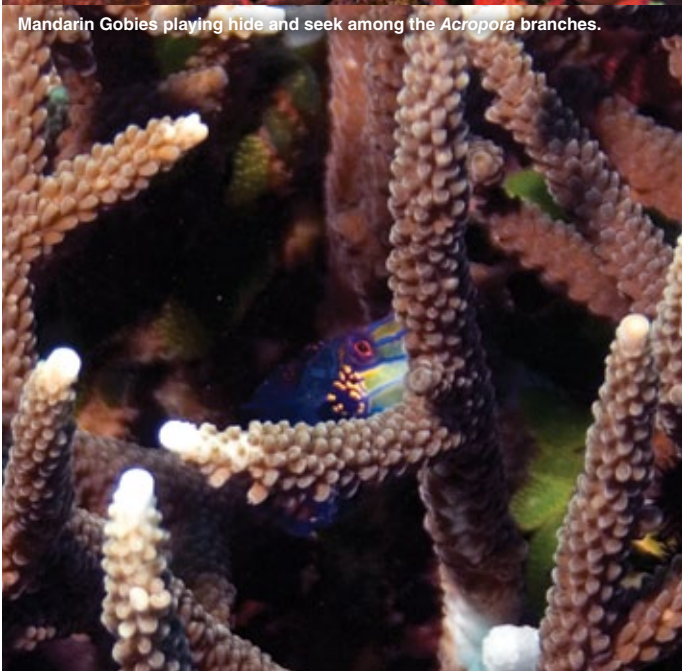
This Porcelain Crab is actually not a crab but a Decapoda, closely related to the squat lobsters.



Bigger than the Emperor, the Six Bar Angelfish is also more territorial and pugnacious.



A huge number of Lyretail Anthias, a pair of Moorish Idols, and an Emperor Angelfish with a Moon Wrasse and a Spotband Butterflyfish.



Mandarin Gobies playing hide and seek among the Acropora branches.

We cross the path of a very nice Narrow-lined Puffer (*Arothron manilensis*), a Greasy Grouper (*Epinephelus tauvina*), a Papuan Toby (*Canthigaster papua*), and some playful wrasses amongst which there's a splendid and reckless Redbreasted Maori Wrasse (*Cheilinus fasciatus*). I spot a young Pinnatus Batfish (*Platax pinnatus*) in its spectacular black, bordered with orange; finery comes to greet us just before our return to the surface.

The days go by in the blink of an eye, and the spectacular diving continues, always very interesting and rich. We head to Manta Point to meet, as the name suggests, Manta Rays and also Blacktip Sharks. We also observe several Green Turtles (*Chelonia mydas*) and a beautiful reef slope, well preserved and very rich with small fish and reef fauna.

The spot called Siaba Kecil is known for its rather shallow reef, where a large number of Mandarin Gobies (*Synchiropus splendidus*) frolic, living between the branches of *Acropora* corals. I did not have the opportunity to make any nocturnal dives during this trip since the boats did not go out at night, but these fish are known to make sumptuous nuptial ballets in the closing light of day. I know this dance very well, as I had countless opportunities to see captive specimens courting—these fish are my favorite. To meet them in the wild, even briefly, was a great satisfaction for me.

This same site is renowned for the variety and size of its coral colonies, which are really impressive. Splendid palms of huge gorgonians capture the nourishing plankton from the strong current. This current moves us very quickly without any chance to decelerate, and actually stopping to take pictures is nearly impossible. Here, Green Turtles, big angels (like Emperors [*Pomacanthus imperator*], Six Bars [*P. sexstriatus*], Navarchus [*P. navarchus*], and Regals [*Pygoplites diacanthus*]), triggerfish, surgeonfish, and wrasses, in impressive quantity and diversity, cross our path without any apparent concern.

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The Tropical Striped Triplefin, a small relative of the blenny family, lives on LPS corals like some similarly colored dwarf gobies, making identification challenging.

The clusters of feather stars on the edges of gorgonians and sponges (among them the splendid pink barrel sponges [*Xestospongia testudinaria*]) are impressive; nature makes such nice arrangements spontaneously! The reef depths are all interspersed with multicolored bouquets of the most exquisite shapes.

Another day and another spot, Sebayur Kecil is a splendid dive for the micro-critter lover. The diversity of coral organisms and other invertebrates is colossal. We encounter sea fans, sponges, whip coral, soft corals, hard corals with broad polyps, anemones, ascidians, and hydroids. On every sessile organism live some small gobies such as *Bryaninops* spp. and *Pleurosicya* spp. in pairs, Sebree's Pygmy Gobies (*Eviota sebreei*) in family groups, small blennies such as the Striped Triplefin (*Helcogramma striatum*), Three-lined Blenny (*Ecsenius trilineatus*), Bath's Comb-tooth



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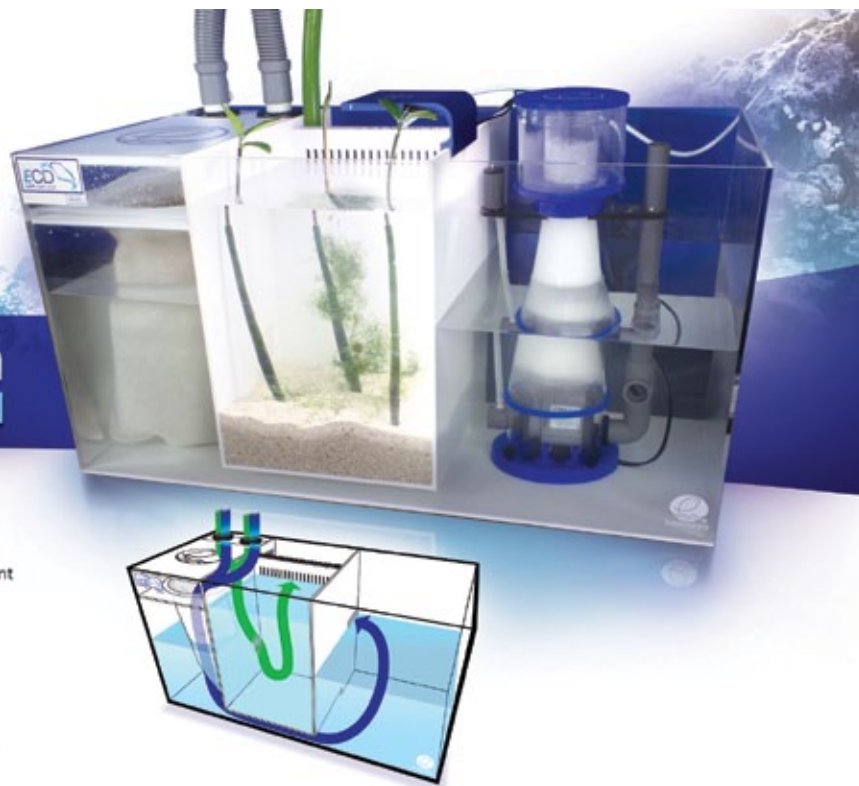
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A dearly prized encounter with a pair of Robust Ghost Pipefish. It takes all the talent of a good divemaster to spot these small, motionless, and well-camouflaged fish.



Branched or potato-shaped, *Tubastraea* (here closed during daytime) can be pink, orange, yellow, green, or black.

Blenny (*E. bathi*), the Australian Blenny (*E. australianus*), Graceful Anemone Shrimp (*Ancylomenes venustus*), and various nudibranchs; the patchwork of life is impressive.

In another spot, named Wainilu, we met another one of my favorite species, the aptly named Robust Ghost Pipefish (*Solenostomus cyanopterus*). I had specifically asked Fabi to try to find some of these kings of camouflage, and he surely succeeded. To see these small fish, body against body, drifting passively upside-down, so peaceful, so quiet, was an intimate spectacle that I'll never forget. Mission accomplished; thank you, Fabi!

Finally, we couldn't finish the piece without reporting on Batu Bolong, as it was the most amazing dive of my life. It is an abrupt slope, a wall covered with exuberance. The first impression is the feeling that you will have to fight between the schools of anthias and damselfish to manage to move forward. The feeling of being a part of this dense and living soup is astonishing.





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Emperor Angelfish seek sponges, hydroids, and Bryozoa to feed on.



The male of this Yellow Boxfish pair shows bright blue flanks, yet one should be careful not to mix him up with *O. cyanurus* or *O. meleagris*.

Then, crossing through clouds of fish, we reached the wall, encrusted with coral, and more particularly with several kinds of *Tubastraea* spp., forming large clumps of orange, yellow, green, or black polyps. Other corals draw our attention, such as the hairy branches of bright purple lace coral (*Distichopora violacea*), the coiled stems of whip coral (*Cirripathes* spp.), and the delicate Neptheid soft corals with shrill colors.

In a cave, a Moray Eel (*Gymnothorax javanicus*) is being groomed by a couple of Skunk Cleaner Shrimp (*Lysmata amboinensis*), experts in dental care. A Hawksbill Turtle (*Eretmochelys imbricata*) explores the patchwork of encrusted invertebrates for a high-class dish.


Farther along, an Emperor Angel is chasing after a huge Potato Grouper (*Epinephelus tukula*) that came to challenge his territory. The friction is violent, yet the grouper, at least twice as big as the angelfish, swims away defeated.

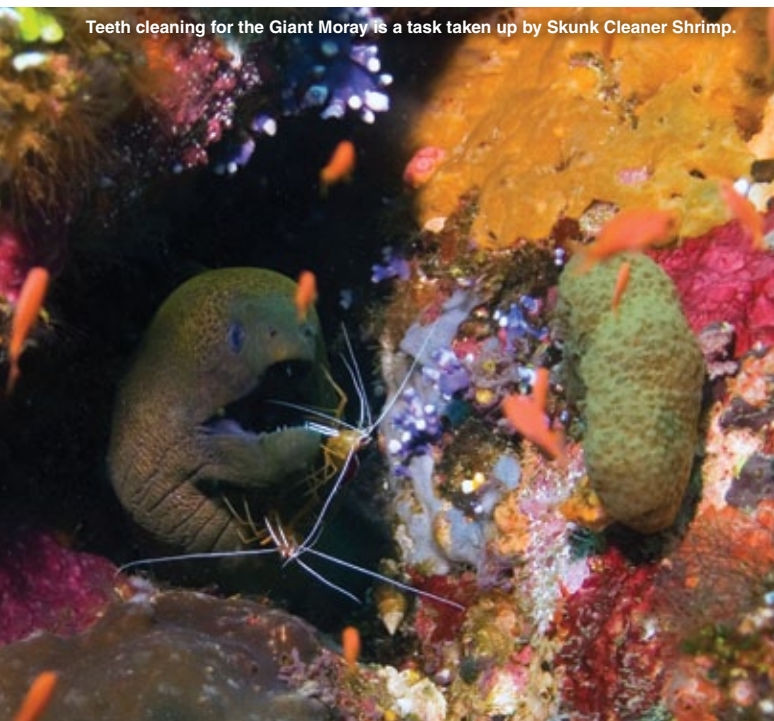
The fish population is so enormous that I think of a new game: to capture the most diversity and rarity possible in a single picture. Within a few shots, I succeed in immortalizing a quartet of Black-backed Butterflyfish (*Chaetodon melannotus*) with a couple of

Emperor Angelfish. Then, a little farther along, I photograph a trio of Moorish Idols with the same couple of Emperors. In the end, the award went to one shot of two Moorish Idols, three Emperor Angelfish, and three different kinds of butterflyfishes, all in the same photograph!

I am then drawn to a couple of Yellow Boxfish (*Ostracion cubicus*), occupied with nibbling the *Tubastraea* mattress. Their yellow and blue coat is so nice, and I had never seen this fish in a pair and of such a large size.

After a dozen dives, thinking back on it, there's no regret. Some of the most renowned sites of Komodo may have been too far from our base to have been visited (Crystal Rock and Cannibal Rock), but what we saw was simply incredible. From the diversity and density of moving fauna and invertebrates to the unperturbed quality of the reefscape, nothing can make us regret our choice.

For those who cannot join a live-aboard cruise, you should not deprive yourself of a land-based trip option. Don't be misled into thinking that the coastline reefs will be disappointing, as this is very far from being true. 



Teeth cleaning for the Giant Moray is a task taken up by Skunk Cleaner Shrimp.



A Hawksbill Turtle resting in a crevice of the reef.

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— **Rich Ross**, Senior Biologist, Steinhart Aquarium, California Academy of Sciences; Marine Societies of North America (MASNA) 2014 Aquarist of the Year



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