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RICHARD ASPINALL

Building a Red Sea Biotope: Structure, Corals, and Fish

The Red Sea has received quite a lot of attention recently, with a greater amount of species collection from its waters and consequently greater awareness of the Red Sea and its species amongst hobbyists and divers. I have had a long association with the Red Sea and have been visiting this remarkable body of water for a decade as a diver and in more recent years with an aquarist's eye. So why is the Red Sea remarkable?

The Red Sea is technically an ocean. It is very slowly being formed as two continental plates (the African and the Arabian) tear themselves apart. Admittedly, this is happening at a pace entirely outside of human awareness, but rest assured that in millions of years, it will be a very large body of water indeed. Incidentally, this tectonic movement is the same process that is continuing to create the African Rift Valley, and it is worth noting that this is driving evolution of fish species in the marine habitat and also driving the evolution of African Rift Valley cichlids.

If you look on any globe or satellite image, you can identify the Red Sea as the narrow stretch of water between Sudan and Egypt on the west and Arabia to the east. Roughly 2,000 km long, the Red Sea is terminated at its northern end by two slender gulfs on either side of the Sinai Peninsula: the Gulf of Suez, which runs towards the Mediterranean and the Suez Canal, and the Gulf of Aqaba to the east.

The Sinai Peninsula is home to a large number of tourist developments, some of which are threatening fringing reefs and sites of religious and cultural interest (including Mount Sinai and Saint Catherine's Monastery). At present, the Sinai is a troubled region with several governments recommending against traveling outside of the tourist hotspots. This is a great shame because the


Red Eye Goby


a clam inside *Turbinaria reniformis*

people and culture of this region are welcoming and fascinating, and the scuba diving is some of the best in the world.

The Red Sea has undergone repeated periods of inundation and desiccation since its formation. It is also one of the most saline of oceans (at around 39 ppt), as it receives zero input of freshwater from rivers. Further, it is only replenished with seawater through the comparatively narrow (and shallow) connection with the northern Indo-Pacific at the Straits of Bab-el-Mandeb (translates to The Gate of Lamentations). It has been argued that the fluctuations of the Red Sea's level (it reached its present level only 5,000 years ago) were the source of the sea's parting in biblical accounts. The upshot of this relative isolation is that the limited input of water and sediment, lack of development, and unique geology has resulted in the creation of a stretch of crystal clear waters with fascinating shipwrecks, an assemblage of species that is quite unique, and some of the finest coral growth in the world. The Red Sea has a significant number of endemic species. It is usually quoted as having around 150 to 170 fish that are found nowhere else, and this figure is still creeping upwards as more species are discovered. Over 300 species of coral are also recorded as living here.

A TYPICAL RED SEA REEF

If we were to describe a typical Red Sea reef, it would consist of a shallow, sand-filled lagoon that would become a more open seascape as we move seawards. This is an area of once species-rich reef crest that is becoming inundated by sand and rubble. Further out, shallow areas may be present that support sea grasses, though these are not ubiquitous. These sea grass beds contain several pipefish and sea horse species, though I have never, despite many hours of searching, found either. Some very small areas of mangrove exist, but these are off limits to tourists.


Favia sp.

The broken, blocky structures of the near-shore lagoon will finally give way to channels that are regularly flushed from the open sea and perhaps a larger lagoon system. This is all before we get to the reef crest, where much of the action takes place. The lagoons are by no means sterile but are of less interest to aquarists. If they are not regularly flushed, they can become low in oxygen.

The limited tidal range of the Red Sea means that reef crests are not subject to regular and stress-inducing immersion and exposure

Pocillopora verrucosa

Male *Pseudanthias squamipinnis* can be found in vast numbers on most Red Sea reefs.

as are similar structures in other parts of the world. The Red Sea is also comparatively sheltered from storms and very powerful wave action, which means shallow reef crests and reef plates can be species-rich and hold extensive coral growth.

Great numbers of Tridacnid clams are found in the shallows. *Tridacna maxima* is the most common in my experience, with *T. squamosa* also found here. It is interesting to note that *T. squamosa* is sometimes found resting on sand in a fashion similar to that in which many hobbyists place them in captivity. *Maxima* clams are frequently found in superb blue colors and are not taken for human consumption here as they are in many other areas of the world.

Descending down the reef wall reveals a stunning amount of fish, with Lyretail Anthias (*Pseudanthias squamipinnis*) frequently predominating. *P. squamipinnis* exists in such numbers that they can be overwhelming. On some reefs, this species is replaced with *P. taeniatus* (and in the south *P. townsendi*). *P. heemstrai* can be seen at similar depth, but I have rarely encountered these fish and have never yet photographed them.

Coral pinnacles are frequently seen, but as one travels deeper, to around 15 meters perhaps, the amount of soft corals of the *Dendronephthya* and *Scleronephthya* genera generally increase, though this is dependent upon water current and available food.

Tridacnid clams are very common in the upper ten meters of water.

At greater depth, sea fans and non-photosynthetic species become commonplace. Some of the largest sea fans can grow to over 2 meters across. These are worth visiting to look for Longnose Hawkfish. They are also used by featherstars at night, which climb on them to reach out into the current.

Individual corals can become vast, with specimens of *Porites* achieving a size of many meters across. Occasionally, large areas filled with *Acropora* species (presumably clonal and formed by fragmentation and continual growth) are seen. Typically, however, the continual growth, over-topping, and collapse of the reef (as well as occasional mild storms) create a very

Individual coral colonies can grow several meters wide.

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This is likely *Acropora humilis*.


Tubastraea micrantha can be found under overhangs.


Chaetodon fasciatus

structurally diverse reef structure, replete with crevices, small caves, and sandy areas. High light intensity corals can be thriving a few meters away from azooxanthellate species.

Where local topography allows, the coral breakage creates a fascinating rubble zone, which frequently merges with flat, bommie-rich areas. These zones can be quite interesting and offer a wealth of aquascaping inspiration and a great time for fish spotters. The rubble zone may reveal groups of Red Sea Flasher Wrasses, occasional Sunrise Dottybacks (*Pseudochromis flavivertex*), and the quintessential Red Sea endemic, Orchid Dottybacks (*P. fridmani*). This area is also great for spotting Rockmover (also called Dragon or Reindeer) Wrasses, where they spend their time happily distributing fallen pieces of reef.

Various other familiar aquarium species can be seen, though a keen-eyed fish spotter will be on the lookout for fish of special aquarium interest such as Purple Tangs (*Zebrasoma xanthurum*), which form quite large shoals. Other tang species here include the Sailfin Tang (*Zebrasoma desjardinii*), which replaces the similar *Z. veliferum* found in the bulk of the Indo-Pacific region. The Sohal Tang (*Acanthurus sohal*) is another endemic species (also found in the Arabian Gulf), which is very commonly seen and can form shoals of dozens of individuals. This large fish (up to 40 cm in adulthood) can be kept in the aquarium but is best added last and only to very large aquaria–it can be quite aggressive.

Endemic *Chaetodon* species such as the Blacktail Butterfly (*Chaetodon austriacus*) and Arabian Butterfly (*C. melapterus*) are well worth noting, even though they present significant challenges to the hobbyist.

A number of angel species can often be seen, including the large Asfur Angel (*Pomacanthus asfur*), the Emperor Angel (*P. imperator*), and the endemic Yellow-ear Angel (*Apolemichthys xanthotis*). These large species roam widely across the reef, and seeing them in the wild reminds us of just how much room these magnificent fish need. One of the most visible angels on the reef is the Regal Angel (*Pygoplites diacanthus*). *P. diacanthus* is commonplace and frequently seen moving between coral heads and within crevices.

As noted previously, bommies are created by a mixture of coral growth and coral breakage from the main body of the reef. They are really interesting to explore and are a nice feature to try to recreate in the home aquarium. Recreating a typical reef wall has fallen out of favor in recent years for several reasons, such as limited current flow and simple changes in our aesthetics. But recently, the bommie and/or isolated pinnacle aquascape has become increasingly popular.

A small Red Sea bommie is easy to create, though some of the ones I have seen in the wild seem to defy gravity. Typically, the bommie will sit on fine sand that may contain shrimp gobies and garden eels if the sand is deep enough. Often, the bommie will contain one or more anemones. Some bommies may only support a small number of hard coral colonies and a great deal of bare rock, which is not a look we always strive for in our captive systems. Soft corals such as *Scleronephthya* sp. might be found here as well. Bommies in which anemones are found will, in the overwhelming majority of cases, contain clownfish and occasionally, young damsels.

The typical (and with a few caveats, *only*) anemonefish found in the Red Sea is the Two-Band Clownfish (*Amphiprion bicinctus*). This is a superb and highly attractive species that is available in the hobby as captive bred specimens. Although it is a beautiful species, *A. bicinctus* might not be ideal for every home aquarium; these fish can become quite boisterous when they form a pair. Naturally, this fish hosts in *Entacmaea crispa* and *E. quadricolor* anemones, so it should be easy for any aquarist to find a home for *A. bicinctus*.

GENERAL AQUASCAPING CONSIDERATIONS

Red Sea biotopes will need to be well lit and well skimmed. If you wish to recreate the high energy reef crest areas, they need to be supplied with a great deal of current, designed to replicate

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the surge of breaking waves. Deeper, bommie-type systems will require more of a constant, laminar flow without the changes and fluctuations in current typically seen in shallow reef crest habitats.

As noted, bommies are ideal for recreating in a tank, but you might also want to consider an aquascape that has as much open structure as possible. This will allow species such as the Orchid Dottyback to hunt and replicate their natural behavior and will be welcomed by several of the wrasse species mentioned.


Christmas Tree Worms require stealth to photograph when open.


Dendronephthya sp. – species ID requires close examination of spicules.


Bryaninops natans – you'll need good eyes to spot these inch-long fish.

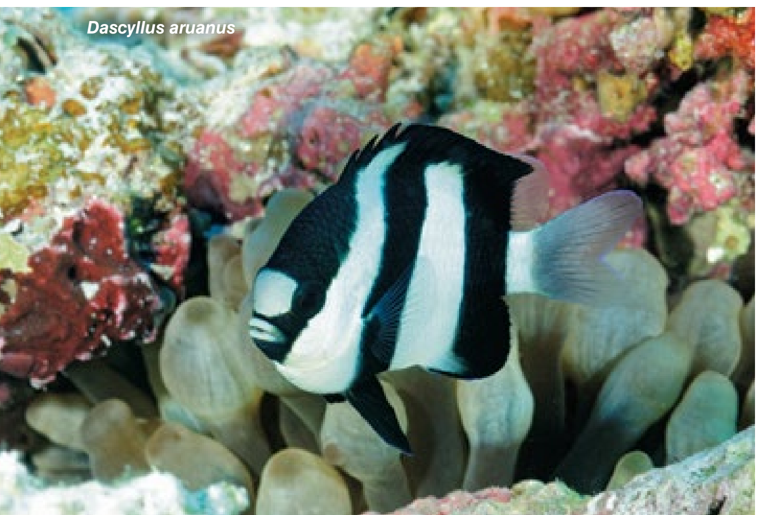
Open water and plenty of swimming room will be appreciated by anthias, but do remember the standards for the successful keeping of anthias. If you can't offer a great deal of room, just keep a single specimen.

With the growth of interest in keeping authentic biotopes, there is none better than the Red Sea, and whilst I've suggested some characteristics of differing habitats within the region, it is likely that in the home aquarium, hobbyists will seek to create something of a mixture of zones. Fortunately, this shouldn't be much of a problem and can be achieved with a little bit of care. Look out for interestingly shaped pieces of live rock, and be prepared to assemble them using mounting rods and a great deal of epoxy to create unique structures that replicate crevices, overhangs, and pinnacles.

SUGGESTED FISH LIST

The following is by no means an exhaustive list of fish that could be used to create a Red Sea biotope. Obviously, some species are not compatible with others, and some represent more of a husbandry challenge than others. It can be used, though, to inspire a fish list that will be accurate for the region.

Amblyeleotris fasciata	**Red-Barred Shrimp Goby**
Amphiprion bicinctus	**Red Sea Anemonefish**
Apogon cyanosoma	**Yellow Striped Cardinal**
Archamia fucata	**Orange Lined Cardinal**
Chaetodon auriga	**Threadfin Butterfly**
Chaetodon fasciatus	**Red Sea Raccoon Butterfly**
Chaetodon larvatus	**Orange Face Butterfly**
Chaetodon melapterus	**Arabian Butterfly**
Chaetodon semilarvatus	**Masked Butterfly**
Chromis viridis	**Green Chromis**
Cirrhilabrus rubriventralis	**Social Wrasse**
Ctenochaetus striatus	**Lined Bristletooth**
Halichoeres iridis	**Rainbow Wrasse**
Heniochus intermedius / diphreutes	**Red Sea / Schooling Bannerfish**
Macropharyngodon bipartitus	**Vermiculate Wrasse**
Nemateleotris decora	**Decorated Dartfish**
Oxycirrhites typus	**Long Nose Hawkfish**
Paracheilinus octotaenia	**Red Sea Flasher Wrasse**
Pomacanthus imperator	**Emperor Angel**
Pseudanthias squamipinnis	**Lyretail Anthias**
Pseudocheilinus hexataenia	**Sixline Wrasse**
Pseudochromis aldabraensis	**Arabian Dottyback**
Pseudochromis flavivertex	**Sunrise Dottyback**
Pseudochromis fridmani	**Orchid Dottyback**
Pseudochromis sankeyi	**Striped Dottyback**
Ptereleotris evides	**Blackfin Dartfish**
Pterois miles	**common lionfish**
Pterois radiata	**Clearfin Lionfish**
Pygoplites diacanthus	**Regal Angel**
Zebrasoma desjardinii	**Sailfin Tang**
Zebrasoma xanthurum	**Purple Tang**



Dascyllus aruanus

MATT HARRIS

EXTREME AUTOMATION PART 3: ADVANCED AUTOMATION PROJECTS

In part 2 of this series, we went over some intermediate aquarium automation projects. In this third and final installment, we will discuss advanced projects. The idea behind this series is to share what I have chosen to automate and how. I'll present an overview, and you can take it from there.

DENITRATOR CONTROL

In the past, I dosed a carbon source into my system in order to lower nitrates (and to some degree, phosphates) with mixed results. I could get the nitrates down to the level I wanted, but I didn't like the bacterial sludge that would coat the plumbing and cause the filter socks to quickly clog. Not everyone is going to run into that kind of issue, but I did. Being that I liked the results I was getting while carbon dosing, I wanted to stick with it but do it a little differently. I ultimately decided to try a bacteria-driven, batch-style denitrator.

The denitrator holds 13 gallons of water and has a small circulation pump inside that stays on all the


denitrator system


This return pump brings treated water from the dentirator back up to the system.


bacteria inside the denitrator

time. Egg crate is positioned in the middle of the denitrator that the bacteria grows on. Because the denitrator is located in my basement, which gets cold in the winter, I installed a heater that is controlled by my Apex controller. There is also an ORP probe installed, and the ORP level is monitored but doesn't control anything.

There are two medium-sized water pumps on the system; one brings untreated water from the sump down to the denitrator and the other returns treated water from the denitrator back up to the system (via the sump). The denitrator is programmed to run on an 8-hour cycle. After 7½ hours of treatment time in the denitrator, there is a 30-minute water exchange period when the newly treated water (which now has barely detectable nitrates and phosphates) is pumped back into the system and the denitrator is refilled with untreated water.

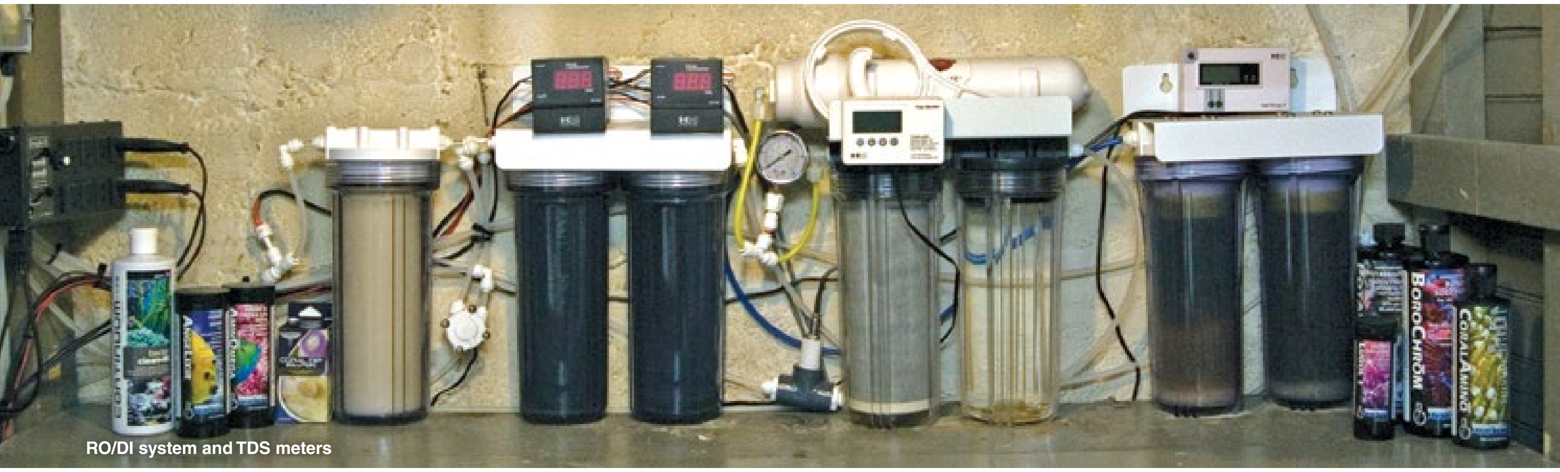
The two water pumps utilize three float switches installed in the denitrator for water level control. I had originally tried to use optic level sensor switches for level control, but they required too much maintenance. I was constantly cleaning bacteria off of them.

One float switch acts as a low water point, the second float switch acts as a high water point, and the third float switch acts as an emergency high water point. During the 30-minute period of water exchange, if the low water point float switch in the denitrator is triggered, the pump that brings water up to the sump is shut off. This pump will remain in the off position until the water level in the denitrator rises and the float switch is no longer triggered. This does not take long, maybe a few seconds, since the pump bringing water down to the denitrator continues to run. If the high water point float switch is triggered while both pumps are on (during one of the 30-minute exchanges), the pump that brings water down to the denitrator will turn off until the water level drops. There are two important things to note. Both pumps are installed with physical siphon breaks on them, so when the pumps turn off, air enters the plumbing quickly to break any siphon. Secondly, the two pumps have identical flow rates; if they did not, the pumps would be constantly turning on and off as the water level readjusted itself. You want to avoid that because the pumps will incur a great amount of wear and tear and fail faster than normal. Then there is the third float switch, which acts as the emergency high water point. If this float switch should ever trigger, both water pumps will shut off, and I will be sent an alarm email.

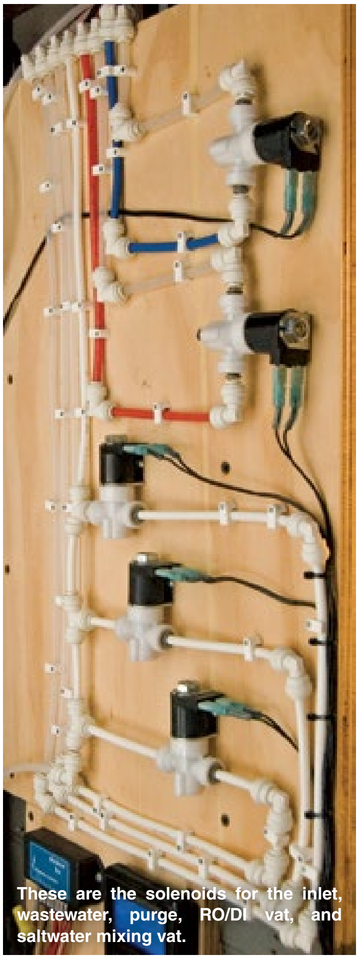
Shortly after the 30-minute water exchange, a dosing pump is turned on and a carbon food source is added to the denitrator. This food source allows me to keep a large amount of bacteria alive in the denitrator. In a 24-hour period, I will have cycled three batches for a total of 39 gallons of treated water. Using this style of denitrator allows me to keep the aquarium nitrates just detectable, but below .2 ppm.

RO/DI WATER ROUTING

This was my first automation project with the Apex controller. It was not originally as complex as it is now, but I credit this project with getting me hooked on automation. I have three vats in the basement that each require RO/DI water: the RO/DI top-off water vat, the saltwater mixing vat for water changes, and a kalkwasser vat. Each water vat has two float switches installed on their sides: one for a low water point and one for a high water point. There are a total of six DC-operated solenoid valves that are used to route the RO/DI water to the vats. The inlet water tube on the RO/DI has a solenoid on it as does the rejection water tube. Next, there are the four solenoids that are located on the purified


RO/DI system and TDS meters

water output that do the actual water routing between the vats. One of these solenoids supplies water to the RO/DI top-off water vat, another to the saltwater mixing vat for water changes, and a third to the kalkwasser vat. A final solenoid routes the water down the drain; we will reference this solenoid by the name "purge solenoid." My idea behind the purge solenoid was that the RO/DI system might not have been used for a few weeks, and I didn't want to collect the water for the first 5 minutes or so after the RO/DI system was activated. With the purge solenoid open, I can dump that initial water down the drain. In addition, I use two TDS meters. This redundancy is important because the system is automated, and I don't want to collect water that might have a TDS reading of one or higher. If either of the TDS meters should read anything above zero, it will trigger the controller to shut down the solenoids in a pre-programmed order, and I will receive an alarm email.


These are the solenoids for the inlet, wastewater, purge, RO/DI vat, and saltwater mixing vat.

The best way to describe the operation of this system is to do a step-by-step walkthrough, using the RO/DI top-off water vat as an example. This top-off water vat is used to feed smaller intermediate vats on the reef display as well as a fish quarantine system, an invertebrate quarantine system, and a finfish breeding system. Let's say that the 2-gallon intermediate vat on the reef display was being filled, and the low water level float switch was triggered in the RO/DI top-off water vat. This low water level float switch is mounted high up enough that even once the switch triggers, there is enough water in the vat that it can still be used by the other systems as the vat is being refilled. With the low water level float switch triggered, the controller will turn on the purge solenoid first. After 3 seconds, the solenoid on the rejection water tube of the RO/DI system will turn on. Approximately 5 seconds later, the solenoid that controls flow to the RO/DI system is turned on by the controller. Another 5 seconds later, the controller turns on the booster pump for the RO/DI system. At this point, we have water flowing into the RO/DI system at a pressure of around 70 psi, as well as wastewater exiting the system via the purge solenoid. The purified water will be dumped down the drain for the next 5 minutes. After that 5 minutes has expired, the solenoid that allows the purified water into the RO/DI top-off water vat is turned on along with the TDS meters. Approximately 5 seconds later, the purge solenoid is shut off. At this point, we have purified RO/DI water filling up the nearly empty RO/DI top-off water vat. The water will continue to fill up the vat until one of three things happens: the vat fills up all the way and the high water level float switch is triggered, 7 hours passes and the vat never triggers the high water level float switch, or a TDS meter registers a high TDS event (TDS reading of one or higher).


These are the solenoids for the protein skimmer cleaner and the kalkwasser vat.

When any of those three events happen, the RO/DI system is shut down in a preset sequence. First, the booster pump that feeds the RO/DI system is shut off, and then 5 seconds later, the solenoid

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This booster pump is used to increase the pressure of the water entering the RO/DI system.

that controls flow to the RO/DI system is shut off. This leaves two solenoids still open: the solenoid on the wastewater line of the RO/DI system along with the solenoid that allows purified water into the RO/DI top-off water vat. These two solenoids will stay on for 2 minutes to relieve any residual pressure in the RO/DI system. After the 2 minutes have expired, the last two solenoids shut off along with the TDS meters.

Going back to the three events I described above, if the system shuts down because the high water level float switch is triggered within the 7-hour working window, nothing else will happen. If the high water level float switch is never triggered, and the system shuts down after being on for 7 hours, I will receive an alarm email. I designed the system so that in the dead of winter with the coldest possible water (and thus slowest RO/DI output), it would still take under 7 hours to fill the vat completely. If the system cannot fill the vat completely in 7 hours, there is something wrong that needs to be addressed, so the 7-hour working window is a safety measure. I would also get an alarm email if a TDS meter registers an event and shuts down the RO/DI system. Again, there would be an issue that needs my attention. The system is currently programmed so that only one water vat can be filled up at a time. So if the RO/DI top-off water vat is currently being filled, and then the saltwater mixing vat tries to trigger the system to send RO/DI water, it will be put into a queue.

AUTOMATED SALTWATER MIXING STATION

Soon after I finished the RO/DI water routing system, I started thinking about salt mixing. I was pondering the time spent pouring the salt in, making sure it was dissolved, and checking the salinity. I didn't think it would be difficult to build something that ran off a conductivity probe reading, but I needed something that added the same volume of salt mix time after time.

What I came up with was a gravity-fed system that uses two pneumatic pinch valves. Since the pinch valves are pneumatic, they require a compressed air source. The pinch valves do not require much in the air delivery category. I use a small 3-gallon oilless air compressor. An air solenoid valve is connected to each pinch valve, and that is how each valve is opened and closed. The dry salt mix

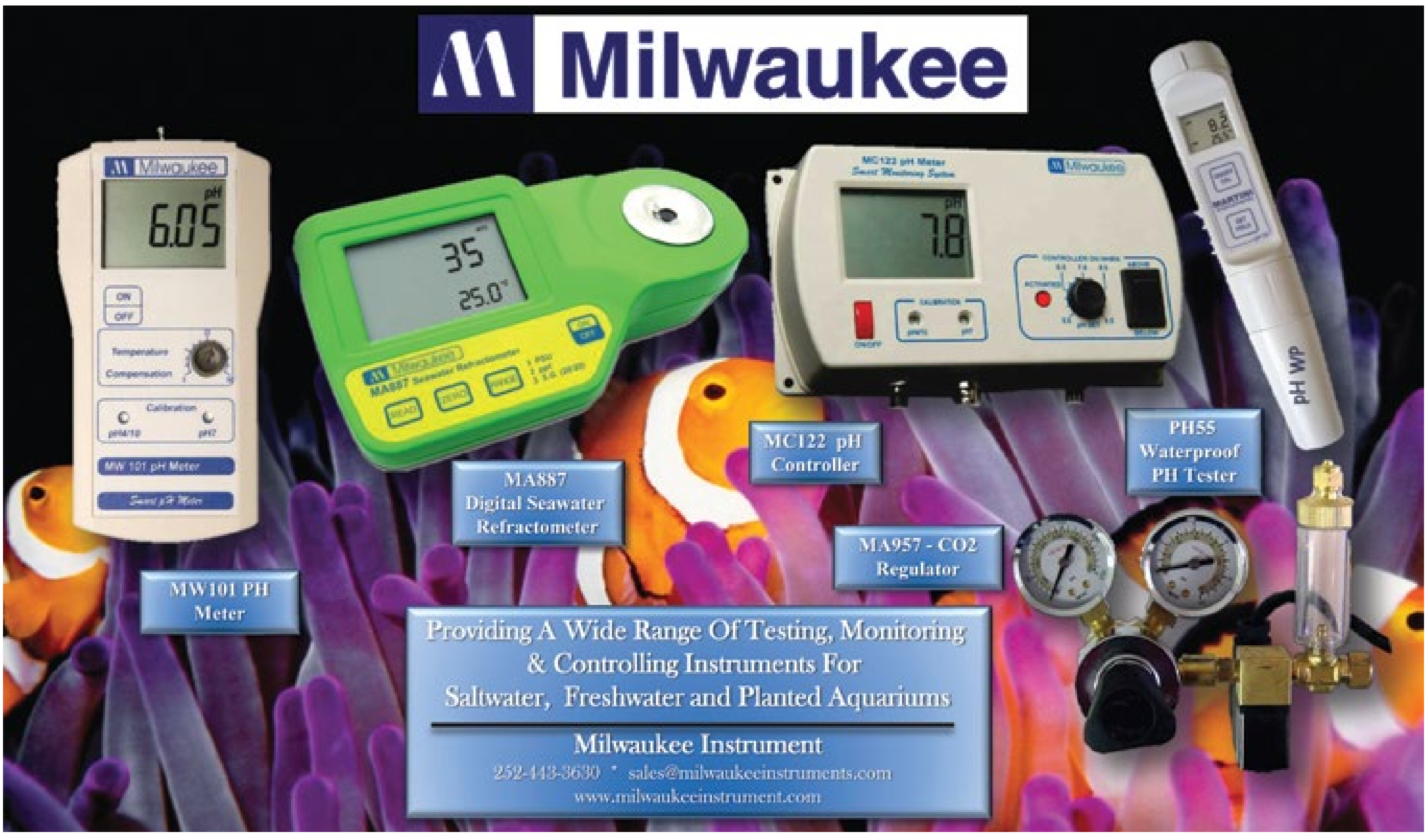
This hopper holds the dry salt mix. Just below the hopper is the top pinch valve.

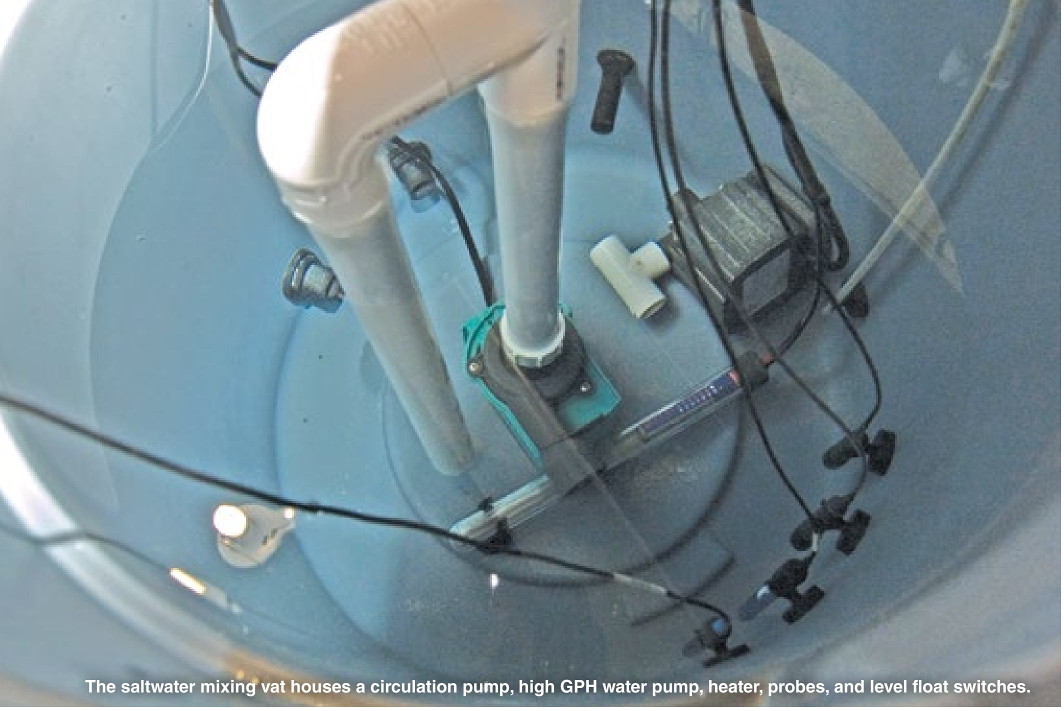
A compressed air source is used to open and close the pneumatic pinch valves.

is housed in a sealed, conical plastic hopper. The top of the hopper has an o-ringed twist lid that is used to refill the dry salt mix. The other end of the hopper has the two pneumatic pinch valves installed. The top pinch valve keeps the dry salt mix in the hopper. After this pinch valve, there is a piece of PVC pipe that holds half a cup of dry salt mix. On the opposite end of this PVC pipe is the second pinch valve, which exits into the saltwater mixing vat below.

Inside this water mixing vat, there is a water heater, a circulation pump, a high gallon-per-hour (GPH) water pump that is used during the mixing period, and probes for pH, temperature, and conductivity (see image on next page). The PVC pipe from the salt hopper that sits between both pinch valves exits directly into the inlet of the high GPH water pump that is used for mixing. There is a tee fitting that is inline on the PVC pipe right below the water level. On the tee fitting, there is a 90-degree elbow fitting installed with another PVC pipe going to the bottom of the saltwater mixing vat. This allows the high GPH water pump to bring water into the PVC pipe from the bottom of the mixing vat, through the 90-degree elbow fitting to the tee fitting, and then back down the PVC pipe to the inlet of the water pump again. This pulls the dry salt mix directly into the impeller of the mixing pump when it is released from the second pinch valve. By the time the salt reaches this high GPH water pump, it has mostly dissolved into a slurry.

Now, let's do a run-down of the system's operation. Imagine that the water change system has been operational for about a week, nearly draining the mixed saltwater reserve. The water change pump that brings new saltwater from the basement up to the sump is on, and the low water float switch is triggered in the




The saltwater mixing vat houses a circulation pump, high GPH water pump, heater, probes, and level float switches.

saltwater vat. Then, the water change pumps shut off along with the circulation pump in the saltwater vat, and the process of filling up the saltwater vat with purified RO/DI water begins. Fast forward 6 hours; the saltwater vat for water changes has been filled with purified RO/DI water, and it has triggered the high water level float switch. The conductivity probe is reporting low salinity, so the water heater turns on (if needed) and brings the water up to 78 degrees, followed by the circulation pump turning on. As soon as the water temperature is within range, salt is added.

The top pinch valve opens first and allows dry salt mix to fill up the pipe (this pipe holds half a cup of salt). What happens when I say the pinch valve opens is that an air solenoid valve is actuated. The solenoid allows the compressed air to quickly leave the pinch valve housing, which in turn opens the sleeve inside the pinch valve housing to allow the dry salt mix to flow through. As soon as power is removed from the air solenoid valve, the pinch valve housing is filled back up with compressed air, which then pinches the sleeve together, stopping the flow of the dry salt mix. So right now the top pinch valve is open, the bottom pinch valve is closed, and dry salt mix has filled up the PVC pipe between the two pinch valves. The top pinch valve stays open for a few seconds and then closes. Right after the top pinch valve closes, a small solenoid that is located on the top lid of the hopper opens and closes quickly. This is done to keep a vacuum from being formed inside the hopper as the volume of dry salt mix is being depleted. A few seconds later, the bottom pinch valve opens and the dry salt mix falls down through the pipe where it hits the water and is then pulled into the high GPH mixing pump. This process of the pinch valves opening and closing continues to happen for a preset number of times. When this number of repetitions is achieved, the pinch valves stop their cycle. If the conductivity reading is within the programmed range, they stay shut off. After a few hours, the high GPH mixing pump is shut off, while the circulation pump and heater stay active. At this point, the water change pumps turn back on as the mixing cycle is complete.

So what happens if the conductivity probe was reading low and was not in the programmed range? The way it was set, I'd get an alarm email, and more salt would be added through a few additional cycles with the pinch valves. Recently, I decided to remove this feature. The reason is that the system has been operational for a few years now, and I can't remember a time when this has happened. Instead, if the conductivity probe is reporting a low reading after the salt is initially added, I just get an alarm email, since there is an issue that needs to be addressed.

I hope you have enjoyed reading about my system. It has taken a lot of time and energy to get it to where it is today. While I have been a fish hobbyist for 24 years, automation only became my passion about 8 years ago. As seen in these three articles, automation can range from basic to advanced. My hope for this article series was to generate interest in automation in my fellow hobbyists and maybe even spark some creativity in you to automate your own system.

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Trumpet Coral


This 3-year-old Acan is one of my most prized LPSs.


Acanthastrea lordhowensis


This colorful zoanthid is one of my all-time favorites.


This beautiful Duncan Coral is a fast-growing coral.

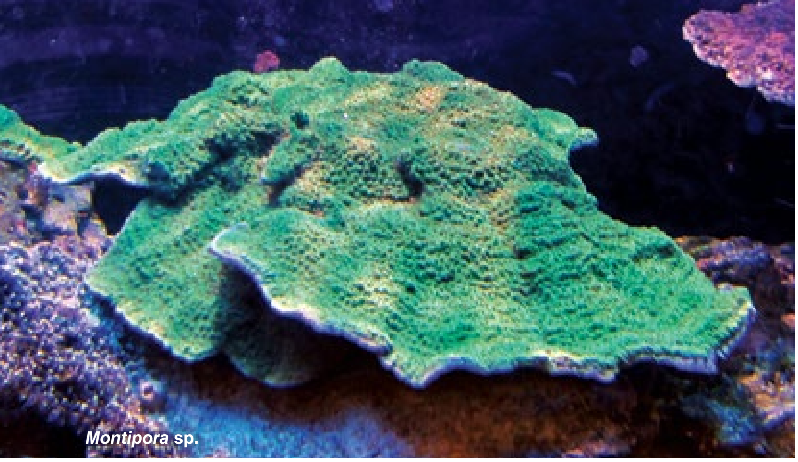

This Frogspawn requires a lot of space for its tentacles to extend.

REEFING IN GUATEMALA

HENRY RAFAEL

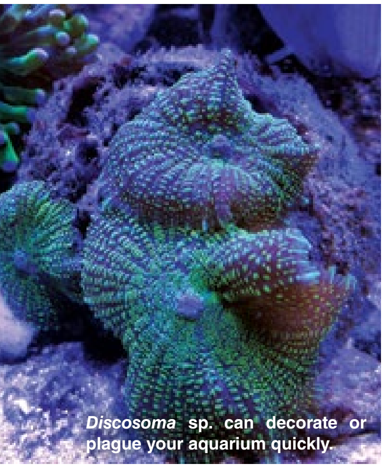
My name is Henry Rafael, and I live in Guatemala City. Even though I have more than 18 years of experience owning an aquarium, it has only been in the last 6 years that I got into the world of reefing. Today, the aquarium hobby in Guatemala is vast. As far as reef aquariums go, I have many friends here who have beautiful reef tanks. Years ago, we didn't have access to the variety of equipment we have now. I remember when I was just getting into the hobby, the only store that imported salt mix would run out, and I would have to wait months before I could get more. I had to make sure that I had plenty of salt on reserve at all times.

Nowadays, we have several stores and many options. There is one store in particular that is pretty large, and we can get just about

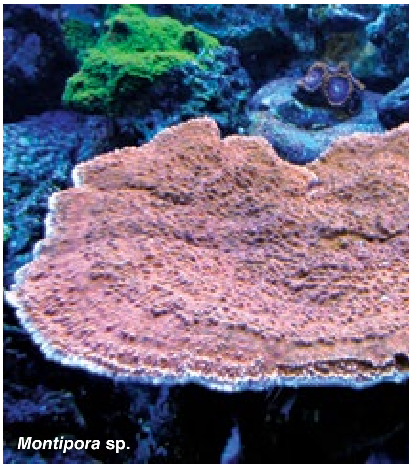


Montipora sp.

Aussie Dragon *Favia*



Discosoma sp. can decorate or plague your aquarium quickly.



Montipora sp.

This *Fungia* nearly doubles in size during feeding time.

anything, from a replacement pump to better lighting and even the most current equipment on the market. This store regularly imports corals and fish, and if someone wants a specific animal, the store can order it for them. I believe that this has helped more people become interested in reef aquariums here and has helped the hobby grow.

When I first started out in this hobby, I had a 20-gallon tank without a sump. The filtration consisted of a hang-on-back skimmer. At that time, I only had a couple of corals but did not have any fish. As the months passed, I spent hours of research learning about reefkeeping. Slowly, I began to introduce frags into the tank. After about 5 months, I decided to upgrade to a 50-gallon tank. Soon after, I acquired my first LPS frags. I kept learning about the hobby, and with time the frags grew into large colonies (even though they had started out very small).

Today, I own three reef aquariums. One contains SPS (*Montipora, Acropora, Stylophora,* and birdsnest), LPS (*Acanthastrea, Blastomussa*), and zoanthids. This 90-gallon tank is my primary aquarium, the one that I dedicate the most time to. My second aquarium, as importance levels go, is a 32-gallon tank. It contains low current corals like *Euphyllia, Blastomussa,* pompom xenias, *Xenia elongata*, and various mushroom corals. My third aquarium is a 125-gallon tank. It runs on water from the partial water changes of my other two aquariums. It can be said that the water I take out of the other tanks gives this tank life. In this system, I keep all the corals that have very few requirements and flourish with high water

Clove polyps come in various exotic colors.

Zoanthids can create colorful gardens in our aquariums.

This is one of the oldest *Acropora* in my collection.

This *Agaricia* sp. is a slow-growing coral.

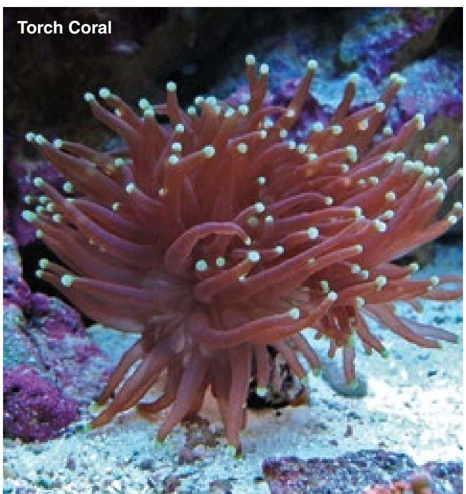
Radioactive Dragon Eye

flow, such as green, neon green, and pink star polyps. I also keep a variety of leather corals that have found the parameters in this tank to be ideal and grow very quickly.

I feel that having multiple aquariums has allowed me to find the optimal environment for each of my corals. A lot of people ask themselves why a certain coral thrives in one person's aquarium but won't in someone else's. Most of the time, we mix all kinds of corals in a tank with standard water and light parameters, but rarely do we think about the fact that not all corals require the same light, flow, and water chemistry. Understanding this idea has allowed me to have great success with my three beautiful reef aquariums.

I believe that our love and passion for reef aquariums is a beautiful addiction. That love and passion grows in me daily, despite occasional frustration. I've recently added a new hobby: macro photography of my corals. I can spend many hours each week attempting to capture that perfect moment in time with my camera. I hope that you all enjoy these pictures of my coral collection.

Montipora sp.



Torch Coral

This Bonsai Acro is my favorite among my *Acropora*.

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Keeping and Breeding the Clark's Anemonefish

Clark's Anemonefish at 75 days

Images by Sustainable Aquatics and Gordon Greenley

GORDON GREENLEY & HEATHER MUTSCHLER

Throughout the world, clownfish are some of the most easily recognized fish by people of all ages. Not only do they star in movies, they are a favorite among hobbyists for their looks, personality, and ease of care and breeding. One of the most unique and underrated of the clownfish species is *Amphiprion clarkii*, also known as the Clark's Anemonefish or Clark's Clownfish.

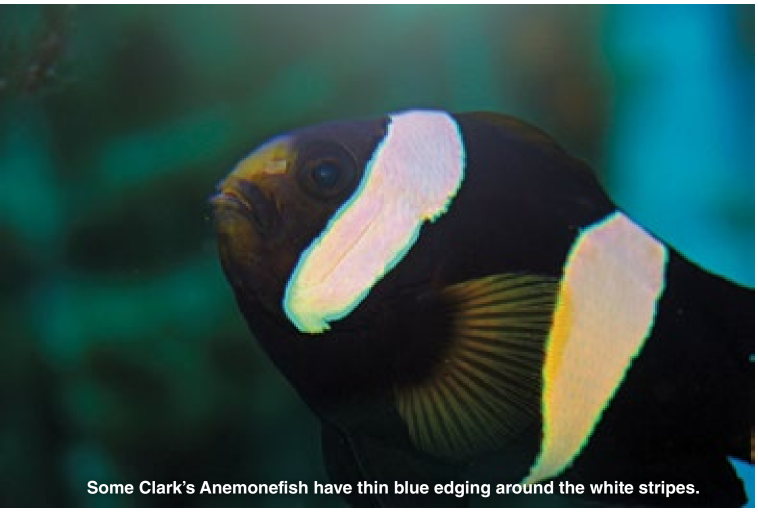
The Clark's Anemonefish is native to parts of Australia and much of the Indo-Pacific region. Depending on its specific origin, Clark's Anemonefish can sport a slew of color variations ranging from light yellow to jet black, typically with two vertical stripes along the body and the possibility of a third stripe before the tail. This species shares many of the same characteristics seen in other anemonefish and when given the right care, makes a really fun and rewarding addition to almost any saltwater aquarium.

The Clark's Anemonefish will grow quite quickly when generously fed, reaching a maximum size of about 5 inches. Like other anemonefish, it can live upwards of 20 years. Fully grown individuals or pairs of this bold and large anemonefish do best in an aquarium of no less than 30 gallons. If kept as a pair, it is important to give these fish plenty of room due to their boisterous nature.

captive bred, juvenile black Clark's Anemonefish

captive bred, juvenile yellow Clark's Anemonefish

The author's pair of 1-year-old black Clark's Anemonefish which has recently reached sexual maturity.



Some Clark's Anemonefish have thin blue edging around the white stripes.

It is also important to remember that the Clark's Anemonefish, as with all clownfish, is a type of damselfish and therefore can be very aggressive to other damselfish (and especially other clownfish). A mature Clark's Anemonefish even has small, visible teeth in the front of its mouth. It is not uncommon for this extremely brave fish to nip its keepers' hands and arms when they're working in the aquarium. In rare cases, it may even draw blood.

One awe-inspiring characteristic shared by all anemonefish is the unique symbiotic relationship they form with sea anemones. The Clark's Anemonefish is not picky when it comes to hosting different species of anemones and will usually befriend any anemone that would typically host an anemonefish. Bubble-Tip Anemones, Carpet Anemones, and Long Tentacle Anemones are all great potential hosts for Clark's Anemonefish in a properly-sized aquarium. Captive bred individuals may not immediately recognize an anemone as a host, so it can take much longer than a wild fish to bond with an anemone. Once bonded, the interactions between the fish and its sea anemone are some of the most interesting in the animal world. The fish will defend the anemone, and the anemone will help protect the fish. Even more remarkably, some people have reported observing clownfish bringing food to their

A family of wild black Clark's Anemonefish living on the wreck of the World War II Japanese supply vessel Hirokawa Maru in the Solomon Islands.

host anemone. It is not currently known, however, if this behavior is actually intended to feed the anemone or serves another purpose.

One reason the Clark's Anemonefish is so easily cared for (and therefore so attractive to many aquarists) is its willingness to eat almost any prepared food. This makes it very easy to provide these fish with a varied and healthy diet. The Clark's Anemonefish will accept many different dry foods along with frozen *Mysis* shrimp, frozen cyclops, frozen brine shrimp, and chopped, raw seafood. Of course the addition of live foods such as live brine shrimp, live *Mysis*


This spawning pair of black Clark's Anemonefish was originally collected in Australia.

shrimp, and different types of copepods are usually welcomed by any anemonefish.

Another attractive aspect of the Clark's Anemonefish is that it is a very hardy and robust fish. Not only will a mature Clark's Anemonefish stand up for itself in a tank with other boisterous fish, but it is very resilient to injuries and is fairly resistant to some parasites and diseases thanks to its thick slime coat. This makes the Clark's Anemonefish a good candidate for either the reef aquarium or the fish-only aquarium, as long as none of its tank mates can fit the anemonefish in their mouth. It is also important to note that due to its larger size at maturity, the Clark's Anemonefish has the potential to eat smaller ornamental invertebrates such as shrimp, crabs, or even very small fish if given a chance.

Determining the sex of Clark's Anemonefish is slightly harder than with other anemonefish species due to the fact that a fully grown male in a pair could be larger in size than the female. Like all other clownfish, the Clark's Anemonefish begins life genderless and is a protandric hermaphrodite, meaning that it first develops into a male and as it grows, may or may not shift to become a female. Some females can develop a white tail at maturity. However, this is not a perfect method for determining the sex of an individual.

Even though sexing is sometimes difficult with this fish, they can easily be paired by putting a smaller, younger fish with a larger, older fish. The reasoning is that the younger fish should still be male. If the second, larger fish is not already a female, he will change into a female and will then assert dominance over the smaller fish to ensure that the smaller individual remains a male. This assertion of female dominance can look vicious, but it is a normal and mostly harmless activity between the pair; small scratches or slightly torn fins are not uncommon. If extreme violence is seen between a pair and severe injuries are becoming apparent, the two fish may both be female. In some cases, it has been reported that the male fish in a breeding pair of Clark's Anemonefish changed into a female, causing fighting and the need to split up the pair. It is not currently known why this occurs. At about a year and a half of age, with regular feedings and a varied diet, the Clark's Anemonefish reaches sexual maturity and can begin to spawn.

The Clark's Anemonefish is one of the easiest saltwater fish to breed. However, effort is still required by the hobbyist, and patience is a must. An aquarium as small as 10 gallons can be used as a breeding tank for a pair of younger individuals. Like other anemonefish, the Clark's Anemonefish prefers to spawn on a bare surface. Clay pots or ceramic tiles make for ideal spawning locations. If present near their territory, the fish will usually seek them out and use them for spawning.

In order to get a large number of healthy eggs from each spawn, it is very important to feed the parents consistently (multiple times per day). Keeping a strict routine is also vital as changes to feeding schedules, light cycles, and even tank decor can cause an interruption of the pair's spawning cycle. The health of the parents is directly reflected in the viability of the eggs and the health of the fry at hatching. When a young pair first begins to spawn, the two will typically produce from 20 to 60 eggs. It is not uncommon for the first one or two clutches of eggs to be unhealthy and eaten by the parents as they learn new parenting skills. As Clark's Anemonefish grow older, healthy pairs can produce over one thousand viable, robust eggs in a single spawn.

Once the eggs are laid, the parents will care for them constantly. They will typically take turns fanning and blowing on the eggs to prevent debris and fungus from building up and will also remove dead or dying eggs as needed. When a nest is present, both fish

Clownfish prefer to lay nests on bare surfaces.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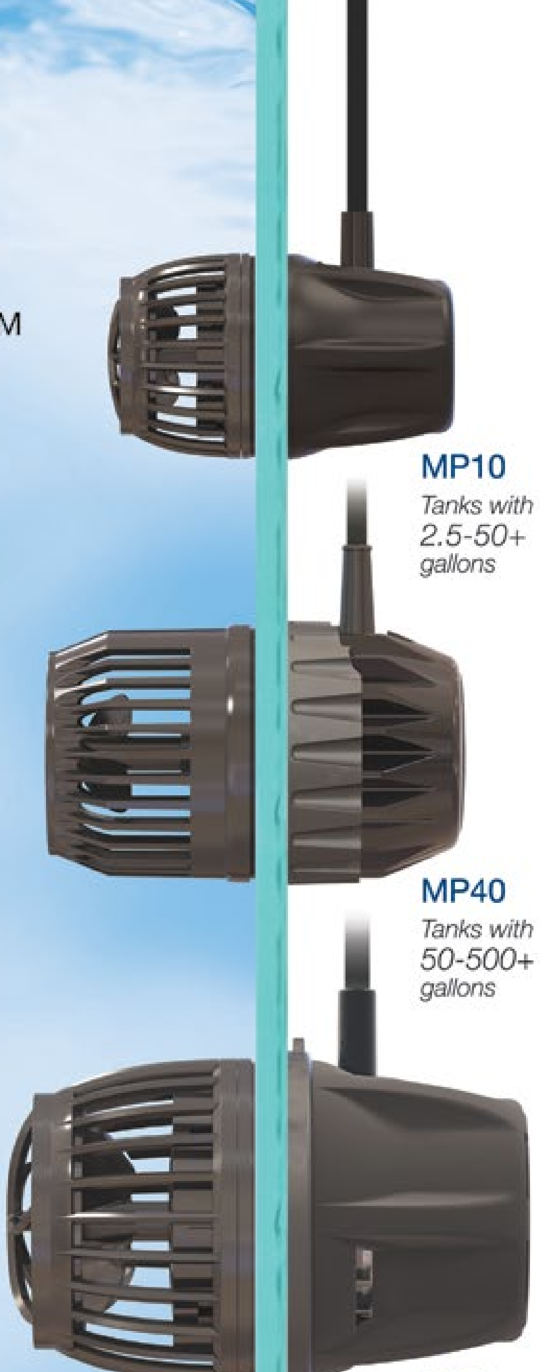

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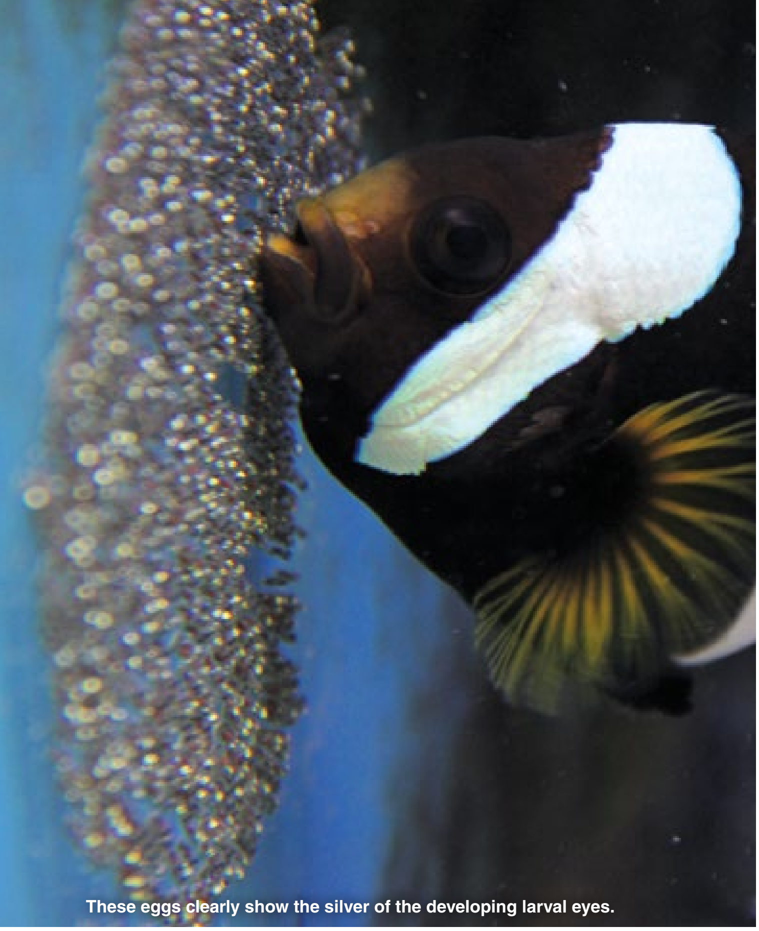
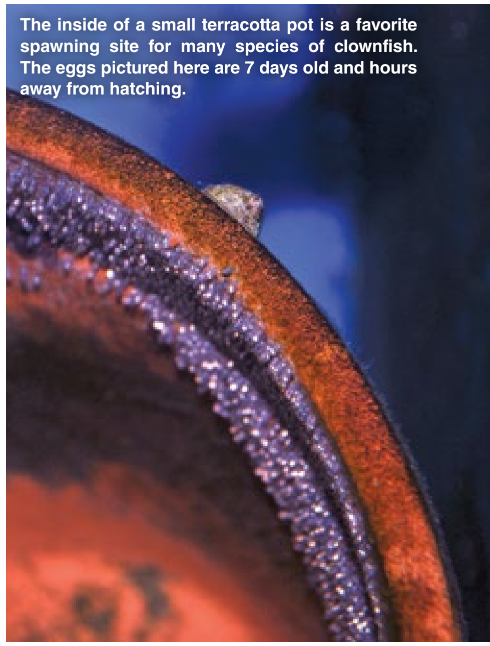


These eggs clearly show the silver of the developing larval eyes.

become very protective and may attack other fish (or hands and arms) that approach the nest. When first laid, the eggs will be bright orange in color and will progress to bright silver just before hatching as the reflective eyes of the fry become visible.

Depending on the temperature, the eggs will hatch from 7 to 10 days after being laid, about an hour after the lights are turned off for the night. At this time, it is extremely important not to expose the eggs to any light because the larvae use darkness as a signal that it is safe to hatch. Exposing the eggs to light at this time can cause a delayed hatch. Before hatching, the pot, tile, or rock on which the eggs have been laid should be removed and placed in a rearing tank.



The inside of a small terracotta pot is a favorite spawning site for many species of clownfish. The eggs pictured here are 7 days old and hours away from hatching.

The rearing process can be a challenging phase of breeding the Clark's Anemonefish at

A magnified view of one of the author's 4-day-old black Clark's Anemonefish larvae. Young Clark's Anemonefish larvae look nothing like the adults.

home, although with the proper technique and a lot of patience, it is quite achievable and very rewarding. A proven setup for the rearing tank is a non-filtered ten-gallon aquarium with all sides blacked out. Add a dim light, a heater, and a rigid airline (without an air stone) to provide gentle water movement and oxygenation. It is important to black out all sides of the rearing tank because this helps provide the larvae with the contrast needed to see their food. Also, it is important to only use a dim light over the rearing tank because if the light is too bright, the larvae will stay on the bottom in an attempt to avoid the bright light. The amount of light can be gradually increased after day 4 or 5 as the larvae become less light sensitive. Upon hatching, the larvae will have fully formed eyes and mouths but will not look like adult fish. They will accept live rotifers immediately. It is important to use greenwater, both to enrich the rotifers and to help provide more contrast for larvae hunting their prey.

For the first 4 or 5 days, it is best to avoid performing water changes as this can stress out the larvae and cause unnecessary deaths. Since there is no active filtration, liquid ammonia detoxifiers may be used in moderation. Be careful not to use too much ammonia detoxifier because it may lead to a delayed metamorphosis (also known as settlement) of the fry.

Around day 4 or 5, live *Artemia* nauplii (also known as newly hatched baby brine shrimp) can be introduced as a new food. The *Artemia* must be introduced in moderation because Clark's Anemonefish larvae (in particular) have a tendency to overeat when first introduced to *Artemia* nauplii. At this point, small amounts of

These black Clark's Anemonefish larvae are 4 days old.

The author's 13-day-old black Clark's Anemonefish larvae. At this point, some have begun to settle and have gained their adult coloration.

crushed or pre-sized dry foods can be given as well as *Artemia* nauplii in order to get the larvae used to seeing the dry food. They may start eating dry food a few days later.

At day 12 to 14, the larvae will be much larger than when they first hatched and will begin to undergo metamorphosis. It is essential to have excellent water quality at this stage, and it may help to perform numerous small water changes in the days leading up to metamorphosis. Metamorphosis is essentially when the anatomy of the larvae changes almost overnight. After metamorphosis, the baby fish will mostly look and act like a miniature adult Clark's Anemonefish. At this time, the stripes form and the body shape becomes more rounded. It is generally accepted that if high water quality is not maintained during metamorphosis, it may result in misbars (incomplete stripes) and other physical defects.

After metamorphosis, the care of the cute, young Clark's Anemonefish becomes exponentially easier. Not only do they now act and look like adults, but the juveniles are much hardier and more tolerant of water parameter fluctuations. They can now begin to handle much larger water changes. The young can now be moved to a grow-out tank and should still be fed often, although they do not need to be fed as often as when they were larvae. They will also be much more adventurous in terms of trying new foods, and their diet can be continuously expanded as they grow.

5-month-old juvenile yellow Clark's Anemonefish

2-month-old juvenile black Clark's Anemonefish

The grow-out tank can have a filter as long as the intake has foam or a mesh screen to exclude the fish. If fed well, the young Clark's Anemonefish will grow very quickly and be large enough to be sold or introduced to another aquarium at about 4 to 6 months of age.

The Clark's Anemonefish is in demand throughout the aquarium industry due to its combination of attractive characteristics. There are numerous companies in the aquarium trade that are currently breeding different variants of the Clark's Anemonefish, and it is well on its way to becoming another "designer" clownfish species. Some variants have extra white spots on the body or different amounts of black or orange coloration. Some Clark's Anemonefish even have thin bright-blue stripes on the outside of their white stripes. With all these different variants, there is sure to be a Clark's Anemonefish to suit just about every hobbyist's taste. This is the perfect fish for the beginning aquarist and for veterans in the hobby alike. If you are looking for a unique, interesting, and active fish or a fun breeding project, the Clark's Anemonefish is the perfect fit for you.

Reference:

Wilkerson, Joyce D. *Clownfishes: A Guide to Their Captive Care, Breeding & Natural History.* Shelburne, VT: Microcosm, 1998. Print.

FRESH IS BEST

A healthy reef depends on plankton, and in this case, fresh is best! AlgaGen has recently launched its Live Feeds Program, which aims to set up culture holding systems in local fish stores across the country. Stores offering the Live Feeds Program will have live phytoplankton, rotifers, brine and/or copepods available to customers to feed their reefs or breed marine livestock with. Now you can provide your reef the nutrition found in nature and elicit the natural feeding responses from all of your tank inhabitants. Ask your local fish store for AlgaGen's Live Feeds Program.

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SPS REEF FROM DOWN UNDER

SCOTT LAMBERT

My name is Scott Lambert, and I am a 31-year-old, self-employed father of three. We live in Australia and reside in the state of South Australia. This hobby of ours is not only a passion of mine but of my whole family. If I didn't have the support of my fiancée, Tammy, there would be no way that this setup of ours would have turned out the way it did.

Our adventure in reef aquarium keeping began nearly 5 years ago. We started out with freshwater, which didn't last all that long once I discovered the beauty of a reef tank. As you all know, reefing's not something you just jump into, so I did my research. I must admit it had me scratching my head for a little while, but now it's just second nature. We started with a 24-gallon tank that soon after was replaced with a 106-gallon mixed reef system. I didn't think I'd ever go any bigger than that, but the more I researched on the Internet, the more I fell in love with the dream of a full-blown SPS tank. I toyed with the idea for a while, trying to figure out what size I wanted to build until I was convinced by a mate to build a 4' x 4' x 2' peninsula tank. I'm very glad I did because it's turned out better than I ever dreamed.

Because I planned for this tank to be an SPS tank, number one on my list of priorities was stability, followed by easy maintenance. I believe that the easier and quicker maintenance is, the more time I have to keep an eye on things and just simply enjoy the hobby itself.

Having a peninsula tank has also made the maintenance part easy as all the cladding is held on by magnets and slots together with woodworking biscuits. This ensures that the frame slots together perfectly every time, and I've learned that having all that open room to work just makes the tank a pleasure to maintain.

As I mentioned, this tank was designed to be as easy to maintain as possible. The tank has been running for 1½ years, and I employ GFO, activated carbon, a skimmer, a refugium, and a UV sterilizer for water clarity. I use a dosing pump to keep alkalinity, calcium, and magnesium levels stable, and all of the listed equipment has been running since day one. Nothing has been added or taken away, and as much as I have thought about changes, I always come to the same conclusion: why mess with something that's been working well so far?

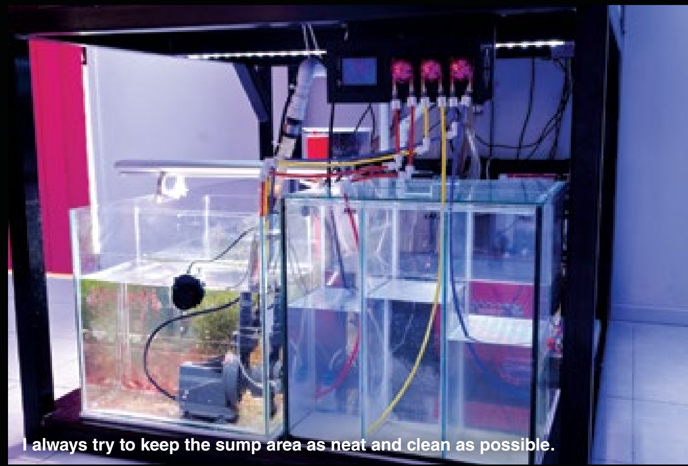

Mystery Wrasse (*Pseudocheilinus ocellatus*)


This is one of my many encrusting *Montipora*.


Blue SPS like this are the standout corals in the tank.

FILTRATION: Water from the display flows into a 12 inch x 7 inch weir with dual 1.5-inch overflow pipes and is dumped into a small chamber. It then flows sideways into another small chamber that houses the Bubble Blaster 5000 feed pump and a 600-watt Schego heater. The feed pump is hooked up to a four-outlet manifold that I built myself. The manifold feeds the 2 Two Little Fishies reactors that run ROWA phos and ROWA carbon, a DeBary 25-watt UV sterilizer, and a spare output just in case I ever need a chiller (which I have not needed so far). All of the water from the second small chamber, the reactors, and the UV then moves into the next chamber where the Royal Exclusiv Bubble King Supermarin 200 is located. The Bubble King is a fantastic skimmer, and after owning one, I'll never purchase anything else. They are very easy to dial in, and on top of that, they are extremely easy to clean. Water then moves into the next large chamber where the refugium is located. All that is in my refugium are two pieces of live rock, *Caulerpa*, and a dual T5 light. From there, water flows into the return chamber. The return pump is a Bubble Blaster 7000, which returns water to the display via a 1-inch pipe. The water then travels up through the middle of the weir to a split and is returned out of each side of the weir with duck-bill enductors. It's not complicated at all and has been working effectively for a while now, so I've had no need to change anything.

LIGHTING: The choice to run T5 lighting over this tank has been the best decision I've made during this whole build. While doing my research, I quickly learned that many people choose to run


I always try to keep the sump area as neat and clean as possible.

T5s on SPS tanks, with halides not far behind in popularity. There were other influences also, like a friend's inspirational T5-lit tank and the fact that we had just installed a 5.64-kW solar system on our home. With all that in mind, I decided I wanted what would be best for my tank, no matter what the cost in power or light fixtures. When it comes to T5s, I think there's a company that stands out above the rest, and that is ATI. We went with two 8 x 54 watt ATI Powermodules. They run for 9 hours on full power and 1 hour at reduced power for dawn and dusk, so 11 hours in total. I run all ATI bulbs: 6 ATI Blue+, 4 ATI Coral+, 2 ATI Aqua Blue Special, 2 ATI

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right-side view

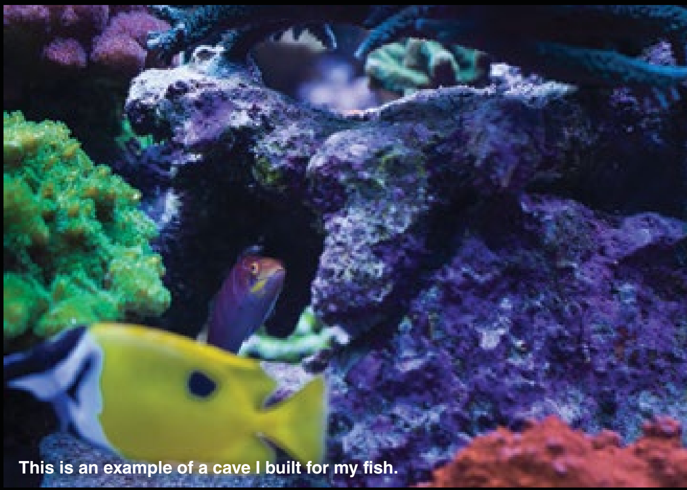
Purple+, and 2 ATI Actinic. I have an extra foot of cabinet space directly behind the tank where I've hidden all the wiring and timers for the lights to make the setup as neat as possible.

ADDITIVES & WATER CIRCULATION: For dosing, I decided to go with Randy's Recipe alkalinity, calcium, and magnesium that I run through a Vertex Libra dosing pump. I've found the Vertex to be an excellent unit thus far with no issues at all. I store it all in a 19.6-inch cube that is split up into four sections: 4.5 gallons of alkalinity, calcium, and magnesium and 18.5 gallons of RO/DI for top-off water in which I'm using a Tunze 3155 auto top-off (ATO). The only extra thing I dose is potassium, which I do by hand when it's needed.

For circulation, I have two Tunze 6205s running off a Tunze 7096 controller. I have them set to sequential and pulse. This makes a really nice wave throughout the whole tank, and when it hits the front glass, the water pushes down toward the bottom of the tank and runs along the sandbed. I tried to keep this flow pattern in mind when I scaped the tank, leaving lots of caves all the way through the rockwork for good flow. I also built the rockwork off of the weir and not against the back glass so that the flow would continue behind the rock as well.

This is the main focal point of the aquascape.

MAINTENANCE & FEEDING: For ease of maintenance, I have a drain hole drilled into the back of the tank so that emptying water is as easy as turning off the water pumps, plugging in a ¾-inch garden hose, and opening a tap. After 15 minutes, the water's out, and it takes another 15 minutes to pump water back in from my mixing drum. I perform weekly 20 percent water changes using Red Sea (blue bucket) salt, and I siphon the sump clean once a month. I was getting 7 to 8 weeks out of my ROWA phos, but now that I've upped the water changes a little, I'm getting 8 to 10 weeks before it's exhausted. I only change the carbon once a month, and my skimmer cup gets

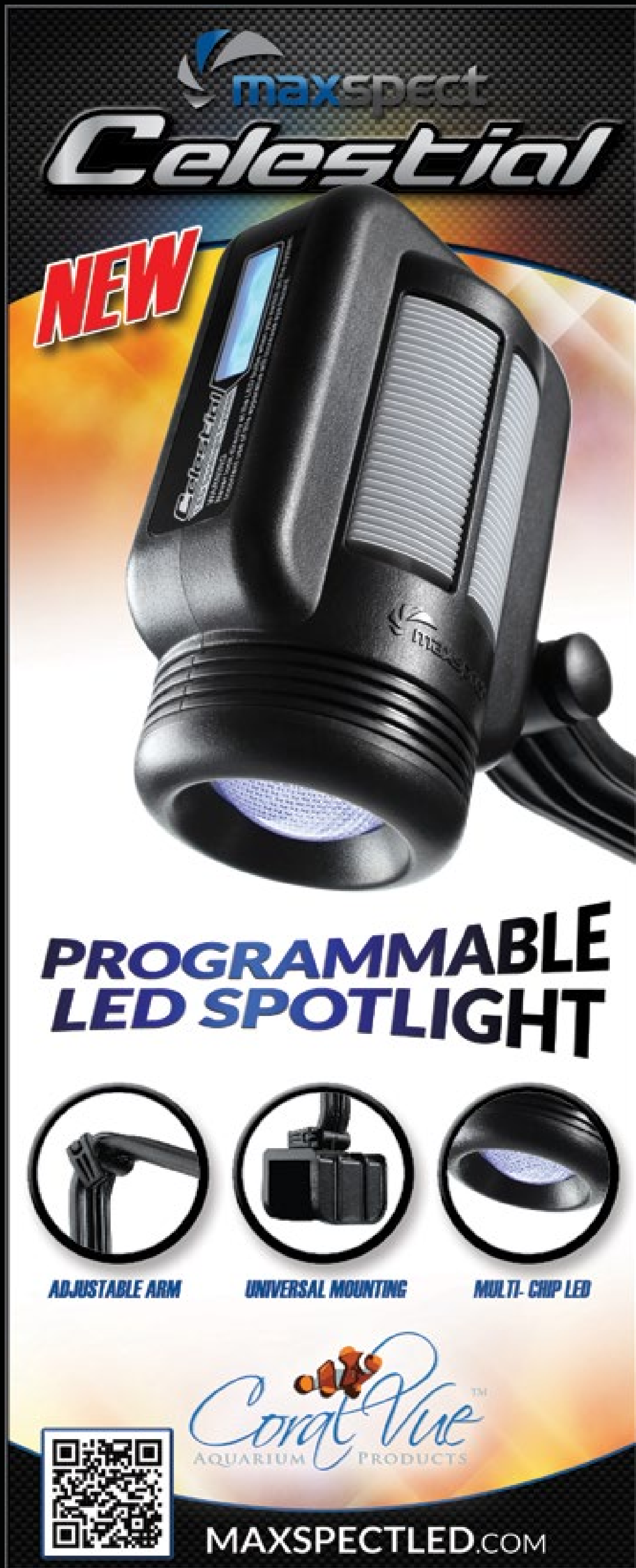

This is an example of a cave I built for my fish.

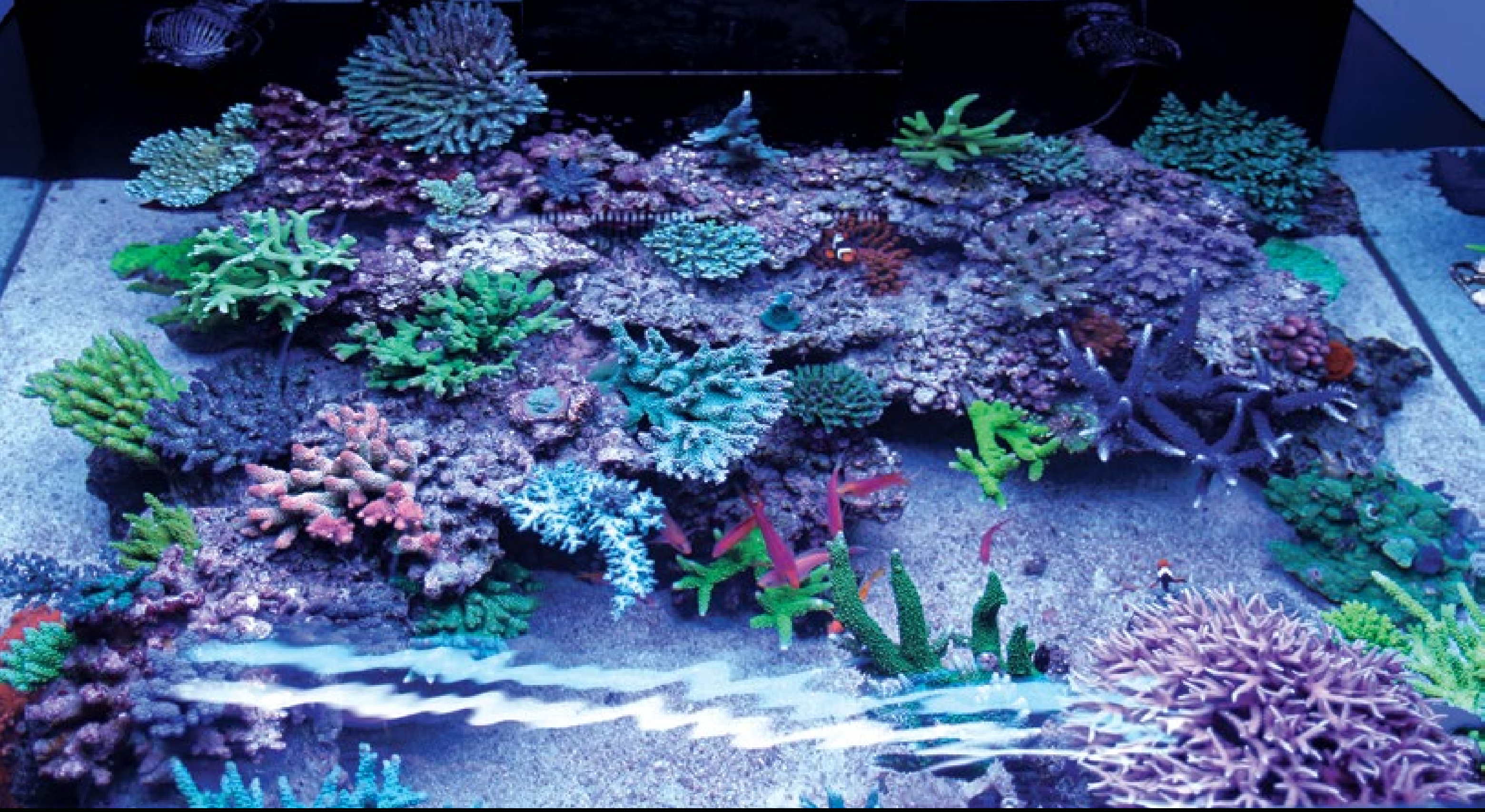
cleaned weekly during water changes. I use a Mag Float to clean the glass every second day during the week, but on water change day, I hand scrub the glass so the buildup doesn't get out of hand.

I'm feeding the tank morning and night with a mixture of large and fine frozen foods, pellets, nori, Ocean Nutrition frozen, and New Era algae pellets (mainly for my tangs). The fish get two blocks of frozen food in the morning with pellets and then two different frozen


Christmas Tree Worms have added great color and variety to the tank.


This tabling *Acropora* is exhibiting new growth.





blocks at night with pellets. They're only fed nori once a week. I don't use any coral foods of any kind; just feeding the fish and keeping water quality high seems to be doing the job so far.

SCAPING & CORAL PLACEMENT: When scaping the tank, I had a number of goals I wanted to achieve. Creating caves, overhangs, and open water for my livestock, making the tank as natural looking as possible for coral placement, creating a good depth-of-field so that the rear of the tank wasn't wasted, and making sure I got sufficient flow throughout the tank were all important. I think I've managed to achieve them all.

Coral placement was a big thing because I wanted to use as little glue as possible. I can count on one hand how many corals have been glued, as nearly all of them have found a spot and were just left to encrust. I was able to create a good depth-of-field by simply starting my scape low at the front and gradually raising it up toward the back of the tank. At the same time, I tried to select the right pieces so that I had slower-growing coral–such as deep water *Acropora* (one of my favorite types of SPS), scrolling and plating *Montipora*, and *Pocillopora* corals–in the lower areas so they wouldn't hide all that I had tried to achieve.

I'm extremely happy with how everything has turned out, and the tank is now full. But I'm always on the lookout for nicer pieces to try and better the tank. I think that's called being an SPS addict, but I don't hear any of my mates complain when I call to say I have some new freebies for them.

My Onyx Picasso clowns host in a Rose Bubble Tip Anemone.

SYSTEM SUMMARY:
Display Aquarium: 228 gallons (4' x 4' x 2')
Sump: 4' x 2' x 2' with 5 chambers
Skimmer: Royal Exclusiv Bubble King Supermarin 200
Lighting: (2) 8 x 54 watt ATI Powermodules
Water Circulation: (2) Tunze 6205 with Tunze 7096 controller
Manifold Feed Pump: Bubble Blaster 5000
Return Pump: Bubble Blaster 7000
Heater: Shego 600-watt titanium
UV Sterilizer: DeBary 25-watt
Reactors: (2) Two Little Fishies 550 (ROWA phos + ROWA carbon)
Dosing: Vertex Libra
Auto Top-Off: Tunze 3155
Auxiliary Power: DIY battery backup system

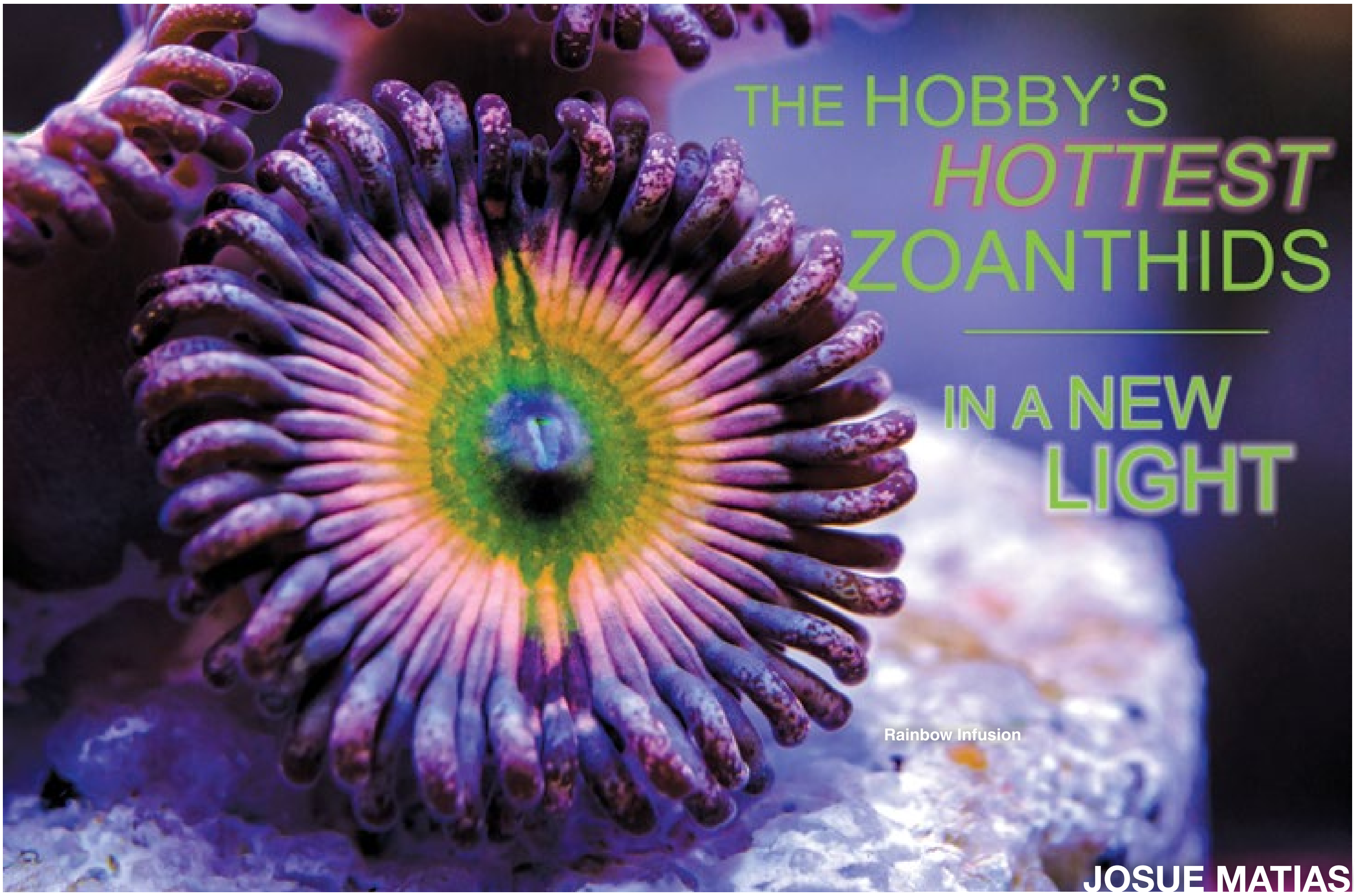
WATER PARAMETERS:

Salinity: 1.026	**Magnesium: 1300 ppm**
pH: 8.2	**Nitrate: 0.2 ppm**
Alkalinity: 7.7 dkH	**Phosphate: 0.02 ppm**
Calcium: 380 ppm	

LIVESTOCK:
Orange Shoulder Tang (*Acanthurus olivaceus*)
Gold Rim Tang (*Acanthurus nigricans*)
Purple Tang (*Zebrasoma xanthurum*)
Yellow Tang (*Zebrasoma flavescens*)
One Spot Fox Face (*Siganus unimaculatus*)
Picasso Onyx Clown Fish Pair (*Amphiprion percula*)
(2) Mystery Wrasse (*Pseudocheilinus ocellatus*)
(2) Yellow Watchman Goby (*Cryptocentrus cinctus*)
(2) Mandarin Dragonet (*Synchiropus splendidus*)
(2) Evansi Anthias (*Pseudanthias evansi*)
(3) Flavicauda Anthias (*Pseudanthias flavicauda*)
Dispar Anthias (*Pseudanthias dispar*)
Watei Anthias (*Luzonichthys waitei*)
(2) Blue Linckia Starfish (*Linckia laevigata*)
Greenfish Sea Cucumber (*Stichopus chloronotus*)
Coral Banded Shrimp (*Stenopus hispidus*)
(7) Maxima Clam (*Tridacna maxima*)
(5) Strombus Snail
(5) Nassarius Snail

ACKNOWLEDGEMENTS

Thank you to *Reef Hobbyist Magazine* for giving me the opportunity to share my tank; I am very grateful. Massive thanks to my family Tammy, Zhaine, Byron, and Monique for all their love and support, to my LFS in Adelaide (MarinePlus), Riki, Alex, Milton, Jackie, and last but not least, my photographer and friend ChorPeng Ng. Thanks again everyone; I hope you enjoyed the read.



Rainbow Infusion

THE HOBBY'S HOTTEST ZOANTHIDS IN A NEW LIGHT

JOSUE MATIAS

Hello again, reefers; Joshporksandwich, zoa and paly addict here. In this article, I would like to talk about my tank's transition to LEDs and highlight some of the hottest palys recently introduced to the polyp world.

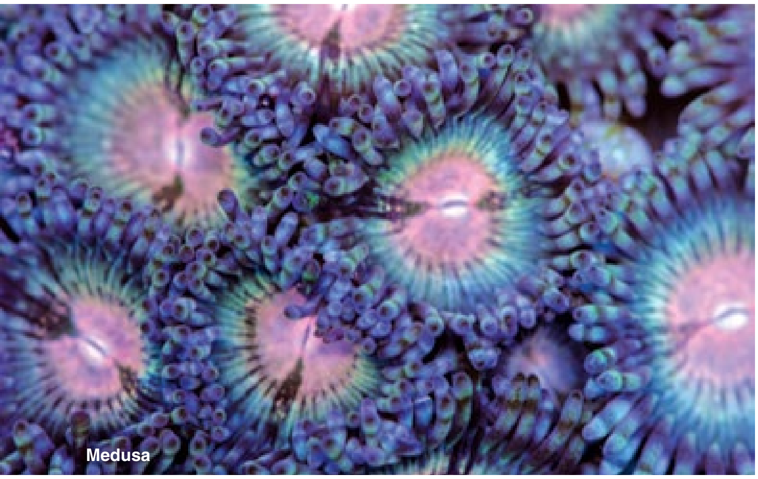
Before we start with the good stuff, I concluded my last article by saying that I was transitioning from metal halides to LEDs, and I would like to briefly fill you in on how that went.

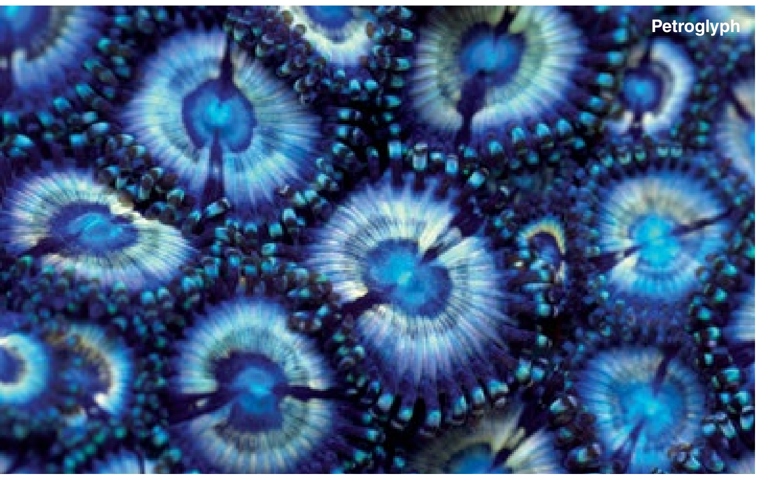
I decided to try the Apollo 6 LEDs that a friend of mine had been using on his 700-gallon display tank. I tested these LEDs on my frag tank for about 6 months. The fixtures consume 244 watts each and are 75 percent royal blue and 25 percent 6,500K white LEDs (non-dimmable). Everything was growing and coloring up

These polyps are lit by white and actinic LEDs.

The same polyps lit by actinic LEDs only.


Mystique


Medusa


Petroglyph


Utter Chaos

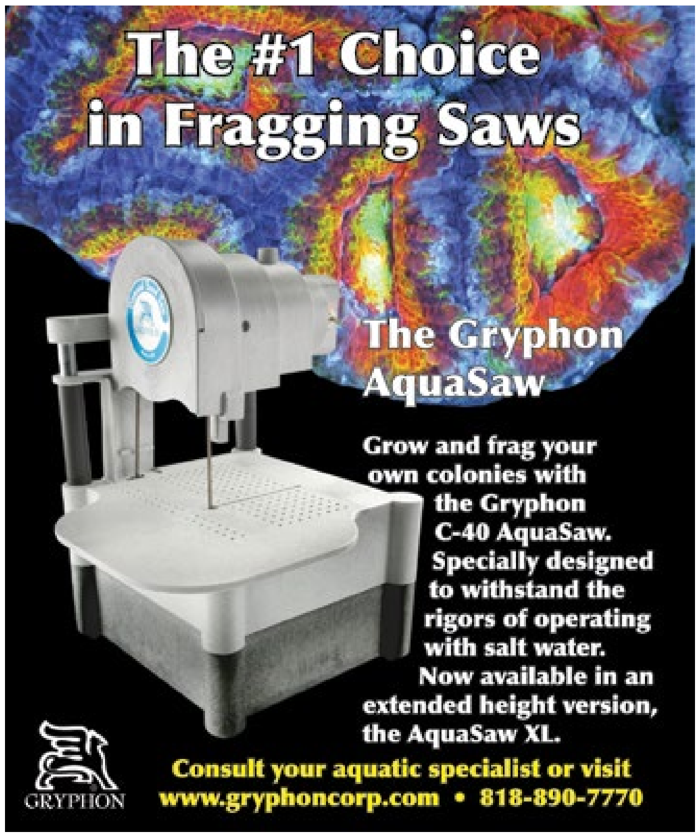
well, so I decided to replace my metal halides and transition to all LEDs over my main display tank.

TRANSITION PERIOD

I used a par meter to test the light intensity in my tank before the transition. I placed the new lights at a height where all my corals were at the same PAR (light intensity) levels as they were with the previous lights. LEDs seemed to be a lot stronger than halides, so I cut the photoperiod from 3 hours white and 9 hours actinic (with the halides) to 2 hours white and 4 hours actinic (with the new LEDs). By testing my lights with a PAR meter, I realized that the intensity of the 25 percent whites was very weak compared to the halides. With this in mind, I decided to increase the duration of the whites to 4 hours. I finally settled on having the whites on from 11:30 a.m. to 3:30 p.m. and the blues on from 4:30 p.m. to 7:30 p.m. I had to place the light fixtures at 36 inches from the water's surface in order to get full coverage along with the correct PAR readings. The painstaking research with the PAR readings was an important part of transitioning from one light source to another while ensuring minimal harm to my tank's inhabitants.

SIZE OF POLYPS

After a few months, the size of my zoa polyps got smaller, but the colony growth overall was better. The colors also got brighter. My encrusting and capping montis went crazy, growing really fast with an abundance of color. I lost a few corals because even though I tried keeping everything at the same light intensity, some zoas and palys didn't like the LED transition. Losing some corals is normal



when transitioning from one light source to another. Luckily, I was able to save some frags by putting them in my frag tank and in friends' tanks, so a majority of my corals survived the transition.

POST-TRANSITION

It took 6 to 8 months for everything to get re-acclimated. I had to rearrange some of the corals until they became "happy" and started growing and thriving again at a more consistent rate.

Check out a video interview of me with my tank on the YouTube channel Afishionado. In the interview, I talk in depth about my setup. My tank has made quite a transition in the last year. In February, it even won tank of the month on Reef2Reef.

Scan this QR code to watch the interview and video footage of my tank.

NEW UPGRADE SETUP TEASER

I can say that I'm blessed because my wife came up to me and said we needed to upgrade to a bigger tank (without any type of bribing). Sometime in the future, I will be showing you her amazing 220-gallon (72" x 24" x 30") peninsula tank with not one but two sides completely covered with some of the most amazingly colored zoas and palys. I will use LEDs with T5 supplementation, a 90-gallon sump/refugium, and a panel of shells by Craig Ganes.

What Really Bugs you ?

Whatever it is, a good bath will take care of it. **ReVive** Coral Cleaner™ is a new type of coral dip solution developed by Julian Sprung. Its formula is based on powerful plant extracts, but it isn't harsh on coral tissues the way iodine-based dips are. For coral dipping prior to acclimation to aquariums, for rinsing prior to shipping, and for dipping newly fragmented corals, such as at coral farming facilities.

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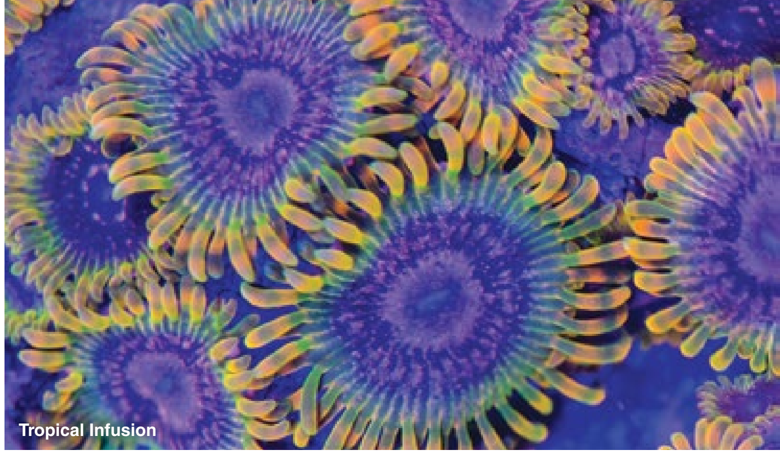
Tropical Infusion


Latin Lover


Watermelon Blossom

THE YEAR OF THE ZOA

The last few years have been a great time for zoas. There has been a boom in pricing for exotic must-have morphs. Some of the hottest zoas have been selling on an auction site where two polyps recently sold for over $2,400. There is definitely a craze for these new, sought after polyps. Some forums have over 100,000 zoa thread views in just 1 year. There is an epidemic of zoa addicts being born every day.

NAMES OF ZOANTHIDS

Naming zoas is tricky. It doesn't come from a scientific point of view, but I believe there is a story behind the name of every zoa. Zoa names can come from a cartoon character, a superhero, an animal, a flower, or even a place. It is really determined by the person naming it. With that being said, the same coral can have different names in different parts of the world. As ridiculous as this sounds, some of those names help identify some of the morphs. I hope that someday, a database can be created where we can enter a description (like color of the mouth, center, outer rim, skirt), and the database can tell us the name of the zoa and where it can be purchased.


God of War

THE YEAR OF THE KRAK

So let's start with the most expensive one: the Krakatoa. This paly was named after a volcano in Indonesia, and it erupted for over $2,400 at auction. This was the first time we'd seen this level of pricing, and I believe it will be the last as no other polyp has even

come close to its price. It's a beautiful paly. Many articles have been written about this coral and its price at auction. Imitation is the best form of flattery, and there were many who tried to cash in on the hype with a similar paly. I hope someday I can get my hands on this morph, but as of today, I've only seen it once. The owner wanted half of my mortgage for it, so I passed without regrets.

Next is the Queen Krak. This morph came from the same vendor, but apparently, a few more of this one were released; it is a very beautiful morph.

Then there's the Pink Krak, released by World Wide Corals, and also the Master Krak and the Golden Empire. These palys are all amazing, and I'm in love with all of them. It is no longer enough to say that I am a reefer. I have more passion than that, more love and devotion for the hobby…I am a zoa addict!

I have been in this great hobby for less than 3 years, collecting only the corals that I find attractive. I spend a lot of time looking for worthy new additions to my zoa collection, but I also make sure to spend a lot of time taking care of these wonderful corals as well. This has resulted in a beautiful display.

I want to thank *Reef Hobbyist Magazin*e, Rick Molina, Eric Ho, my Coral Mafia brothers (Miguel and Xiomara Hurtado), and David Hammontree of Reef2Reef for allowing me to post so many pictures that inspired reefers to become zoa addicts. I also want to thank my son Josh (Peanut) for naming some of my morphs. Hopefully, my new setup turns out well, and I can share it with you in a future issue of *Reef Hobbyist Magazine*.


Krakatoa


Queen Krakatoa


Pink Krakatoa


Master Krakatoa


Golden Empire

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Let's Start A Story

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- **Louie T,**
President/CEO of Eshopps

"I started fish keeping with my father when I was 7. The hobby led me to many ventures."
- **Ralph C Cabage III,**
CEO of Sicce

"My friend Victor and I started to collect & grow corals, and 3 years later, our sickness led to the start of a retail store and a website."
- **Lou Schiavo,**
Co-Owner World Wide Corals

"I received a 10-gallon freshwater tank for my 12th birthday (1977)."
- **Scott Kohler,**
VP of Red Sea

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