Evolution of a 10 Year Old Reef

Richard Ross

My home reef tank is now 10 years old and has been an integral part of my life for one year longer than my daughter, and I love them both. Over the years, my reef system has been an interesting, entertaining, painful and wonderful teacher.

Background and Basics

I became a reef keeper in the early 1980's when algae covered rocks were considered cool and hair curlers were the ultimate in bio-filtration media. I took a break from the hobby after college but got back into it in the late 90's. As I experimented and worked to catch up with new methodologies, my 50 gallon tank slowly took over the living room like some sort of creeping infection – there were top-off, dosing, feeding, and monitoring apparatuses everywhere. Needless to say, though she loved the tank, my wife was less than pleased with the situation, and I agreed. Wouldn't it be better to have all that life support concealed so that the focus was on the animals rather than the equipment?

Anticipating the birth of our daughter in 2002, we moved to a larger house, and every reef keeper knows what that means – a new, bigger, better tank! I settled on a used, 150 gallon tank mainly because it fit well along a wall in the living room. I was adamant that the tank go in the living room because that is where I spend most of my time at home. It wasn't an easy feat to put the tank in place. We needed to relocate a bathroom door, but my wife gave the okay provided that I keep "tank creep" to a minimum. I installed the new bathroom door and at the last moment, decided to keep the original bathroom door in place, allowing me to have unrestricted access to the back of the tank which is awesome.

Philosophy

The main idea behind this system was to maximize the joy of watching animals grow and thrive but minimize the drudgery of the myriad everyday maintenance tasks that actually allow the animals to grow and thrive. Water changes are done by opening valves and flipping switches...no more buckets and hoses. Everything that I could make automatic, I did. At this point, even the skimmer effluent fills a bucket that automatically shuts off the skimmer when the bucket is full. Then, I flip a switch to pump that effluent to the sewer. Of course, automation has its own headaches, but the ability to leave the tank for work or vacation for three weeks at a time or just relax all weekend without having to worry about the tank has greatly enhanced my overall enjoyment of the reef.

Hiding the Mess

Reef keeping creates its own detritus; test kits, magnetic cleaners, tubes of glue, towels, spare parts, feeding cups, and lots of other stuff cover every surface if left unchecked. To combat this tendency in the new house, we ordered a custom cherry stand and canopy to hide things both above and below the tank.

The best idea we had to deal with the potential mess was to drill a hole through the living room floor and put all the support equipment – sump, skimmer, top-off, reactors, etc. – in the 40 inch-high crawl space under the house. All the noise, humidity, and detritus could live there and bother no one. I installed a 180 gallon sump and a 150 gallon Rubbermaid trough as a freshwater storage/saltwater-mixing basin. Experience has taught me that it is critical to have the ability to do large water changes on short notice, and this particular hedge against disaster has saved my reef several times.

Just flip a switch and all this skimmate is pumped to the sewer. The float switch turns off the skimmer when the bucket gets full.

Hiding the Mess: What's Changed

Though I loved the custom stand and canopy, we took the opportunity to make the tank 'semi' built into a wall when we had to have the floor redone. I say semi because I used the existing stand (I just painted it) and used 2x2 framing but did not attach it to the floor around the tank nor the neighboring bookshelf. This would allow for easy removal of the tank and 'walls' if we moved or, shudder, decided we didn't want the tank anymore. It looks like a full built-in, which I love, but it's really just a facade.

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The original sump, kalk reactor, top-off reservoir and skimmate collection area. Note the mess and salt creep that no one cares about because it is all under the house.

The semi built-in as it neared completion.

The space above the tank is huge (30 inches by 5 feet) and goes all the way to the ceiling. I can easily get my entire torso over the top of the tank. The lights are now hung from the ceiling, which makes raising and lowering them during work or lamp changes very easy. There is a storage shelf on one side of the tank and a magnetic storage strip on the other for things like scissors, tweezers, and bone shears. There is also a vent fan to the outside of the house built into the side wall to keep humidity down and keep the lights from overheating the tank during hot weather.

Aquascaping

It was important to me that the tank wasn't a 'wall of rock' on top of a bed of sand because not only do I think such setups are visually unappealing, but they also don't promote coral coverage or water flow. Even worse, detritus can collect under and behind rock walls, and if a coral accidentally drops behind that wall, it's gone forever unless you are willing to remove everything from the tank.

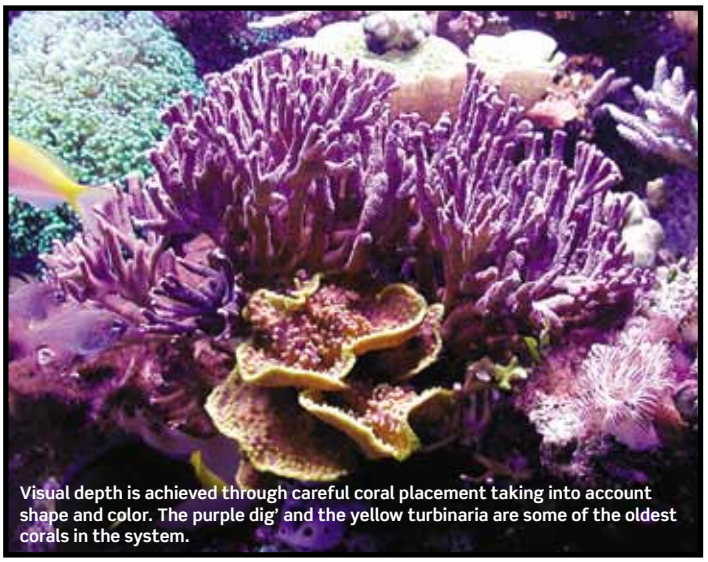
My solution to avoiding the 'wall of rock' was to purchase several nicely shaped, large pieces of live rock (one is over 50 pounds) and rest them on smaller pieces of live rock to raise them off the bottom of the tank. I also glued some tabs to the overflows and the back of the tank to help hold rockwork in place. The large pieces already came with swim-throughs and had interesting shapes. I arranged them in such a way as to minimize areas of low flow and maximize coral placement sites while giving visual depth to the display. To me, it feels like a real reef in the sense that you have to keep looking behind corals to find more corals.

Aquascaping: What's Changed

The aquascaping arrangement has remained essentially the same over the entire 10 years this tank has been set up. I removed the deep sand bed, and in addition to the potential safety impacts (discussed below), a huge benefit was reclaiming the valuable space the sand took up in the display tank.

Water Motion

The water flow was originally designed following the best thinking of the day and the prevailing thought was to maximize random flow. An Ampmaster 3000 is the main return from the sump and it feeds two 1-inch Sea Swirls located in the front corners of the


Visual depth is achieved through careful coral placement taking into account shape and color. The purple dig' and the yellow turbinaria are some of the oldest corals in the system.

tank. A Danner Mag 9.5 on a SQWD in a closed loop enters the tank in the bottom-back corners and prevents detritus build up. I also have a Danner Mag 7 running a SQWD with one output to the above tank refugium and the other able to be moved around the tank depending on where I think more circulation is needed. Finally, two powerheads on an MVT wave maker eliminate dead spots, and one large power head, also on the MVT, acts as a surge across the top of the tank. That seems like a lot, but in 2002, we really didn't have a great concept about what 'a lot' of flow actually meant.

Water Motion: What's Changed

The idea that random flow is the key to coral growth did not seem to pan out, and the idea of moving the entire mass of water has taken its place. I am an advocate of the idea of changing flow over the course of the day, in a way mimicking the current and tidal changes over the course of a day on a wild reef. I want the flow in my tank to be laminar for part of the day, random for part of the day, calm for part of the day, and going the opposite direction for yet another part of the day. Almost all of the water pumps in my system are now on some sort of timer so the flow in all areas of the tank varies over time.

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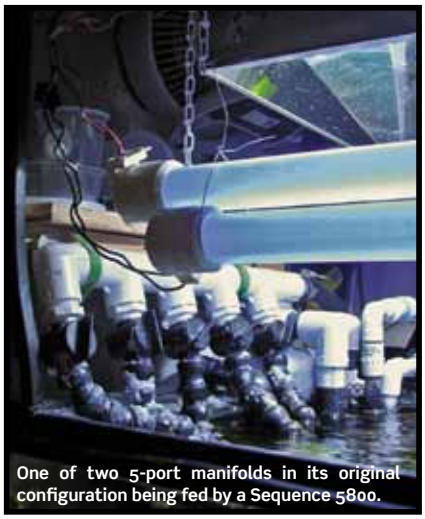
One of two 5-port manifolds in its original configuration being fed by a Sequence 5800.

The Ampmaster 3000 is still the main return. Out went almost all the powerheads, SQWD's, and Sea Swirls, and under the house went a Sequence 5800 on a heavy duty timer cycling off/on six times a day feeding two 5-port ¾ inch manifolds on each side of the tank. These are still in use and the flexibility they give the system is part of the key to its success. As corals grow, they impact flow, and being able to alter where the flow goes by moving the Loc-Line has really helped me tend my underwater garden. I have also started to put small water rotators, powered by the water moving through them, at the ends of some of the Loc-Line runs for even more water movement.

When they became available, I installed Vortech MP40s at both ends of the display tank. If these had been available when I initially designed the system, I would have designed the rockwork differently. But whatever visual impact these propeller pumps now have is more than justified by their operation - several different ways to vary their wide, massive flow over time is built into the units, not to mention the option of battery backups! These units really help get the entire body of water moving.

Behind the rockwork now are two eductors facing the middle-back of the tank powered by a Poseidon titanium pump which keeps any detritus from settling at the back of the tank. The MVT wave maker is still in operation, turning a Hydor Koralia on for six minutes, then off for eight minutes in a continuous cycle. There is also a Hagen 801 in one of the overflows with the output of the pump plumbed back into the tank which provides the added excitement of raising and lowering the water level in the display about ¼ inch.

Lighting

When I set up this system, double-ended metal halide bulbs were new, and I loved their small form factor. I installed four 250 watt PFO fixtures, but quickly added a fifth. The bulbs were arranged 20,000K/10,000K/20,000K/10,000K/20,000K for a nice blending of color temperatures. I also had two 48-inch VHO bulbs.

Lighting: What's Changed

When I changed the canopy, I replaced all the double-ended fixtures with two 400 watt MH bulbs in Lumenarc fixtures. Bigger is better, adds more punch, and uses less electricity overall. But after a while, I really began to miss the variability in light that more fixtures and multiple color bulbs gave me, and I also thought that I had better coral growth when I had more bulbs. I didn't go back to the double-

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Custom Lumenarc reflectors with two bulbs each. The evolution of the Loc-Line manifold is also evident in this shot.

ended bulbs because I broke too many of them during installation and the originally advertised electrical savings didn't seem to hold up. Instead, I got the nice guys at Lumenarc to make me custom reflectors that held two bulbs. I would lose some of the reflector's punch by moving the bulbs off center, but that should more than be made up for by the light from the additional bulbs. I have run a few different combinations of wattages in these reflectors, and one of my favorites was a 400 watt, 20,000K Radium with a 250 watt, 10,000K XM bulb in each. Currently, to save electricity, I run a 250 watt, 20,000K Radium with a 250 watt, 14,000K Ushio in each fixture, and I haven't noticed a significant change in growth or color. The light timers are staggered with the full array of bulbs on for only three hours a day, and the total photoperiod for the metal halides overall is eight hours.

I have also replaced the two 48-inch VHO tubes with two 48-inch, blue Reef Brite LED strips. LEDs seem like a fantastic solution for supplementation, but I have not yet felt compelled to try LEDs as my main lighting.

Life Support

I am not a fan of constant mechanical filtration on reef tanks so when this tank was set up, I added the ability to run filter socks or pleated cartridge filters when needed. Water flow would keep detritus from settling in the display, allowing it to settle in the long sump under the house where it could be netted out. Most of the filtration was biological in the form of live rock and sand.

When the tank was first set up in 2002, deep sand beds were in vogue. The deeper the better, went the wisdom of the times, and I ended up with a three to four inch DSB. I added a refugium mostly for algae growth to help export nutrients, a EuroReef CS-3 skimmer with an ozone generator plumbed into the needle wheel, and a DIY reverse flow calcium reactor.

Life Support: What's Changed

As the home tank got going, I decided an in-tank DSB wasn't for me. I didn't like the space it took up in the display, the way it limited the water movement in the tank, and how detritus seemed to build up on it. But more importantly, I had an incident where a powerhead fell out of place, stirred up the sand, and many animals died. I don't know for sure if it was the sand bed that caused the deaths, but when a second similar event caused similar results, I decided that the sand bed had to go. I invited a few friends over, removed everything from the tank, removed the sand bed, and put everything back. Since I liked the idea of a DSB for natural nitrate reduction, I plumbed a 20 gallon tank into the sump and filled it with sand for a remote deep sand bed (RDSB), and it seems to work well.

The faux sand bed was made by gluing sand to roughed up Starboard.

After removing the sand bed, I didn't like the look of the bare glass bottom so when the tank became semi built-in, I made a faux sand bed by gluing sand to cutting board pieces. I love it; the look of a sand bed without the sand bed.

Gone are both the algae refugia and the ozone generators. As either broke down for various reasons, I saw no degradation of water quality or animal life, so it seemed there was no reason to spend money or time on either. The EuroReef CS-3 skimmer is still chugging away. I added a kalk reactor to the automatic top-off. In the last year, I replaced the impeller pump that fed the calcium reactor with a peristaltic pump which I consider one of the best purchases I have ever made; I have not needed to adjust the feed to the reactor since this upgrade.

Disaster Preparedness

Because there are so many things that can go wrong in a reef tank, I decided it was important to control what I could. I installed several extra electrical circuits so different pumps, heaters, and lights are on different breakers. There are heaters in the sump and heaters in the display. A single powerhead near the top of the water line in the display tank was put on its own UPS battery backup, and there are several battery powered air pumps that switch on automatically during a power failure. There are two overflows in the display in case one gets blocked, and the main return pump is connected to a float switch on the display so if both overflows get blocked, the return pump shuts off, preventing a flood in the living room.

Nadelkopf?

The influence of German on reef aquarium keeping is evident in the use of words like "Kalkwasser." But something gets lost in the translation when you talk about a pin cap in German. Like "pinhead" in English, "nadelkopf" is slang for "stupid person." A pin cap on a glue dispensing bottle is not a stupid idea. On the contrary, it's one of those handy Little details that's pretty clever. Next time you need a big quantity of adhesive for your aquascaping and coral fragging activities, just reach for our CorAffixPro, ten ounces of fast-curing, easy to use, ultra pure cyanoacrylate gel with a 2 year shelf life, *and a pin cap* to keep the tip from clogging.
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Disaster Preparedness: What's Changed

The power head on the UPS is now a Koralia for more water motion in a power outage. Vortech MP40's have been added to either side of the tank and one of them has a battery backup. All of the out-of-tank electrical devices are now stored on a wire shelf above and behind the tank where it is nearly impossible for them to get splashed with water.

The 150 gallon freshwater storage/saltwater mixing container was great, but I added a 240 gallon tank just for saltwater mixing and storage. Now I can have 150 gallons of freshwater on hand at all times as well as more than 200 gallons of saltwater.

Crashes

Sanjay Joshi says that the single biggest point of failure in any reef system is the reef keeper, and my experience agrees. The biggest disasters in my home system have been from me doing something unwise: at various times forgetting to close a freshwater valve, not securing a powerhead properly, etc. All these things have sadly resulted in the death of fish and corals in my home system, and that's all squarely on my shoulders. Luckily, most of these disasters have been mitigated by the large volume of mixed saltwater I always keep on hand.

Disaster struck in 2008 in the form of a pH spike due to a human error based kalk overdose. 90% of SPS corals were lost, but the tank was back to the pre-disaster level within 2 years.

Diseases

This system has been right on the leading edge of reef pests, and it's interesting to see how most of these pests initially seem like the ultimate disaster, but end up not being the worst things in the world. Acoel flatworms turned out to be mostly just ugly and easily controlled by siphoning and off the shelf treatments. Red bugs were not quite as easy as an off the shelf solution, but with a little research, a practical treatment is available. Montipora-eating nudibranchs are tricky, and I don't think there is a decent treatment available. I dealt with them by manual removal of adults and eggs, fragging, and the addition of several wrasses I wanted anyway (though it is important to note that I don't really know if the wrasses actually helped to control the pest). Acro-Eating Flatworms seem quite easy to control by getting ahead of their life cycle, and I have had no significant fish diseases in this system ever, which I attribute to selective animal choices and strict quarantine practices.

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Stocking

Coral: The tank has always been an SPS dominated mixed reef, and most of the corals have been grown from fragments. I started with the fruit stand method of putting fragments everywhere, and as the fruit stand matured, colonies were moved around/removed for both aesthetic and coral health reasons. I love to let corals grow into each other and hope one day that the tank becomes a near solid block of living coral with fishes. There are several corals that have been with me since the 50 gallon tank in the old house. I have also been adding some large-polyped, NPS (non-photosynthetic) corals to the tank, and they have been doing well for several years.

Fish: Generally, the fish population stays stable, and I only lose fish in catastrophes. The oldest fishes in the tank include a female blue stripe pipefish (*Doryrhamphus excisus*) that refuses to accept a mate, a Swales Basslet (*Liopropoma swalesi*), a pair of Blotchy Anthias (*Holanthias borbonius*), a Radiant Wrasse (*Halichoeres iridis*), and a pair of Mandarin Dragonets (*Synchiropus splendidus*). Since the last disaster three years ago, I have added a Margined Butterflyfish (*Chelmon marginalis*) which helps with aiptasia control and a pair of Orchid Dottybacks (*Pseudochromis fridmani*).

Feeding

I feed the tank a lot; I use mostly Reef Nutrition products but I also feed Cyclopeeze, PE Mysis, and fish eggs when I can find them. For the corals, I practice the flood feeding approach, saturating the tank with food so it's easy for sessile animals to eat. At least every third day, I feed the tank enough to see food everywhere in the water column and let the animals and the skimmer clean it up.

Water Quality

The tank gets a 20% water change every two months. I try to keep salinity at 34 ppt, water temperature between 76 and 80 degrees F, ammonia at 0, nitrate below 20 ppm, alkalinity above 3 meq/l (approx. 8 dkh), calcium above 400 ppm, magnesium at about 1300 ppm, and pH above 8. The one weird level is phosphate which tends to run between .1 and .3 ppm regardless of how much GFO (granular ferric oxide) I run on the system or how much feeding is reduced and water changes are increased. I stopped worrying about that 'high' level because I have not seen any slowdown of growth or decline in coral health and I have no nuisance algae problems, so I am not going to worry about it.

On the Horizon

I am considering adding a carbon source to my kalk/top-off, but cannot yet justify this addition. I believe that stability is the key to a healthy reef and that corals can adapt to a relatively wide range of parameters as long as most of those parameters are reasonable and stable.

Other than that and ongoing regular maintenance, I plan on no changes because I am at my favorite stage of keeping a reef tank; leave it alone and watch it grow!

Thanks to everyone that has helped with this system over the years, especially my wife Libby and daughter Kalin. And just about everything I have ever written about this system (and more) is available on the website www.packedhead.net.

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A full-sized colony of *Agaricia* that was originally a hitchhiker coral as featured on page 42.

A top-down shot of a number of corals beginning to form a solid block and growing to the water's surface.

Corals growing into each other in every direction.