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SECOND QUARTER 2016 | VOLUME 10
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View of a U.S. Fishery: An Interview with Florida Colletors

Images by Kara & Philipp Rauch

INTERVIEW WITH KARA & PHILIPP RAUCH

There are many reasons to care about what happens to our animals before they make it to our home tanks. Obviously, these are living creatures and so are entitled to be treated well just like all animals, but there are some very pragmatic reasons you should care as well. Our hobby is composed mainly of wild fish and to a lesser extent wild corals. This reality is often overshadowed by the availability of a large number of captive-bred fish, but this availability is primarily limited to a few species of clownfish, gobies, and a smattering of others. Given this preponderance of wild-caught animals, we as hobbyists should be very aware that there are differences in how the industry in different collection areas is legislated and how animals are treated. And finally, how an animal is collected, held, and shipped has a direct impact on how successful you're likely to be with that animal in your home tank.

Luckily, we in the continental United States have easy access to fish from some of the best-regulated and well-studied ornamental marine fisheries in the world. Hawaii gets a lot of attention and certainly supplies some of the most iconic fish in our hobby. For example, almost all Yellow Tangs come to us from this fishery. But we have an even closer fishery that's well studied and, through many years of contentious politics, is also extremely tightly regulated. Of course I'm referring to Florida. While Florida has no coral harvesting, a lot of the fish that we love come from this fishery. Queen, Blue, French, and Black Angels are all sourced primarily from Florida and the Caribbean. Rock Beauties come from here, as do many of the most popular gobies, blennies, and basslets. As mentioned earlier, Florida doesn't allow any coral harvesting at all, but the fishery supplies a large quantity of the Atlantic *Ricordea*, feather dusters, snails, crabs, and starfish that we enjoy in our tanks. The Florida ornamental fishery is many decades old and has, over this time, refined its methodology for the collection, holding, and shipping of animals in ways that directly benefit the animals, the hobbyists, and the reputation of our hobby in general.

To provide our readers with a little insight into the best practices of Florida collectors, we arranged an interview with two veteran collectors, Kara and Philipp Rauch.

The iconic Queen Angelfish (*Holacanthus ciliaris*)

RHM: What led you to become marine collectors?

Kara & Philipp: I was lucky enough to be born into a family living in the Florida Keys that was running a tropical fish collecting business. Being brought up in a family with a love for the ocean and the marine life within, it was natural for my own love for the ocean to begin at a young age. Over the years of diving with my father, Ken Nedimyer (the founder of Coral Restoration Foundation), this love only grew stronger. I spent lots of time in the water with my father and learned many skills of the collection process over the years. Even in college, I would come home on long weekends and over summer break to dive with him. Then, my husband, Philipp, came

Kara and Philipp at the Coral Restoration Foundation nursery

A Florida blenny in its home burrow

into the picture. He was raised far away from the ocean in Germany. We met while living in West Palm Beach while he was in his last year of schooling in business management. He was able get a glimpse of my love for the ocean through snorkeling trips and eventually dive trips. At the time, neither Philipp nor I had any idea that this would be our eventual career path. As my dad was running his collection business, he began to notice the decline of the corals in the Florida Keys. When he began to see staghorn corals settle in his ocean-aquacultured live rock, he took this chance to make a difference.

Coral Restoration Foundation began to form, and his interests as a fish collector began to shift towards coral restoration projects. This was the point at which he began pondering how to transition out of the fish collecting business, and Philipp and I decided to step in.

RHM: What is your holding facility like? What type of environment is provided for the animals, and what is the process to prepare them for shipment?

Kara & Philipp: Our holding facility at the warehouse is separated into two systems: a system just for fish and a system for invertebrates. The fish system is around 1,200 gallons, which is kept medicated with Nitrofurazone Green [a wide-spectrum anti-microbial, anti-protozoan, anti-bacterial, and anti-fungal], copper [anti-parasitic], and Praziquantel [for worms and flukes]. The system water is circulated through a large UV sterilizer. The invertebrate system is around 2,500 gallons and is not medicated with anything but employs several large protein skimmers.

The fish are introduced to frozen *Mysis* or bait shrimp as needed to get them to start eating as soon as possible. Then they are introduced to pellet food so that they will readily take most foods offered to them in their future homes.

Since there is a steady supply of aquacultured live rock and fresh ocean water brought in to the system weekly, supplemental feeding for filter feeders such as sponges or scallops is usually not needed.

Aquacultured live rock

Some of the KP Aquatics holding tanks

A Porcupine Puffer (*Diodon holocanthus*) in a holding tank

Beautiful Atlantic tunicates

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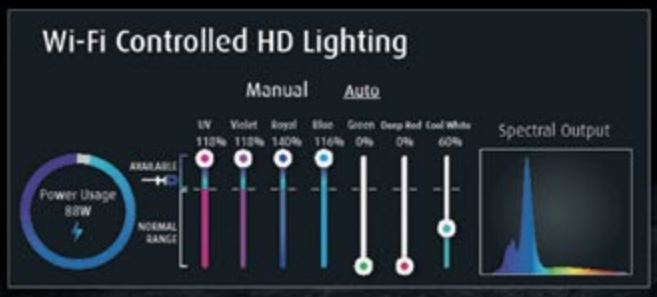

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Yellowhead Jawfish (*Opistognathus aurifrons*)

One of the Atlantic octopus species

Every time we go out on the water, fresh ocean water is brought in for water changes, so the change rate is typically several hundred gallons per week. The ocean water is brought in from several miles off shore since the near-shore water has a higher level of nutrients and pollution.

Because our system is kept outdoors, the biggest struggle is to keep adding fresh water so that salinity does not get too high from evaporation. The water parameters are tested weekly, and fresh water made from a reverse-osmosis system is added when needed. Copper levels are also closely monitored to be kept at a therapeutic level at all times.

The fish and invertebrates are fed daily until about 2 days before they are to be shipped. This gives the fish a chance to purge their bodies of waste so that it ends up in our tanks rather than in their shipping bags. Additives to neutralize ammonia are added to the shipping water so that if there is some waste in the bags, it does not make the water toxic for the animals. Pure oxygen is added to the bag, and the bag is then either hand-tied closed or sealed with a heat sealer.

RHM: What permits are required in order to be a tropical fish collector in Florida?


Serpent Sea Star (*Ophioderma* sp.)


A Florida gorgonian

Kara & Philipp: There are quite a few aspects of running a fish collection business that a lot of people do not realize. First, one must have a collection license, wholesale dealer's license, and occupational business license. The hardest license to acquire is the Saltwater Products License with a Marine Life Transferable Dive and a Restricted Species Endorsement. The Saltwater Products License is basically a fishing license but necessary for the collection of tropical animals. To get a Marine Life Transferable Dive and a Restricted Species Endorsement is difficult because the state of Florida no longer issues them, so you have to get it by working for someone who has one and is willing to sell it to you. Even if you want to buy one and have someone willing to sell one, you have to work for them to make enough "landings" so that you are eligible to purchase it.

RHM: How do you choose where to collect?

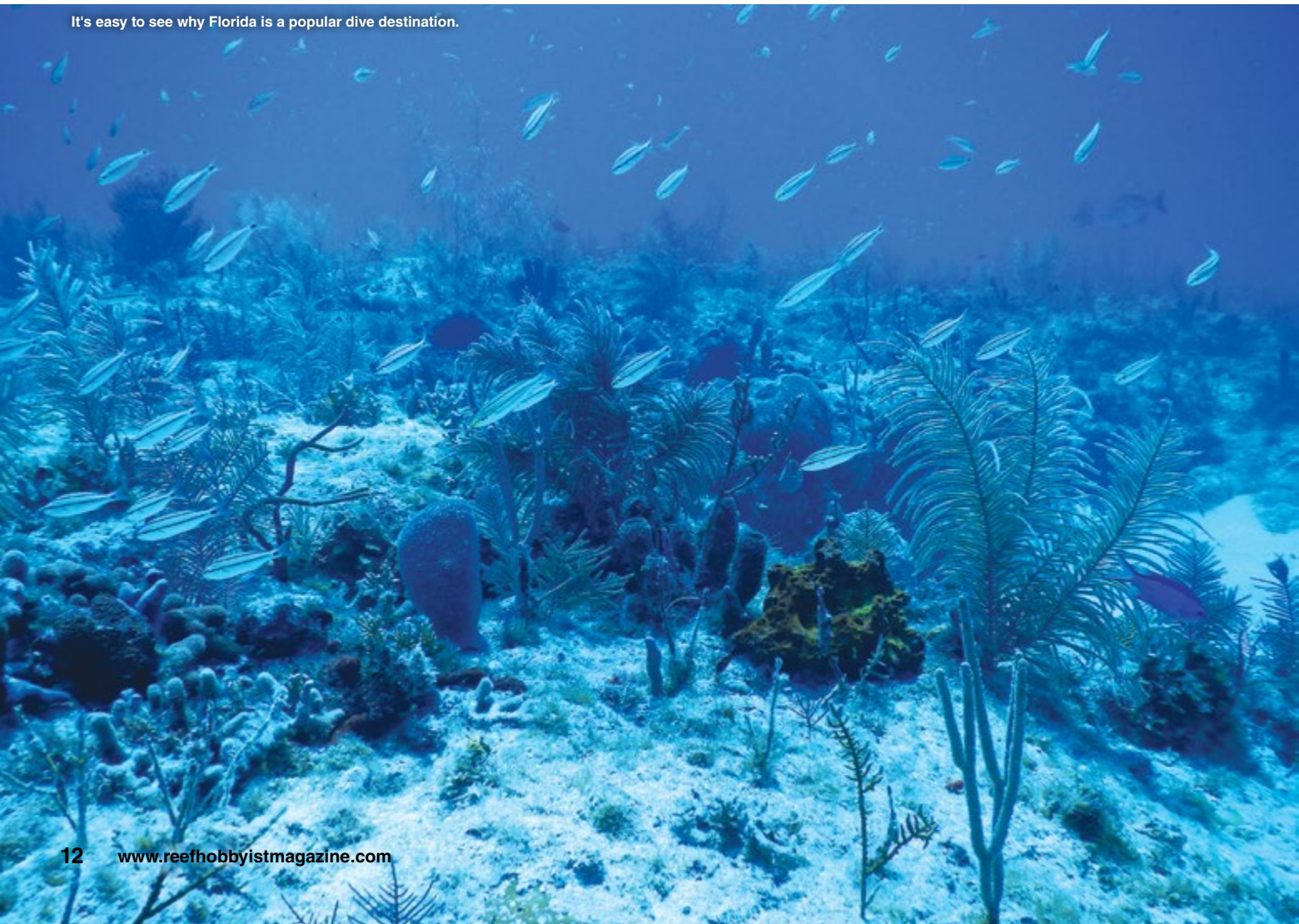
Kara & Philipp: It takes lots of experience to be able to predict where you will find all the different marine life you are hoping to collect. In the Florida Keys, we are lucky to have a lot of diversity when it comes to habitat. We have shallow grass flats, patch reefs, sandy areas, all the way down to reef edge and deeper. But there are also quite a few "no take" areas a collector needs to be aware of and stay out of. We also impose a few "no take" areas on ourselves

A Porcupine Puffer in the wild

Scrawled Filefish (*Aluterus scriptus*)

even though there are no rules against it. Since the Florida Keys is a well-known dive and snorkel vacation area, we stay off the reefs that are popular with the dive shops and tourists coming to the keys. People pay lots of money to see the fish in their natural environment, so we feel that we should leave the fish there for people to enjoy.

We thank our readers for understanding that how and where your reef animals are sourced is important for your success as a hobbyist and the success of the hobby in general. Next time you're at an LFS (local fish store), we hope you'll consider bringing home something collected domestically.



It's easy to see why Florida is a popular dive destination.

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A Clothcrete Adventure in Texas

KARIM WASSEF

Ever since I set up my first reef in the early ’90s, buying live rock and trying to create a realistic, safe, and functional reef environment has always been a challenge. I grew up snorkeling, so I know what nature’s chaotic artistry looks like. I wanted ledges that appeared suspended in mid-water and pillars and multi-tiered caves with overhangs. Since I had always wanted to create my own rockscape, I decided to make my own live rock. I envisioned something light, but also solid and sturdy, capable of being hung over the sand so that almost the entire sand bed was exposed, mimicking the real rock/sand balance on the reefs I was familiar with.

When I started learning about DIY rock in the early 2000s, I was intrigued by the concept. I played around with Thorite and acrylic binders, both with and without live rock. It didn’t go as planned, and I eventually decided to work with classic concrete instead.

I knew the finished product had to be porous and light, so I experimented with Styrofoam peanuts and other fillers, as well as surface treatments. While it required a lot of trial and error to finally find a combination that worked for me, the real challenge lay ahead: how to create interesting shapes.

I tried using foam and wood forms. For more complex shapes, I even made a giant sandbox to create molds. But the complex shapes were a disaster. I watched YouTube videos for inspiration and tried to use balloons that I could later pop to make caves. I also tried using large salt crystals to create porosity as they dissolved in water.

The idea of using a mold couldn't be wrong, I thought to myself. Everyone uses molds. Cured concrete is too hard to chip or cut into shape. That's when it clicked for me. To make a complex shape, I needed a matrix skin material with a solid form underneath to support it. Since I could make most shapes out of PVC and eggcrate, those would be the foundation, and I would glue or zip-tie them together. They're structurally sound and can handle a lot of weight if used properly. I would then use pieces of terrycloth covered in concrete to create a porous surface skin. The concept of Clothcrete was born.

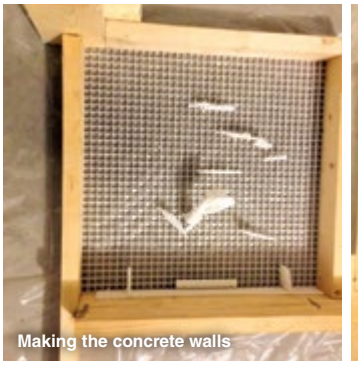
PLANNING

I started by making a miniature clay mock-up of the entire rockscape as I envisioned it. I have a coast to coast overflow weir, and I had planned to hang part of the rockscape on it to avoid having the rock sit directly on the sand. The model also helped me to visualize the PVC pipes running behind and around the rockwork.

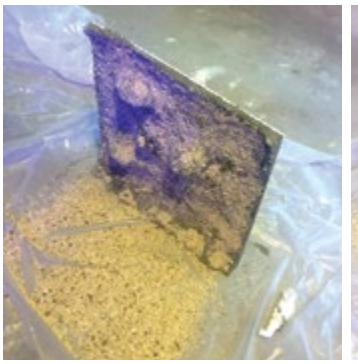
BUILDING THE FRAMEWORK

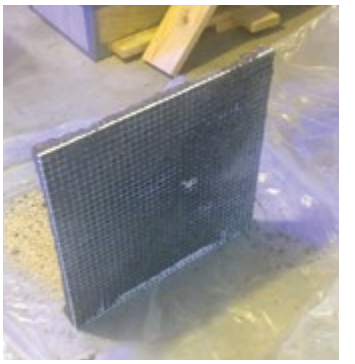
As mentioned, my plan was to use my overflow as a hanger for some of the concrete structures. In water, the rock structures were very light due to the buoyancy of the pumice, but I needed the structures to stay up if I drained the water too.

I started by making concrete walls for the two sides of the tank. To make the walls, I used eggcrate with PVC connections zip-tied on and covered them with concrete. A wooden mold holds it all together. I stuffed tissue paper into the PVC openings so they would stay clear while pouring the concrete. After setting, I brushed on another thin layer of concrete and sand. The result is air cured and then water cured. Once the walls were completed, I moved on to the hanging ledges.



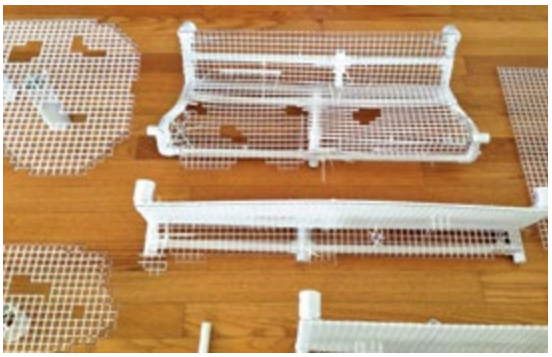
Making the concrete walls

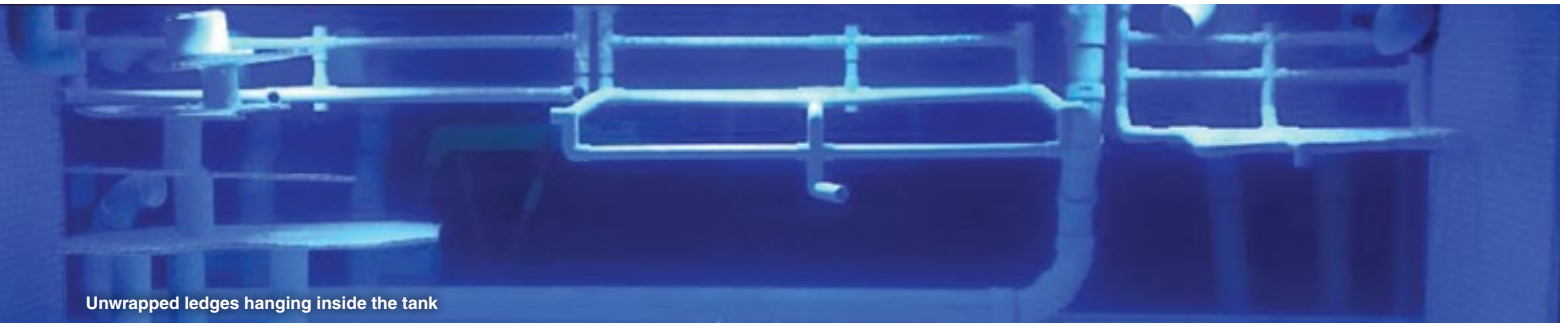




Miniature clay mock-up

Various ledges taking shape





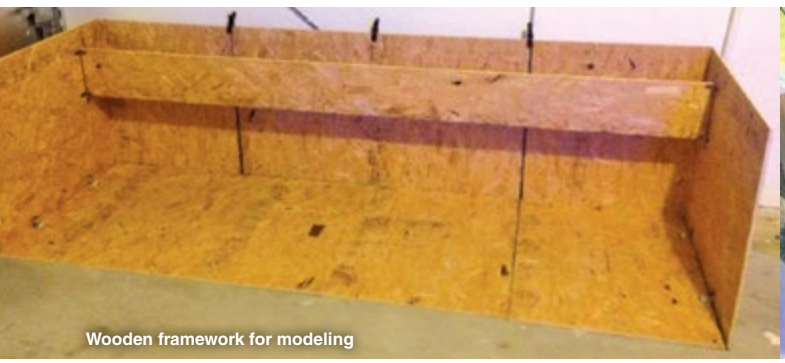
Unwrapped ledges hanging inside the tank

The idea for the ledges was to leave enough open spaces to create a very natural flow of water. I followed my model and created all the various ledges utilizing eggcrate and PVC.

BUILDING THE INTERIOR REEF

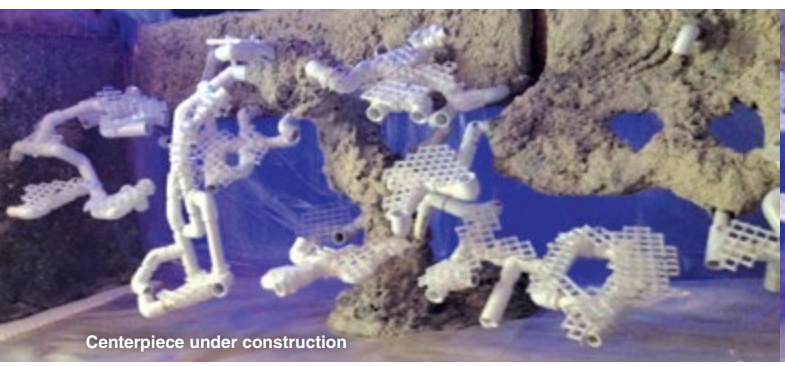
Now that the hanging ledges and walls were done, it was time to create the interior reef. I began by experimenting with a few different shapes in the tank to see how they would look. The PVC connections built into the walls, ledges, and centerpiece were the starting points, but the whole structure needed to be assembled. This was too hard to do in the enclosed space of my tank since it is built into a wall, so I created a wooden framework that was the same size and shape as my tank. I used the cheapest composite wood available since this was just a temporary model.

Eventually, after trying multiple different arrangements, the final rockscape design took shape. I numbered each piece and created

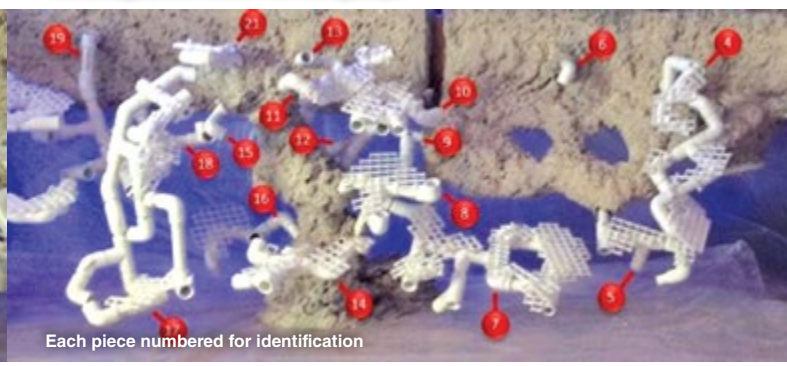


Wooden framework for modeling

Walls, ledges, and interior reef taking shape



Centerpiece under construction



Each piece numbered for identification

a map so that it would be easy to put back together when the pieces were later disassembled and moved into the display tank. Next, each piece needed to be individually wrapped with Clothcrete.

THE MATERIALS AND MIXES

I tried a number of different materials and mixes but finally ended up with two formulas. Please consider wearing a simple air mask when mixing these dry ingredients since they kick up some dust.

THICK MIX (in parts by volume): **1 cement + 1 sand + 2 crushed oyster shell + 1 pumice.** The dry ingredients are mixed together first. Then enough water is slowly stirred in until the mix has the consistency of wet mud.

SLURRY (in parts by volume): **1 cement + 1 sand** mixed dry. The dry ingredients are mixed together first. Then stir in water until the slurry pours like a thick milkshake.

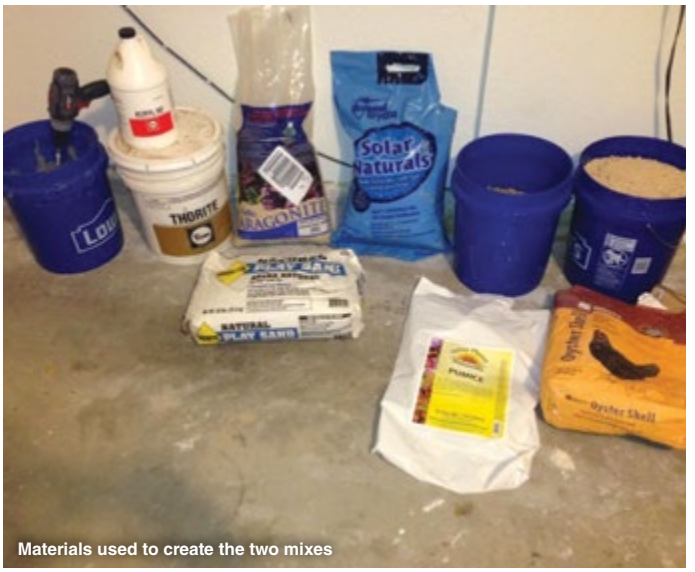
The cement is Portland Cement Type II. It cures stronger and faster than other types. Faster curing means that it doesn't release as much alkalinity into the water, so it can be used sooner than other concrete. White Portland is even better aesthetically, but the gray stuff will eventually get covered up with coralline—just be patient. Most big outlet stores will not carry this type. I had to get it at a masonry outlet.

The sand is aragonite. I think oolite is best to create the grainy look I see in live rock. When I ran short, I used silica play sand. I regret this choice since I believe it contributed to an eventual diatom bloom.

The pumice must be white pumice only. This is used as potting material for desert plants like cactus.

The crushed oyster shell is normally sold alongside chicken feed. You can get it at most agriculture stores.

The crushed oyster shell and pumice must be hand washed over and over again until the water runs clear. In the end, even this



Materials used to create the two mixes


The slurry, thick mix, and damp terrycloth ready for application

wasn't enough to remove all the phosphates, but it minimized them and reduced the algae bloom to come.

PREPARING CLOTHCRETE

Always use gloves! Since this process requires a little tactile feedback for best results, thinner gloves are preferable. Have a box ready, and be prepared to toss them out regularly throughout the process.

Make sure your workspace is open and covered in a large plastic tarp. You will want to premix more than enough material for the shapes you're planning to make. If you run out of cloth, slurry, or the thick mix prematurely, the ensuing scramble to make more often results in mistakes or poor mixing. Any savings in material realized upfront by trying to mix small batches will be lost when the final result needs to be scrapped. The better you prep, the better the results. And allow yourself the freedom to fail a few times.

APPLYING CLOTHCRETE

Here are the directions for wrapping the pieces:

1. Wash the terrycloth strips and gently wring them, leaving them damp so they can take up the slurry.

2. Soak the cloth in the slurry until it's thick with it. It'll get much heavier and have the consistency of mud. Squeeze it in the slurry and give it time to resoak.

3. Hold it up and allow any unsoaked slurry to drain off the surface. You can squeegee the surface a little bit by running it through your thumb and index finger made into an O shape, but don't expel the slurry inside the cotton fibers.

4. Dip the soaked Clothcrete in the thicker, muddy mix. It'll get heavier and thicker and should feel stickier.

5. Now wrap the plastic framework with the Clothcrete. The start and end wraps are important here. You need to make sure the first wrap is covered quickly. This anchors your construction and allows you to make subsequent wraps more easily. Each wrap should cover a new section of the plastic frame until the Clothcrete is used up. If you gauge it right, you should end the final wrap over the structure's top so the Clothcrete will hold its ending position and give you a starting point for the next wrap.

6. I've used toothpicks to hold the starts and ends, but the best help is a partner to hold the end while you get the next wrap ready.

7. Make sure all the exposed plastic is covered, and use your hands to form it as needed. Clothcrete can be bunched up and formed into ridges and even little caverns. It's an artistic medium like clay. Don't worry about the backs or unseen sections. I intentionally leave those open for life to find its way in.

8. Once the form is wrapped, apply more of the thick mix, taking some of the mud and letting it dribble out of your hand over the structure so it looks like it was built up naturally. This is intended to be a thin layer for texture and a little strength. It's


Various pieces of the rockscape being wrapped


Fully wrapped and assembled rockscape

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not intended to be another layer of concrete. This heavier application should be used sparingly. DO NOT USE YOUR FINGERS TO FORM—the result will be unnaturally smooth and will not blend.

9. Cover it all with a heavy dusting of sand. I took handfuls of sand and threw them at the damp structure, but you may find a better method.

10. Let it dry for a day.

THE CURING

After allowing the rock to dry for a day, you'll need a large container for curing. Put the solid shapes in the tub and fill it up with tap water. For the next 24 hours, slowly trickle water through the container while keeping the rock pieces submerged.

The water will get very murky. After the 24 hours, drain the water and inspect the rock. It should be solid, hard, and light enough to carry without much effort, and each piece should feel like a single mass when you move it. If the application of thick cement was too thick, it will show up here as fractures or loose sections that will fall off. If any pieces are loose, remove and repair them using the Clothcrete process again.

Now the real curing begins. The concrete will release a lot of alkalinity into the water. You need to add CO_2 gas to accelerate the cure. In my case, I put the rockwork in my tank filled with tap water and ran my oversized skimmer.

Initial curing in a large container

Curing is continued in the tank with the skimmer running.

An aggressive phosphate removal plan successfully eliminated hair alage.

The constant injection of high volumes of fresh air allowed the rockwork to cure in about a week. Others use acid, but I find that heavy air injection is very effective. I monitored the pH with my controller to see how far into the cure the rockwork was. The water was drained every 3 days, and new tap water was added. This went on for a week.

POST-CURE

I used a ¼" masonry bit to drill multiple holes in each structure. This seems simple enough, but the effort and number of drill bits used up was not insignificant. I strongly recommend this step since the holes become hiding areas for benthic creatures that help keep the rockwork clean and allow for water to flow in and out, improving the rock's function as a secondary filter medium.

After the full cure (pH < 8.4), the tank was drained, filled with RODI for a day with the skimmer on, and drained again. Then, I performed one more fill with RODI and another draining before the final fill.

Next came the salt. This was the official birth of the tank. At this time, I also added sand. Coral rubble followed after that, and with it came the first life: hair algae and the first living animals (pods probably).

With a fish or two added and some feeding taking place, the hair algae exploded into '80s-rock hair algae. It was beautiful in its own right, but not a good foundation for an SPS (small-polyped stony) tank. So I began an aggressive phosphate removal plan with a chaeto farm in the sump, alumina media, and water changes. This was starting to work, but to accelerate the deforestation, in came the vegetarians, including snails, urchins, sea hares, and big tangs.

As the hair algae receded, a white fuzz remained, and that turned into a more dangerous pest. The white fuzz became a base for dinoflagellates. They started slowly and then began to take over. I hadn't encountered these dinos before, but they were killing my snails and spreading. I used an aggressive course of UV sterilization and darkness and finally managed to bring them under control.

I believe that some pests, like dinos, gain a foothold in systems that lack the resiliency created by natural live rock. Live rock in nature is populated by many organisms, most of which we don't even see. The biofauna in live rock is so diverse that my artificial rock was essentially a desert in comparison. In systems where biological diversity is low, some pathogens can grow out of control once introduced. With no natural predators, the tank becomes a wasteland dominated by one species.

LESSONS LEARNED

With every adventure comes lessons learned to pass onto the next generation of adventurers.

1. I love complex structures adjacent to open spaces. I would say that empty space is just as valuable as rockspace, and designing in the "negative space" is critical. I wish I had left more space for corals to grow into. My complex spaces are now congested with growth, and my open areas have been encroached upon.

2. When I ran out of aragonite, I used silica sand. The result was a diatom bloom. In the big scheme of things, it worked out, but it was still an annoyance that could have been avoided.

3. I took my time in the beginning, but once I saw the rockscape take shape, I rushed to add life. The rock still had plenty of phosphate from the crushed oyster shell. I should have given it more time and cycled the dead rock with lanthanum chloride and RODI water. A month of aggressive phosphate leaching with lanthanum chloride solution may have saved a year of troublesome phosphate management in a living system.

4. I noticed that coralline algae prefers to attach to non-porous surfaces. Unfortunately, I intentionally designed my rock to be very porous, and the coralline struggled to adhere. However, a few areas that had epoxy or superglue were quickly encrusted. If I could go back, I would apply a thin layer of epoxy to the upper rock surfaces facing the light.

5. I should have cycled the fresh rockwork in the dark with a large portion of live rock. This would have seeded the biological filter. This isn't just bacterial seeding, but a biofauna exchange—it can't be purchased in a bottle.

6. Based on my experience, the gentlest form of phosphate removal is accomplished with an algal turf scrubber. Instead of stripping the system of life, I would have preferred to feed it.

Overall, I found the adventure of making my own live rock very fulfilling. I was able to create the rock shapes I desired and gained valuable experience in customizing my own rockscape. If you have the time, inclination, and interest, I hope you'll consider this process as an option to help you achieve your ideal tank aesthetic.

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PREPARING A REEF FOR EXTENDED VACATIONS

ELTON WANG

I believe every tank has its own unique stories, and my tank's are the result of a series of unavoidable circumstances. Every year, I take extended family trips away from my tank. These trips last 30 days in the winter and at least 60 days in the summer when I travel to my other home for vacations with my wife and kids.

It is imperative for my tank inhabitants to coexist with my schedule and still thrive. Over the course of about 3 years, I have managed to develop a strategy that has allowed me to take these extended vacations. This approach has allowed my tanks to thrive during my absences of 60 and even 80 days. Although my techniques have continued to evolve, this strategy has now been successful with two separate reef tanks.

My first system was a 700-liter SPS (small-polyped stony) reef lit by HQI and T5s. Using this strategy, I was able to leave that tank for

The 700-liter reef was prepared for my vacation, which began on June 25, 2014.

60 consecutive days. My current system is a 1000-liter SPS reef lit by T5s. I have been able to leave this tank for 80 consecutive days. Both reefs were running Korallen-Zucht-based systems.

The foundations of my tank's vacation management system are as follows:

1. Reliable equipment: the most important thing for me to consider while I am away is not if the livestock is alive or dead, but whether or not the equipment is working continuously and safely. It is imperative to use highly reliable brands for the main pump, protein skimmer, and dosing pumps.

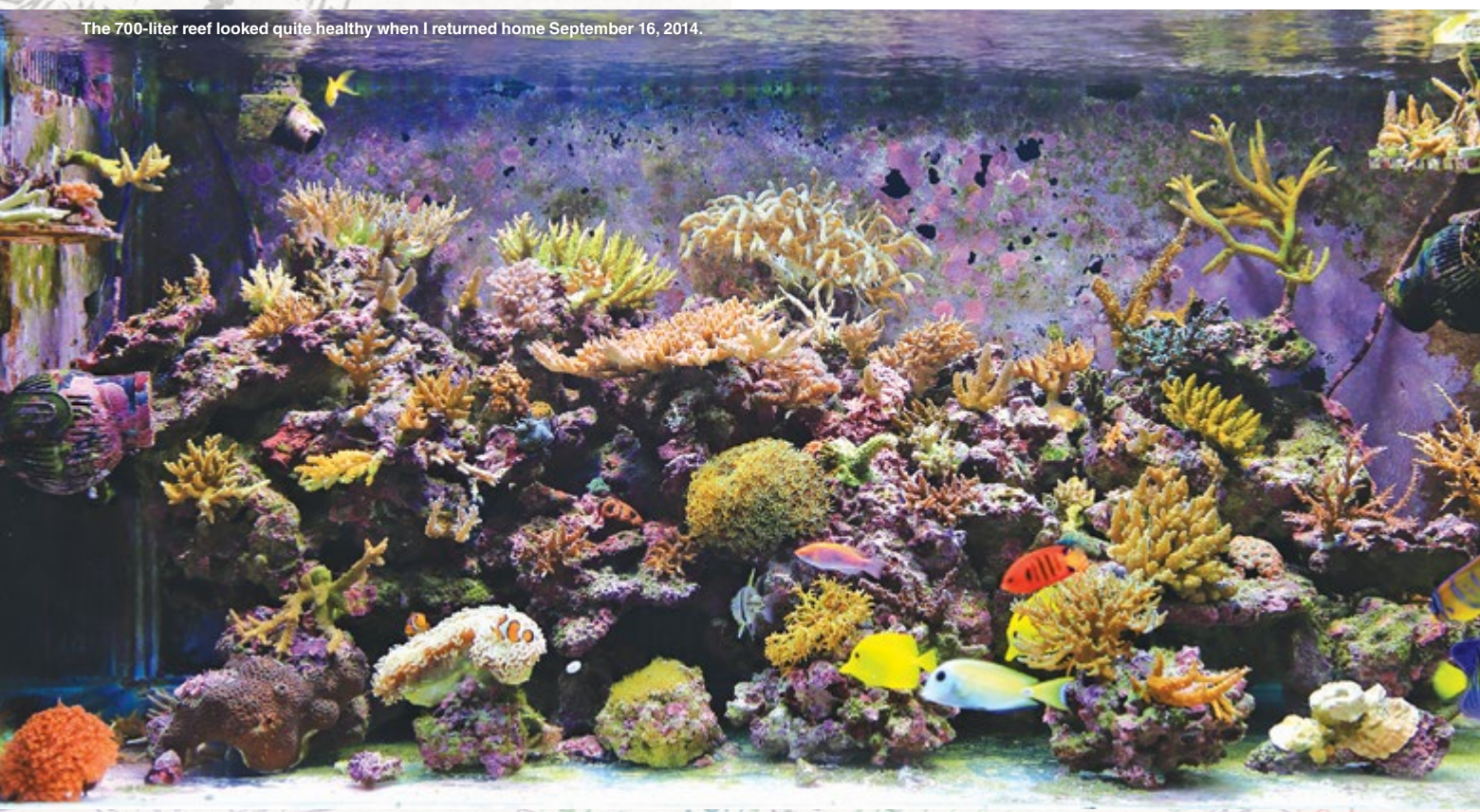
2. Video surveillance system: a consumer-grade IP camera will do the trick.

3. Data log of routine testing: a must-do and easy task for most reefers. It is crucial to keep a water testing log in order to predict dosing volumes accurately.

The items above are considered basic for most reefers. However, as a reefer that takes long vacations, I take extra measures before every trip as follows:

1. Stop doing water changes 20 to 30 days before the trip.

2. Raise calcium to 500 ppm and magnesium to 1500 ppm 20 to 30 days before the trip.



The 700-liter reef looked quite healthy when I returned home September 16, 2014.

3. Make sure KH dosing is stable at least 20 to 30 days before the trip.

4. Over the course of about a week, slowly raise PO_4 (phosphate) to 0.5 ppm and NO_3 (nitrate) to 5 ppm. I find tripotassium phosphate and potassium nitrate (K_3PO_4 and KNO_3) to be relatively easy to use to reach the desired NO_3 and PO_4 levels.

My goal with the steps above is to create a less than ideal environment for SPS, forcing them to go into a semi-dormant state and slow down their metabolism. Calcium, magnesium, and KH consumption is slowed down to a point where my dosing reservoir has just enough capacity to last through the trip. Early on, there were times when I returned home to find KH dangerously low and the SPS dying. The consumption of KH was something that I needed to control while I was not present to monitor it or top up the dosing reservoir. I discovered that the more I could slow down the corals' metabolism, the easier it was to make it through a long vacation. I have to forewarn readers that this practice is like walking on thin ice. Extra caution must be taken at all times.

I have tried various other methods in the last 3 years to help my reef survive through my long absences, such as maintaining an ultra-low nutrient system and reducing lighting. But doing so caused SPS corals to bleach from the bottom up, although not as badly as rapid tissue necrosis. I also tried keeping the 400-watt (20,000 K) HQI on while maintaining low nutrient levels, only to find that bleaching still occurred. I have tried keeping high nutrient levels in combination with low lighting, but that also failed.

There were times when I returned home to dying SPS.

In the process of trial and error, KH management was the most problematic and difficult to control. At a reefer meet-up, a few friends and I came up with some ideas to build a DIY system to monitor and control KH. Fortunately, one of my

This is my 1000-liter reef just before my 80-day vacation.

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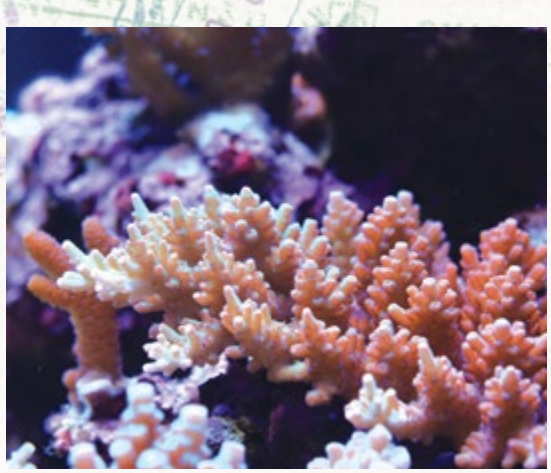
Koralia 2450	8.5	2450 gph	1600 gph	1850 gph	1750 gph


My SPS were in good health upon my return from the 80-day vacation.




KHG

friends took action and built his own KH controller (code named KHG). After refining the controller over several beta versions, we had a device that completely took over manual and repetitious testing and fine-tuning of KH dosing. The combination of KHG and my controller finally allowed me to keep my reef stable during my absence for extended periods.

Currently, everything I need to remotely monitor and control my tank equipment is just a few clicks away, no matter where I am. Knowing that my reef tank remains stable while I am away makes me feel free. My last trip abroad was 80 days. The tank was running with KHG, and it performed flawlessly. In addition to KHG, I have in the past also maintained a 1-inch layer of fine sand as a nutrient sink to slowly supplement my tank with necessary nutrients (NO_3 and PO_4).

One last comment I would like to add is about protein skimmer preparation for a long absence. In the last few trials, I found that my skimmer efficiency reduces gradually when it is not being cleaned regularly (e.g., when I'm away for a long time). The longer I leave the skimmer unattended, the lower the bubble/water interface line will drop. As that line drops, it becomes increasingly difficult for the skimmer to push skimmate out. To solve this problem, I set the interface line as high as possible. If I set it to about an inch below the rim of the skimmate collection cup, my Royal-Exclusiv BK300 skimmer can work up to 100 days unattended.

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The 1000-liter reef was in good health upon my return from the 80-day vacation.

As I am writing this article, I am away from my tank on vacation. I have upgraded to a newer beta version of the KH controller. As it monitors my KH value automatically, it will also dose the correct amount of KH solution to my tank.

This time, I also removed all my sand, turning my tank to bare bottom for precise management of the nutrients. With the combination of a small chiller and precise forward and reverse function step dosing of Korallen-Zucht BAK, Pohl's Coral Vitalizer (made by Korallen-Zucht), and amino acids, my reef is stable and safe while I am away.

In a perfect world, none of us would have to leave our tanks for extended periods. But if you do, I hope what you learned here helps your reef thrive while you're away!

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Image by cjmac

6 BUZZWORTHY FISH-FOOD INGREDIENTS

JASON ONEPPO

Superfoods, nutritional supplements, and organic ingredients are the bee's knees when it comes to human nutrition and diets. It seems like every day there is some new food or botanical that destroys free radicals, increases brain activity, or reduces your risk for something or other. There is scientific validation for some of these claims, and others remain unproven.

Human consumables are where most pet-food ingredient trends begin, yet we don't seem to be as quick to accept these claims when evaluating food for our beloved fish.

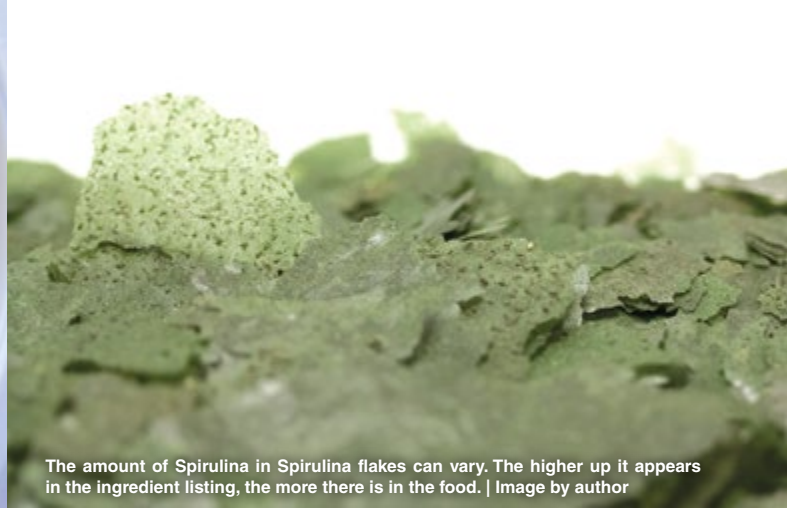
The ingredient list plays an important role in how fish food is perceived. Back when I got into the hobby, it was considered a miracle if you could get marine fish (outside of the usual clownfish, damsels, and wrasses) to eat at all. Today, most fish arrive in good health and accept food fairly readily due to improvements in collection, transportation, and retail-store expertise. This is why we are now more often concerned with *what* fish eat rather than *whether* they eat. We, as hobbyists, probably pay more attention to the ingredient list on fish food than on our own food.

Words like "human-grade ingredients" tend to make a product seem like it is of superior quality. But depending on which ingredient we're discussing, it may or may not be better than feed grade! Some ingredients used in human food are not allowed in pet food. Just because an ingredient is beneficial to humans doesn't necessarily mean it will be beneficial to other animals, and an ingredient that is good for a carnivore isn't necessarily good for an herbivore. Some commonly used fish-food ingredients are neither approved nor banned for use in pet or animal feed, and there are ingredients that are only approved for a specific purpose or animal.

Ingredients are regulated and approved by the FDA, and the laws surrounding them are enforced by the Association of American Feed Control Officials (AAFCO), which also provides guidelines on how those ingredients can be listed and what label claims can be made. Most ingredients used in fish food are generally recognized as safe (GRAS), and others fall into the category of specialty pet feed and need to be shown to be necessary or provide a benefit in order to be used.

The six buzzworthy fish-food ingredients we will examine in this article are commonly found across a range of formulated frozen and dry fish foods, such as flakes, pellets, and wafers. You will find at least one of these ingredients in almost any aquarium fish food, except for single-ingredient frozen and freeze-dried foods. Having one, none, or all of these ingredients doesn't make one fish food better or worse than another. Some foods serve a specific purpose and may be what are considered

Menhaden fish oil is a popular ingredient due to its high level of omega-3 fat content. | Image by author



The amount of Spirulina in Spirulina flakes can vary. The higher up it appears in the ingredient listing, the more there is in the food. | Image by author

a species-specific diet and therefore have a target for which they were developed, while other foods are for general purpose feeding and tend to include more ingredients in order to satisfy a greater diversity of aquatic organisms. So let's begin!

FISH OIL

Salmon oil, cod-liver oil, and other fish oils have long been used in fish food as sources of omega-3 fatty acids (DHA and EPA). Fish oil is touted for its high level of omega-3 fatty acids, which play an important role in providing energy for fish. These essential fatty acids also contain phospholipids and sterols, which serve as fuel for growth, fecundity, and disease resistance. Similar supplements such as SELCO have been around for over 30 years and were developed for use in aquaculture. Several fish-food companies that were involved in aquaculture at that time started using these products in their formulations back then, before anyone in the hobby really knew what they were. Fast forward to the present day and fish oil, omega-3s, and SELCO are everywhere, not only as ingredients in fish food, but as supplements that fish food can be soaked in to enhance its nutritional value.

SPIRULINA

Another ingredient worth mentioning that has been used in fish food for as long as I can remember is Spirulina algae, more commonly referred to as Spirulina. It is a blue-green algae that is an excellent source of plant protein and has been shown to have other health benefits. Interestingly enough, even though it can be found in many fish foods, it was actually banned for use in pet foods, although approved for use in human consumables. This was causing headaches for fish food companies some years back when the AAFCO decided to crack down on it. Fortunately, enough fish-food companies provided evidence and went through the proper procedures to get an exception for the use of Spirulina in fish food. The bottom line is this: when it comes to fish food, Spirulina is good stuff.

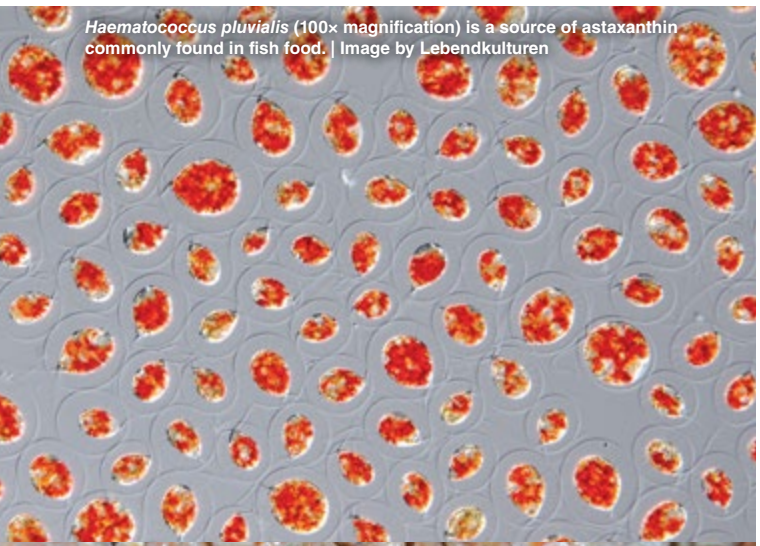
Both fish oil and Spirulina have been used to create bio-enriched brine shrimp products. When brine shrimp are enriched, they are

Spirulina powder is a common ingredient in omnivorous and herbivorous fish foods. | Image by author

fed Spirulina or fish oil and become gut loaded. The New England Aquarium ran a test on lobsters comparing Spirulina-enriched and omega-3-enriched brine shrimp to see the different effects each product had on the growth of lobsters. The group that was fed the brine shrimp enriched with omega-3 grew faster, while the group that was fed Spirulina-enriched brine shrimp grew at a slower rate, but had thicker shells. Eventually, those that were fed Spirulina-enriched product caught up in size to those fed omega-3 enriched product. Those that were fed omega-3-enriched product eventually grew thicker exoskeletons to match those that were fed Spirulina-enriched brine shrimp. So you can see how different combinations of these ingredients at different life stages would be beneficial.

ASTAXANTHIN

Astaxanthin is a carotenoid (carotenoids are naturally occurring pigments that are sources of red, yellow, and orange color) and is required for vibrant colors in tropical fish. Astaxanthin is found in microalgae, yeast, salmon, trout, krill, shrimp, crayfish, and the feathers of some birds. The most common form used in fish food is *Haematococcus* algae meal. This ingredient is found in almost every fish food, especially those touting color-enhancing capabilities. It is sometimes listed as NatuRose, a brand name of astaxanthin derived from *Haematococcus* algae. Astaxanthin can also be purchased as a supplement to be used as an additive for fish food when people want to enhance the color of their fish.



Haematococcus pluvialis **(100× magnification) is a source of astaxanthin commonly found in fish food. | Image by Lebendkulturen**

Freeze-dried krill naturally contains high levels of astaxanthin. | Image by SFBB

Brine shrimp is inspected under a microscope after being gut-loaded with Spirulina. | Image by SFBB

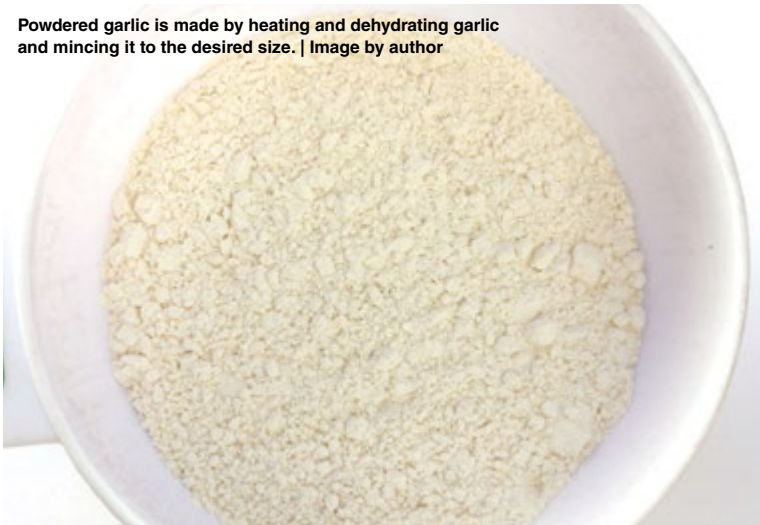
GARLIC

Image by Christophe Livert

The use of garlic as a health food dates back to ancient times. This probably explains why its use as a fish-food ingredient is so popular. It is promoted for its ability to kill parasites, fungus, and bacteria in fish. The compound in garlic responsible for this is allicin. Allicin is not very stable and starts to oxidize quickly, which makes it a very difficult ingredient to use. There is no doubt that garlic has health benefits for people, but its effectiveness in the treatment of fish disease and parasite control is largely unsubstantiated. There have been multiple experiments performed that suggest its benefits, but these experiments have flaws and lack proper scientific controls. From the experiments I have come across, the evidence does point toward garlic having a negative impact on bacteria, and it has been shown to kill ich and its cysts when used in very high doses for treating freshwater fish. To my knowledge, there has not been any documented research showing its effectiveness for controlling ich in saltwater fish.

Garlic is also used as a natural appetite stimulant. It has been speculated that it is the unfamiliar smell of something new entering the water that attracts fish. But it has also been shown that it does not attract all fish. There could be several reasons for this. First, it

Powdered garlic is made by heating and dehydrating garlic and mincing it to the desired size. | Image by author



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could be that there are underlying health issues that are affecting the specimen's response. Second, there could be individual fish that are just not attracted to it. I do believe the majority of evidence points toward fish being attracted to garlic for the reason stated above. I have also never heard or read of fish that were healthy and eating, suddenly refusing food when garlic or a garlic supplement was added. According to the manufacturers of garlic supplements and foods containing garlic for fish, garlic is not harmful to fish at any level normally used.

PROBIOTICS

Probiotics is one of my favorite topics and probably the newest of the buzzworthy ingredients to hit fish-food labels. Probiotics are health-promoting bacteria that reside in the gut. These bacteria help the intestinal tract to better digest and absorb the food being broken down during the digestive process. As a result, fish make better use of the vitamins and minerals in the food and less waste is excreted. The idea and use of probiotics has been around for a long time in human nutrition (e.g., yogurt). They have been used in the pet industry since at least the 1980s when they were sold as bacteria supplements for hand-feeding captive-bred birds. Then, in the early 2000s, they became all the rage as supplements and ingredients in products for human consumption, and this trend started to make its way into the pet-food industry and eventually fish foods. It wasn't until about 5 years ago that they were actually approved for use in pet foods. In the ingredient listing on a fish-food label, you will not see the word "probiotics." They must be referred to by their scientific name followed by the words "fermentation product" (e.g., dried *Bacillus subtilis* fermentation product).

A 3-D rendering of probiotics, the beneficial bacterium often promoted as a natural health remedy. | Image by somersault1824

Another interesting thing about probiotics is that they themselves can be fed in order to thrive and multiply. Food for probiotics is referred to as prebiotics. Prebiotics are ingredients that are indigestible, but can be used as a food source by probiotics.

SALMON

We're down to the last item on the list: salmon. It is a common enough ingredient that it is worth mentioning. You will find companies that use whole salmon, salmon filets, salmon meal, whole salmon meal, salmon oil, and salmon eggs as ingredients in fish food. Salmon is an excellent source of omega-3s, vitamin D, and protein. In humans, salmon is said to increase brain activity, be good for the heart and circulation, prevent chronic eye

Research shows there is little difference in the omega-3 content of wild versus farm-raised salmon. Wild salmon contain higher levels of potassium and selenium. | Image by Marcus Osterberg

Salmon fishmeal does not contain the same levels of omega-3s as whole salmon or salmon filets because fish meals are squeezed to extract the oils. | Image by author

conditions, and reduce the risk of depression. I am not aware of any scientific evidence showing salmon having the same effect on fish. The one thing we do know is that salmon is a natural source of protein and omega-3s, which makes it an excellent choice as an ingredient for fish food. Many companies that use salmon as an ingredient state that it is wild caught. Wild caught fish generally have a better nutritional profile than farmed fish.

So there you have it—6 buzzworthy ingredients that can be found in fish food. Some old, some new (to the fish-food industry), and some possibly controversial. What will be the next ingredient that shows promise for fish food? Will this discovery come from within the aquarium hobby or aquaculture, or will it ride the coattails of a trendy ingredient that has supposed benefits for people? Whatever it is, you'll hear about it here first. Until then, keep it real, fishes!

FROM FARM TO TANK: MARICULTURE FROM INDO

Image by Jake Adams

NICOLE HELGASON

For the past 2 months, I've traveled around Indonesia to answer one question: how do Indonesia's beautiful maricultured corals end up in our home tanks here? To find the answer, I met with coral farmers, dove with coral collectors, and toured export facilities in Bali, Sumbawa, and Jakarta to get the full picture.

Staring out to sea, only a few miles from the hustle and bustle of Denpasar (the capital of Bali), it would be easy to miss what is going on beneath the surface. Above, you might spy surfers paddling between crashing waves and fishermen casting their lines, but below are rows of perfectly manicured corals being cultured at the Serangan Island coral farm for reef hobbyists around the world.

At Serangan, some of the coral racks are a short 5-minute walk out to sea. At low tide, these racks almost break the surface; this is a shallow, well-lit environment perfect for growing SPS (small-polyped stony) corals. The bay at Serangan faces out to the Indian Ocean, and cool water is flushed over the corals with each changing tide. At low tide, it is easy for workers to access and maintain the racks but more difficult as the tide rises and brings in stronger currents.

Growing on the racks at Serangan Island is a colorful mix of smaller encrusted corals and larger broodstock colonies. Workers use the larger colonies to produce frags that they prepare at the surface before moving them onto empty racks below. At low tide, workers equipped with hand brushes scrub the corals' cement bases, removing everything from crabs to sponges and algae. Some of the racks are surrounded by netting to prevent fish from picking at healing tissue, and some are deep enough that a scuba tank is required to perform the coral maintenance. Tending to the coral farm is a labor-intensive process that requires daily attention.

CORAL FARMS

Serangan is not the only coral farm around the island of Bali. Coral farms are found in a range of habitats, and the different conditions at each farm are important for growing a wide variety of coral species.

Coral frags are taken from mother colonies growing below. | Image by Jake Adams

These colorful *Acropora* corals will be packed and sent off to an export facility. | Image by Jake Adams

For workers, each farm presents its own unique challenges. To tend any racks deeper than 4 or 5 feet, workers have to use compressed air from a hookah line or scuba tank. The deeper a rack is below the surface, the less light will reach the corals. These deeper racks are better suited to growing deep-water *Acropora* species or lower-light LPS (large-polyped stony) corals.

Depending on the species, corals will grow anywhere from a few months to 2 years at the farm before they are ready to be harvested for export. Once corals have been selected for export, they are gathered, packed, and then transported to a holding facility. There are over 18,000 islands in Indonesia with coral farms scattered throughout the country, and the methods for getting corals from the farm's holding facility to an exporter are different for each location.

For corals leaving the Serangan coral farm, this means a 10-mile drive through the city, which can be anywhere from a 30-minute to several-hour ride depending on traffic. Coral farmers take care to properly package corals, but transportation delays between coral farms and export facilities are hard to control. This initial transport is the first of many stressors in a coral's journey to your tank.

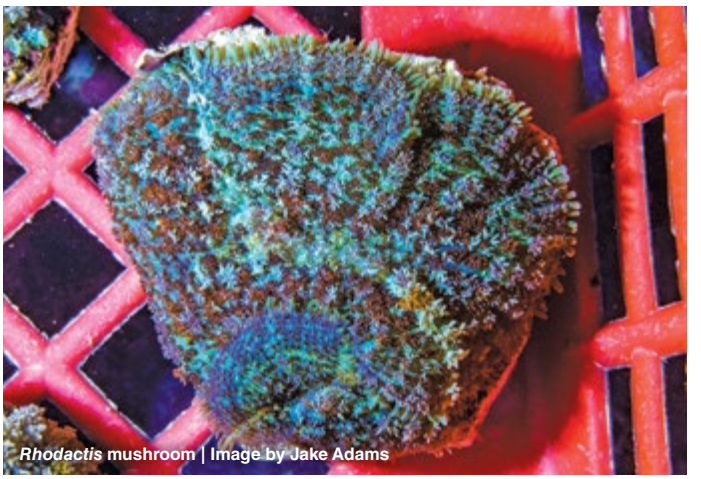
EXPORT FACILITY

Corals arrive at the export facility from all over the country at all hours of the day and night. They are immediately unpacked and placed in a large raceway for newly arriving corals. After sitting in that first raceway for 24 hours, the corals are spread around the facility and placed into larger raceways with different light and flow parameters based on each coral's requirements.

The export facilities take advantage of the sunny weather by building large open-area buildings with roofs made of clear blue plastic sheets that allow sunlight in to maintain coral color and growth. Some of the raceways have LED and T5 lights hanging above them, and the bottoms of the raceways are either bare or covered with rocks, gravel, or sand. These raceways are typically equipped with fans and chillers to regulate the water temperature.

Acropora efflorescens | Image by Jake Adams

Acropora valida | Image by Jake Adams



Rhodactis mushroom | Image by Jake Adams

Acropora aspera | Image by Jake Adams

These days, coral collectors and farmers are becoming more in tune with which corals are popular. For example, the bounce-mushroom craze hasn't gone unnoticed. For an exporter to acquire one or two A-grade bounce mushrooms, they are often asked to buy 20 or more less desirable B-grade mushrooms from the diver. In Indonesia, the coral export business is very competitive, and if you pass up the opportunity to buy a coral, you may not get a second chance. Exporters are caught in a balancing act, trying to please

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Workers place corals in Styrofoam boxes filled with seawater before transport. | Image by Jake Adams

their customers while still maintaining a good relationship with their suppliers.

EXPORT PROCESS

In Indonesia, the industry of collecting and exporting corals is highly regulated. Coral farms are audited yearly and have specific quotas for the number of corals they can collect and grow, which includes the harvest of wild corals for both export and broodstock. Each coral exported must be accounted for on a CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) permit, and even one misspelled word ("Aquairum" instead of "Aquarium," for example) could result in days of delays while the export forms are resubmitted.

When packing an order, the exporter will select corals from the customer's request list and will also add other corals to fill out the assigned CITES permit totals, which are government allocated. It is important to use as much of the currently available quota since this influences the size of the next quota allocation. Because not all species of coral can be grown at one farm, exporters typically pick corals from dozens of farms around the country to fill out each CITES permit.

Many exporters ship hundreds of boxes of coral a week, with at least one shipment per day to international customers. All corals have to be packaged and shipped the same day or be unbagged and returned to the holding tanks.

Corals leaving Indonesia are shipped to importers/wholesalers around the world. Most exporters count importers in the United States as among their biggest customers. However, exports to Japan, Europe, India, South America, and the Middle East are also important for their businesses. Whereas exporters are regulated as to the amount of corals they can ship per year, importers have no such restrictions and can order corals from exporters throughout Indonesia (and the rest of the world), taking advantage of available corals from multiple sources.

A colorful mix of smaller encrusted *Acropora* colonies | Image by Jake Adams

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Acropora horrida | Image by Jake Adams

Acropora tenius | Image by Jake Adams

Blue staghorn *Acropora* | Image by Jake Adams

IMPORTERS/WHOLESALERS

Once a shipment is packed, forms filled out, and space on the airplane reserved, the corals are one step closer to their final destination. In the United States, corals are generally imported into port cities, with California and Florida being the most common entry points. Once the corals arrive at an importer's facility, they are unpacked and typically placed into holding tanks for observation before they are distributed among the import facility's raceways.

It may take a few days for the corals to perk up and regain some colors that might have been lost during transport. Most of us will see a frag in person at our LFS or from an online retailer and may not be aware that the coral may have looked different on the farm than it does now. Some coral species are particularly susceptible to losing color, while others may only lose some highlights and still look brilliant when they are unboxed at the importer/wholesaler. The amount of water a coral was packed with, the time it stayed in the bag, and the fluctuating temperature during shipping are all factors that affect the coral's overall health when it arrives.

Wholesalers will usually let new arrivals sit for a few days before photographing and cataloging. From here, corals get sent out to retail shops around the country.

RETAILERS

By the time a coral arrives at the retailer, it may well have taken three flights, been on a ferry or bus, and been bagged and boxed at least three different times. At each subsequent step in the chain of custody, the transportation becomes more reliable, but you can imagine how many times a coral has been handled before reaching your store.

At every stage of the process, there are corals that don't make the cut. Either they have suffered throughout the multiple rounds of shipping or languished in a raceway due to their lack of desirable characteristics.

It really amazes me that corals can survive this journey and that a small colony of coral grown at Serangan Island can land at your LFS looking almost as good as it did on the farm. You can tell if a coral has been maricultured if it is attached to a rough cement base with a waterproof identity tag sticking out of the cement. You may have seen one online or at your local retailer. However, few full colonies end up in our homes.

Retailers often use maricultured colonies to continue propagating specific corals in their stores. They will keep the mother colony growing while they sell the frags. Given the proper conditions, corals from the wild can start to look even better than they did in the ocean, and small frags of the very best colonies will fetch double, triple, or even ten times the price of the original colony. Retailers grow their new frags under carefully selected, controlled growing

Removing algae from the coral racks is important for maintaining healthy corals. | Image by Nicole Helgason

conditions using specialty aquarium lights to help brighten existing colors and bring out any subtle highlights the coral may be hiding.

Although this is a great business model, it can also cut out the Indonesian farmers who produced the original colony. This goes for all maricultured corals that are fragged in the United States and continue to be propagated and sold from the original maricultured piece. It is also true that not every frag at your LFS has gone through this journey, and there are certain strains of corals that have been grown for years at the retail store or even in someone's home tank.

So the next time you are in your LFS, consider how far your new coral might have traveled and the work that has gone into getting that coral from a farm to your tank.

PRODUCT REVIEW: EUROQUATICS E5 LAMPS

JIM ADELBERG

From time to time, we at Reef Hobbyist Magazine see a product we think might interest our readers, and if the manufacturer agrees to send us samples, we review the product for you. Today, we are reviewing the new E5 lamps by Euroquatics. Euroquatics is the aquatic lighting company started by Gavita, a horticultural lighting company based in Holland, and their newest offering is well worth a close look.

These E5 lamps are T5HO LED retrofits, which is a fancy way of saying that they're various-length LED light bars fitted into T5HO holders ready to mount in and be powered by traditional T5HO fixtures. The available lengths are 24", 36", 48", and 60". This size range covers all T5HO bulb lengths commonly used in aquarium lighting fixtures.

According to the Euroquatics website, these bulbs consume around half the energy of a traditional T5HO bulb of comparable length. The website also states that the bulbs put out as much light as the same length T5HO bulb. This does make sense when taking into account how much more efficient modern LEDs are when compared to almost any other kind of lighting. One of my major complaints about traditional T5HO bulbs is the speed at which their light output drops off. After a year of running an old-style T5HO for 8 or 10 hours a day, its output is so reduced that it's time for a new bulb. Obviously, this gets expensive very fast. The Euroquatics E5 lamps claim an 8-year lamp life at which point they're still running at 85% of full output. Again, this makes sense for a modern LED. This is a good time to point out that while a little more expensive than equivalent-size T5HOs, they're not double the price. If it was just a matter of the savings in energy costs and bulb replacement costs, this would be an interesting product, but these bulbs look really good over coral, and that's what makes this product so outstanding.

The diffuser tubes spread the produced light out in a very nice general glow up and down the length of the tube. I'm used to LED light bars that have naked diodes or individual diffusers over the diodes, but they all seem to create heavy banding in the tanks. These E5 bulbs didn't create that banding in the test setup where I tried them out. In the interest of full disclosure, my setup is not dimmable (though the E5s are, down to 19% of full output), so this effect might change at lower outputs.

I also like the variety of spectral output available through their line of E5 bulbs. Currently available are 3 daylight colors (Warm Daylight, Daylight, and Cool Daylight) with an additional bulb called Blue Daylight coming soon. Also available is a bulb called Blue Pop, and soon there will be a Marine Pink bulb. A recurring problem for many LED fixtures is the weak rendition of colors in the actinic range. This isn't as true for the higher cost LED fixtures but plagues lower cost fixtures. The E5 Blue Pop solves this problem and produces a very usable 420–450 nm actinic effect. Being a gear freak, I tried the Blue Pop bulb paired with all 3 versions of the daylight bulbs and felt that the Daylight, rather than the Cool Daylight or Warm Daylight bulbs, gave me my favorite combination. It appears that the upcoming Blue Daylight bulb is nearly that exact combination contained in 1 bulb! Of course, different people have different preferences in their reef lighting (especially on the daylight side of the spectrum), and I think it was wise for Euroquatics to offer a few daylight options. Add to this a 3-year warranty, and I think we're looking at a pretty exciting product. I had retired my T5HO fixtures because of my frustration over bulb cost and longevity, but Euroquatics has made them viable again. Thanks, Euroquatics!

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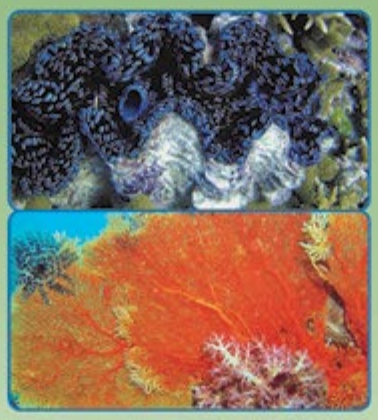

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