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When is a Refugium not a Refugium?

By Gregg Palastro

In a reef aquarium system a refugium is an additional tank, connected to the display tank, that may contain live rock, sand, macroalgae, corals, and possibly even fish, depending on the intent of the aquarist. There are many benefits to having a refugium. They include increased total water volume for the system, which allows an increased bioload without an increase in waste accumulation. Another benefit is the possibility for reverse daylight photosynthesis, lighting the refugium for a period opposite the day in the main tank, to help reduce pH fluctuation during the dark hours. A third benefit is the additional space provided that can be used for quarantine or propagation. Finally, refugia can be a place for live food organisms to thrive and reproduce without the direct threat of over-predation by the animals in the main display tank.

For a food-producing refugium to operate most efficiently it should be located higher than the main tank. Water is pumped into the refugium from the sump or the main tank and then flows into the main tank. Occasionally an amphipod or copepod or other planktonic animal will get drawn into the main tank, where it can be consumed by a fish or by coral. The majority of the food animals will stay in the refugium.

Unfortunately, many mini-reef aquarium hobbyists don't have the space to set up a refugium on the display tank, and I am among them. Following is a description of how I established a system to raise amphipods in a system separate from my main display tank. It is a simple system in a two-gallon desktop aquarium that contains one pound of live rock. After filling the tank almost to the top with water from the main tank I added one *Astrea* snail, a small piece of *Caulerpa taxifolia*, one small piece of *Caulerpa racemosa*, and the sponge from a small Hydrosponge® filter connected to a small power head. The power head flow rate is approximately 25 gallons per hour. There is no heater and no substrate on the bottom of the tank. The tank is lighted by a 15 watt incandescent bulb 14 to 16 hours a day. It was inoculated with 18 amphipods that were caught from the filter floss in the overflow box of my 75 gallon reef tank.

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Photo by Michael P. James

A blue sponge, Haliclona sp., from Bali

The Rebirth of Sponge Keeping

by Michael P. James

There has been a rise in interest in sponges in the past year. A greater variety has been collected than in the past and new foods are available, so curiosity has been growing among hobbyists. There are over five hundred species of sponges described thus far with new species appearing regularly. Sponges inhabit wave-swept shallow reef crests and dark deep waters and every conceivable location in between, and are second only to corals in abundance on tropical reefs. They are present throughout the world's oceans, but until now, collecting and shipping problems have prohibited widespread success in hobby aquaria.

Common Aquarium Species

There are normally two ways for sponges to be introduced into an aquarium. First, specimens can be purchased. These are usually brightly colored species with an upright growth pattern. The most commonly available are the Indo-Pacific blue sponge (*Haliclona*), and the red or yellow ball sponges, colored rope sponge, and grey tube sponge (*Callyspongia*) from the Caribbean. Second, sponges can come along into an aquarium with live rock or a piece of coral. These are a portion of the aquarium livestock called cryptofauna, and live in areas lacking in light. The health and growth of these sponges in a maturing aquarium indicate a good chance that a purchased colored specimen will survive.

Sponges may seem to be simple in design, but are actually quite complex. Various types of cells perform different functions. Some cells organize to make up a system of pores that filter food particles from water as it passes through. Other cells deposit calcium, silicate, or gelatinous substances called spongin that make up the rigid support structure of the sponge. The composition varies according to species. Regular water changes will replenish these materials that are taken from the water and ensure that healthy growth can continue.

Captive Care

Selection of a healthy specimen is a key factor of success with sponges. Observe a specimen at least a week in a shop before purchasing it. Most dealers will hold a specimen if you show serious interest in it. Most sponges are aerophobic; that is, they must be covered with water at all times. In the past, sponges were shipped partially dry, as corals are. Recent success in shipping

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The Rebirth of Sponge Keeping

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healthy sponges results from the change in shipping methods so that the sponge tissues are never out of the water. If a sponge becomes dry its internal pores hold pockets of air that rapidly cause rotting from the inside out. The outer surface may look healthy, but the sponge will decompose very quickly.

In an aquarium, sponges are often placed in areas devoid of light. They can do well in this situation if there is ample water flow. Some species, however, can gain indirect benefits from being near a light source. Commensal organisms such as shrimp and brittle stars will scavenge detritus from the surface of sponges. Even low light areas of a reef tank will have normal day/night cycles that encourage proper cleaning of the sponge surfaces by these organisms. If a sponge receives too much light and is therefore covered with algae, gently brush the algae off the surface and move the sponge to an area that has less light.

Feeding

Some sponges do contain symbiotic algae or cyanobacteria, but most species collected for the aquarium trade do not. Unlike corals that have some photosynthetic capabilities, sponges are filter feeders. They collect microscopic food particles from water as it is pumped through a network of internal canals. To be sure that the natural food source for sponges, bacteria or protozoa, is present in ample quantities, the aquarium should have been established for six months to a year before the purchase of a sponge. Start adding supplemental food a week before purchase of the sponge. This includes liquid invertebrate food and bacterio-plankton additives. Live phytoplankton cultures have the benefit of containing bacteria that can also supplement a sponge diet. Adjust the amount of food added carefully so that most of it is consumed quickly. Even when a protein skimmer is present to remove extra protein, too much food in the water can lead to excessive unsightly algae. Long term success with sponges is directly linked to regular supplements, but they must be added carefully.

Adequate water flow is critical for moving food to the sponge. Sponges pump water through themselves, but a good current in the aquarium brings food to the sponge from areas beyond the immediate location of the animal. One Maxi-Jet® 900 or Maxi-Jet® 1200 power head for every three feet of tank length, placed at the level of the sponge, should provide adequate water movement. Sponges should be positioned so each receives a gentle, continuous flow. Factors such as rock structures and coral heads will influence the water motion. Monitor the area surrounding the sponge to be certain that water flows past it and is not stagnant.

Photo by Michael P. Jones

A group of cryptic sponges living in low light.

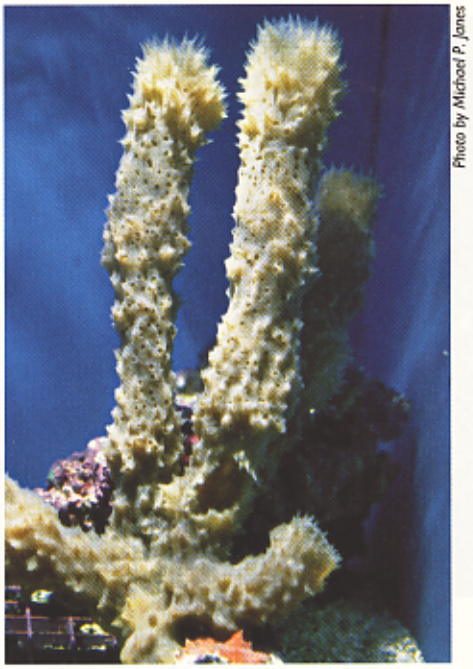
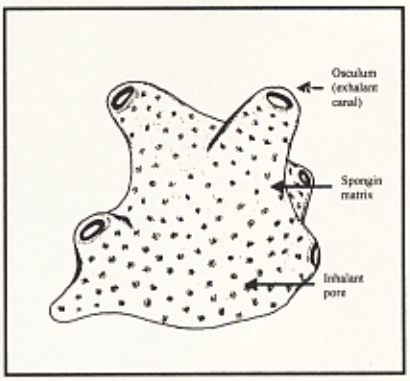


Photo by Michael P. Jones

The Caribbean gray spiny tube sponge, Callyspongia vaginalis



Surface features of a sponge.

Conclusion

Sponges have not been common in home aquaria despite their abundance on tropical reefs. New collection and shipping techniques that keep the sponges completely submerged have made healthy specimens more readily available, particularly those from the Caribbean area. With appropriate food and water flow, it is now easier to maintain healthy sponges in a mature aquarium for longer periods. Because sponges can be multiplied by cuttings, similar to small polyp stony corals, there is potential for artificial propagation and sharing with fellow hobbyists, one of the most gratifying experiences in the hobby.

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The tank gets a two quart water exchange every three to four weeks. I feed it about three times a week with either a *Spirulina* disk or sinking plankton pellets. I drop these in when I turn off the light at night. I have pruned the *Caulerpa* once in two months and fed the cuttings to the yellow tang in the display tank. The *Astrea* snail keeps the glass relatively free of algae.

Two weeks after setting up the refugium and inoculating it with 18 amphipods I fed the tank a *Spirulina* disk and turned off the light. After ten minutes I turned the light on and was amazed at the number of amphipods scurrying over the rock to get something to eat. There were over a hundred of them. Then I decided to start harvesting animals to be fed to the display tank. I removed the power head sponge when doing a water exchange and shook it in the container of water removed from the refugium. I did not remove any amphipods from the live rock, the *Caulerpa*, or the tank bottom. I didn't wring out the sponge, only shook it gently. I counted 22 amphipods that I then fed to the display tank by means of a length of airline tubing. My watchman goby and orange striped cardinal ate all 22 amphipods before any of the other fish could get to them.

I have only one problem using this system. It is difficult to separate the amphipods from the tank water, as they hide in the corners of whatever container holds them. I have tried to pour the water through a 50 micron plankton filter. This will catch the amphipods but then they must be washed off the filter.

I am sure that this method could be adapted to a five or ten gallon aquarium, using a few more pounds of rock and a slightly larger power head. With minimal space and effort it is possible to culture live foods for a mini-reef display tank.