

Fishless Cycling in a Saltwater Aquarium

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Biological Filtration

Fish, corals and invertebrates produce ammonia as a waste product. Even at levels as low as 0.5 mg/l, this is extremely toxic to marine and freshwater animals alike.

Biological filters contain nitrosifying bacteria that use ammonia as a source of energy, in the process converting it into much less toxic nitrite. Another class of bacteria called nitrifying bacteria use this leftover nitrite as their energy source, producing nitrate as their waste product. Nitrate is relatively harmless, and simply diluting the nitrate by doing regular water changes is generally all that is needed to keep marine fish healthy. Provided the nitrate concentration is below 20 mg/l (20 ppm), most marine fish will do well, though reef tank invertebrates are less tolerant of nitrate, and the aquarist will need to keep the nitrate concentration below 5 mg/l (5 ppm) for animals like corals and polyps to thrive.

The problem facing an aquarist setting up a saltwater tank is that the required bacteria need time to fully colonize the filter before they are able to adequately process the ammonia produced by the livestock. It takes from four to eight weeks for a tropical marine aquarium to develop the required populations of bacteria, a process known as "cycling."

Why Use a Fishless Cycling Method?

Until recently it was common for saltwater aquarists to use certain hardy, inexpensive fish to provide to give a new tank the ammonia required to begin the cycle. However, few saltwater fish tolerate any level of ammonia for very long, limiting the range of species that could be used. Hardy damselfish, such as humbugs and dominoes, were often used; or else brackish fish, such as black mollies, would be used instead.

The problem with this approach is that the aquarist can end up being stuck with unwanted fish. Damselfish tend to be very territorial and aggressive, limiting the range of potential tankmates. Brackish fish don't tend to cause problems, since most species are fairly easygoing, but if an aquarist wanted to keep brackish fish, why set up a marine aquarium in the first place?

Fishless cycling avoids both of these problems by providing ammonia for the bacteria without the need to buy any fish. Once the aquarium is cycled, you're free to add whatever fish species you want.

Using Ammonia

Cycling a saltwater aquarium is essentially similar to cycling a freshwater aquarium, particularly with the amount of ammonia needed and how often that ammonia will need to be added. In brief, add enough ammonia so the concentration in the aquarium is about 4 to 5 mg/l (4 to 5 ppm). Make a note of how much ammonia is needed to get that concentration, and add the same amount each day.

Using Fish Food

An alternative to using ammonia is to add a pinch of food every day, just as if there were fish in the aquarium. As the flakes decay, they will produce ammonia, and that will allow the filter to mature. Though messy, as you will have a pile of decaying fish flake on the bottom of the tank, this approach is easy and works well as an approximate method.

Test Kits and Measurements

Test the aquarium water for ammonia and nitrate three or four hours after adding the daily ration of ammonia or fish food.

Initially, the ammonia concentration will be high: up to 5 mg/l (5 ppm) if you're using the ammonia method. But after a few days, the ammonia concentration will fall, indicating that the nitrosifying bacteria are multiplying and the first stage of the cycling process is underway.

As the nitrosifying bacteria produce nitrite, you will find the nitrite concentration rises up from zero to some peak value and

then starts to go down. This takes a couple of weeks, but as the nitrite level drops, you know that the nitrifying bacteria are using up nitrite and producing the relatively nontoxic nitrate as a waste product.

Eventually there will be adequate populations of both types of bacteria, and consequently ammonia and nitrite concentrations will consistently remain at zero. When this happens, your aquarium has been cycled.

Time Scale

Saltwater aquaria take about a month to cycle, though this varies depending on a variety of factors, including oxygen concentration and temperature.

During this period, take time to make sure you understand how to monitor and regulate salinity and water chemistry. Filter bacteria won't be bothered by slight changes in environmental conditions, but most fish and invertebrates will be, so it's worth getting the salinity and water chemistry parameters exactly where you want them while you have no fish in the tank that could be harmed.

First Fish

Captive-bred clownfish are particularly good fish for simple marine aquaria, being hardy enough to tolerate many mistakes you might make while starting out in the hobby. On the invertebrate front, turbo snails and blue-legged hermit crabs are easy to keep, and they play a useful role cleaning up algae and uneaten food.

Seeding

To speed up the cycling process, add beneficial bacteria to a new aquarium with a few cups of substrate from a mature aquarium or some live filter media from a mature filter. If that's not an option, consider buying at least a couple of pieces of live rock; while you won't get all the benefits live rock provides when used in quantities of around a pound per gallon, the live rock will at least jumpstart the cycling process, seeding both the filter and substrate with useful bacteria.

Neale Monks studied zoology at the University of Aberdeen in the north of Scotland and obtained his Ph.D. at the Natural History Museum in London. He's also been a marine biologist, a high school teacher, a university professor and a museum's exhibit designer. But his real love has always been tropical fish. His particular interest in brackish water fish culminated in his editing of the first encyclopaedic book on the topic, 'Brackish-Water Fishes', published by TFH in 2007. Neale regularly contributes to all the major English-language fishkeeping magazines, focusing especially on community tanks, biotopes, healthcare and water chemistry issues. After living in London and then for a while in Lincoln, Nebraska, Neale now lives in a quaint cottage in a pretty market town in Hertfordshire, England, where he divides his time between teaching and writing.