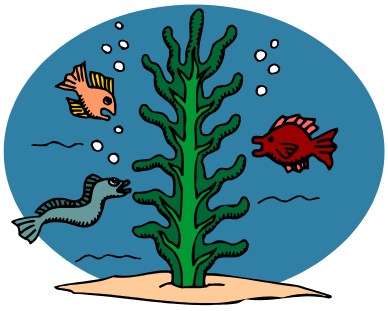


How to Set-up a *Halimeda* Aquarium

Heather Spalding, Gk-12 Program

Setting up a salt-water aquarium for tropical fish requires a lot of time, energy and resources. The nutrient levels, salinity, water temperature, light, and number and type of fish in the aquarium must be closely monitored every day. Setting up an aquarium for algae, though, is a lot simpler. Marine algae absorb nutrients from the water, and are a lot more resilient to changes in water temperature, salinity, and light. Just add seawater, light, a bubbler, and some algae, and you're good to go!

What do marine algae need to survive?

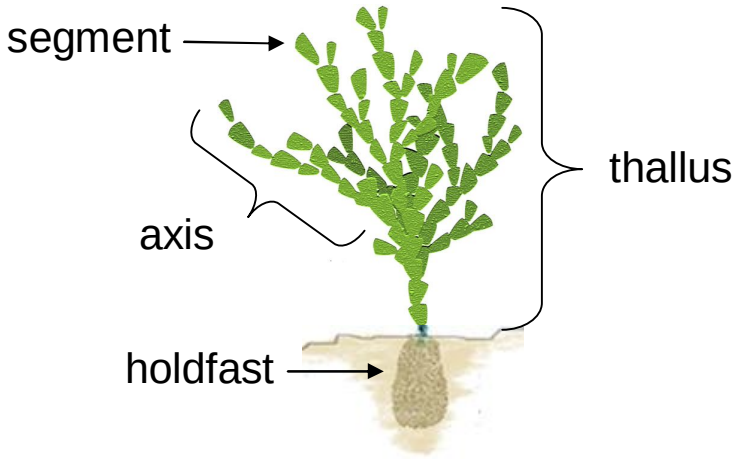
Part of building an algae aquarium is learning to understand the factors that affect algal growth and survival. Marine algae are in the Kingdom Protista, and are not considered "true plants". However, plants evolved from green algae (Chlorophyta), and share some basic similarities with algae in terms of what they need for growth and survival. Both use photosynthesis for energy, and need light to grow. Algae and plants also require nutrients, but their pathways for nutrient absorption are different. Plants primarily absorb nutrients dissolved in freshwater through their roots. Marine algae absorb nutrients from seawater over their entire body, or thallus. Nutrients in the marine environment come from fish waste, decomposing organic matter, or fertilizer.

To keep your algae alive and growing, you will need to monitor the nutrient levels, light, and salinity in the aquarium. The air bubbler will keep the water circulating and oxygenated, and keep the algae, organisms and bacteria alive and well. All are needed to keep your algae aquarium ecosystem running smoothly!

***Halimeda* meadows in Hawaii**

Halimeda kanaloana is a calcified green alga that grows in the sand from ~30 to 300 feet deep around Maui, Lanai, Molokai, and Kahoolawe. When the *Halimeda* dies, the calcified segments fall to the seafloor and become sand. Areas densely covered with *Halimeda* are called *Halimeda* meadows. These meadows create important habitat for fishes and invertebrates. *Halimeda* plants collected offshore of Maui will be "planted" in your aquarium in the sand, and you will be able to observe you own little *Halimeda* meadow ecosystem!

Although *Halimeda* is an alga, it has many specialized body parts that resemble plants. *Halimeda* is composed of segments, or small little pieces, that resemble small little leaves. The *Halimeda* segments are organized into branches are called axes. The holdfast looks like a root system, and anchors the *Halimeda* into the sediment.



ACTIVITY

Construct and maintain an aquarium for *Halimeda kanaloana*

MATERIALS

- 10 gallon (or larger) aquarium
- carbonate sand (enough to cover to ~ 6 inch deep in aquarium)
- Instant Ocean or seawater salt mixture
- chopsticks or flat ruler/yardstick
- air pump (or bubbler) with air stone and small fishing weight
- *Halimeda kanaloana* plants, cleaned of any ephiphytes or invertebrates
- aquarium scrubbing brush
- aquarium net
- small sponge
- colored or white tape
- powerstrip
- fluorescent lighting or location of aquarium in window with natural sunlight

PROCEDURE

1. Place the aquarium on a firm, solid surface under the fluorescent lighting or in the sunlight.

2. Place sand in aquarium to a depth of ~ 6 inches. Make sure the sand is evenly spread out over the aquarium.

3. Mix the seawater according to the directions on the container

4. Slowly and carefully add the seawater into the aquarium over the sand. Fill the aquarium with seawater until it is ~3-4 inches from the top of the aquarium.

5. Use the chopsticks or ruler to gently remove air bubbles caught in the sand.

6. Use the aquarium net and sponge to “clean up” the brown scum off the top of the tank.

7. Mark the level of the seawater in the tank with the tape and mark with the date and time. If the level of seawater drops below the mark, then add freshwater up to the mark. (You can also purchase a hydrometer at an aquarium pet store, and keep the salinity in the desired range between 30-34 ppt).

8. Plug in the air pump with the airstone, and put the tubing and airstone in the aquarium. You should see bubbles coming from the airstone. The fishing weight should be attached to the end of the airstone to keep it on the bottom of the sand.

STOP NOW! Let the aquarium run for a week, and monitor the water level.

9. Create a small burrow in the sand in the aquarium.

10. Remove the *Halimeda* from the bucket, and gently place the holdfast into the burrow in the aquarium. Completely cover the holdfast with sand.

11. Repeat step 8. with additional *Halimeda*. Evenly space the *Halimeda* plants in the aquarium.

12. Re-mark the level of the seawater in the tank with the tape and record the date and time. If the level of seawater drops below the mark, then add freshwater up to the mark (or monitor salinity with hydrometer…see step 7.)

13. Monitor the health of the *Halimeda* on a weekly basis. Remove any dead or dying organisms from the tank. If needed, a nutrient fertilizer stick can be added to increase the nutrient levels in the tank and increase *Halimeda* growth. Optional: monitor nutrient levels in the tank with a nutrient kit for ammonium, nitrite, and nitrate purchased at an aquarium store.

The Nitrogen Cycle in Aquaria

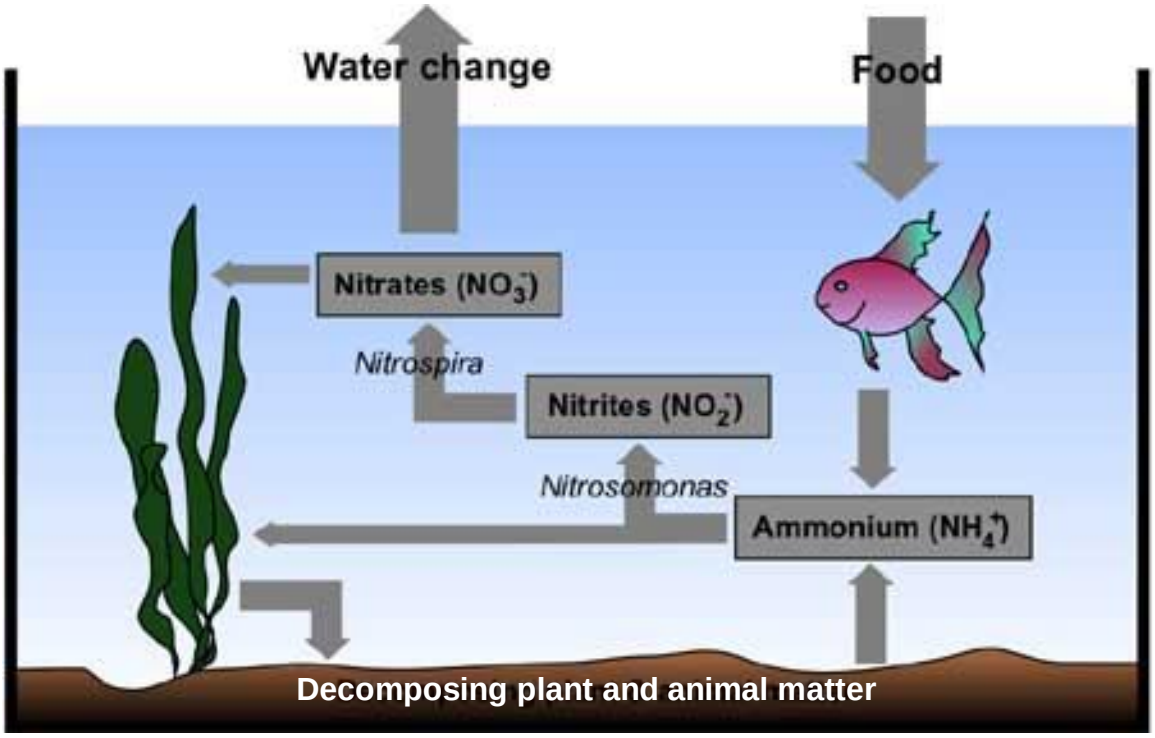
Nutrient levels can quickly build-up in an aquarium with fish, and if not regulated, the fish will get sick or die. Understanding the **nitrogen cycle** in a tank with fish will help to understand how nutrients work in the ocean, and also in your algae aquarium.

Nitrogen Cycle Stages

Stage 1

Ammonia is introduced into the aquarium via tropical fish waste, uneaten food, or organic matter in the sediment. The tropical fish waste and excess food will break down into either ionized ammonium (NH_4) or un-ionized ammonia (NH_3). Ammonium is not harmful to tropical fish but ammonia is. Whether the material turns into ammonium or

ammonia depends on the ph level of the water. If the pH is under 7, you will have ammonium. If the pH is 7 or higher you will have ammonia.



Stage 2
Soon, bacteria called *Nitrosomonas* will develop and they will oxidize the ammonia in the tank, essentially eliminating it. The byproduct of ammonia oxidation is **nitrites**. So we no longer have ammonia in the tank, but we now have another toxin to deal with - nitrites. Nitrites are just as toxic to tropical fish as ammonia. If you have a test kit, you should be able to see the nitrite levels rise around the end of the first or second week.

Stage 3
Bacteria called *Nitrospira* will develop and they will convert the nitrites into **nitrates**. Nitrates are not as harmful to tropical fish as ammonia or nitrites, but nitrate is still harmful in large amounts. The quickest way to rid your aquarium of nitrates is to perform partial water changes. Once your tank is established you will need to monitor your tank water for high nitrate levels and perform partial water changes as necessary. There are other methods to control nitrates in aquariums besides water changes. For freshwater fish tanks, live aquarium plants will use up some of the nitrates. In saltwater fish tanks, live rock and deep sand beds can have **anaerobic** areas where denitrifying bacteria can breakdown nitrates into harmless nitrogen gas that escapes through the water surface of the aquarium. This process is called **denitrification**.

COOL HIGHLIGHT……Nitrospira are nitrite-oxidizing bacteria that are important in marine habitats. In aquariums, for example, if the nitrogen cycle is thrown off, the ecosystem suffers and fish can get sick or die. Therefore, nitrite-oxidizing bacteria as well as the other bacteria in this system are important for healthy marine ecosystems. In addition, *Nitrospira*-like bacteria are the main nitrite oxidizers in wastewater treatment plants and in laboratory scale reactors.

NITROGEN CYCLE TERMS

Ammonia - abbreviated as NH_3 (one part nitrogen and 3 parts hydrogen), ammonia is released into the aquarium from uneaten fish foods, fish wastes and other biological processes. Ammonia is always being released into the aquarium and adequate biological filtration is needed to prevent the life forms from suffering because it is very toxic to fish. Ammonia is thought to be the number one killer of fish in aquariums, most likely due to aquariums going through the nitrogen cycle.

Anaerobic - means that there is no oxygen is present or an organism does not require oxygen. Some of the bacteria living on the inside of Live Rock that convert nitrates to harmless nitrogen gas are though to be anaerobic.

Denitrification - is a process where nitrates are converted to harmless nitrogen gas that escapes at the tank water surface. In order for this process to take place there needs to be anoxic **or** anaerobic conditions in the aquarium. These anoxic or anaerobic places are usually found in the lower layers of Deep Sand Beds and deep within Live Rock**.**

Nitrate - NO_3, occurs toward the end of the aquarium nitrogen cycle and can harm fish in high enough concentrations. In tanks without any form of denitrification, water changes are needed to remove nitrates.

Nitrite - NO_2, is the middle step in the aquarium nitrogen cycle where ammonia is converted to nitrites and nitrites get converted into Nitrates. Nitrites are not as harmful to fish as ammonia, but can still be deadly if the fish are exposed for prolonged periods.

Nitrogen Cycle - sometimes called new tank syndrome, the aquarium nitrogen cycle refers to the conversion of ammonia to nitrite and then nitrites to nitrates by beneficial bacteria that form inside the aquarium and in the filtration system.

Information on maintaining a saltwater aquarium and the Nitrogen Cycle from **http://www.fishlore.com**