

Aquarium Water Chemistry

Anyone wanting to be successful at the tropical fish hobby must put forth the time necessary to understand some basic fish tank water chemistry. This will help your fish to not only survive but thrive!

I recommend that you get a good [aquarium water testing kit](#) or many individual kits. You will need kits that will test for the following:

- **Ammonia**
- **Nitrite**
- **Nitrate**
- **pH**
- **Water Hardness**
- **Chlorine / Chloramine**

Definitions

Aerobic Bacteria

This is bacteria that requires oxygen to live.

Anaerobic Bacteria

This is bacteria that can live without the presence of oxygen, or bacteria that does not require oxygen.

Ammonia

This chemical is the result of fish waste and decomposing food in the aquarium. Ammonia is the leading killer of tropical fish. New tanks that are going through the [aquarium cycle](#) or heavily stocked tanks will show ammonia readings with your [test kits](#). Ideally, we want the ammonia reading to be 0 ppm.

Chloramine

Chloramine is a combination of chlorine and ammonia. It is a stronger disinfectant than chlorine alone and is used in areas where this extra disinfectant is needed. As with chlorine, you must eliminate this chemical from your tap water before adding it to your aquarium or it too will kill your tropical fish.

Chlorine

This chemical is found in most tap water and it is used to kill the bad bacteria in our drinking water. Chlorine must be eliminated before entering your aquarium or it will kill your tropical fish.

Copper

This heavy metal can come in with the tap water if you have older copper pipes. It can also get introduced to your tank if you've used any copper based medications. Copper can be very harmful to fish and invertebrates.

[Copper test kits](#)

Nitrate

Nitrites are converted to nitrates during the cycling process. Nitrates are not as toxic as ammonia or nitrites but they are harmful and will stress your fish at high enough levels. The only way to remove the nitrates is through a partial [water change](#). Ideally you want to have [test kit](#) readings of less than 20 ppm in [freshwater tanks](#) and even less in [saltwater tanks](#).

Nitrite

Ammonia gets converted to nitrite by the bacteria in your tank. Nitrite levels will soar in new tanks that have not yet been [cycled](#). Nitrite is just as toxic to tropical fish as ammonia and the only way to quickly reduce nitrite levels is through a [water change](#). Nitrites will eventually be converted to nitrate by the bacteria growing in the tank and filters. Ideally, in established tanks you want this reading to be 0 ppm with your [aquarium test kit](#).

Nitrogen Cycle

This cycle usually takes from 2-8 weeks to complete and will happen in all new aquariums. You could speed up the process by using the filter material or gravel from an established tank. Even then it could still take a few weeks for the tank to cycle. This is the cycle whereby Ammonia is converted to Nitrites and Nitrites are converted to Nitrates. Please read the [Nitrogen Cycle](#) for more information.

Ammonia -> Nitrite -> Nitrate

pH

pH is the scale used to measure the acidity or alkalinity of water. The scale ranges from 0 to 14 with 0 being the most acidic, 7 being neutral and 14 being the most alkaline. It is possible to raise or lower your pH levels with water changes or chemicals from your local pet store.

Phosphate

Phosphate can be introduced to your aquarium mainly from tap water, dead plants and fish food. High phosphate levels can cause algae outbreaks. There are products on the market to remove phosphates and you can do your part by keeping up with your [aquarium maintenance](#) and performing regular water changes. Saltwater reef tank keepers and freshwater plant keepers may want to invest in a [phosphate test kit](#).

Salinity

This is the amount of dissolved salts in water and is measured using a hydrometer.

Specific Gravity

This is a density measurement for the amount of dissolved salts in saltwater compared to freshwater. Explained another way, saltwater is composed of many more elements than freshwater. The specific gravity measurement shows us how much heavier or denser saltwater is compared to freshwater.

Water Hardness

The hardness level of water has to do with the amount of minerals that are dissolved in the water. Calcium and magnesium are the primary minerals that are dissolved in tap water. "Soft" water has relatively few dissolved minerals whereas "hard" water has many dissolved minerals. Water hardness is not really an issue unless your water is excessively soft. Then you may have problems with runaway pH levels. For [saltwater aquariums](#) this is especially true. The carbonate hardness of saltwater can give you a good indication of how stable your pH is.

The Aquarium Nitrogen Cycle

This information presented below may be rather boring to most people, but it is absolutely essential to understand this process if you want to be successful at keeping tropical fish!

Some call it the biological cycle, the nitrification process, new tank syndrome or even the start-up cycle. They all are referring to the same cycle - The Nitrogen Cycle. This very important cycle is the establishment of beneficial bacteria in the aquarium and in the filter media that will help in the conversion of ammonia to nitrite and then the conversion of nitrite to nitrates. Check out the [aquarium water chemistry](#) page for more information on these terms.

This process can take from 2 weeks to 2 months or longer to complete. It is vital for anyone planning on keeping an aquarium with [tropical fish](#) to understand this process. Learning about this process will help you to be successful in keeping tropical fish. The best way to monitor the nitrogen cycle is to purchase a [freshwater test kit](#) or [saltwater test kit](#) that will test for ammonia, nitrites, nitrates and ph.

Test your aquarium water every other day and write down your readings. You will first see ammonia levels rising. A few weeks or so later you should see the nitrite levels rising and the ammonia levels dropping. Finally, after a few more weeks you should see the nitrate levels rising and the nitrite levels dropping. When you no longer detect ammonia or nitrites but you can detect nitrates you can assume that it is safe to add your tropical fish.

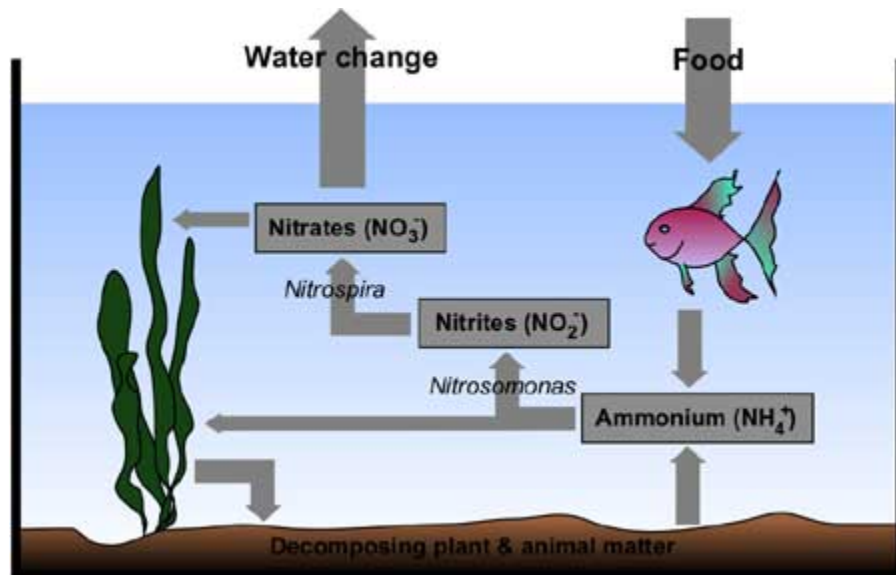


Photo Credit: Ilmari Karonen

Nitrogen Cycle Stages

Stage 1

[Ammonia](#) is introduced into the aquarium via tropical fish waste and uneaten food. The tropical fish waste and excess food will break down into either ionized ammonia (NH₄) or un-ionized ammonia (NH₃). Ammonium is not harmful to tropical fish but ammonia is. Whether the material turns into ammonia or [ammonia](#) depends on the ph level of the water. If the ph is under 7, you will have ammonia. 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 nitrobacter 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.

Getting The Nitrogen Cycle Started

There are two ways to get the aquarium cycle started, either with fish or without fish.

Starting The Nitrogen Cycle With Fish

This is **not** the preferred way to get the nitrogen cycle started because the fish are being exposed to ammonia and nitrites during this process. Many fish can not and will not make it through the cycling process. Often times the fish become stressed and [fish disease](#) starts to break out. I wonder what percentage of disease is caused by the cycling of new aquariums?

Certain species are hardier than others and seem to tolerate the start-up cycle better than others. For freshwater tanks, the [zebra danio](#) is a very hardy fish that many use to get the nitrogen cycle started. For saltwater tanks, some have reported success using [damsel fish](#) to get the process started. Again, using fish to cycle is not a good idea and you may be throwing your money (on dead fish) out the window. There is a better way. Read on, young grasshopper.

Starting The Nitrogen Cycle Fishless

There are a few different ways to get this process started. To easily get an ammonia reading from your tank water try the Seachem Ammonia Alert. It sticks inside the tank and has a circle that changes color depending on the ammonia levels in the tank.

- **Option 1:**
Using [Fish Food](#)
Drop in a few flakes every 12 hours. As the food decomposes it will release ammonia. You will have to continue to "feed" the tank throughout the process to keep it going.
- **Option 2:**
Use a small piece of raw fish or a raw shrimp
Drop a 2 inch by 1 inch chunk of raw fish or a raw shrimp into the tank. As it decomposes it will release ammonia into the tank.
- **Option 3:**
Use 100% pure ammonia.
Using a dropper, add 5 drops of ammonia per 10 gallons of aquarium water. Continue this process daily until you start to get nitrite readings with your test kit. Once you can detect nitrites you should only add 3 drops of ammonia per 10 gallons of aquarium water. Continue this process daily until you get nitrate readings with your test kit. Do a 30% water change and your tank is ready.

- **Option 4:**
Use gravel and/or filter media from an established and cycled tank
This is the best and fastest way to go. This will seed the tank with all of the necessary bacteria for the nitrogen cycle. "Feed" the tank daily with flake food until you are getting nitrate readings. Depending on how fast you were able to get the gravel and filter media into your tank, you may be getting nitrate readings in only a day or two. There are some drawbacks to this method. Ask your source if they have recently used any copper medications in the tank. If they have and you are planning to have invertebrates in the tank you should probably not use this method. Invertebrates will not tolerate copper. Get a [copper test kit](#) to determine if it's safe to use.
- **Option 5:**
Using [live rock](#) in [Saltwater Tanks](#)
The use of [live rock](#) in saltwater tanks has really taken off over the past few years. The reason for this is because it is one of the best forms of biological filtration available for saltwater tanks. The shape the rock is in when you get it will determine how long the nitrogen cycle will take. See step 7 on the [saltwater setup](#) page for more information on [live rock](#).
- **Option 6:**



Use Biospira made by Marineland. This product claims to contain some patent pending species of nitrifying bacteria that will cycle your tank in 24 hours. Some of the FishLore forum members have tried it and it sounds like it is legitimate. It is kind of expensive, but if you already have fish in your tank and they are suffering through the cycle, you may want to check this stuff out. 1 ounce of this product is supposed to treat a 30 gallon freshwater tank. There are both freshwater and saltwater versions of Bio-spira. Please let us know if you use this and if it works for you by submitting comments below.

Once the cycle has started only add one or two fish at a time. Wait a couple of weeks before adding more fish. This will give your tank the time it needs to catch up with the increased bio-load.

Speeding Up the Cycling Process

There are things you can do to speed along the process of cycling your aquarium.

- Increase the temperature of your aquarium water to 80°F-82°F (27°C-28°C)
- Get some beneficial bacteria colonies. Borrow some gravel from an established and cycled aquarium. If you have another tank with an extra filter you can use it. If you have a really nice friend with an established and cycled aquarium, ask if you can have one of their used filter media. It will be loaded with the good bacteria that we are looking for.
- There are products on the market that claim to introduce the beneficial bacteria. For more information, check out this product called [Cycle Water Conditioner](#).

Also check out Bio-spira in option 6 above.