A Primer for the Beginner Setting Up a Fishtank

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The first time fish tank owner is often beset with a myriad of advice and choices when it comes to setting up an aquarium, selecting a filter, purchasing fish and maintaining water quality. It can all be intimidating and confusing. The purpose of this article is to provide an easy to understand reference to help guide you through the process. Keeping tropical fish is not hard or time consuming if you understand the basics. It is also important to realize that in many situations there is not just one right way of doing something. There are many ways to set up and decorate a tank, just as there are many filters which will keep your fish alive. Much of the advice you will get comes from past personal experience. What you need to do is make sure you understand what you are being told and why. The advice-giver should be able to explain to you the reasoning behind the advice they are presenting. So if you don't understand, ask questions and get clarification until you feel comfortable.

Setting Up The Aquarium

Once the decision has been made to purchase a fish tank, the next questions to answer are: where am I going to put it and what kind of fish do I want. The common advice for buying a tank is to get the largest you can afford. The reason is that it is "harder" to make mistakes when you have more water. What this really means is that it takes longer for things to go wrong from such common mistakes as overfeeding or overcrowding. Better advice is to decide what kind of fish you are going to keep before buying the tank. For many fish, like tetras or barbs, a 10 or 20 gallon tank will be fine. However, in some cases, such as many species of cichlids, it is wiser to get a larger tank such as a 55 gallon.

Having decided on the type of fish and the tank size, the aquarium should be placed out of direct sunlight and in an area of your home that does not receive constant foot traffic. Direct sunlight can cause problems with algae and if people are walking by the tank all the time the fish tend to hide or dash around injuring themselves. Place the tank on a sturdy stand and not over anything electronic. It is best to have a ground fault circuit interrupter to plug everything into. You will need several wall plugs for the tank and its accessories, so to be safe make sure you install the proper devices to increase the number of plugs from the common two plug household outlet.

The Three Types Of Basic Filtration--the technical stuff

Without filtration of some sort, fish and invertebrates in an aquarium will not survive. The range of filtration systems goes from the simplistic to the complex. For the beginning hobbyist, it is important to purchase a filter that you understand so that you will maintain it. There are three basic types of filtration which every good filter should provide. However, no filter contains the fourth, and most important component--the servicing of the filter. There are no maintenance-free aquarium filters no matter what the advertisements or brochures say. It doesn't matter whether you pay $25.00 for a filter or $2,500.00 for one, they all need to be maintained and that is the duty of the hobbyist.

In order to properly maintain the filter, you should understand the three basic types of filtration which are: mechanical, chemical and biological.

Mechanical Filtration

Mechanical filtration removes uneaten food, feces, plant material and other particulate material that contributes to the turbidity or haziness of the aquarium. A mechanical filter should be the first component of your filtration system because the particles it removes will clog the chemical and biological filtration media, rendering them less effective. Mechanical filtration is usually described as the "trapping" of particulate and suspended matter from the water by straining. It is performed by passing the water through a media which

retains the "dirt." Clean water is then returned to the aquarium. The finer the media, the smaller the particles trapped. Mechanical filters, by nature and design, will become clogged and then either the water will bypass the filter media or the flow of water through the filter will decrease. This necessitates periodic changing or cleaning of the media.

The second part of mechanical filtration is the removal of the strained material from the aquarium. The removal of this material must be done because most of this material is organic in nature. Since the filters do not remove the dirt from the aquarium system, but simply confine it in one area (usually out-of-sight), it is subject to degradation by bacteria (called heterotrophic bacteria). The degradation end-products include ammonia and dissolved organic compounds (DOC). The heterotrophic bacteria are also aerobic, meaning they consume oxygen from the aquarium water. Thus, these bacteria are consuming oxygen that could be utilized by the fish, and at the same time are polluting the water with their waste. The purpose of changing or cleaning the mechanical filter media is to remove the organics from the system before they are broken down by the bacteria.

Chemical Filtration

Chemical Filtration involves the removal of dissolved substances by chemically or physically binding them to the filter media. Unlike the particulate material removed by mechanical filtration, the compounds being chemically filtered generally cannot be seen because they are dissolved in the water. This filtration process is called adsorption and is a phenomenon associated with interactions between two different phases of matter (in this case, the liquid phase of water and the solid phase of the filter media). It is in contrast to absorption, in which there is no interaction between the different phases of matter. The most common type of chemical filtration media is granular activated carbon (GAC).

The sources of these dissolved substances are varied. Some come from the biodegradation of organic substances (i.e., dissolved organic compounds). How well the adsorption process works depends upon a few general rules which apply to all chemical filtration media. First, and mostly importantly, the effectiveness of chemical filtration depends upon contact of the media with the water carrying the pollutants. Having lots of media in little contact with the water is ineffective. Second, chemical filtration should come after effective mechanical filtration to keep particulate material from clogging the pores and spaces of the chemical media, allowing water to flow through it freely. In conjunction with this, the media must be positioned so that the water has to go through as much of the media as possible, eliminating bypass. Third, no chemical filtration media lasts forever. GAC cannot be recharged by the hobbyist. It is often safer, easier, and cheaper to simply throw away the old media and replace it with new. Fourth, using chemical filtration does not eliminate the need for water changes and other good fish-husbandry practices. Chemical filtration is but one tool required to maintain a healthy environment for aquatic organisms.

Biological Filtration

It has long been accepted that biological filtration is the critical phase of filtration in the home aquarium. Fish and other aquatic organisms release toxic ammonia into the water as their principal waste product. Ammonia levels will quickly reach a lethal level in the closed environment of an aquarium. Fish may survive for some time with inadequate mechanical or chemical filtration, despite the water's murky or discolored appearance. But the absence of a process for eliminating (invisible) ammonia and nitrite will kill fish within hours if the level rises high enough.

A simple definition of biological filtration is: The conversion of ammonia to nitrite, then nitrite to nitrate, by bacteria. This process is called "biological" filtration because the filtering is done by living organisms as opposed to mechanical and chemical filtration, which are accomplished by inert media. A technical term for the process is "nitrification." Biological filtration may also be termed the "nitrifying cycle," but this is not really correct as the process is not cyclic.

Biological filtration is the biochemical process by which bacteria obtain the energy they need to live, grow and reproduce. Although it is certainly not necessary for the aquarist to know biochemistry, a basic understanding of the process will be helpful in caring for and maintaining the bacteria whose presence in the aquarium is as important as that of any prized fish specimen.

The bacteria we are concerned with are called nitrifiers and they are "obligate aerobes," meaning they must have oxygen to survive. They typically go by the names Nitrosomonas and Nitrobacter, but recent research which I have published in the scientific literature shows that these are not the genus of bacteria responsible. However, it takes a long time for new information to percolate into this hobby, so you will continue to hear and read those names for years to come.

In any case, the nitrifiers grow in colonies, preferably on surfaces, rather than floating freely in the water. The media on which they grow must be clean of detrital material, and the levels of DOC (dissolved organic compounds) must be low, a result of proper mechanical and chemical filtration.

When ammonia is released into the water by the fish, bacteria called ammonia-oxidizing bacteria start converting it through an oxidation process, into nitrite, another toxic substance. Nitrite is utilized by a second group of bacteria, called the nitrite-oxidizers which convert it to nitrate. The bacterial colonies are relatively slow-growing and it takes about 5 weeks to establish a functioning biological filter (meaning the filter is able to keep ammonia and nitrite concentrations continuously low). The first 35 days after setting up a new aquarium is a break-in period which may be frustrating for the new aquarist who is anxious for the biological filter to cycle. During this time period, ammonia and nitrite levels follow a predictable pattern. Ammonia increases rapidly over the first 3 to 5 days, then starts to decrease and is usually zero by day 10. The nitrite levels, however, remain in the toxic range and may stay high for 3 weeks or longer. When the nitrite level drops, the biological filter is "established."

Most aquarists falsely assume that the nitrifying bacteria have to be constantly underwater to work. Actually, the most efficient types of biological filters, called wet/dry filters, take advantage of the fact that the bacteria need only intermittent contact with the ammonia-laden water.

Selecting The Filter

There are several choices when it comes to buying a filter. For a long time, the conventional wisdom was that to be successful you had to install an undergravel filter in the aquarium. This is wrong and there are many tanks with healthy fish without undergravel filters. You can narrow the filter choices by deciding what kind of fish you want and how mechanically inclined you are. For most first aquaria, ranging in size from 5 to 55 gallons, a power filter of the proper size will do fine. The caveat here being that there is not a heavy fish load, the fish are not overfed, and the filter is maintained on a regular schedule. I will discuss the two most common types of filters, either of which is a fine choice for a first aquarium.

Power filters are convenient to set up and use and take little time to service. The typical power filter has three basic parts. The first part is the filter box which holds the water and hangs on the back of the aquarium. A lift tube fits into the filter box and curves over the top aquarium and extends down into the water. Secondly, there is a strainer at the end of the tube so fish do not get sucked into the filter. Water is drawn up the lift tubes by a self-starting mechanism, so you only need to add some water to the filter box to get the process going and plug the filter in. The water returns back to the tank via a spillway moulded into the filter box (this also serves to hold the box on top of the tank). At this point, however, the unit is just a water pump that is circulating water from the tank. The third part is the filtration component. Actually for most power filters, this is a series of pieces which together form the filtration system.

Earlier the three basic types of filtration for successful fishkeeping were explained. For power filters, mechanical filtration is performed by a filter floss which can be attached to a cartridge or shaped like a bag. Some filters use a sponge. No matter the type of mechanical filter, it should be rinsed frequently. Clogs cause less water to flow through the filter and eventually the water will start to bypass the filter altogether. How is possible? The fundamental difference between a power filter and a canister filter (to be described

next) is that a power filter will continue to pump water into the filter box even when the mechanical filter is clogged and this results in unfiltered water returning to the aquarium via a bypass weir built into the filter. The water flow from a canister filter, on the other hand, will slowly decrease as the mechanical filter clogs and eventually it will stop. A once a week rinse of the mechanical filter component should be sufficient.

For chemical filtration, most power filters use activated carbon. The carbon will last about a month depending on fish load and feeding rate. Changing or replacing the carbon is generally easy. For some filters you merely throw away the filter cartridge which contains the carbon and also doubles as the mechanical filter and replace it with a new one. For others there might be some assembly required or the carbon comes separately in a pouch. In any case, rinse the carbon under tap water for a minute and then place it in the correct position in the filter.

Some power filters have separate biological filters which rarely, if ever, need maintenance. The problem is that they will become discolored with a bacterial film and new hobbyists believe that they are dirty and need replacing. Resist the urge to replace your separate biological filter, the discoloration shows it is working and has an active culture of bacteria.

Other power filters have the mechanical and chemical filtration components doubling as the biological filter. The basis for this is that over time, the nitrifying bacteria will grow on these surfaces and convert ammonia to nitrite to nitrate. With these filters you have to be careful not to change the mechanical and chemical components at the same time or you risk losing the beneficial bacteria and having an ammonia spike in your tank.

The other popular type of filter is the canister filter. These filters are the choice for large aquaria or tanks which will have a lot of fish. They are more complicated than power filters and have tubing, valves, inserts and other pieces. However, the basics are the same as a power filter: mechanical, chemical and biological filtration. Generally, canister filters are more expensive than power filters; but they can hold more media and are versatile. Don't automatically drop a canister filter from consideration when setting up an aquarium even if you are new. Have the sales person show you the features of the filter and discuss with them the size of the aquarium and the types of fish you plan to have. A 55 gallon tank with a cadre of African cichlids, such as mbuna, is a prime candidate for a canister filter.

A canister filter is shaped like cylinder and sits on the floor under the aquarium. The pump can be either on the top or bottom depending on brand. There are two hoses, one in which water flows from the tank into the filter and the other whereby water is pumped from the filter back into the aquarium. Usually there are valves on the hoses so the canister can be quickly removed from the systems for cleaning at a sink. Inside the canister there may be different containers to hold or position the mechanical and chemical filtration media.

Canister filters can seem intimidating, but they are not once you have been shown how to assemble one. Ask the store clerk for a demonstration of one, you may find it is just the filter for your tank.

There are other types of filters such as large wet/dry systems, simple corner filter, ion exchange resins, protein skimmers, ultraviolet sterilizers, ozonators and more but space precludes an explanation of every filter type.

Purchasing Fish

The services of a good fish store can be invaluable when it comes to buying fish. If you have your eyes on a particular fish, make sure that you discuss the needs of that fish with the store clerk. Ask such questions as whether it is a community type fish, what types of feed it prefers, and how big it gets. This last one is especially important as many times beginning fishkeepers choose a small fish that grows to a large size and starts to eat its tankmates or outgrows the aquarium.

The first stocking is important. As detailed earlier, when you first set up a tank it will take several weeks for the nitrifying bacteria to grow numerous enough to handle all the fish waste. Therefore, you have to start

slow, with a low number of fish, and light feed. This will keep the ammonia down. If the fish look stressed, such as clamped fins, or the water gets a little cloudy (a common occurrence in a new tank), do a partial water change. In fact, it is rare that one could do too many water changes. Don't be afraid to change 25 to 33% of the water everyday, if need be at some point, during the first few weeks of a new tank.

Try to avoid impulse buying of fish. If a certain fish has caught your eye, find a knowledgeable sales person or consult a book to see if that fish will be compatible with the fish you already have. It takes experience to know how many of a certain species should be put in a tank, so ask questions and find out about stocking your tank before it's too late.

Maintaining Water Quality

There are four simple steps to maximizing the chance of success with your aquarium. Number one is don't overcrowd your tank. There is a finite number of fish which your tank can hold. That number depends on the size of the tank, the filter and your maintenance schedule. If you don't do much maintenance or water changes, then the more fish you have in the tank, the more problems will occur.

Step two is don't overfeed. Fish will always "look" hungry, but they don't need to be fed more twice a day. Feed what they eat in a few minutes and no more. With this regime no fish will starve to death, while with overfeeding fish can die because the tank becomes polluted.

Step three is doing water changes. Change 25 to 33% of the water every three or four weeks minimum. If your tank has a lot of big fish, or if you have violated step one or two, then you will have to change more water more often to maintain water quality and fish health. There is no such thing as an aquarium which never needs a water change. It is part of keeping fish just like you need to clean the catbox if you have cats. There are devices to help make water changes easier and make less work.

Step four is filter maintenance--it must be done. Follow the manufacturer's directions and clean the filter on a regular schedule according the guidelines in other parts of this article.

Final Words

Keeping fish is a fun, life-long hobby. You can have a fish tank in many places which don't allow other pets. Fish tanks are neither time consuming or difficult if you understand the basics as outlined here. Too often a new fishkeeper "pampers" their fish to death by trying too many things. For your first tank, keep it simple. Start with a moderate tank with some community fish and get comfortable with the procedures. Don't worry about mastering all the terms and becoming a chemist or biologist. Set the tank up, stock it lightly, do water changes regularly and enjoy the results. After a while you can graduate to a more difficult tank such as reef tank or breeding a certain fish. Enjoy!

Originally published in Aquarium Fish Magazine, Jun. 1996
Courtesy of Marineland (www.marineland.com)