The Marine Aquarium
Part 1
by Gerald C. Corcoran

What is NANFA doing printing articles on marine aquariums? Aren't we dealing strictly with freshwater animals? What purpose does it serve? They're too hard to maintain, aren't they? All of these questions, and more, will be answered in this series of articles.

To begin with, the inclusion of the word "native" in the organization's name does not distinguish between fresh and salt water. To ignore the marine animals would be to shut out a large proportion of our population living in coastal areas. NANFA has received many inquiries from members who are beginning to develop an interest in keeping marine specimens in conjunction with their freshwater animals. Rather than continue answering these letters on an individual basis, I've decided to give everyone a chance to find out about it at the same time.

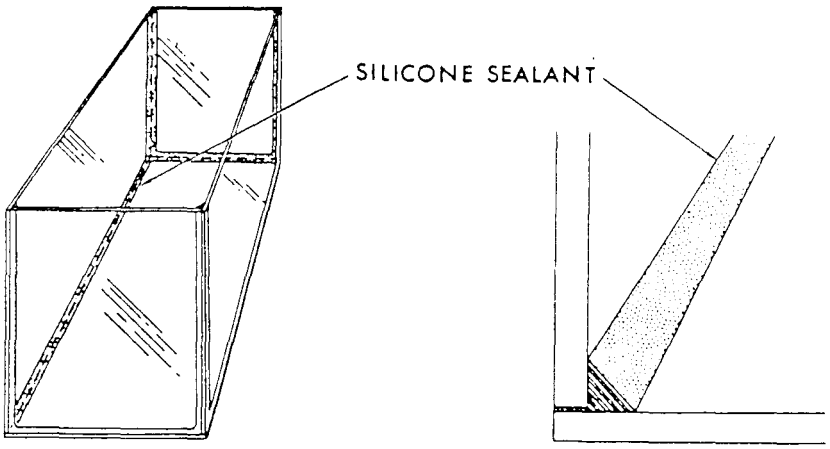
As in any field of endeavor the information presented here will be what works for us here at the Marine Education Center. There are, no doubt, many expert marine aquarists among the membership who will disagree because they use a different technique. I invite these people to write down their procedures and share them with us. If it works for you it will no doubt work for someone else. The fact of having a choice is what makes the world go round.

As to the purpose this article serves, pure and simple it's membership. Saltwater enthusiasts feel that the saltwater members of the fishes are just as much natives as any freshwater fishes, and I tend to agree with them. Certainly there is enough room in our organization for both. These articles may serve to attract new members or give old members something else to think about and possibly try.

How many times have you heard, or said, that marine aquariums are much harder to maintain? They are, aren't they? Most emphatically, no! Different, yes. Harder, no. Perhaps that should be qualified. If you think it's too much trouble to pay attention to detail and follow a rigorous schedule then marine is not for you. In fact, maybe you'd better give up on fish altogether. Rather than any more preaching, let's talk about equipment.

The choice of an aquarium for any type of aquatic animal should be based on quality and utility rather than cost alone. A good aquarium costs only a few dollars more and will give a great many years of enjoyment. The ideal thing is to talk to other people who have maintained aquariums for many years and take their advice on what brands to buy.

Stay away from any tank with a metal frame or with any metal that could possibly come in contact with the water. All metals, including stainless steel, will gradually leach out into the water introducing metallic ions which will kill the fish. They could be rendered safe by coating them with an epoxy paint or some other inert substance but all-glass aquariums have reached the stage of development where they are practically foolproof.



All-glass aquarium showing method of sealing.

On any type of aquarium it is a necessity to provide some type of cover. Again, stay away from any metal. Plastic or glass covers can be purchased that are completely safe in salt water. The cover should keep dirt out, fish in, retard evaporation and prevent people from putting their fingers in the water. Choose a cover which is tight fitting if you plan to keep large snails or an octopus.

Large numbers of filters on the market today employ small diameter air lift tubes and large bubbles to circulate water. While they may work for awhile in fresh water they are not efficient enough for the marine aquarium. When purchasing your filter be sure it has a lift tube diameter of at least 3/4 inches. We also prefer to use medium air diffusers made out of tiny glass beads.

Salinity

Average seawater = 3.4%
= specific gravity of 1.024 at 68°F

Saturation Values of oxygen in normal seawater

°F	mg/1 (ppm)
34	11.3
50	9.1
60	8.2
68	7.5
77	6.6
86	6.3

The gravel placed in the tank to act as a filter must serve several purposes. First it must act as a mechanical filter, then as a site for bacteria to grow and finally as a buffer. The marine tank must remain alkaline in order to support the animals. As part of the metabolism of the aquarium and its inhabitants a weak acid is formed which could, in time, build up and kill the fish. The acid reacts with the gravel and becomes neutralized. Dolomite, coral sand or even crushed oyster shells will supply the necessary buffering action.

Many people who would like to try to set up marine aquariums give up because they have no supply of sea water. The use of synthetic salts has all the advantages of natural sea water and none of its disadvantages. You have complete control over salinity, pH and trace elements and don't have to worry about weather, tides or pollution. Most brands are suitable, but do not choose on price alone. Talk to others who have used these salts and follow their lead.

Fish can survive for a relatively long time without food but will last only a few hours without an adequate air supply. The only air pump we use at the Marine Education Center is the Silent Giant which is known for its dependability and long life. We recently sent a 15-year-old pump back to the factory and had it completely rebuilt for $2.25. It may cost more to begin with but it will more than pay for itself over the years.

Prior to placing any new animals in your aquarium it will be necessary to compare the salinity of the water they are in to the salinity of the water in the tank. The same is true when mixing your synthetic salts. The hydrometer will allow you to match salinities so that your animals will not get a shock when you place them in the aquarium or make partial water changes.

The buffering action of the gravel has already been mentioned. To keep a check on it you will need a pH test kit which is an inexpensive piece of equipment and can save your fish from suffering through acidosis before they die. Future articles will cover this in more detail.

Many other accessories are available to make the tank more pleasing or easier to maintain. Special lights, plastic plants, imitation coral and items you can use in many ways. The amount of frills you wish to put on your aquarium is up to you.

With the exception of the gravel, every piece of equipment we mentioned can be used for either salt or fresh water. The next article will cover filters in much more detail and future articles will work up to a complete system.

THE MARINE AQUARIUM PART II

by

Gerald C. Corcoran

At the risk of boring some of the old-timers in the hobby, this article will be written with the beginner in mind, with the hope that a little of the information can be used by the more advanced hobbyist.

In any aquarium system, whether salt or fresh water, I like to think in terms of stratification or layering. The aquarium is built up layer by layer until it is a complete unit. With most of the tasks in life we have to start from the bottom and work our way up. Our aquarium is no exception.

Aquarium enthusiasts have, for many years, been using undergravel filtration with not much thought as to where the original idea came from. To learn more about why this type of filter works so well all you have to do is visit a local sewage disposal plant. You will then realize that we are trying to build a miniature sewage disposal system in our aquariums. The techniques are practically identical.

The first consideration should be "how much water can the filter pass through itself?" Most commercial filters on the market are well designed units that will pass a sufficient amount of water for the majority of aquarists. Recent trends are aimed at passing a greater volume of water in a given time, and I often wonder how long it will be before we begin to suck fish, decorations and gravel through our filters. Certainly there has to be a point of diminishing returns.

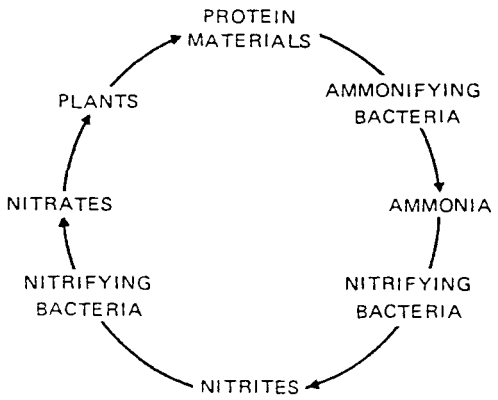
Homemade filters can be constructed that work just as well as the commercial variety. These range from PVC tubes with holes drilled through to corrugated fiberglass to eggcrate (fluorescent lighting) grating. Construction techniques can be found in back issues of such magazines as *Freshwater and Marine Aquarium*. The choice of commercial or homemade is up to you.

Gravel is the next consideration and is very important in its physical and chemical properties. For fresh water any number of different materials may be used, preferably inert, such as crushed glass, sandblasting gravel, coal and others.

For the marine aquarium, the choice is more or less restricted to Dolomite and coral sand, both of which are rather expensive. A word of warning is in order here. Don't try to save money on cheap gravel. Always buy from a reputable dealer who carries a proven product.

The physical size of the gravel has to be such that it is small enough to trap particulate matter but large enough to allow a good flow of water to pass through. Experiments have proven that a gravel of 2 to 5 mm is the ideal size. Anything smaller will cause the particles to block the flow of water and a larger size will allow the particles to be drawn down under the filter and back up through the lift tubes.

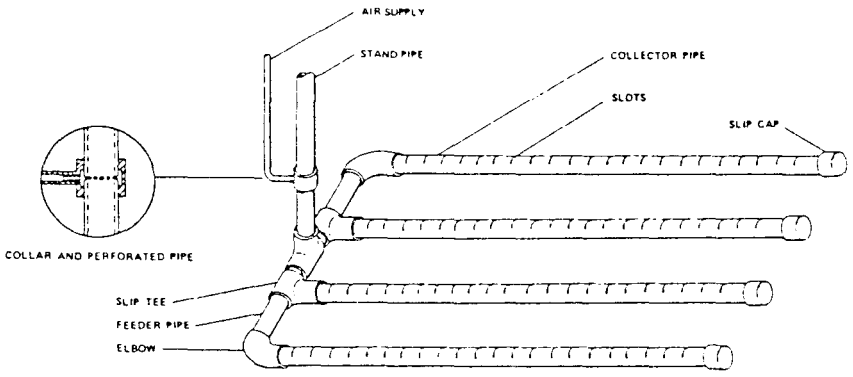
Depth of the gravel is also important. If too thin a layer is placed over the gravel, there is not sufficient surface area for the breakdown of the waste products. Too thin a layer is really a waste of material and slows down the flow of water. The optimum depth is 2 to 3 inches. Since I like to live dangerously I will advise 2 pounds of gravel per gallon of tank capacity will change the required amount: For instance, a 20-gallon regular versus a 20-gallon long.

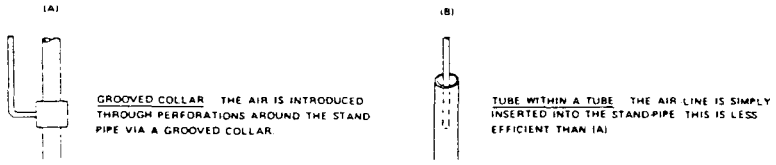


A simplified nitrogen cycle illustrating the production of highly toxic ammonia and its modification to essentially non-toxic nitrates. In the marine aquarium, the cycle is not complete since only a fraction of the nitrates is usually taken up by plants.

A home-made sub-sand filter for large aquaria.

Construct the filter out of unplasticized polyvinyl chloride pipe (UPVC). Use the "glue" or "slip" fittings, but leave them unglued for easy cleaning. With a hacksaw cut slots in the collector pipes about 1/3" through and 1" apart. The distance between the collector pipes should not exceed 4 inches. Design your filter with a capacity to filter the equivalent of the aquarium's water in 2 hours or, preferably, less. Turnover rate will depend primarily on the size of pipe used, especially in the stand-pipes and collector pipes.





METHODS OF INTRODUCING AIR INTO STAND-PIPES

Construction of a plastic-pipe sub-sand filter.

Temperature

F°	C°
86	30
77	27
68	20
60	15.5
50	10
40	4.5
32	0

The lift tubes on the filter should be large enough to allow an air diffuser to be placed near the bottom; therefore anything less than 3/4 inch tubing is unacceptable. This is considering the fact that you've decided to use air to move the water rather than a motor-driven power filter. A little experimentation with air flow rates will give you a good idea of necessary water movement. Another word of caution: Be sure your lift tubes are topped off with an elbow to direct the flow across the aquarium or some of your water will end up on the floor.

Now, let's have a fast review of how this filter works. Common bacteria found in gardens or just about any soil are the "heart" of the system. The gravel size was chosen for the reasons mentioned before and also to allow a surface for bacteria to grow. The more surface area the more bacteria. There are two kinds that we are concerned with and each one has a particular job to do.

The first of the little animals we'll be concerned with is called *Nitrosomonas*. This type of bacteria uses the ammonia given off by the fish, which is highly poisonous by the way, and breaks it down in an oxidation-reduction process to nitrite. There are ways of explaining this using chemical symbols but for our purposes it is sufficient that we know it happens. Nitrite is still poisonous to the fishes and invertebrates so we must get rid of it and that is accomplished by another bacteria.

The second type of bacteria, called *Nitrobacter*, utilizes the nitrite in another oxidation-reduction process and converts the nitrite to nitrate, which is nowhere near as poisonous but should not be allowed to accumulate. It too can cause problems. We will cover its removal in another article.

There are other bacteria in the aquarium that will not make their presence felt until a few hours after the air is turned off or an electrical failure occurs. These are anaerobic bacterial and cannot operate in the presence of oxygen. Remember we said that our helpful bacterial used an oxidation-reduction process? That requires oxygen. It won't take you long to realize that the anaerobics are in operation. If you begin to smell rotten eggs you know it's too late.

There are many more words that could be written about the action of the undergravel filter and more will be written later. This much should give you an idea of what goes on in the filter and why it is so important.

Please don't rush out and try to buy all the materials to set up a marine aquarium. We've only got the bottom layer of our stratified aquarium set up. We must still cover animals, maintenance and several other subjects before you're ready. Remember, too, that what has been covered so far applies to both fresh and salt water aquariums.

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