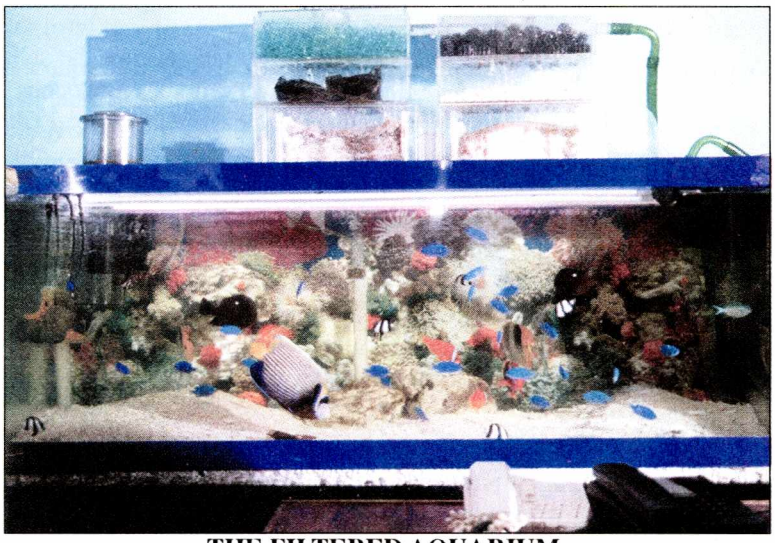
The marine aquarium

By **MB Surtida**

Have you heard of divers being mesmerized by the beauty of the ocean floor? "That's true," says Henry Young, a professional diver and hobbyist-entrepreneur from Iloilo City (west central Philippines). "I didn't know I had stayed too long until my buddy nudged me 'awake', only to find I had very little air left."

Perhaps this is the reason why to many, keeping marine fish becomes a consuming passion despite the complexity of simulating the ocean floor environment in small, confined, aquaria. Aside from the belief in some cultures that fish bring good luck, its therapeutic, soothing effect on modern man cannot be ignored.



THE FILTERED AQUARIUM

The protein skimmer is found left. Above it is the biofilter set (the tube of the undergravel filter is visible in the middle). The outside filter is at right

Start right

It is best to decide first what kind of aquarium you would want to maintain. Would it be a fish tank? Or would it be one for invertebrates with sea urchins, octopuses, hermit crabs, anemones? or a cross-section of living corals with shrimps, worms, and other invertebrates? This decision would help you select the fishes that would go with one or two invertebrates or the soft and hard corals that would go into the "living reef" you would want to put up. This basic decision would also make you decide how much you want to invest as these selections have varying requirements as to feeding, filtration, and even lighting. But it makes sense to get as much information as possible before making the plunge by reading everything you can find and talking to dealers and successful hobbyists.

The size and shape of aquaria

Choosing the correct size, shape and material is crucial because it will spell the success or failure of your hobby. It is important to remember that seawater is corrosive to most metals and aluminum in a marine tank. Most all-glass tanks have aluminum alloy lids. If you do choose one, paint it first with a suitable primer and two coats of a good quality gloss paint to reduce corrosion.

The shape and size of a marine tank is important because the filtering capacity and of course the number of fish that the tank can carry will be determined by it.

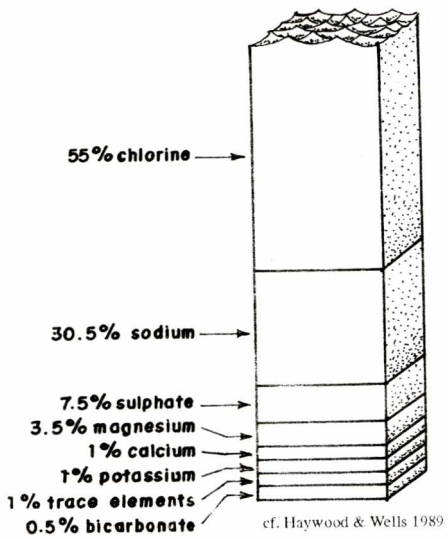
A 20-gallon tank is a convenient start. Dimensions (all glass pieces are 0.25" thick): 3 pieces of size 30" x 12.5" for bottom, front, and back sides; 2 pieces 12 x 12.5" for left and right ends.

Be careful not to overstock. With fish, an absolute maximum of 1" of fish length per 6 gallons of water based on estimated lengths at or near adulthood is a good start because the possibility of ammonia toxicity is greatly reduced and future growth still allows adequate space for normal social interaction. As living animals, they load the filtration system, thus it is impossible to say "this much inch per gallon" because of the wide variety of species. It is best to remember that animals of different species should not be placed in direct contact with each other. Corals and anemones expand and contract, thus, a gap of at least 2" between one fully expanded coral and the next must be allowed.

The water

The life of an animal is largely dependent on the quality of the environment in which it lives. Throughout the world, the chemical composition of seawater is similar.

Composition of sea water



cf. Haywood & Wells 1989

next page

For your aquarium, you may either use seawater or artificial seawater (now available in commercial quantity).

If you decide to use seawater, gather it offshore in an area that has good tidal flushing and no obvious nearby sources of pollution. Look for live fish, crabs and other life in the area. If they appear healthy, the water must be good. Filtering the seawater from plankton and particulate material is a good practice. The best way to treat seawater before using it is to store it for two to three weeks in a dark place. Remove the water carefully so that the sediments are not disturbed. Some hobbyists use the seawater immediately without storing with a degree of success but small parasites may be introduced this way especially if the seawater is not well filtered.

If you use artificial seawater, be aware that it differs from nature and all impurities present in the makeup water become part of the aquarium environment. Follow the manufacturer's instructions when you mix the salts and the trace elements. If you are just starting, you may mix directly in your aquarium, but if you have an established tank and changing water, it would be best to mix the salts in a plastic pail. Wait until the solution clears and the elements are dissolved before adding the newly mixed water in the tank.

If you want to mix your own seawater, you may try the formula in an article by Lyman and Fleming titled *The composition of seawater* in Journal of Marine Research Vol 134, No 3 (in grams for 1,000 g water):

Sodium chloride	23.477
Magnesium chloride	4.982
Sodium sulphate	3.917
Calcium chloride	1.102
Potassium chloride	0.664
Sodium bicarbonate	0.192
Potassium bromide	0.096
Boric acid	0.026
Strontium chloride	0.024
Sodium fluoride	0.003

The formula makes up 1 liter solution. Multiplying each ingredient by 100 will make more or less 25 gallons and it will be much easier to weigh out the chemicals.

Marine aquaria lose a significant amount of water each week by evaporation. When this occurs, it leaves the seawater in your aquarium more salty. The most convenient way to measure the salt content of seawater is to determine its salinity with a hydrometer. Follow the user's manual. Another instrument that measures salinity is the refractometer.

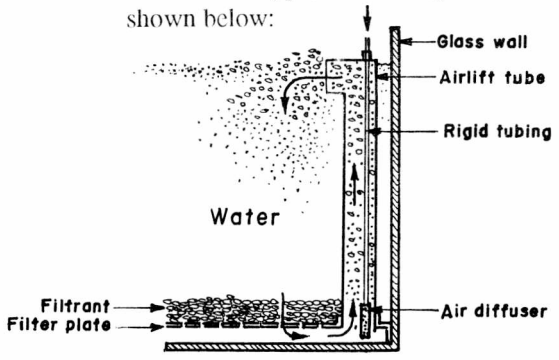
You can check the pH of seawater by using a simple pH test kit. It should produce a reading of around 8.3. A reading below 8.1 and above 8.5 may occasionally result in problems in excessive ammonia if filter system is not fully biologically active or if there is a tendency to overfeed.

Filtration

A good biological filter system is at the heart of every successful marine aquarium. You must know, understand, and work well with the basic principles of biological filtration. There are two basic types of contaminants: suspended, physical particles and dissolved chemical compounds.

Mechanical filter. Mechanical filtration removes suspended particulate matter. It may utilize sand, gravel, floss, metal or plastic screens to strain particles from the water.

Biological filter. Nitrogenous waste matter produced by all animals primarily appear in the form of ammonia. Biological filter systems convert these dissolved waste products into progressively less toxic substances by bacterial action. We shall discuss one type, the undergravel filter, shown below:



cf. Bower 1983

The undergravel filter is a perforated plate, covered by a 2.75 to 4 inch layer of suitable substrate, ideal quantities of coral gravel, coral sand, and a commercial buffering material. In a down-flow set up, polluted but oxygenated water is drawn downwards to the surface where colonies of nitrifying bacteria living on the surface of the substrate particles break down nitrogenous wastes. The drawback to biological filtration is that the process does not remove waste products from the aquarium but only transforms the waste compounds with very limited toxicity. These compounds accumulate in the aquarium and eventually have to be removed through a complicated filtration system or through the simple process of periodic, partial water changes.

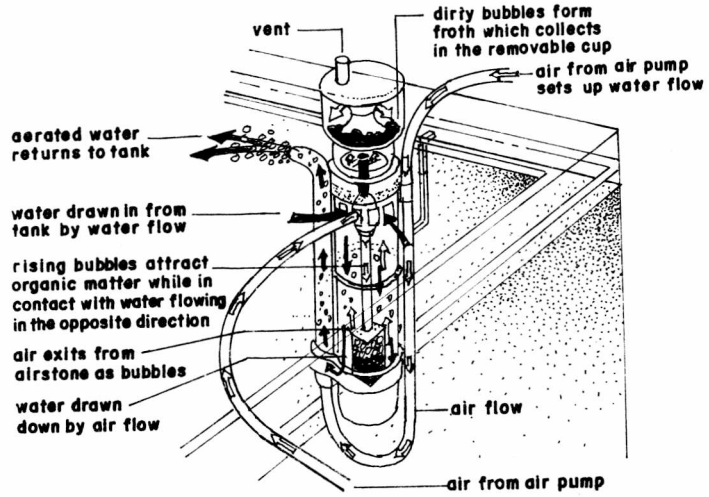
Chemical filter. Many chemicals in the water are not easily removed by undergravel filter. Chemicals from the water are removed by the process of absorption. Synthetic pads and activated carbon are normally used in the canister of an external power filter. Carbon is cheaper but an absorbing pad has the added advantage of its useful life being seen -- the color of the pad changes from white to blackish brown when it has absorbed all it can. Thus, you will know that the pad needs to be changed. In contrast, the effective life of carbon is not easy to estimate, and, once "full" with adsorbed chemicals, is liable to release them back into the tank, thus negating all its previous beneficial work. However, carbon can be extremely beneficial when used in small amounts and changed weekly.

Protein skimmers. Protein skimmers or air-stripping devices remove harmful waste products such as proteins, phenols, and albumins. In air-operated units, a column of enclosed water is fiercely aerated with very fine bubbles. The proteins and other wastes "stick" to the bubbles (a natural tendency of so-called "surface-active" dissolved organic molecules) and are carried to the top of the column in a stiff foam. This foam spills over into a plastic cup, where it collapses into a murky brown

☞ page 36

The aquarium ... from page 30

Counter-current protein skimmer



cf. Haywood & Wells 1989

liquid which can be discarded. Motor driven protein skimmers are more expensive but even more powerful and efficient.

Selecting your fish

There are five criteria for selecting fish in dealer's aquaria: (1) immediate condition, (2) potential survivorship, (3) ease of care, (4) compatibility with other animals, and (5) potential for growth.

Accept fish from dealers with the following characteristics:

- Skin unblemished, bright, and shiny
- Mucous coating transparent and not obvious, fins intact and unbroken, starvation not extreme
- Activity normal for fishes
- Swimming motions normal
- Breathing slow and regular
- Fins in normal position
- Winner of territorial dispute

For crustaceans, accept them when all their appendages are intact. Sea anemones should have their columns and tentacles extended fully while sea urchins should have erect spines. Sea stars should be active.

Compatibility

Compatibility between species -- and among individuals of the same species -- is largely unpredictable. For example, two individuals might be compatible if they differ substantially in size. Under different circumstances, the same individuals might get along only if their sizes are similar.

Feeding

Flake and freeze-dried feeds are readily available in marine aquarium stores. These are good but must be supplemented with live food. The most preferred live feed is adult brine shrimp.

Remember not to overfeed as overfeeding fouls the water. The best way is to offer small amounts of food daily, preferably four times. It is also good to know the feeding characteristics of your fish. Planktivores and grazers feed almost continuously during the times they are active. But large carnivores such as groupers consume large amounts at a single feeding, and then fast for long periods. Always watch the fish as they feed and make sure that all get enough food. Look for signs of weight loss.

Compatibility of fishes and invertebrates in marine aquariums (from Spotte 1993)

	Animal group	Sometimes incompatible with these groups
Fishes		
1	Angelfishes	1, 16, 27
2	Angelfishes (pygmy)	2
3	Basslets	17-19, 21, 23
4	Blennies	19-19, 21, 23
5	Butterflyfishes	5
6	Cardinalfishes	17-19, 21, 23
7	Damselfishes	17-19, 21, 23
8	Dottybacks	17-19, 21, 23
9	Dragonettes	17-19, 21, 23
10	Drums	17-19, 21, 23
11	Eeltail catfishes	17-19, 21, 23, 27
12	Filefishes	—
13	Gobies	27, 30
14	Hawkfishes	17-19, 21, 23
15	Jawfishes	17-19, 21, 23
16	Moorish idol	17-19, 21, 23
17	Morays	1
18	Roundheads	3, 4, 6-10, 13-15, 26, 27
19	Scorpionfishes	3,4, 6-10, 13-15, 26, 27
20	Seabasses (anthiines, others)	—
21	Seabasses (groupers)	3, 4, 6-20, 13-15, 26, 27
22	Seahorses	17-19, 21, 23
23	Squirrelfishes	3, 4, 6-10, 13-15, 26, 17
24	Surgeonfishes and tangs	27
25	Triggerfishes	27, 30
26	Wrasses (small species)	3, 4, 6-10, 13-15, 26, 27
Invertebrates		
27	Crustaceans (crabs and shrimps)	1, 10, 12, 17, 18, 20, 22-25
28	Sea anemones	—
29	Sea stars	—
30	Sea urchins	12, 25

Marine aquarium animals may be maintained in good health for years on a combination of prepared feed, raw seafood, and live brine shrimp. Offer a variety of feed daily. This encourages shy fish to eat more consistently and may sometimes discourage aggressive companions from consuming more than their share.

Feeding fish gather around the open fresh clam that was dropped into the aquarium. The uneaten portion should be immediately discarded

Resting brine shrimp cysts purchased from dealers may be hatched at home to adult size. Using rice bran as food, they may then be reared to reproduce to have a continuous supply of live food.

Diseases

Bacteria and protozoans are the most common causes of infection and the most troublesome in marine aquariums. Watch out for these signs of diseases in your fish: loss of appetite, loss of coordination, hemorrhaging of the skin, weight loss, loss of tissues in fin edges, inactivity, labored breathing, milky cloudiness of the body surfaces, open cuts that do not heal, and persistent red sores.

Generally, antibacterials and other chemicals are readily available. But be sure that you follow label directions in their application. Most fish that are infected must be separated from the rest of the stock in treatment aquaria. Remember that treatments that exceed 12 hours are stressful to fish and not recommended.

References:

Bower C E. 1983. The basic marine aquarium. Charles C. Thomas Publisher USA.

Chadwick DH. Coral in peril. *National Geographic* 195 (1), January 1999.

Doubilet, D. Coral eden. *National Geographic* 195 (1) January 1999.

Haywood M and S Wells. 1989. The interpret manual of marine invertebrates. Salamander Book. London.

Moe MA Jr. 1982. The marine aquarium handbook, beginner to breeder. The Norns Publishing Co., Marathon, Florida.

Spotte S. 1993. Marine aquarium keeping. John Wiley and Sons, Inc., New York NY 10158-0012.

Zerbe WB and CB Taylor. 1953. Seawater temperature and density reduction tables. Spec. Publ. No. 198, US Coast Geodetic Survey, 21 pp

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'No' to cyanide ... from page 33

of the target coral area. (When scared by sound or movement), the fish instinctively dart back in the direction of their coral refuge. The barrier net, however, denies the fish access ..., giving the collector enough time to harvest them with scoop nets and buckets. Unwanted fish are (then) released, and the reef is left virtually undamaged."

IMA gives the fisher enrollees the barrier nets initially for free and teaches them to make their own through an instruction manual. The one-week training course includes three days of inland "classroom" sessions on cyanide-free fishing technologies, post-harvest management of catches, cooperative marketing and safe diving techniques. The next four days in water are for the actual experiencing of how the different technologies work. Follow up continues for months or years on such activities as organizing local fishing associations and cooperatives and developing value-added livelihood schemes (Barber and Pratt 1997).

Cyanide detection tests (CDT). This computer-based test developed by IMA-USA accurately detects cyanide in fish tissues and organs. Managed by IMA and the Philippines' DA-BFAR (Department of Agriculture—Bureau of Fisheries and Aquatic Resources) office, six CDT laboratories are operational nationwide. CDT aims to be an enforcement tool to effectively curb cyanide misuse in fisheries.

IMA's success in implementing its Cyanide Fishing Reform Program is attributed to their development of effective partnerships with fishing communities, and to their advocation for policy reforms in both source and consumer countries.

Policy measures (Barber and Pratt, 1997) include: the banning/restriction of export of vulnerable species; regulation in the import, distribution and use of cyanide; a firmer legal framework (such as a mandatory licensing and certification system); public awareness campaigns in media and schools; strengthening consumer awareness; and establishment of a national system for monitoring the live fish trade.

Enterprise development. CRMP or the Coastal Resources Management Project is another non-profit, non-government organization whose work (though broader) closely aligns with that of IMA, in some aspects. A special project of the Philippines' Department of Environment and Natural Resources, it is funded by the United States Agency for International Development (the same organization that supports IMA).

AQD staff had a recent conversation in Cebu, with CRMP Enterprise Development Officer Monette Flores. She talked about the organization's current involvement with Central Visayan coastal livelihood projects which include mussel/oyster culture and *Eucheuma* seaweed farming in Bohol, and a pending mangrove project (for which she expressed she might need SEAFDEC assistance).

Contrasting Australia and the Philippines as aquarium fish exporters, she noted that the former has a well-managed marine ornamental fish industry, and practices sustainable fishing. Its fish collectors are themselves traders and exporters while getting higher prices for their products. Australians are even better buyers than the Americans.

☞ page 38