

## Reef Aquarium Habitats

### **Managing your reef aquarium habitat so that both mobile and sessile animals thrive.**

*By Richard Harker*

An attitude has developed within reefkeeping that there is no single best way to design a reef tank. Hobbyists argue that one is free to create a reef system any way he or she chooses. Unfortunately, this belief ignores the fact that the coral reef animals in our reef tanks are not randomly scattered across the reef. Each animal lives in a specific area or habitat of the reef where its needs are best met. As caretakers of these animals, it is up to us to recreate these habitats as best we can.

A high proportion of reef inhabitants - animals such as fish, mollusks, shrimp and so on - can move around the reef in search of suitable habitat. For these animals, we need only provide a suitable area in the tank, and they will find it on their own. Other animals are sessile - immobile - and settle on a particular area, living the rest of their lives in the same spot. For these creatures, it is not enough to have a suitable environment somewhere in the tank; we must place them in the suitable environment and see to it that conditions remain appropriate for them. We're going to look at why reef animals live where they do and discuss the importance of designing a reef tank with their natural habitats in mind.

#### Animals on the Move

In some respects, designing a tank layout for its mobile inhabitants is easier than designing it for its sessile inhabitants. It is not, however, without pitfalls. On a natural reef, a mobile animal that finds itself in an unsuitable habitat can simply move on. It can keep searching until it finds a more suitable area. In the close quarters of a reef tank, this is not always possible. Consequently, the hobbyist must study the natural habitats of the tank's inhabitants and make sure that the aquascaping is suitable.

Ideally, one should decide which animals will go into the tank before contemplating the tank layout. Failing this, references should be consulted before a new animal is added to a reef tank to see if it meets the animal's environmental needs. Once the new inhabitant is introduced, the hobbyist should watch the animal to see how it reacts to its new home and how other inhabitants are reacting to it.

For example, reef fish occupy different areas of the reef in part because of the availability of food, but equally important, also because of competition. Some fish are gregarious and active, constantly investigating their surroundings. Fish such as wrasses and surgeonfish are quite active, and can be very intimidating to other more timid fish. In the wild, timid fish simply avoid active fish, seeking an environment far away from active fish. Too often, hobbyists attempt to keep both gregarious and timid fish in the same small reef tank - and the timid fish can become ill or starve due to the stress of being confined with intimidating fish.

Compatibility can be an issue even when combining fish of similar disposition. On a natural reef, suitable habitats are scarce, and fish compete for the best of them. Territorial fish even patrol their territory, prepared to drive out other fish that might compete for needed resources. Introducing a new fish to an established tank is the same as an interloper entering another fish's territory.

In the wild, the interloper would be driven away, and things would quickly return to normal. In a reef tank, however, there is no escape. Consequently, the two fish do something in a reef tank that is quite unusual in the wild - they continue to battle. This is a stressful situation for both the aggressor and the attacked, as well as other inhabitants of the tank. Sometimes, the battle is fought to a draw, and the new fish is ultimately accepted; but too often, the battle results in the death of the new fish.

Fish have an innate sense of the space they will defend, and a competing fish outside this space will be left alone. There is consequently a limit to the number of competing fish one can keep, and this varies with tank size. The larger the tank, the more potentially competing fish a hobbyist can keep. Again, it pays to read about a fish's habitats and particularly any other fish with which it might fight.

Fish are the most obvious territorial mobile reef animals, but other reef inhabitants are also territorial and need sufficient space. Some ornamental shrimp, for example, defend territories and can be lethal to other shrimp. The confining space of a small reef tank can turn normally docile invertebrates against one another. The key is to study the behaviors of these animals and watch for any changes when new animals are added.

### Sessile Animals

Aquascaping layouts for sessile animals are challenging for a number of reasons. First, most hobbyists want to keep a variety of sessile animals that may have varying needs. Secondly, a reef tank is constantly changing as animals grow, so an ideal design might become less so over time. Careful planning, combined with research regarding the animals, is vital. The most important thing to keep in mind as one designs a new reef tank is that success at reefkeeping means that the animals will grow - often very quickly. Providing the space needed for growth will pay dividends many times over in less maintenance, healthier animals and a more natural-looking reef tank.

When most hobbyists think of sessile animals for a reef tank, it's usually corals. Corals can transform a sterile-looking saltwater fish tank into a dramatic display. Corals, however, should not be thought of as mere decoration to be placed according to what looks good. Corals grow in specific habitats or environments on coral reefs for a reason. So, a healthy reef tank for corals means replicating as best we can a realistic environment similar to what corals experience in the wild.

The three most important environmental considerations for corals are light, water motion and space. Most of the corals we keep are photosynthetic. They rely on light to provide most, if not all, of their nutritional needs. So, providing adequate light is a key requirement. Equally important is water motion. Sessile animals, such as corals, rely on water motion for oxygen exchange, waste removal and nutrients. Even with adequate lighting, the health of sessile animals can be impaired without adequate water motion.

Space is the third essential component and is often the one that is overlooked by hobbyists. Like fish, corals compete for space, but in a less apparent (but no less deadly) manner. Corals need space to facilitate the other two components (light and water motion). Therefore, corals have developed effective means by which they can successfully defend their space.

### Bright Light

Studies have found a direct link between coral growth rates and intensity of lighting, so most hobbyists opt for the brightest lighting system they can afford. With today's systems, one can create realistic light intensities that rival a natural reef. Unfortunately, there are other aspects of sunlight that hobbyists have yet to adequately mimic. As the sun passes over a coral reef, the angle at which light strikes the reef varies. Because the sun moves across the sky in an arc, most of the reef receives some sunlight at one time or another in the course of a day. Consequently, corals can grow over most portions of the reef, even in areas that are in shade part of the day.

The lights over a reef tank are stationary. They generate the same intensity and cast the same light field from the moment they come on until they are turned off. The result is that some areas of the tank are brightly lit all day, whereas other areas are less brightly illuminated, and some areas are left in shadow throughout the day. Because of this, hobbyists must be careful about the placement of photosynthetic corals so that the most light-demanding species are closer to the light, while less demanding corals are placed in less intensely lighted locations.

### Water Motion

Water motion is critically important to the success of a reef tank, but because it is difficult to measure or see, it receives less attention than lighting. Corals are morphologically plastic; that is, they can grow in a multitude of ways to take advantage of lighting and water motion. In the wild, corals deal with raging tidal currents, swirling surge and wind-induced waves. It is very difficult to replicate realistic water motion in a closed system because of the forces involved. The water displacement of even a modest surge washing over a coral reef is greater than the volume of an entire typical reef tank. So we must improvise, knowing that water motion in our tanks will be a fraction of that experienced by corals on a reef. Fortunately, with some careful planning, success can be achieved.

The key is to create an open environment in which water can freely circulate throughout the tank. With a great deal of open space, a hobbyist can use any of a number of different methods to create water motion in a reef tank. Placing powerheads strategically throughout the perimeter of the tank is one common method. A powerhead can create a strong jet of water from its nozzle, so be careful about placement of these devices. Several smaller powerheads are better than one large one, particularly if they are cycled with a wave generator. A second method is the use of a closed loop and external pump. Water is drawn from the tank, then pumped back into the tank through a pipe. In elaborate systems, the water can be returned through manifolds and even electric ball valves to vary the water flow. There are even more elaborate methods using dump buckets or surge devices.

Any of these methods can be successful but only if the reef tank has sufficient open space to allow water to reach all areas. There is an unfortunate tendency to fill reef tanks with too much rock and too many corals, leaving too little open space. The traditional aquascaping approach of stacking live rock along the back of the tank is not ideal for creating adequate water motion. Water is blocked from circulating behind the rock wall, and areas of low water circulation are

created around the rocks. Because it is on top of the rocks that one places corals, this approach nearly guarantees there will be poor water circulation around the corals. For alternatives to the traditional wall of rocks approach to aquascaping, see Charles Delbeek and Julian Sprung's *The Reef Aquarium*, Volume 1.

This problem is compounded by coral growth because as they grow, they further reduce the amount of water flow in the tank. In extreme situations, successful reef tanks can literally choke themselves when water flow to dangerously low levels is reduced.

#### Space

Space allows competing fish to escape from one another and enables light to reach the photosynthetic inhabitants of the tank. And space allows water to circulate throughout the tank to keep the inhabitants bathed in oxygen and nutrient-enriched water.

Space also minimizes competitive pressures among the tank's sessile inhabitants. There is constant deadly warfare for space on a coral reef. Space is always at a premium even on huge reefs, and corals (along with other sessile animals) have developed effective weapons to secure space. Some methods are apparent to even casual observation. Anemones have strong stinging tentacles and can kill most other animals that encroach on their territory. Other animals have less visible but no less effective means to defend space.

Many soft corals, such as *Sinularia*, use chemical warfare. They release turpinoids into the surrounding water, which are toxic to competing corals growing close by. Stony corals, such as *Acropora*, don't have the stinging power of an anemone or the toxic chemicals of a soft coral. They instead shade and overgrow slower-growing corals.

This constant warfare plays out on a natural reef with little consequence other than to the corals immediately impacted. However, in a reef tank, the by-products of these battles can impair the health of the entire tank. Giving tank inhabitants more space provides room for them to grow, but more importantly, it reduces competition and improves the health of the tank.

On a natural reef, form does indeed follow function. For success in reefkeeping, modeling our tanks after natural reefs gives us the best chance for success.