# Berlin Reef Tank

**Switching to a Berlin reef tank is easier than many think.**

*By Scott W. Michael*

Q. After reading an article on the Berlin system of reefkeeping, I am convinced I want to convert my system to this type of setup. The tank is only about six months old, so the amount of live rock in it isn't extensive.

I currently have a 75-gallon tank that is filtered with a large wet-dry system that can handle up to 300 gallons. I have a protein skimmer in the sump of the filter and an outside power filter. There is a small powerhead on the bottom of the aquarium for additional water movement. I have removed all the substrate, and lighting consists of two 48-inch, 40-watt 50/50 tubes and two 24-inch, 20-watt actinic tubes.

I'm thinking of replacing the skimmer with one 36-inch unit, and adding a new lighting system using three very high output fluorescent tubes, eventually going to metal halides. I have several questions about water changes, fish populations and the live rock load. What kinds of live rock should I use and how much should I purchase? And, what types of invertebrates should I include?

A. From the letters I received it is apparent that the article prompted many readers to consider trying this reefkeeping method, although many of you apparently believe it's more complicated than it is. If you are considering converting your existing aquarium or setting up a new aquarium using the Berlin method, there are a few key principles you should understand.

Although not exclusive to the Berlin method, the following are the key elements necessary for successfully maintaining your reef aquarium — good livestock selection, live rock, effective protein skimming, proper lighting, rigorous mechanical filter maintenance and trace element replenishment. And I highly recommend that you introduce a 1-inch-deep layer of live sand on the aquarium bottom.

First, let's discuss good livestock selection. It is important to decide what types of cnidarians (e.g., anemones, corals, false corals and so on) will be the focal point of your aquarium. The cnidarians that we are concerned about can be divided into two groups based on their aquarium care: the soft corals — mushroom anemones and zoanthids — and the hard corals.

It's best to stick with one group or the other and not try to keep a collection of both. This is particularly true if you want to have long-term success with small-polyped hard corals. Problems tend to arise because of competition for growing space between soft and hard corals. Soft corals have evolved an arsenal of chemicals that they use to retard the growth or even destroy hard corals that grow around them.

In nature there are large stands of soft corals, with relatively few hard coral species growing in close proximity. This is due, in part, to the effective chemical warfare that soft corals wage. A closed system that houses a forest of these animals will become a chemical soup and can negatively affect hard corals growing in the same aquarium. To a limited degree, activated carbon and protein skimming are able to keep these chemicals in check.

Mushroom anemones, especially the knobby varieties, can also interfere with your attempts to keep hard corals. They have potent nematocysts (stinging cells) that sting animals they are close to, and also produce chemicals that irritate neighboring hard corals.

For the neophyte reefkeeper I would recommend keeping soft corals and mushroom anemones. These animals will grow and multiply if your water quality is good and there's adequate lighting, and ample current in the case of soft corals. Also, more fish can be kept in a soft coral aquarium than a hard coral tank because soft corals can withstand higher levels of dissolved organics and nitrogenous wastes.

Some hardier, large-polyped hard coral varieties, such as the open brain (Trachyphyllia geoffroyi), tooth (Lobo~phyllia spp.), bubble (Plerogyra sinuosa), fox (Nemenzophyllia turbida) and elegance (Catalaphyllia jardinei) corals, can be successfully housed with soft corals. Although these species are not immune to soft coral chemicals, they are not usually as adversely affected.

Although some people are having incredible success with small-polyped stony corals, such as Acropora spp., Pocillopora

spp. and Montipora spp., they are best left to the more advanced hobbyist. For more information, see The Reef Aquarium by J. Charles Delbeek and Julian Sprung. This is an incredibly comprehensive volume that is well worth the money. You will easily make up the cost of the book in the number of corals you save! Volume two is also now available.

Another important component of the successful Berlin system is live rock. The surface, pores, nooks and crannies of live rock are a substrate for nitrifying bacteria. Therefore, live rock is a great biological filter, particularly if enough is placed in an aquarium.

In order to provide enough rock for biological filtration I would recommend that you have at least half of the aquarium volume taken up by live rock. Unfortunately, there is no exact formula when it comes to knowing how much rock you should add per gallon of water. The actual density of the rock can vary from one region to another. For example, much of the rock being exported from the Marshall Islands, Fiji and Indonesia (Indo-Pacific rock) tends to be lighter than the rock from the Gulf Coast of Florida and the Florida Keys. And the density can vary between pieces from the same area as well.

The amount of rock you use will also depend on what kind of habitat or visual appearance you are trying to create. For example, I like a more open look, with large areas of the aquarium bottom uncovered by rock so that gobies and other bottom-dwelling fishes, as well as plate corals, have plenty of room to move in. No matter what look you prefer, it is very important that you stack the rock so that there is enough space between pieces to allow adequate water circulation and the movement of detritus to areas where it can be removed by external means. By configuring your reef in this way you will also provide more usable hiding places for your fish.

Depending on the density of the rock you select and the type of reef formation you want to create, you can probably count on using from 1 to 2 pounds of rock per gallon. This will form a reef that will rise about two-thirds up the back of the aquarium.

The industry breaks live rock down into two categories. One of these, referred to as base rock, typically has few encrusting animals, at least when initially placed in the aquarium, and is usually not that interesting to look at. Some of the more desirable base rock will have coralline algae encrusting the surface. The base rock is the foundation of the reef structure, upon which the more creature-infested pieces of rock and live corals are placed.

The second category of rock usually has more obvious signs of life, which may include plants, sponges, tunicates, bryozoans and Christmas tree and feather duster worms. This rock is often referred to simply as live rock (as opposed to base rock) or reef rock. This rock is more likely to cause problems if it is introduced into an aquarium that is already established.

If you are buying a significant quantity of uncured rock for an aquarium that already contains livestock, you need to cure it in a separate container first, preferably one with some form of biological filtration. This way, if some of the rock is a little bad, the nitrifying bacteria present in the tank will prevent the rock from becoming worse.

You can set up a separate aquarium to be used for curing new pieces of rock, or move an external filter with conditioned filter media (e.g., a canister filter with carbon or plastic biomedia that has been running on the aquarium for several weeks) from your display tank to the container in which you will cure your rock. There should be water pumps to provide adequate water flow.

Observe the rock for about two weeks before moving it into your display aquarium. Remove any dead organisms from the rock by siphoning them out of the container with flexible tubing, brushing off the rocks with a toothbrush or using tweezers to pick them off. If there is a lot of dead material, place a small amount of water from the holding container into a bucket and agitate the rock in this water. Then discard the water.

When the rock is ready for the display aquarium it will not have any white film, black spots of rotting material or a strong odor. Live rock will always have a slight aroma when removed from the water, but it should not be strong.

To avoid all this hassle, I find it easier to buy rock that has been in my local pet store for a week or more. Being able to select rock out of a retailer's holding tank allows you to get the shapes and sizes you want, plus you don't have to worry about a rock killing all your aquarium inhabitants.

Whether you are using the Berlin method or not, water movement is a key ingredient to the successful care of sessile invertebrates. When you are setting up your reef, make sure you have additional water pumps so there is plenty of water movement. I would recommend placing as many as three extra powerheads, with a pumping capacity of 200 gallons per

hour each, in a 75-gallon aquarium.

The trick to using powerheads is proper placement. Because some species of corals appreciate current more than others, you need to strategically position the water flow to meet the specific needs of the animals. For example, mushroom anemones and open brain corals do well without lots of water movement, and may actually suffer if placed in a direct flow.

On the other hand, soft corals (such as tree corals, finger leathers, leather corals, star polyps, Anthelia, Xenia and gorgonians) and small-polyped hard corals require vigorous water movement to help them shed excess slime and to keep fresh oxygenated water flowing around their tissues. However, even current-loving species may do poorly if buffeted by a powerful, direct stream of water. Vigorous water movement can also help prevent the growth of hair algae and keep detritus in suspension where it can be removed by the prefilter.

When using powerheads make sure that soft-bodied invertebrates and fish cannot be sucked up into the impeller. I have seen tree coral arms and anemone tentacles mulched by these. Place strainers or sponge filters over the powerhead intake to prevent this situation, but remember that if you use any material that will trap detritus you need to clean it several times a week.

A good protein skimmer is a vital piece of equipment for ensuring success with the Berlin method. The protein skimmer, or foam fractionator, pulls dissolved organic molecules out the water before they begin to break down. This can help prevent algae blooms and help maintain a more healthy environment for your corals.

There is an amazing array of skimmers available, but for the most part they all use either airstones or a venturi valve to create a column of fine air bubbles that protein molecules adhere to. This creates a foam that collects in a cup, which you can remove and empty.

I have always found protein skimmers to be a difficult subject when talking to aquarists. Although essential for successful long-term reefkeeping, it is often hard to convince people to place a 4-foot PVC skimmer (that looks like a rocket launcher) in their living rooms! Also, many of the large skimmers can be very sensitive and are prone to ejecting water out of the collection cup and all over the floor if they are not properly adjusted.

I must stress, however, that when it comes to protein skimmers, bigger is always better. In order to determine the size and number of protein skimmers you need, use the following rule of thumb: the entire aquarium volume should be subjected to skimming at least once per hour (see The Reef Aquarium).

When selecting a skimmer, remember that you should be able to easily disassemble it completely so that you can clean the reaction column and the neck. It is important that you do this several times a year. Also, make sure you have a strong enough air pump if you use airstones, or a powerful water pump if you use a venturi skimmer.

A surface skimmer prevents the buildup of substances on the water's surface that can inhibit gas exchange (namely oxygen and carbon dioxide) and light penetration. This can consist of an overflow box built into one corner of the aquarium or a conversion unit that hangs on and over the back glass. In either case, water is drawn off the surface and flows through a mechanical filter before draining into the sump.

This sump can be used to house additional pieces of live rock, which can serve as a place for invertebrates to live and repopulate the display aquarium, as well as a water receptacle for the protein skimmer. It is important that any mechanical filter used should be accessible and easy to clean.

Another component of the successful reef aquarium is good lighting. The amount of light that you must provide is somewhat dependent on the organisms you hope to keep. For example, open brain corals and mushroom anemones do not need intense lighting to thrive, while tridacnid clams and many small-polyped hard corals do.

The thing to remember is that there are few corals that will be harmed by too much light, if they are exposed to it gradually, whereas there are many that will do poorly if subjected to low or improper types of illumination. It is wise to switch over from standard fluorescents to very-high-output (VHO) tubes. An ultraviolet shield (UV-absorbing acrylic) should also be used because these tubes do emit some harmful UV radiation.

I would recommend the use of one blue fluorescent (like the actinic 03) to every one daylight tube. For a setup with only three fixtures, I would suggest two daylight tubes and one blue fluorescent. This way you are using three tubes that have a combination of daylight and actinic. You will also want to replace your VHO tubes once a year due to a decrease in intensity and a color shift over time.

Many reefkeepers consider a metal halide system later when there is sufficient money available. If you shop around you may find that some of the halide systems are not much more expensive than a VHO setup. However, you can have success with either type of lighting. One advantage to metal halides is that glitter lines (the patterns of light created by sunlight) are produced, which are reminiscent of the lighting you observe on shallow reef areas.

Rigorous maintenance (cleaning) is also an important practice that will ensure success with the Berlin method. You should do water changes (about 10 to 20 percent per month) and frequent cleaning and changing of any mechanical filter material. For example, prefilter sponges should be cleaned daily.

If you use a canister filter on the tank, it too should be broken down and cleaned several times a week (this will keep most people from using one of these filters on their aquarium). It is important that all matter collected by mechanical filters be removed from the aquarium as soon as possible. This will prevent trapped phosphates and other nutrients from being released into the water by microbial breakdown.

In addition to previously noted requirements for successfully keeping corals with the Berlin method, it is also necessary to replace those trace elements that the marine animals need to flourish. Corals require a variety of elements to live and grow. One of the most important of these is calcium. In corals and Tridacna clams this element is essential in the deposition of their hard skeleton and shell — without calcium they will cease to grow.

In order to maintain proper calcium levels you must have good-quality calcium, pH and alkalinity test kits. All three of these levels are interrelated, and it's important to monitor them when making calcium additions (more on this below). The latter two test kits are easy to locate at your local aquarium store, but an accurate calcium test kit is often more difficult to find. There are several inexpensive test kits available that will suffice (e.g., Aquarium Systems' SeaTest and ReefTest), but the serious hobbyist may want to invest in a more refined monitoring system (e.g., Hach's Total Hardness and Calcium test kits). For detailed information on calcium test kits and their reliability see Schiemer (1994).

The calcium levels in natural seawater range from 380 to 480 mg/L (Delbeek and Sprung 1994). In the aquarium, calcium ions are a limited resource, and the level will fall as they are utilized by the tank's inhabitants (e.g., corals, clams, crustaceans and calcareous algae). Water changes, especially when a salt mix with extra calcium is used, will help bring calcium levels up, but between water changes the concentrations will drop again.

In order to constantly maintain acceptable levels of calcium in your reef aquarium it is advisable to add calcium. You will find a number of different calcium supplements on the market, but one of the best ways to maintain calcium levels is with kalkwasser. Using kalkwasser has other added benefits as well. It will help maintain alkalinity and precipitate the phosphate that can encourage algae growth (Delbeek and Sprung 1994).

To make a kalkwasser solution, follow these simple steps. Add 6 grams of calcium hydroxide or calcium oxide to 1 gallon of fresh water (preferably reverse osmosis water). Note that calcium hydroxide is very dangerous to breath and is caustic — it's a good idea to use a dust mask and gloves when handling it. Stir the solution vigorously and then let it sit for several hours. After an ample amount of time you will find that the calcium hydroxide that has not dissolved forms a white precipitate on the bottom of the container. Pour or siphon off the clear liquid and discard the precipitate or use it to mix up more kalkwasser.

In order to ensure that your kalkwasser contains enough calcium ions to be effective, you should mix up small, fresh batches that will last you two or three days, rather than larger quantities for longer periods of time. When adding this solution to your aquarium it is very important to do so slowly. Kalkwasser has a pH of around 12, so if you add even small amounts too quickly you could cause a dramatic rise in the pH level of the aquarium water.

The easiest way to add kalkwasser is by dripping it directly into a sump or the aquarium at night. When the lights are off, photosynthetic activity will decrease and the pH level will drop naturally due to an increase in carbon dioxide. Although not essential, an automatic carbon dioxide dosing system is a helpful tool to counter the rise in pH resulting from kalkwasser addition.

It should be obvious why it is important to monitor the pH, especially when kalkwasser is used. It is also important to watch the alkalinity levels. Although the kalkwasser should not cause an alkalinity drop if it is fresh (two or three days old), the precipitate that accumulates in an old solution may cause this level to fall. For more information on kalkwasser usage I highly recommend Nilsen (1993) and Delbeek and Sprung (1994).

Alkalinity is another parameter that needs to be kept within a certain range. To do this we need a test kit and a commercial

buffer. Inexpensive, but accurate, alkalinity test kits are available that use a metric scale (milliequivalents per liter, meq/L) or measure in degrees of carbonate hardness (dKH). You should maintain your aquarium between 7 to 10 dKH (2.5 to 3.5 meq/L). As indicated above, kalkwasser, if used correctly, will facilitate maintaining the appropriate alkalinity, but sometimes a buffer supplement is needed to raise the alkalinity.

A minor element that is vitally important for maintaining healthy growth of coralline algae, corals and clams is strontium. This element should be available as strontium chloride from any aquarium store that handles invertebrates. There are no kits available in the trade to measure strontium levels. Therefore, you must be careful not to overdose the tank. Make sure you follow the directions on the strontium supplement very carefully.

For additional minor and trace element supplementation I use Sera Marin Vit (on the advice of Alf Jacob Nilsen), but do not add as much as they suggest in the directions. I add about 1 milliliter per 12 gallons of aquarium water once a week. This product will not only help keep your corals and clams healthy, but will help enhance their coloration as well.

Iodine, which is available in different forms, is another important trace element that will help keep your corals and mushroom anemones healthy. And, at least in the case of the mushroom anemones, will help intensify their color.

More is not always better in the case of trace elements. Adding too much of some trace elements acts as a fertilizer for undesirable algae growth and can interfere with the corals' health. Also, adding these elements too quickly may cause a distress response in some animals. Therefore, it is best to mix these in small containers of aquarium water and then slowly drip them into the tank.

I also use a high-grade carbon in an external filter for approximately one week every month. This will help pull some dissolved organics out of the aquarium, but will also remove important trace elements. This is why I would not recommend continual use. It is also a good idea to use reverse osmosis or deionized water to replace evaporated water and for make-up water when you do water changes. Tap water has too many possible pollutants, including nutrients that encourage algae growth.

One final comment on the Berlin method. I know many people who have pulled the filter media out of their wet/dry filters, and in only two of these cases did problems arise as a result. Both of these aquariums had extremely heavy fish loads. If your aquarium has a large number of fish, I suggest you remove the filter media in small portions over several weeks' time.

The media that you remove should be placed in a bucket of aquarium water and aerated vigorously in case you need to place in back in the filter. During the period when you remove the media, closely monitor the ammonia levels. If the levels should rise, there is either not enough live rock or there are too many animals in the aquarium to allow you to dismantle the wet/dry filter. In order to bring the ammonia levels back down immediately, place the media from the bucket back into the filter.

Remember that the keys to successfully setting up an aquarium using the Berlin method are good live rock, invertebrate selection, skimming and lighting, as well as frequent detritus removal and trace element replenishment/supplementation. It's as easy as that!