Lighting: Reef Aquarium Lighting System Design and Selection

Drs. Foster & Smith Educational Staff

In the last 20 years of fish keeping, nothing has rivaled the explosive growth and popularity of the "reef"; nor has anything stirred up so much discussion. While many people attempted various modes of reef keeping, it was the introduction of the Dutch reefs with wet/dry filters, which triggered the hobby's growth in the U.S. With the new biological wet/dry filters, it became possible to have stable, large, bio-load systems which could support more delicate life, such as corals and anemones. Once the filter platform was available, other shortcomings in chemical filtration and lighting became evident, spurring the evolution of new products and controversy.

Please remember that reef keeping is still relatively new, and many successful systems are available. If you have talked to other enthusiasts, you are aware that there are several ways to set up your reef. Keep in mind that what works for someone else may not work for you; you may need to set up a traditional wet/dry system or jump into the latest "Berlin" skimmer system. Plan your approach to avoid frustration.

Proper aquarium size

The first step to a successful reef is to obtain the proper size of aquarium. Ideally, you want a fairly large tank; a minimum would be 18" wide x 48" long x 18" deep. Large, wide tanks are advantageous because they include more area for aquascaping and for the lighting system.

Reef lighting

Among the most important aspects of reef keeping is the lighting system. With lighting, we want to provide the proper photoperiod, intensity, and spectrum for good coral and anemone growth. Most applications use a 12-hour photoperiod. With multi-light systems, you can use timers to vary the intensity by varying the number of lights on at any one time. Usually, one bulb comes on for an hour, then all bulbs for 10 hours, then one light is left on for an additional hour while the others are turned off. This is one method to duplicate the sun passing over the reef. On really elaborate systems, some hobbyists have even designed cloud cover patterns.

To provide proper light intensity, use 3-5 watts per gallon and use multiple fluorescent lights if the tank is 30" deep or less. Deeper tanks require more elaborate systems, usually involving hanging metal halide pendant lighting. Most books suggest one 175-watt metal halide per 4 square feet of surface area, hanging about 1 foot above the tank.

The development of electronic ballasts for Very High Output (VHO) fluorescent lighting, has allowed enthusiasts to design high wattage systems in small spaces. A 48" VHO bulb outputs 110W, versus 40W for a standard bulb. VHO systems require special end caps to withstand the higher heat emitted. Most of these tubes are available with internal reflectors to maximize intensity. Use bulbs with a CRI of 90-99 (CRI 100=sunlight), or color temperature of 5500-10,000K.

Most corals have light intensities at which they grow best. This is important to know when selecting bulbs and determining at what depth a certain coral should be placed. Most corals are a little forgiving as light intensity goes. It is important, though, not to "blind" new coral when placing them in the tank, as this can lead to light shock or bleaching of the zooxanthellae. Place new corals deeper in the tank than the optimum and provide some shading. Once acclimated, (generally about 2 weeks), raise them to the optimal level.

Choosing the right bulbs

To provide zooxanthellae with the proper wavelengths of light for photosynthesis, different bulbs have been developed to mimic sunlight filtered through different depths of water. As light penetrates water, different wavelengths with different "energies" will penetrate to varying depths. Red light (630-780 nm) penetrates to about 15 m, while blue light (420-490 nm) goes as deep as 250 m. So, it is not surprising that most zooxanthellae have evolved to absorb light best at 420 nm in the blue range. This has led to development of fluorescent bulbs that emit light primarily at this peak: Actinic 03-type bulbs. While you could use all actinic lighting on a reef, you may find the result disappointing. (Our eyes do not perceive blue light as very bright, and find yellow light more aesthetically pleasing.) Also recommended are "full spectrum" bulbs, "tuned" to produce light across the full spectrum, mimicking natural sunlight. These tubes show the true colors of corals and fish, and are pleasing to our eyes. Most reefs work best with a 1:1 ratio of actinic to full spectrum bulbs. Also available to hobbyists, are combination bulbs often called 50/50 or actinic white; these emit light across the full spectrum, with extra "actinic" phosphors for additional light at 420 nm. Most metal halides have adequate spectrums for reefs, though most hobbyists supplement with actinic 03-type bulbs to bring out corals' red and green fluorescence. Another effect of metal halide use, since they are a single point light source, is that we will get light defraction waves in the tank. While these waves are found in nature and are pleasant to the eye, they have not been shown to be essential to reef keeping.

The size and lighting choices that you make will have a big impact on the success of your reef. While this may appear confusing at first, make sure to take the time to research your options and then choose the ones that will allow your tank to thrive.