

Marine Aquarium Lighting

The lighting needs of marine organisms vary considerably depending on the depth at which the animals normally live in the wild.

By Karen Randall

Q. I have a 40-gallon "plant-exclusive" tank in my home. The tank is lighted by three Osram lamps (5000 Kelvin each) and a 24-inch full-spectrum tube. This seemed like plenty of light to propagate plants. Unfortunately, the only plants I have had success with are Hygrophila species, and limited success with a Cryptocorne balansae. Slow-growing plants seem to succumb to a bluish-green hair algae. In fact, the edges of the crypt are starting to show signs of the algae.

My question isn't so much about the algae as it is about lighting. I recently read a magazine devoted entirely to the "Dutch" aquarium. Upon reading the descriptions of the tanks illustrated I noticed one thing — the wattages for the lighting were quite high. I was always under the impression that wattage wasn't the most important thing, spectrum was. That appears to be the case for marine reef tanks with corals.

A. First, let me say that the lighting needs of marine organisms vary considerably depending on the depth at which the animals normally live in the wild. While spectrum is important, the number of lights and their wattage can be just as significant a factor in reef aquariums. And, while many marine organisms need light that is strong in the blue (actinic) end of the spectrum, these are deep water life-forms. Almost all of the plants we use in freshwater aquariums are marginal or relatively shallow water plants. There is no need to simulate the lighting conditions found in deep water, such as emphasizing the blue end of the spectrum. Your combination of Osrams, whether 9 or even 13 watts each, combined with your 20-watt, 24-inch fluorescent tube, is simply not adequate lighting for any but the most shade-tolerant species of aquarium plants.

Some aquarists make lighting for the planted tank into a very complicated issue. The fact of the matter is that plants are very adept at using whatever light is available to them as long as the intensity is sufficient and the photoperiod is adequate.

While it is true that plants use certain parts of the spectrum more easily than others, they are capable of using light from an amazingly large portion of the spectrum. Light from the blue end of the spectrum encourages short bushy growth, while light from the red end encourages long lanky growth. Plants are least able to use light from the green portion of the spectrum.

Because most of our plants come from tropical or subtropical areas of the world, a photoperiod of 10 to 14 hours a day is appropriate. I run most tanks on a 12-hour photoperiod, but if you are having algae problems, you might want to limit the photoperiod to 10 hours, as long as the intensity is adequate.

Beyond a 14-hour photoperiod, most higher plants stop photosynthesizing anyway, even in the presence of light. In fact, there are many plants (*Rotala wallachii* is a good example) that actually close up their leaves when they have had sufficient light. Algae, on the other hand, is very capable of benefiting from an extended light period, and can cause all kinds of problems in a live plant aquarium.

Of course, we can easily control the photoperiod we provide for our plants. A little research will provide you with information on the spectral curve of any particular lamp you use for your tank. What is harder to quantify is the intensity of any particular bulb or tube. And, intensity is the third, and most critical, part of the lighting equation.

It's just about impossible to over-light an aquarium with standard fluorescent tubes. While there are definitely some tubes that put out more light than others, when speaking about standard, high output (HO), very high output (VHO), compact fluorescents (CF) or metal halide (MH) lights, the amount of light they put out for the amount of electricity used is in the same ballpark. For all these types of lighting, 2 to 4 watts per gallon will produce adequate growth. This rule is not applicable to incandescent or other types of lighting that use more electricity to produce smaller amounts of light, but these other types of lighting have limited application in the aquarium anyway for a multitude of reasons.

If you are trying to squeak by with the smallest number of tubes possible over a tank, it's important to look for tubes that will give absolutely the most plant-useable light for the electricity consumed. For most of us, I think it is less complicated and more cost-effective to shoot for something in the mid range as far as watts per gallon is concerned, and not worry

about paying big bucks for the very fanciest tubes available.

Another point that needs to be factored in when appraising a particular bulb is re-lamping costs. We do not operate our fluorescent tubes under optimum conditions. Most aquarists still use far ballasts, and we run the tubes under conditions that are much warmer and more humid than they were designed for. Because of this, the tubes degrade more quickly than they do under manufacturer test conditions. The problem with using fluorescent tubes until they completely wear out is that they have lost much of their light output long before then.

Most aquatic gardeners agree that it is best to replace fluorescent tubes on a rotating basis so that no tube over a tank is more than one year old. For instance, if you run three tubes over a tank, change one every four months. This will give the most consistent illumination.

Whether you use standard fluorescents or one of the higher intensity forms of light is a matter of the dimensions of your tank and your own personal preference. A "normal" (not a deep or "show") tank can be well lit with standard fluorescents. With tanks deeper than about 20 inches, or those where the footprint (length and width) is significantly smaller than the height of the tank, like hexagonal tanks, it is often necessary to go to a more intense form of lighting. If the tank is long enough, HO or VHO lamps may fit the bill. For tanks that are shorter in length, or those that do not easily accommodate the standard 2-, 3- or 4-foot fluorescent tube lengths, CF tubes or MH may be the best answer. Most aquarists who want to work with open-top tanks prefer to use MH lighting because of its greater intensity and more focused beam.

Once you have decided on the type of lighting you want to use, you can begin to narrow down the choices of specific tube types. If you have chosen something other than standard fluorescent tubes, your choices will be more limited. For standard fluorescents, the choices are so broad that things again become confusing.

Most of the terms we use for assessing a light are based on human perception of light. Lumens, lux and color rendering index (CRI) are all ways of measuring the qualities of visible light. Unfortunately, the part of the spectrum perceived as "brightest" by the human eye is the part of the spectrum least useful for the growth of healthy plants. Also, our eyes are very adept at adjusting to light sources available, and sometimes give us the impression that a light is brighter than absolute measurements tell us it is.

The good news is that whatever fluorescent tubes you choose, if you use enough of them, your plants will grow. Now that I've pretty much told you that I can't tell you what the best lamps are, I will give you my personal criteria for choosing standard fluorescent tubes.

I want tri-phosphor tubes that have an "M"-shaped spectral curve — strong in red and blue light, less in the yellow-green area. I want tubes that have as high a lumen-per-watt rating as possible. While this is more an eye appeal criteria than one of plant need, I prefer tubes with a Kelvin (K) rating of between 5000 and 6500 K. This is similar to the color temperature of the sun directly overhead at noon.

I like to come very close to 3 watts per gallon, and I change one tube every four months. I also have a number of tanks that need plant-quality lighting. For these reasons, I cannot afford tubes that cost \$20 apiece or more. This puts most of the specialty aquarium tubes out of reach. Cost wise, the next step down in tubes is the Vita-Lite. These can be purchased for under \$20 from a number of sources. They put out an excellent-quality light, and are easy to find for most people either through lighting shops or mail order.

If you are willing to do a little more digging, you will find that there are a number of manufacturers now producing excellent tri-phosphor, full-spectrum fluorescent tubes for under \$10 apiece. I have used those made by both Phillips and GE. There are other manufacturers as well.

As a final word on your algae problems, remember that lighting, by itself, does not cause algae problems. An imbalance between plant growth, stocking and maintenance, lighting and nutrient levels is at the root of most algae problems.