Factors that Influence Coral Coloration

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There are many environmental reasons why corals may change color. However, in home reef aquariums, the most common cause of dramatic color change is due to lighting.

Corals react to light by adjusting the number of cells responsible for utilizing light, as well as the pigments that provide protection from strong light. What we perceive as color change is, in fact, the coral's natural response to a particular light source. Corals will strive to achieve a balance where the number of cells and amount of pigment matches the corals' needs for both nutrition and protection.

Light intensity and coral color

Many corals have the ability to adapt to different light intensities. For example, certain photosynthetic corals possess special, light sensitive cells called zooxanthellae cells. These symbiotic cells contain chlorophyll and provide nutrients to the coral in exchange for protection. To ensure a continuous source of necessary nutrients, the host coral regulates the number of zooxanthellae cells and amount of chlorophyll within those cells. One of the basic criteria for zooxanthellae cell and chlorophyll regulation is light intensity.

If the light is more intense than what the coral is accustomed to, then one of two things may occur. Either some zooxanthellae cells will be expelled from the coral or the amount of chlorophyll within those cells will be reduced. Having excess zooxanthellae cells in a brightly lit environment can be dangerous to corals. Under intense light, oxygen generated as a by-product of zooxanthellae photosynthesis can accumulate to toxic concentrations within the coral.

In contrast, if light intensity is lower than what the coral usually receives, the photosynthetic zooxanthellae cells will not be able to produce the sufficient amount of nutrients for the host coral. Subsequently, the number of zooxanthellae cells, as well as the amount of chlorophyll within those cells, will increase in an effort to capture more light energy.

> Q: My new coral addition is starting to look a bit faded. What's going on?
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> A: Test water parameters to see if everything is within an acceptable range for your particular species. Also, photosynthetic corals need time to acclimate to new lighting conditions. Allow your coral to adjust to its new home and gradually alter its position to ensure proper light levels.

So how does zooxanthellae cells and chlorophyll concentration affect coral coloration? These cells range in color from a golden-yellow to brown and large numbers of these cells give the coral a brown appearance. In other words, light intensity alters the color of photosynthetic corals by affecting the concentration of both zooxanthellae cells and the amount of chlorophyll present within those cells.

Therefore, in less intense lighting conditions, photosynthetic corals will appear darker brown since the corals host more zooxanthellae cells to produce more nutrients. If the same coral is placed under intense lighting, zooxanthellae cells will be expelled and the reduced amount of chlorophyll will give the coral a lighter appearance.

Color change due to light spectrum

The light spectrum, or Kelvin rating, of aquarium lighting will also alter the appearance of corals. In general, bulbs with lower Kelvin ratings will cast a "warmer" yellow light while bulbs with higher Kelvin ratings will produce a bright, crisp, white to blue light. Different light fixtures with different spectrum bulbs impart varying color effects on corals. For example, bulbs that emit light heavy in the actinic blue range bring out dazzling fluorescent colors not visible under full spectrum daylight bulbs. While different hobbyists prefer different combinations of light spectrums, a typical lighting system for a reef aquarium consists of 50% white light with a high Kelvin rating and 50% blue, actinic light.

Color change due to UV light

In nature, ultraviolet light waves (UV-A and UV-B) penetrate the ocean's surface but are filtered out as the light travels through the water. Both UV-A and UV-B light waves have been found to cause destruction of DNA and RNA within coral tissue. In response, many corals have made adaptations to reduce the effects of these harmful rays. These corals developed protective pigments that are often blue, purple, or pink in color. Most corals that contain these pigments come from shallow waters where the amount of UV-A and UV-B light is higher than in deeper areas of the reef.

In home reef aquariums that rely on metal halide lighting, it is important to protect corals from UV light. Coral without these protective pigments as well as shallow water corals that may have lost their pigments during transportation are especially susceptible to the effects of UV light. Fortunately, preventing any UV light from entering the aquarium is as simple as employing glass aquarium canopies and making sure the protective glass lens on the metal halide fixture is properly installed.

It is not uncommon for corals with these bright colors to adjust to the lower UV-A and UV-B conditions found within home aquariums. The loss of colorful pigmentation is not necessarily a sign of an unhealthy coral - it is simply a normal coral adjusting to its new environment.

It is a common misconception among many hobbyists that color changes in newly received coral is an indication of unhealthy coral. Many times the color change is merely the result of corals adjusting to the new lighting intensity, spectrum, and change in UV light. With this in mind, it is important to consider the color of newly received corals and understand their lighting requirements. Be sure to properly acclimate corals to new lighting conditions and allow time for them to establish their coloration.

References and Further Reading

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