Optimal Temperature for a Stony Coral Tank

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By Terry Siegel

Many reefkeepers, especially those who have been keeping stony corals for many years, found themselves scratching their collective heads about a new article by American invertebrate zoologist, Ronald L. Shimek, Ph.D. The article, entitled "Reef Temperature and Salinity Levels," appeared in the June 2001 (vol. 13, no. 6) issue of Aquarium Fish Intl., Pp. 44--51. In essence, Shimek argues that many reefkeepers keep the salinity and temperature too low. While other reefkeepers and I have no argument that salinity should be keep at natural seawater levels, Shimek also argues for an optimal temperature of 84 degrees Fahrenheit. Following, quoted directly from Shimek's text, is the section related to his argument.

"As far as any life form is concerned, the first priority is simple existence. The first priority is to stay alive. This is accomplished by making the basic life processes the first recipients of ecological energy. This energy is sugar that is derived from food, and the basic life processes include all the enzymatic processes necessary to stay alive.

Enzymes are biological catalysts, and as such they have defined temperature optima. In different organisms these processes run at different rates, but the basic rate is determined by the temperature of the animal. In animals without the capability of maintaining their own temperature, the external environmental temperature determines the speed at which these processes run.

Below a certain temperature, the speed of the processes is too slow to produce enough of the basic necessary intracellular chemicals to keep the animal alive, and it dies. The temperature at which this rate is just barely fast enough to keep the animals alive is the absolute lowest temperature limit for the species. For reef animals, depending on the species, this lower limit ranges from about 60 to about 75 degrees Fahrenheit. The organisms cannot be acclimated to cooler temperatures, and this lower temperature limit is what, in most cases, determines the latitudinal limits to the distribution of these animals.

Animals maintained at or near this lower limit will survive, but they will not repair injuries, grow or reproduce. As the temperature increases, the rate of internal cellular enzyme functions also increase, and the animals can process enough energy and make enough other chemicals to do more than just barely survive. If they have enough food, the first additional thing they do is repair injury. As the temperature increases, provided they have enough food and raw materials, they will then start to grow. Finally, as the temperature rises yet further — provided food is available and they are in good condition and of the appropriate size — they will start to be able to metabolize sufficiently in the time available to become reproductively active.

From the preceding discussion, it would seem that the key to keeping the animals happy and healthy would be to simply raise the temperature to the hottest temperature possible. Obviously, this is incorrect. All animals have a range of temperature tolerance, and once the optimal temperature has been passed, the metabolic functions start to degrade.

At higher temperatures the enzymes don't work as well and the amount of products they can make decreases with increasing temperature. The sequence of failure is reverse of what is seen below the temperature optimum. First reproduction ceases, then growth, then injury repair, and finally the animal dies of overheating. The upper limit of temperature tolerance, like the lower one, is fixed. Most reef animals cannot survive extended periods above 93 degrees Fahrenheit. Some reef animals from cooler reefs may experience problems at lower temperatures — in the high 80-degree range — if they are not acclimated first.

Consequently, there is a range of temperatures within which the organisms do best. This range is generally within a couple of degrees Fahrenheit of the temperature at which growth is fastest. In virtually every animal that has been tested, this optimal temperature is the temperature at the center of the species' distribution.

One easy way for a hobbyist to determine the optimum temperature of any given species is to do a bit of research to determine where it is found in nature. Then find the center of that distribution and use the average temperature found there as a starting point. Most corals that have been tested have a temperature of maximal growth of around 84 degrees, and most scientists consider the temperature range of 82 to 85 degrees as being optimal for most corals."

Though I do not have the expertise to question the longitudinal temperature related distribution of stony corals in the wild, I have serious reservations about keeping stony corals in our captive reef habitats at temperatures between 82 to 85 degrees for extended periods of time. To those unfamiliar with corals, arguing that corals kept in closed system aquaria at 78 to 82 rather then 82 to 85 degrees Fahrenheit may seem a trivial matter. However, corals kept in aquaria or in the wild have a very narrow temperature survival range. It has been documented many time that when temperatures, even in the wild, reach 90 degrees for more than a few days, mass bleaching occurs. Corals have often been called the canaries of the ocean, comfortable in a very narrow environmental range. Furthermore, the difference between maintaining a temperature between 78 to 82 and 82 to 85 is often the difference in warm weather between the judicious use of fans as opposed to an expensive chiller.

It has been my anecdotal experience, and that of other experienced reefkeepers, that corals grow quite well — often so well that continuous pruning is required — at the lower mentioned range. For example, see the accompanying photo of Greg Schiemer's 500-gallon reef tank! Schiemer goes to considerable trouble to keep his tank's temperature at or around 78 degrees Fahrenheit. In fact, every few months he has to prune his staghorn corals because they reach the water surface. However, his tank is illuminated with five 400-watt 6500K Iwaski bulbs. It is our experience that the intensity of light supplied is a much greater factor in the general well being of corals in captivity than temperature.

It has been my experience, along with many others, that it is during the summer months, when reef tank temperatures are generally highest, that aquarists have the most trouble with what we call RTN (rapid tissue necrosis), in which corals slough off their living tissue and usually die. Whether the higher temperatures stress corals in captivity or the bacteria responsible — if bacteria are responsible — for RTN reproduce more quickly at these higher temperatures is unknown. I recognize that these are simply impressions of mine and that of many experienced reefkeepers, but until someone is able to scientifically test the success of keeping captive corals at different temperatures under conditions where variables are carefully controlled, I'll play it safe with the lower temperature range.