Coral Reef Restoration:
Returning the caretakers to the reef

Continued from page 3

reefs with the urchins, brown foliose algae cover went from 10% to 5.13%, a decrease of 45% in one year. On the control reefs without the urchins, brown foliose algae cover went from 4.5% to 5.9%, an increase of 31%. These combined figures for both experimental reefs and both control reefs don't tell the complete story. On experimental reef #1 that had the most extensive coral growth and the largest population of urchins, brown foliose algae cover declined from 11.0% to 1.75%, an 84% decrease. Control reef #4, with its small natural population of urchins, started the project with only a 3.0% brown foliose algae cover and ended the year with a 1.0% cover. Experimental reef #2 had a 6.0% decrease in brown foliose algae and control reef #3 had a 79% increase.

The reduction of brown foliose algae on the experimental reefs, especially reef #1, and the increase on control reef #3 show without a doubt that the presence of the urchins greatly diminishes this competitive algae on the reefs. Its presence in low quantities on control reef #4 only supports this conclusion because of the presence of low numbers of adult urchins on this reef before and during the study.

Considerations on restoration of the long-spined sea urchin, *Diadema antillarum* to the reefs of Florida Keys

It is obvious that the restoration of *Diadema* to the coral reefs of the Florida Keys would be immeasurably beneficial to the ecology of the coral reefs and to the future economy of the Keys and all of South Florida. It may be that in time *Diadema* will repopulate the reefs of the Keys naturally. But as we wait for this to occur, and it has already been two decades, our coral reefs continue to decline. If

Photo by Martin A. Moe

Ken Nedimyer releasing diadema urchins on their home at experimental reef #1. The urchins quickly move into the rocky crevices of the reef as soon as they are released.

it is possible to enhance the recovery of *Diadema* on Florida reefs through human effort, it must be done soon.

There are two main pathways that should be followed that may aid restoration of *Diadema* to the reefs.

The first is the translocation of juvenile *Diadema* from areas where they are at high risk of mortality from storms and predation, to small, complex reef areas. We have demonstrated that the act of translocation causes little, if any, direct mortality. Development of small reef areas with pre-plague population levels of urchins will allow for effective reproduction of the urchins by placing them in close proximity to each other, and create reef areas where corals can grow without intensive algae competition.

The second avenue is to work with hatchery techniques to produce larvae and juveniles from captive brood stock of adult *Diadema*. This process would be more costly but would have the advantage of controlled production with release in specific areas at specific times of large numbers of late larval and juvenile urchins.

There is little that can be done locally to reverse or mitigate the effects of global warming or pollution from far off sources such as the rivers that empty in the Gulf of Mexico, but it may well be possible, through restoration of the long-spined sea urchin, to greatly reduce the algae growth that is smothering our reefs. The value of a successful *Diadema* restoration program can be measured by the value of our coral reefs to the economy of the Keys and South Florida. It could be that efforts to restore *Diadema* to Florida reefs may not succeed. The potential for restoration, however, is great enough, and the need for restoration of this herbivore so critical, that it is imperative that we at least make a strong effort to return *Diadema* to our reefs.

PUBLICATION INFORMATION

SeaScope® was created to present short, informative articles of interest to marine aquarists. Topics may include water chemistry, nutrition, mariculture, system design, ecology, behavior, and fish health. Article contributions are welcomed. They should deal with pertinent topics and are subject to editorial reviews that in our opinion are necessary. Payments will be made at existing rates and will cover all author's rights to the material submitted.

SeaScope® is published quarterly for free distribution through local aquarium dealers. Dealers not receiving copies of **SeaScope®** for distribution to their customers should call Aquarium Systems, Inc. to be added to the mailing list. Telephone: 1-800-822-1100. The SeaScope® newsletter is now available on-line at www.marineland.com under the News tab. Go to the "What's New" section and choose SeaScope® newsletter for the most recent issue.

Address comments, questions, and suggestions to Dr.Timothy Hovanec, Editor. Marineland, 6100 Condor Dr., Moorpark, CA 93021
or E-Mail: seascope@marineland.com

Aquarium Systems is a Marineland Company

Editor's Corner

Continued from page 1

with a low pH, such as 3, has a hydrogen ion activity of 0.001 mol/L while a solution with a higher pH, such as 8, has only 0.00000001 mol/L of hydrogen ions. Since 0.001 is a larger number than 0.00000001 the solution with a pH of 3 has a much greater hydrogen activity, making it more acidic.

Pure water (H_2O) consists of two hydrogen ion (H^+) and one hydroxide ion (OH^-) with the formula of $H_2O = H^+ + OH^-$. If there are equal numbers of hydrogen and hydroxide ions than, by definition, the pH is neutral and its value is 7 (the concentration of both hydrogen and hydroxide ions is 10^{-7}). Pure water is one example of a neutral liquid. The pH of a liquid can be either acidic, basic (also called alkaline) or neutral depending upon the concentration of the hydrogen ion. A basic solution has a concentration of hydrogen ions less than 10^{-7} while in an acidic solution the hydrogen ion concentration is greater than 10^{-7}.

While the words acidity and alkalinity look like they are adjectives for acidic and alkaline, they are not. This has, in my opinion, resulted in some of the confusion and misinformation about pH, as well as alkalinity and acidity.

Alkalinity is the acid-neutralizing capacity of a water. Namely, it is a measure of the buffering ability of the water. Water with high alkalinity can accept a lot of hydrogen ions before the pH starts to drop. Conversely, acidity is the measure of the ability of a water to accept a base (caustic) solution before the pH increases. Both alkalinity and acidity are commonly expressed in terms of mg/L of calcium carbonate ($CaCO_3$), a much different scale than that of pH. Thanks for reading

Future Events and Conferences

Dr. Timothy A. Hovanec will be speaking at the Brooklyn Aquarium Society Jan. 9, 2004 at the New York Aquarium on Surf and West 8th Street, Brooklyn, NY. More information at www.brooklynaquariumsociety.org

Aquaculture 2004. March 1-5, 2004. Honolulu, Hawaii. More information at www.was.org

Marine Ornamentals '04. March 1-4, 2004. Honolulu, Hawaii. More information at www.hawaiiaquaculture.org/marineornamentals04.html.

Aquality – The 1st International Symposium of Water Quality and Treatment in Aquaria and Zoological Parks. April 1-6, 2004. Lisbon, Portugal. More information at www.oceanario.pt

IMAC 2004. June 4-6, 2004. Chicago, IL. More information at www.theimac.org

MACNA XVI. Sept. 10-12, 2004. Boston, MA. More information at www.masna.org