



CORAL RESTORATION

Giving Mother Nature A Kick-start



By Alex Brylske

What do a 14-year-old girl and a 4-H project have to do with saving the world's coral reefs? More than you might imagine. The story gets even stranger when you learn that her dad, Ken Nedimyer, is the longtime proprietor of Sea Life Inc., a tropical fish-collecting business based in the Florida Keys. But Nedimyer is no reef pillager; in fact, just the opposite. A marine biologist by training, he has devoted as much of his life to marine conservation as to growing his business — if not more. He also sits on the Sanctuary Advisory Council of the Florida Keys National Marine Sanctuary, and heads a grass-roots conservation organization called the Coral Restoration Foundation (CRF). In the process, Nedimyer has become one of the world's leading experts in staghorn coral (*Acropora cervicornis*) propagation and restoration. And that's important because over the past three decades more than 95 percent of all staghorn coral in Florida and the Caribbean has vanished. (Most of it has died off from a condition known as white band disease that started in the late 1970s.)

As part of their marine biology program, students at Coral Shores High School are helping the Coral Restoration Foundation grow coral in the Florida Keys.



In 2001, Ken's daughter, Kelly, was lamenting over what to do for her 4-H project. A few years earlier Ken began noticing young staghorn corals growing among his one-acre (0.4 hectare) live rock nursery offshore of Key Largo. (See the sidebar "What's Live Rock?" on Page 37.) All stony corals are federally protected but an exception in the live rock aquaculture laws allows the sale of any corals that settle and grow on cultured live rock. (At the time, this applied to staghorn coral until it, along with its cousin elkhorn coral [*Acropora palmata*], made the federal endangered species list. Now, while Nedimyer still technically "owns" his corals, he can no longer sell these two species.) So Ken suggested to Kelly that, rather than the usual 4-H project of raising goats, cows or pigs — a real challenge in the Florida Keys — why not grow coral? The result: A first-place finish in the regional competition, and second-place finish in the state contest.

The next step in Kelly's 4-H career was a required community service project. For that Ken suggested inviting the marine biology class at the local high school to participate in raising the coral critters. Fortunately, the high school in question, Coral Shores, had on staff a veteran marine science teacher, Dave Makepeace, who was cut from a different cloth of educator. A marine scientist by training, Makepeace found teaching a much more rewarding career, and for more than 30 years has developed what is perhaps the most innovative high school marine science program in the nation. It turns out that scuba diving was already an integral part of the Coral Shore marine science curriculum, so the idea of raising corals was a perfect fit. (See the sidebar "A High School Class of a Young Diver's Dreams" on Page 34.)

By 2003 what had started out as only five small fragments of staghorn coral in the Nedimyer nursery blossomed into nearly 50, and some had grown into formations the size of an extended hand. This gave Ken yet another idea, and it wasn't to make a boatload of cash sell-



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Meticulous records must be kept in order to monitor the success of the coral growth.

ing corals. He wanted to use these hardy little survivors to help restore the reefs that, so long ago, had inspired his love of all things ocean. So, he contacted officials with the Florida Keys National Marine Sanctuary and asked to transplant them on Molasses Reef off Key Largo. Molasses Reef is what's termed a Special Preservation Area, or SPA, one of several set aside as a no-take zone to protect and preserve the marine environment. What's more, Molasses Reef is probably the most popular dive site in the Western Hemisphere, if not the world. But, unfortunately, a sizeable chunk of it was flattened and pulverized when the cargo ship *Wellwood* went aground on the reef back in 1984. Since then, numerous efforts have been made to restore the area, but like most other reefs in Florida and the Caribbean, there's still almost no live staghorn coral. What better place, Ken thought, to give a helping hand. And so

it began. "In the pilot project we took six clippings just to see what would happen and they all lived," Ken says.

Soon folks ranging from scientists to the local tourism development office caught wind of what Nedimyer was up to, and it didn't take long to exhaust the capability of his singular effort. But money to continue was difficult to come by because, as Nedimyer himself says, "No one's going to give a grant to a fish collector." Taking the bull by the horns once again, he formed a nonprofit organization, the Coral Restoration Foundation, as a mechanism to accept and administer funding to support and continue the restoration.

However, based on more out-of-the-box thinking, Nedimyer's approach wasn't to take the normal route of finding only deep-pocket donors and financing organizations. Recognizing that divers are some of the most passionate people on the planet when it comes to protecting coral

reefs, he had another idea. Why not marshal them to both help fund and do some of the physical work? Thus, in 2007 he launched a series of workshops to teach the divers about his work, and give them an opportunity to participate in an actual restoration project. Currently, the program involves two days, and is hosted by one of several Keys dive operators. (See "Want to Attend a Workshop?" on Page 35 for a list of dive centers that sponsor CRF workshops.) The workshop includes two lectures and two half-days of diving. Some workshops include an additional Reef Environmental Education Foundation (REEF) day, with an evening lecture and fish survey dive.

A Personal Perspective

I had the opportunity to participate in one of the CRF workshops recently hosted at Amoray Dive Center in Key Largo and, even for someone with an extensive background in coral reef science, I found it a unique and fulfilling experience. The lectures started out with Ken providing us with some often-humorous personal background on how the project got started. (With four daughters, all of whom are divers who at some time helped their dad, you can imagine the stories.) That was followed by a discussion of the problems facing coral reefs in Florida and around the world. Next was an overview of what's being done to address these problems, and finally a summary of what the CRF is doing to restore coral reefs in the Florida Keys. Of particular interest was Ken's perspective on how the Keys has fared over the years; and, take my word for it, only fish have spent more time on the local reefs than Ken Nedimyer. On balance, I can describe the first morning as both depressing and hopeful.

As enlightening as the classroom presentation was, the workshop highlight is clearly the open-water work. Our first dive was spent at Ken's nursery, which is now as much a home to staghorn coral as its intended purpose, raising live rock. Laid out before us was row after row of cinder blocks — reminiscent of a farm field — each holding a tray of 10 small-

to medium-size pieces of staghorn coral. Prior to our group, other volunteers clipped pieces, termed “frags” for fragments, of two or three centimeters in length, and mounted them to pedestals with special underwater epoxy. Having been unattended for several weeks, our job was cleaning and preparing the trays of coral for transplant on Molasses Reef the next day.

As we learned in class, each coral started from what Ken describes as a “knuckle clipping” in the nursery. And this is no willy-nilly process. Consideration is given to make sure that there’s DNA diversity at each transplant site. To accomplish this, DNA analysis was done to identify the genotype (the genetic constitution of an individual organism) of each family of corals growing at the nursery. This will help scientists identify which corals have the greater ability to survive under the conditions present. Each frag is tracked by genotype, the number of generations away from the parent colony and a fragment number, all

For More Info
Coral Restoration Foundation
www.coralrestoration.org

critical information in determining the ultimate success of the project. After about a year, when they have grown branches and stand about four inches tall, they’re ready for transplant or for use as parent colonies for more clippings.

Our class was composed of several divers from around the Southeast, plus a large group of high school students from Connecticut. Given the challenges of supervising a boatload of beginners, Ken used several assistants. On board to help out were Chris Calderwood, a Nedimyer colleague and marine science teacher from a local private school, and two of Dave Makepeace’s marine science students, Thomas Tafoya and Dannon Magrane. All have been working with Ken for some time. (On our second day of div-



CRF student volunteers use the ocean floor as their classroom.



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A white silhouette of a diver in full gear, including a tank and fins, positioned inside a red circle.



A High School Class of a Young Diver's Dreams

For almost 30 years teacher Dave Makepeace has been building a niche at Tavernier's Coral Shores High School with an honors marine science curriculum. Rather than sitting in a classroom, Makepeace emphasizes "service learning." That means actually doing what you read about in textbooks. What's more, grades are based not on regurgitating facts, but through submission of portfolios that include scientific reports, journals, photos, Web sites and videos. And, of course, being a certified diver is a requirement.

Over the years, under Makepeace's guidance, Coral Shores students have studied and restored seagrasses with the Florida Fish and Wildlife Research Institute, created artificial reefs using Reef Balls®, monitored local coral reefs using the same scientific protocols as professionals, and have even explored the Dry Tortugas with none other than "Her Deepness," Dr. Sylvia Earle and the National Geography Society. So, when Nedimyer approached the school about the CRF project the only question was, "When do we start?"

Since 2003 more than 130 Coral Shores students have assisted Nedimyer and the CRF, both during class and on their own time. "I have 30 more ready to dive in as soon as Ken is ready," Makepeace says. "This project is perfect for my students.

They get an opportunity to apply and learn real science, help make a lasting contribution to the ocean, interact with extraordinary role models like Ken and, of course ... their diving. It doesn't get much better than that."

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ing, proving that Ken's operation is truly a family affair, his wife, Denise, joined us as a fourth assistant.)

I entered the water a bit late and found the bottom already rife with busy divers going about the business of cleaning the coral trays and stands with wire brushes, chisels and putty knives. The trays of coral looked like serving dishes, each containing eight coral fragments. The cloud of debris around them was full of fish, many of which were the rarely seen juvenile stage angel and butterflyfishes that, in their adult form, inhabit nearby popular dive sites. Of course, there were also the ubiquitous triggerfishes and wrasses wrangling their way in for a free hand-out of the scrapings. At that point the nursery looked as much like a tropical fish farm as a repository for coral and live rock. "Feeding frenzy" came to mind. I'm not sure who was busier; the divers cleaning or the fish eating.

Day two began with another informative lecture on coral reef science, and the wide assortment of coral reef

restoration techniques being used today around the world. Then, it was off for the second day of diving at a dive site called Snapper Ledge near Molasses Reef. Armed again with wire brushes, chisels and, this time, two-part epoxy, the objective was to prepare the sites where the new coral colonies would spend the rest of their lives. Unlike most noiseless dives, this one was accompanied by the constant sound of banging, scraping and brushing. The cacophony was accompanied by other divers kneading the modeling claylike epoxy to affix the corals' bases. The epoxy team reminded me of a sculpture class in which dutiful students intently prepare their works of art for an approving instructor. Along with the worker-bee divers was a third group of data recorders who meticulously measured each branch of each coral to determine the total length so that, over time, growth can be accurately documented. This is an essential task — as critical as placing the corals — because the goal of the project is not only to transplant, but to document the corals' health and to what degree they're benefiting the local ecosystem.

A quick tour of the area before heading back to the boat allowed me to spot dozens of previously transplanted colonies, all of which seemed to be healthy and prospering. Ken explained that from the initial six colonies placed as a proof-of-concept back in 2003, they have so far transplanted nearly 100 more on Molasses Reef and Snapper Ledge. From these immigrant parents about 500-600 new colonies have appeared. And all this is an area that hasn't seen significant live staghorn coral in more than two decades. "It's amazing how fast they grow," Ken told me on our way back to the dock. "A two-centimeter [0.78-inch] cutting will be 30 or 40 centimeters [11.8 to 15.7 inches] in just a year." Ken also explained that he has recently turned his attention to the staghorn's cousin, elkhorn, and has begun a preliminary transplant program with that endangered species as well.



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What's Live Rock?

The term "live rock" is actually a misnomer. What makes it live are the many forms of micro and macroscopic marine life that live on and within it. The rock itself is the calcium carbonate (limestone) skeletons of long dead corals, or other calcareous organisms. Live rock is used by saltwater aquarists. It provides an aquarium with essential algae, bacteria and small invertebrates, all of which contribute to the overall water quality. It functions as the main nitrification base and a biological filter. It also enhances the look of the aquarium and provides shelter for the aquarium's residents.

Under a special permit, Florida law allows a person or company to lease a small area of the seabed for live rock harvest. However, it does not allow harvesting of the seabed rock, itself. Instead, the rock that eventually will be harvested must be brought in from somewhere on land (Nedimyer's nursery has about 600,000 pounds [270,000 kg] of transplanted rock), then allowed to acquire the microbes and organisms that give live rock its name and value.



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A Continuing Success

Since my participation in the restoration workshop in June, there's been even more encouraging news. Continuing his commitment to involving youth, Ken has been working with a Tampa Bay-area organization called SCUBAnauts International. In August, under the supervision of Nedimyer and Florida Keys National Marine Sanctuary scientists, a group of 21 high school-aged SCUBAnauts documented the first known case of spawning of farm-raised coral in the entire Atlantic and Caribbean. "It's big news," Nedimyer told press representatives afterward. "This is what we have been trying to do. We are not just trying to restock the coral population. It's about letting them spawn and reproduce. We are just trying to give them a jump-start ... I'm excited that it happened in just two years."

The SCUBAnauts group not only observed the spawning but also collected the staghorn gametes (eggs and sperm). Some of the larvae had already settled onto ceramic discs, which were taken back to the nursery for grow-out. Gametes were also collected from the water column by scientists for further research, and will be used for fertilization projects with the aim of eventually transplanting the offspring. Dr. David Palandro, a research scientist for the Florida Fish and Wildlife Conservation Commission and head of the SCUBAnauts program, described the experience as being like a great big circle of life. "Corals were transplanted here and we're collecting the gametes from those transplanted corals and we hope to take those gametes and transplant them someplace else." But to Nedimyer there's something else that's equally important:



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Want to Attend a Workshop?

Below is a listing of the dive centers that sponsor the Coral Restoration Foundation, the Web site explaining their involvement with the workshops and dates of their next program.


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www.amoray.com

Florida Keys Dive Center
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Indian Valley Scuba
 Harleysville, Pennsylvania
www.indianvalleyscuba.com

the people who have done this. "The corals have been cut and moved by Coral Shores students," he said, "placed on restoration sites by [Florida Keys Community] college students and discovered spawning and reproducing by another group of students. Kids have done this whole thing."

While local success is important in proving the transplantation concept, Nedimyer recognizes that Molasses Reef is just a tiny dot within the massive coral reef ecosystem of the Atlantic and Caribbean. So, his plans are to expand to other areas. With modest resources, that means the next steps for CRF will probably take place elsewhere in the Keys. Already there are plans in the works to develop a partnership with the marine science department at the Florida Keys Community College to create and maintain a coral nursery in the Lower Keys. And Ken has had a number of requests for programs throughout the Caribbean. "All actions have local impact," Nedimyer says, "and everybody can make a difference." As for me, it was great to see that there's a way to do something that truly makes a difference but involves more than just writing a check. And I have the epoxy stains on my wet suit to prove it. 

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