

Sowing Seeds for Eelgrass Harvest

By Kalle Matso

In an effort to make large-scale eelgrass restoration a reality, researchers at URI are currently testing a boat-pulled sled that automatically deposits eelgrass seeds below the surface of the sediment in estuaries and near-shore coastal areas. Test plantings took place this past fall and results on seed germination and seedling survival will be available this summer.

Currently, most eelgrass restoration experts use the "adult-shoot" method, where plants are uprooted from one area and transplanted to another. This work is very time-consuming since each shoot must be extracted and then replanted by waders, snorkelers or, as is often the case, scuba divers. Seeds, on the other hand, can be collected and planted in groups, so that less time and personnel are required.

"Having done my share of sticking eelgrass shoots into the ground, I can tell you that, if seed-based restoration can be mastered, it may become the most cost-effective means for restoring multiple-acre sites," says Mark Fonseca of the NOAA National Ocean Service Laboratory in Beaufort, N.C.

But he cautions that seed-based restoration is still very much in the experimental phase. "We've yet to see a full-scale field restoration that can reliably use seeds. It can be done. But we're still waiting for a cost-evaluated, long-term project to give us some data."

The URI project, funded by the Cooperative Institute for Coastal and Estuarine Environmental Technology ([CICEET](#)), addresses one of the main problems with seed-based eelgrass restoration methods: the tendency of the seeds to be washed away or consumed by predators before finding a haven in the sediment. To increase seed survival, URI researchers, led by Scott Nixon, URI oceanography professor and past Rhode Island Sea Grant director, encased the eelgrass seeds in a gelatin matrix, which is pumped directly into furrows carved by the sled. A weighted flange on the back of the sled then covers up the furrows, burying the seeds under approximately an inch of sediment.

Known more for his work in systems ecology, particularly nutrients, than for eelgrass restoration, Nixon believes that restoration is becoming increasingly relevant.

"A lot of work is being done to reduce the nitrogen released from wastewater treatment plants," says Nixon. "So we're going to be lowering the nutrient burden that the coastal waters are receiving, and that's going to make the environment more eelgrass friendly, and then restoration really becomes a viable management tool."

It stands to reason that eelgrass restoration will become more viable as it becomes more affordable. Stephen Granger, a marine ecologist on the URI project, is hopeful that their work will increase the efficiency of seed-based restoration.

"We're planning on planting 2,000 eelgrass seeds per square meter," Granger says. "With 50 percent survival, which is what we've seen in our tank experiments, we're hoping for 1,000 eelgrass shoots per square meter. That's about the upper range of the carrying capacity for eelgrass in this area."

Anything close to 50 percent survival in the field would be an unqualified success. Robert Orth, [Virginia Institute of Marine Science](#) professor, has worked with seed-based eelgrass restoration in Chesapeake Bay for over 10 years. In his experience, survival rates only approached 50 percent when the seeds were contained in burlap bags. Moreover, attempts by his lab to use an underwater planting sled did not exceed the 5 to 15 percent survival rate achieved when he simply threw the seeds over the side of the boat.

URI ecologists are hoping that the measures they've taken to secure the seeds in the sediment will reap rewards. Marine researcher Michael Traber, also working on the project, came up with the idea of mixing the eelgrass seeds into the gelatin matrix. A specialized pump, used in the food processing industry to inject precise amounts of jelly into donuts, is then used to push the seed-gelatin mixture to the sled and into the ground. The pump was built by the Edhard Corporation in Hackettstown, N.J., and provided to the researchers at a reduced cost.

Traber notes that a method may work in one area but be largely ineffective in a different area, so the idea is not to design the cure-all method, but rather to add more tools to the coastal resource manager's arsenal. Even within this one project, scientists don't want to be guilty of putting all their eggs in one basket. Horticulturist Brian Maynard, URI plant science associate professor, has been brought aboard the project to look at alternative methods for increasing the germination rates of eelgrass seeds.

The Future of Large-Scale Eelgrass Restoration

Eelgrass (*Zostera marina*) is a vascular marine plant (i.e., it has roots, stems, and leaves, unlike seaweed) that has been shown to have significant ecological value. The plant converts the sun's energy into carbon for food and provides habitat for invertebrates and juvenile fish. In addition, eelgrass roots reduce erosion, dampen the effects of flood events, and promote water quality.

Studies have shown that eelgrass is in decline worldwide, due primarily to degraded water quality caused by human pollution. In response to this trend, eelgrass restoration activity has increased in the past decade.

Because of the amount of work involved in eelgrass restoration, most experts conclude that the best way to conserve these ecosystems is to strive for higher water quality so that less eelgrass habitat is lost in the first place. That said, scientists do believe that eelgrass restoration can help kick start the recovery process, as long as the water quality has returned to adequate levels and there is a history of eelgrass presence at the site in question.

Efforts to restore eelgrass are not new. Adult-shoot restoration goes back to the work of C.E. Addy in Chesapeake Bay during the late 1940s. While adult-shoot restoration is still much more common than seed-based restoration, most experts acknowledge that a more efficient method is necessary to successfully carry out large-scale projects.

The largest successful eelgrass restoration projects-far outnumbered by the number of failures-are less than 10 acres in area, and the majority of these are closer to 1 acre. Recently, however, several large restoration projects-still in the planning stage-have placed particular focus on the cost-effectiveness of various restoration methods. In Laguna Madre, Texas, managers and scientists are planning a 70 acre restoration project in response to a recent oil spill that wiped out local eelgrass meadows. In Rhode Island, the [U.S. Army Corps of Engineers](#) is considering three separate restoration projects in coastal lagoons that, taken together, account for 180 acres.

For adult-shoot transplanting, that's a lot of acreage. Fonseca notes that, based on successful Federal Court cases in which he has been involved, adult-shoot planting efforts have run \$41,836 per acre (in 1996 dollars). At that rate, the Rhode Island coastal lagoons project would cost more than \$7.5 million.

The possible advent of these vast restoration projects accentuates another potential drawback of adult-shoot transplantation methods. Up to now, restoration projects have usually been limited in size and the negative effects of harvesting on the donor bed have been considered negligible. Now, managers are expressing concern that large scale harvesting of eelgrass shoots for various restoration projects could have a substantial and detrimental effect on existing populations.

These concerns, and projects on the scale of those in Texas and Rhode Island, highlight the need for more efficient restoration methods. If researchers like Orth and those working on the URI project can make seed-based restoration viable, they will no doubt find managers willing to put these new techniques to the test.

-Kalle Matso is Communications Director for CICEET.

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Virginia Institute of Marine Science <http://www.vims.edu/>
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