FINAL REPORT

Groundwater-Seepage Demonstration Project

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Introduction

The purpose of this project was to visually demonstrate if and to what degree saline nutrient-rich groundwater may stimulate or retard growth of a variety of naturally occurring benthic and planktic species using a unique mesocosm constructed over a flowing well.

Construction methods

Two mesocosms, one as a control, were constructed using a clear flexible plastic (vinyl) curtain attached to rock bottom with quicksetting cement and aluminum rails. The rails were cemented to the bottom to form a circle 3 m in diameter. Before attaching the curtains, a grid constructed with nylon lines was placed over the bottom and vertical photographs taken to document benthic biota. Next, heavy gauge clear vinyl was attached to the rails using stainless steel bolts. An additional 3-m-diameter rail was attached to the other margin of the curtain to which polyfoam floats were attached with plastic tie wraps. The floats held the curtain vertical in the water column, producing a flexible corral-like mesocosm open to the atmosphere and capable of flexing like an accordion with waves and changing tides.

One mesocosm was placed over an existing well which had been cased with 1-inch-diameter PVC. The other was placed on adjacent rock bottom to serve as a control.

After installation, it was determined that the previously installed 45-ft-deep well had become slightly clogged and was not producing sufficient groundwater for a meaningful test. A new well was therefore drilled to a depth of 25 ft and the open 3-inch-diameter hole was left uncased except for a short section of 3-inch-diameter PVC casing cemented at the top. A slotted PVC pipe cap was placed over the casing to which a thin polyethylene 3-inch-diameter tube was affixed with a hose clamp. The thin tubing (constructed from a

plastic zip lock bag) was about 8 inches in length and served as a one-way check or "flapper" valve. When the tide was falling, water flowed unimpeded from the well but during rising tide when water is "sucked" into the bottom, the flapper valve was sucked against the slotted cap, creating a seal that effectively prevented inflow. The new well provided sufficient flow to completely replace ambient water during each low-tide phase. Excess water flowed over the top of the curtain. Fluctuating tides also caused exchange of water in the control mesocosm. Water depth at the study site fluctuated between 1.8 and 0.60 m with each tidal cycle; thus, a column of water as much as 1 m thick had to flow out of the mesocosm at low tide. Flow was over the top around the upper rail and floats.

Results

Soon after installation, an unidentified person or persons slashed the plastic curtain and floats on one of the mesocosms. The damage was repaired but within a few days a severe thunderstorm caused further damage. Damage from the storm was also repaired and additional bungee cord tie downs were added to provide more resilience. Constant flexing of the rails due to waves eventually caused further damage during the following 2 weeks. After one month, we terminated the failed experiment and removed the rails. The wells are still in place.

What was learned

In principle, such devices are feasible and we think could be useful for environmental research in the future. Open in-situ mesocosms would function especially well in more protected areas. Even in open-water conditions, such devices would work if constantly watched and protected from vandals.

During the short period the devices were functioning, a slight increase in green algal growth on the plastic curtain surrounding the well was evident. Increased algal growth was expected because abnormal growth had been observed around leaky underwater monitoring wells elsewhere in the Florida Keys. Corals and gorgonians within both mesocosms did not appear to be affected by the experiment.