Restoration of sponge beds in the Florida Keys

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Due to circumstances, representatives from the Florida Sea Grant (University of Florida) were unable to attend our Hydra conference. Given the global importance of the Florida Keys sponge bed restoration programme, I have prepared a brief account of the project, based on available online information.

The need for remedial action

The importance of sponge beds in marine ecosystems is attested. The porous bodies of sponges act as water filtration systems that regulate water chemistry, and they have a potential for cleansing polluted waterways. For instance, removing toxic ammonium from the water. They also provide homes to juvenile fish and invertebrates (in the case of Florida, spiny lobsters and stone crabs, which are important commercial species in the local economy).

Cyanobacteria, better known as blue-green algae bloom, caused a massive sponge die-off in the Gulf of Mexico and Florida Bay in the early 1990s, in 2007, and in 2013. More than 500 square miles of sponges in the Florida Keys suffered (an area the size of a large metropolis), and 22 of the 24 most common shallow-water sponge species experienced a mortality rate of over 90%. Because these sponges are a foundation species, their losses are having severe impacts on the ecosystems they support.

Recruiting teams of volunteers

Faced with this disaster, marine scientists in the region decided to explore the possibilities for remedial action to restore the sponge beds. In cooperation with the Florida Fish and Wildlife Conservation Commission and other agencies, university and state biologists (including researchers at the University of Florida and Old Dominion University, along with more than 40 volunteers from around the world) have established a network of nine research areas and four nursery areas where cuttings of eight Florida Keys sponge species have been growing for replanting.

The logic of remediation

Sponge harvesting is an extractive industry, and as such has been historically characterised by excess. Overfishing and seabed trawling have combined with disease epidemics to decimate sponge populations.

Research work has show that damaged sponge communities can take not just a few years but decades to recover. When sponges face stressors that wipe them out in mass quantities, they need help becoming re-established, due to slow growth and low rates of larval dispersal. Recovery is protracted because sponge larval duration is short (6-8 hours), and currents in the Florida Bay do not transport larvae far from the parent sponges.

Compared with the thoughtless extractive techniques of the past, sponge harvesting techniques have changed. In the Florida Keys, diving for sponges is prohibited. Fishermen harvest sponges by using a hook on a long pole to tear a sponge free from the bottom. [Off the Gulf Coast near Tarpon Springs, sponges are found in deeper water and diving is permitted.] New regulation means that only larger sponges are harvested (minimum size 5 inches). And nowadays divers have a practice of cutting sponges rather

than uprooting them from the seabed. This makes regrowth possible and harvesting more sustainable.

Possibility of remedial action

Underwater nursery areas have been established near the town of Marathon (the town is set on 13 islands and is known for its beaches and barrier reef). These nurseries grow sponges for replanting. Four large areas have been targeted for replanting, in waters north of the Florida Keys. They are in the Middle Keys, from the south end of the Seven Mile Bridge to Vaca Key.

The transplanting of sponge cuttings is seen as a way of speeding up natural processes so that the seabed ecosystem doesn't reach a point of no return. It is a simple process. As one researcher says: "Take a sponge, cut it into bits, zip-tie it to a paver and grow as many sponges from it. […] You can create a sponge factory, if you will." Apparently the sponge transplants adhere to the paving stones within two weeks.

All work is performed by snorkelers in waters no deeper than 10 feet. Volunteers with boats are welcome but snorkeling volunteers can also be assigned to team vessels.

Thus far, the team has seen success in four species: the loggerhead sponge, the vase sponge, the brown branching sponge and the yellow rope sponge. These species were chosen because of their large adult size and their role as major filter feeders. The researchers are also interested in stinker sponges, sheepswool sponges, and brown branching sponges.

After piecing together various aspects of sponge biology and ecology, the research team found that cuttings of several sponge species can be successfully transplanted to restoration sites and that, after a few years, new populations begin to emerge. In short, researchers have found that the recovery process can be assisted by "farming" sponges, and adding them to the surviving stocks on the seabed, thereby speeding up the recovery process and also enabling basic research into the role of sponges in the ecosystem. The plan is not one of wholesale repopulation of sponge beds, but of establishing small beachheads, intact communities that can augment a natural recovery.

Benefits of remedial action

Shallow-water sponges in the region were once considered as not much more than houses for juvenile lobsters, which are important to the local economy. Recently, however, this perspective has changed. The importance of sponges is increasingly recognised. As filter-feeding animals, sponges cleanse water by passing it through their porous system of tiny internal canals and chambers. They attract tiny shrimp and crabs, which in turn bring larger fish to an area. The presence of sponges assures the presence of other marine organisms. Researchers have suggested that the biotic sounds caused by the inhabitants that occupy the sponges (including the snapping of shrimps) may help guide the larva of fish and invertebrates to safe habitat, similar to coral reef communities. Their sounds draws the bigger fish, and thus the whole reef system is healthy, active, and thriving. Sponges are also important for creatures such as sea turtles, and they play a role in stabilising bottom sediment. Research has also shown that compounds from sponges show promise for pharamceutical developments. The cancer-treating drug cytosine arabinoside was made from a Caribbean sponge, *Cryptotethya cripta.*

Recruiting teams of volunteers

Community involvement is an important component for gathering support from funding agencies. Since science is no longer an ivory tower activity, research grants are increasingly requiring an outreach component. Therefore the Florida Sea Grant

researchers seeks to recruit volunteers from among the local community, and they also organise volunteer events. They have a commitment to share their data and research findings with non-scientists and the general public, so they organise open forums where sponge matters can be discussed.

Outcomes

In the first phase of the project, upwards of 7,000 cuttings were planted out. The eventual aim is to have 15,000.

Thus far, the team has seen success in the four above-mentioned species. The species were chosen because of their large adult size and their role as major filter feeders. However, these four represent less than 10 percent of the naturally-occurring species in the Florida Keys. By test planting a greater variety of sponge species, the researchers will be able to see if additional species are viable transplant candidates.

Having achieved the first step of successful transplanting, the next step is to determine whether the restoration sites have the capacity to develop into the thriving and diverse ecosystems that they once were.

For a long time the Florida Keys economy revolved around sponging. However, although today commercial sponging still continues in the Keys, it is a far smaller industry, and it is no longer the biggest sponging source in Florida. But the wider global importance of this bio-remediation exercise should not be underestimated.

Sponge exchange at Key West

REFERENCES

For further information, see:
www.flseagrant.org/wp-content/uploads/SGEF_215_SpongeRestoration_web.pdf

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