Ocean Reserves Protect The Invaders As Well As The Natives

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DURHAM, N.H. -- While ocean reserves are increasingly being used to safeguard exploited native species, there can be one harmful side effect – non-native species may be flourishing under such protection, as well.

Jeb Byers, assistant professor of zoology at the University of New Hampshire, reports in the February issue of the journal "Ecology" that this is the case regarding a native and non-native little neck clam species found in Puget Sound, Washington. His work was funded by Washington Sea Grant and a private, nonprofit called Marine Ecosystem Health Program (now SeaDoc Society).

Byers studied three reserves and eight nonreserves in the San Juan Islands to quantify the abundance of these intertidal clams.

"My research focuses on nonindigenous -- or non-native species and I wanted to know if and how conservation strategies alter the abundance and impact of this non-native clam," Byers says. "I also wanted to know if the relationship between the native and non-native species varies in a protected environment."

What his study revealed was that a heavily harvested non-native species, Venerupis phlippinarum, was significantly greater on reserves. In contrast, the abundance of a similar, harvested native species, Protothaca staminea, did not differ between reserves and nonreserves. The non-native species was also larger on reserves than in non-protected environments, while size of the native clam did not differ.

To better understand how the relationship between the two species may be altered by the increased densities of the non-native clams in a protected environment, Byers followed these surveys with a yearlong field experiment replicated at three reserve and three nonreserve sites. The experiment examined the effect of the high non-native species densities on the native species, as well as what the impact of natural predators might be. These predators include crabs, seagulls, starfish and fish.

"Even at experimental densities 50 percent higher than their natural levels measured in the field,

Venerupis had no direct competitive impact on Protothaca," Byers says. "But the non-native clam flourishes in its protected environment. This is due to the fact that it has a shallower 3-centimeter burial depth, making it easy prey for natural predators and humans. Remove the predators and there is little to stop it from thriving. The native clam, on the other hand, buries deeper, 6 centimeters, potentially providing itself a better buffer from excavating predators like crabs and humans."

Why they bury at different depths is connected to dissimilar survival strategies. The native clam buries deeper to protect itself, but this means it cannot feed as efficiently from the water column. Less food means it grows and reproduces at a slower rate. The non-native clam, being closer to the surface, has better access to food. It grows and reproduces faster.

Byers explains that the more vulnerable non-native clam seemingly eases pressure on the native clam, because humans and intertidal foraging crabs more readily harvest it. In a sense, it plays a "sacrificial role" that partially protects the native clam from predator mortality in the natural world.

"That the only species consistently benefiting from protection was nonindigenous highlights a potential, unintended consequence of marine reserves, " Byers says. "Land managers routinely apply control measures for nonindigenous species; our findings suggest a similar proactive approach for marine reserves, as well. Because, even though the native clam in our study does not appear to be negatively impacted by the non-native clam in a protected environment, this may not be the case for other marine species."