Coral Reefs: Ever Closer to Cliff's Edge

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A study in the Nov. 1 issue of the journal *Nature* uses a novel analytical approach to assess the health of failing Caribbean coral reefs and offer suggestions for saving them.

The authors are UC Davis theoretical ecologist Alan Hastings, an international leader in using mathematical models (sets of equations) to understand natural systems, and ecologists Peter Mumby and Helen Edwards of the University of Exeter.

Mumby, Hastings and Edwards studied Caribbean reefs that are being overrun by seaweed (also called macroalgae) after a plague in 1983 killed virtually all the plant's natural grazers, a sea urchin named Diadema antillarum. With the sea urchins gone, the only line of defense against the algae is parrotfish. But parrotfish numbers are falling fast because of overfishing.

The researchers created a mathematical model of the reef, and then looked at what the future holds if human practices don't change. In particular, they examined a process known as hysteresis -- the lagging of an effect behind its cause.

"The idea of hysteresis is that you go over a cliff, then find the cliff has moved," Hastings said. "Going back is harder than getting there.

"In this case, the loss of sea urchins sent the reef off the road, and now the only guardrail is the parrotfish. Our model showed that if we overfish parrotfish, and the reef goes off the cliff, we would need four

times the fish we have now to bring the reef back."

Mumby said the local authorities should act now to reduce parrotfish deaths, including changing existing policies that allow the fish to be caught in fish traps. "We also call on anyone who visits the Caribbean and sees parrotfish on a restaurant menu to voice their concern to the management," Mumby said.

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Source: UC Davis