Study highlights snowball effect of overfishing

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Florida State University researchers have spearheaded a major review of fisheries data that examines the domino effect that occurs when too many fish are harvested from one habitat.

The loss of a major species from an ecosystem can have unintended consequences because of the connections between that species and others in the system. Moreover, these changes often occur rapidly and unexpectedly, and are difficult to reverse.

"You don't realize how interdependent species are until it all unravels," said Felicia Coleman, director of the Florida State University Coastal and Marine Laboratory and a co-author on the study.

Coleman and her co-authors, led by FSU biological science Professor Joseph Travis, examined case studies of several distressed ecosystems that had been thoroughly changed over the years because of overfishing.

For example, in the Northern Benguela ecosystem off Namibia, stocks of sardine and anchovy collapsed in the 1970s from overfishing and were replaced by bearded goby and jellyfish. But the bearded goby and jellyfish are far less energy-rich than a sardine or anchovy, which meant that their populations were not an adequate food source for other sea animals in the region such as penguins, gannets and hake, which had fed on the sardines and anchovies. African penguins and Cape gannets have declined by 77 percent and 94 percent respectively. Cape hake and deep-water hake production plummeted from 725,000 metric tons in 1972, to

110,000 metric tons in 1990. And the population of Cape fur seals has fluctuated dramatically.

"When you put all these examples together, you realize there really is something important going on in the world's ecosystems," Travis said. "It's easy to write off one case study. But, when you string them all together as this paper does, I think you come away with a compelling case that tipping points are real, we've crossed them in many ecosystems, and we'll cross more of them unless we can get this problem under control."

The full study appears in the Dec. 23 issue of "Proceedings of the National Academy of Sciences. "

Travis, Coleman and their colleagues are hoping that their research will accelerate changes in how fisheries scientists approach these ecosystem problems and how fisheries managers integrate system issues into their efforts. They hope that more effort will be devoted to understanding the key linkages among species that set up tipping points in ecosystems and that managers look for data that can show when a system might be approaching its tipping point.

"It's a lot easier to back up to avoid a tipping point before you get to it than it is to find a way to return once you've crossed it," Travis said.

Fishing experts do generally understand how overfishing affects other species and the ecosystem as a whole, but it "needs to be a bigger part of the conversation and turned into action," Coleman said.

More information: Integrating the invisible fabric of nature into fisheries management, www.pnas.org/cgi/doi/10.1073/pnas.1305853111

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