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Research Ties Human Acts to Harmful Rates of Species Evolution

By [CORNELIA DEAN](#)

Human actions are increasing the rate of evolutionary change in plants and animals in ways that may hurt their long-term prospects for survival, scientists are reporting.

Hunting, commercial fishing and some conservation regulations, like minimum size limits on fish, may all work against species health.

The idea that target species evolve in response to predation is not new. For example, researchers reported several years ago that after decades of heavy fishing, Atlantic [cod](#) had evolved to reproduce at younger ages and smaller sizes.

The new findings are more sweeping. Based on an analysis of earlier studies of 29 species — mostly fish, but also a few animals and plants like bighorn sheep and ginseng — researchers from several Canadian and American universities found that rates of evolutionary change were three times higher in species subject to “harvest selection” than in other species. Writing in *The Proceedings of the National Academy of Sciences*, the [researchers say](#) the data they analyzed suggested that size at reproductive maturity in the species under pressure had shrunk in 30 years or so by 20 percent, and that organisms were reaching reproductive age about 25 percent sooner.

In Alberta, Canada, for example, where regulations limit hunters of bighorn sheep to large animals, average horn length and body mass have dropped, said Paul Paquet, a biologist at the University of Calgary who participated in the research. And as people collect ginseng in the wild, “the robustness and size of the plant is declining,” he said.

The researchers said that reproducing at a younger age and smaller size allowed organisms to leave offspring before they were caught or killed. But some evidence suggests that they may not reproduce as well, said Chris Darimont, a postdoctoral fellow in environmental studies at the University of California, Santa Cruz, who led the work. The fish they studied that are reproducing earlier “on average have far, far, far fewer eggs than those who wait an additional year and grow a few more centimeters,” he said in an interview.

Dr. Darimont said it was unknown whether traits would change back if harvesting were reduced, or how long that might take.

The researchers also noted that the pattern of loss to human predation like hunting or harvesting is opposite to what occurs in nature or even in agriculture.

Predators typically take “the newly born or the nearly dead,” Dr. Darimont said. For predators, targeting healthy adults can be dangerous, and some predator fish cannot even open their mouths wide enough to eat adult prey. Animals raised as livestock are typically slaughtered relatively young, he said, and farmers and breeders retain the most robust and fertile adults to grow their herds or flocks.

But commercial fishing nets and other gear that comply with conservation regulations typically trap large fish while letting smaller ones escape. Trophy hunters typically seek out the largest animals. And for some fish in some areas, as much as 50, 60 or even 80 percent of the stock may be caught every year.

“Targeting large, reproducing adults and taking so many of them in a population in a given year — that creates this ideal recipe for rapid trait change,” Dr. Darimont said.

Some fisheries scientists have said their studies of fish stock had not shown a correlation between fishing intensity and growth rates. And some wildlife conservationists question the idea that hunting can have harmful effects on species.

Dr. Paquet said that although he had confidence in the new findings, he knew there would be questions about the analytical methods he and his fellow researchers used. “That’s expected,” he said. “That’s how science proceeds.”

He said he had anticipated that the work would be “contentious” among trophy hunters. “Essentially, we are saying, ‘You should not do this because it is having effects even you might not like,’ ” he said.

Daniel Pauly, who directs the Fisheries Center at the University of British Columbia, said the new findings “make sense.”

Though Dr. Pauly said he had not seen the new work, he recalled similar changes in black chin tilapia, fish that live in brackish water. He said in an interview that he had studied the fish more than 30 years ago, when he was a young graduate student doing field work in Ghana.

After decades of heavy fishing, the size of the typical adult fish had shrunk to about 10 centimeters from about 15 centimeters. But at the time, he said, “I did not realize what was happening.”

Some fisheries managers are already suggesting that conservation regulations should be changed to safeguard larger fish in protected species. “Lots of people argue for that because the big ones are so fecund,” Dr. Pauly said. But he said customers in fish markets typically prefer larger fish. And if fishers are not permitted to keep the big ones, they “must catch enormous quantities of fish to have a good tonnage.”

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