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The bear necessities: Managing salmon for grizzlies and people

Sidney, British Columbia - In an article published today online in the scientific journal *PLoS Biology*, researchers at the Raincoast Conservation Foundation and the University of California Santa Cruz investigate how increasing "escapement," the number of salmon that escape fishing nets to reach spawning streams, can influence both the natural environment and long-term fishery catches.

We know that salmon can either enter a fishing net or a mouth of a grizzly bear, but can we manage fisheries for the interests of both fisheries and bears? The authors of the *PLoS Biology* article, "Using Grizzly Bears to Assess Harvest-Ecosystem Tradeoffs in Salmon Fisheries," suggest a way to do just that. Allowing more salmon to spawn in coastal streams can often benefit grizzly bears, other ecosystem recipients *and* salmon fisheries in the long term – a scenario that serves ecosystems and humans.

In cases where conflict does exist, the researchers took a novel step: they calculated how much helping bears could cost the fishing industry in lost catches. Notably, these places were on the Fraser River, where remaining grizzly bears are highly threatened.

"Salmon are extraordinarily valuable, ecologically and economically. But in many cases, if salmon fisheries are managed differently, these values need not be in conflict," said Dr. Chris Darimont, Science Director for Raincoast and postdoctoral fellow at UCSC. Darimont co-authored the article with primary author, Taal Levi, who is a UCSC PhD candidate.

The team focused on the relationship between grizzly bears and salmon. Grizzlies make an ideal research subject to determine how different levels of salmon harvest can affect the ecosystem. Levi and colleagues first determined how much salmon were available to 18 grizzly bear populations in British Columbia and what percentage of their diet was comprised of salmon.

The relationship between salmon and bears is basic: "If provided more salmon, bears consume more salmon," said Misty MacDuffee, Raincoast biologist and co-author. "And importantly, they will occur at higher densities. Letting more salmon spawn helps bears and the ecosystem when bears distribute the remains of the partially eaten fish."

When salmon are plentiful in coastal streams, bears thrive and produce more cubs. Additionally, when salmon are plentiful, bears eat less of each fish, selecting the nutrient-rich brains and eggs and casting aside the remainder. These salmon scraps feed other animals, scavengers and fertilize the land. In contrast, when salmon are scarce, bears produce fewer cubs, if any, and eat more of each fish. Less discarded salmon enters the surrounding ecosystem with fewer benefits for other life.

Levi and his co-authors argue that, in four out of six study areas, allowing more salmon to spawn will also mean more salmon in the ocean. This translates to larger harvests over the long run.

Given this obvious benefit, why are salmon not already managed this way? "When the number of salmon returning to spawn from their open ocean migration is variable, managers favour the short term benefit of harvesting some salmon each year, even if salmon are at low levels and even if they give up larger harvests in the future. If society values both bears and the fishing industry in the long run, managers should reconsider current models," said Darimont.

In the two systems where helping bears would reduce catches in the long term, the researchers estimated the potential financial cost. They looked at two salmon runs on the Fraser River, B.C., and predicted a cost of about \$500,000 to \$800,000 annually. However, the associated increase in spawners could help locally threatened grizzly bear populations or help recover lost ones.

Although the studied fisheries are certified sustainable by the Marine Stewardship Council (MSC), the research suggests the MSC principle that fisheries "have minimal ecosystem impact" might not be satisfied, given that the Fraser River fishery is likely impacting grizzly populations.

Commercial salmon fisheries often usurp 50% or more of the salmon bound for their spawning sites, the mouths of bears, and the forests they nourish. "We asked, is it enough for the ecosystem? What would happen if you increase escapement? We found that in most cases, bears, fishers, and ecosystems would all benefit," Darimont said.

The researchers conclude the same analysis can be used to evaluate fisheries around the world and help managers make more informed decisions to balance economic and ecological outcomes.

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For more information contact:

Dr. Chris Darimont
Science Director, Raincoast Conservation Foundation
(250) 589 7873 (cell)
darimont@ucsc.edu

Misty MacDuffee
Biologist and Wild Salmon Program Coordinator
(250) 818-2136 (cell)
misty@raincoast.org