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ANIMALS

Beavers on the coast are helping salmon bounce back. Here's how.

The arrival of beaver dams in the Pacific Northwest's Elwha River delta may have surprising benefits.

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Port Angeles, Wash.— On a blue-sky summer day, threatened Chinook salmon leap from the Elwha River, in northwest Washington, as they persevere upstream. Here at the river mouth, the water flows powerfully enough into the Strait of Juan de Fuca to almost knock me off my feet while standing in a side-channel, a testament to salmon's strength. Upstream, the fish will muscle through the verdant delta, cross Lower Elwha Klallam tribe land, and persist up through the waterways of the rolling green mountains of Olympic National Park. There they will lay their eggs in streams much smaller than this wide river, and their offspring will hatch in the snowmelt from the Olympic mountains.

When the young salmon begin their own journey out to sea, down the streams and across the land, they'll find a very different delta than their grandparents did. The Glines Canyon and Elwha River dams, both close to a hundred years old, were dismantled between 2011 and 2014—the largest dam removal project in history. Within months, the sediment-starved delta was restored.

Since 2014, the Elwha's delta has grown by at least 100 acres and pushed out into the strait more than 300 feet, creating new space for birds, butterflies, willow, alder, yellow-tongued monkeyflower, and lavender searocket. Threatened Chinook salmon, whose overall population has declined by 60 percent since 1984, have almost doubled in the Elwha since the dam removal. A record 9,000 salmon are expected this year, according to Patrick Crain, chief fisheries biologist at Olympic National Park.

This tidally salty wetland might seem a strange place to search for beaver, which are known to settle in freshwater ponds, lakes, rivers, and wetlands throughout North America, but that's what I had come for. The beavers' presence is remarkable not just because they're only typically found inland, but also because their ecosystem engineering is the suspected key to the remarkable Chinook salmon recovery that's going on here.

A cross-species connection

Hiking across acres of the new, windswept beach of the Elwha delta, Anne Shaffer, lead scientist and executive director for the nonprofit Coastal Watershed Institute, leads me into quiet, dense wetland. Fuzzy cattails wave in the sea breeze several feet above our heads and a stream bubbles into a pond, all part of the varied ecosystem of the delta. We soon find trails into the brush that Shaffer points out are clearly "beaver-belly shaped." In river side channels, we find both small and big beaver dams across the water, forming pools behind the rodents' handiwork.

These dam-created pools are one of numerous, well-documented ways beavers create advantages for fish. They provide havens

during times of drought. They also create slower-water habitats that host many more insect larvae—which feed fish—than fast-moving channels. Beaver lodges offer physical refuge for young fish navigating the predator-rich waters.

In near-shore areas, where tides impact the lives of all animals daily or seasonally, low-tide pool habitats created by beaver dams allow juvenile fish to seek refuge from predation, says Greg Hood, a senior research scientist at Washington's Skagit River System Cooperative, who has researched beavers there. "The pools beavers make are too shallow for diving predators like mergansers and kingfishers and bigger fish. But the pools are too deep for waders like great blue herons, and there's too much shrub around the margins, so birds with big wings can't get in there."

In his research, Hood found that pools created by beaver dams in the tidal marshland channels tripled juvenile Chinook salmon habitat compared to similar marshlands without beavers.

Despite this evidence, there has been resistance to beaver dams in salmon streams, the concern being that they might impede the salmon's ability to swim upriver—after all, the reason human-made dams have been removed is to help salmon. "Beaver dams are nothing like human-built dams though—they are lower, semi-permeable, and due to their porous construction, fish can go over or around them," says Ben Goldfarb, author of *Eager: The Surprising Secret Life of Beavers and Why They Matter*, who points out that beavers and salmon co-evolved in the same ecosystems.

The beaver balance

Deep within the Elwha wetland, Shaffer shows me how beavers create foot-deep channels by dragging branches and other dam materials back and forth, deepening the rut in the middle. This regular excavation provides cooler, deeper water, which is especially important for juvenile salmon to travel safely. "The near-shore zone waterway is a nursery habitat for salmon," she says.

How much assistance the beavers are contributing to salmon recovery is hard to measure because of the incredible flux in the delta over the past five years resulting from dam removal. But Shaffer says the beaver is one of the restoration's sentinels: "All we have to do is get out of their way and these coastal engineers will work their magic."

The beavers themselves are also a success story. Before Europeans colonized North America, beaver populations were estimated at up to 400 million; after intensive hunting for their hides to make hats and clothing—beginning in the 1630s on the East Coast and the early 1800s in the West—populations declined to around 100,000. Thanks to conservation efforts, many of which are still ongoing, beaver have recovered to a current population of about 15 million.

Since North American beavers have begun recovering from their near-decimation, they've been exploring new habitats—or at least places they haven't lived for hundreds of years.

That the sharp-toothed rodents are moving into the tidally influenced Elwha River system's streams might be a surprise to many, including biologists, because beavers are known as a freshwater-only species. But trekking through several wetland areas on the Elwha delta, I found gnawed tree trunks and willow limbs, as well as a small dam and historic beaver lodge, all within earshot of the Strait's waves. But this might not be the first time beavers have lived here.

Beavers have probably continuously lived in environments that are difficult for people to access, says Hood. Beavers in out-of-the-way places were protected from humans and other predators, so they were likely unknown—or forgotten. Hood blames "ecological amnesia" for some of our assumptions about where beavers are "supposed" to live. He found just as many beavers living in the tidal shrub marshlands at the mouth the Skagit River than in other non-tidal rivers.

"There are these remnants of pristine habitat on islands [in the river] that are hard to get to. So we still have beaver there, and I think they were common there historically," he says.

That doesn't mean beavers are suited to an ocean-dwelling lifestyle. Too much saltwater exposure can be toxic. Nonetheless, they've been anecdotally reported in estuaries on the East Coast, from Maine to the Long Island Sound. They've also been spotted

along the Oregon coast and swimming in Puget Sound, where some have taken ill and been brought to wildlife rehabilitation centers, possibly because of salt toxicity. Despite the hazards, this is likely natural behavior, as young beavers leave their home territories and strike out to find new streams or rivers, sometimes utilizing salty sounds and bays to access them, says Goldfarb.

Back at the mouth of the Elwha, Shaffer shows me how the beavers here are trying different channel locations and building techniques for their dams, looking for just the right placement in this particular ecosystem. It's this kind of adaptive flexibility to local environments that led to beaver's widespread success in North America in the past—and is key to its survival in the future. Because beavers' building naturally expands entire ecosystems, their triumphs are a boon for other animals too, including those in need of all the help they can get—like Chinook salmon.