Student Reading

How Bears Feed Salmon to the Forest

Trees Get the Table Scraps from a Fish Dinner

By Robert S. Semeniuk

Wearing night-vision goggles, Thomas E. Reimchen maneuvers our inflatable boat around rocks, deadfalls, and barnacles as we pick our way in the dark up an estuary in Canada's Pacific Northwest. In our wake we leave brilliant bursts of bioluminescence, as schools of fleeing salmon agitate unicellular algae called dinoflagellates. Why the "dinos" emit light is open to interpretation. One explanation, Reimchen tells me, is that the light attracts fish that eat zooplankton such as copepods, which are predators of the dinoflagellates.

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Bears fish for salmon in a variety of ways. This brown bear attempts to "guide" the salmon into its mouth with its paw.

A biologist at the University of Victoria in British Columbia, Reimchen specializes in predator-prey interactions. We are here to observe black bears catching spawning salmon (the bears get most of their catch in the dark). The field study is part of an investigation born more than a decade ago at Bag Harbour in the Queen Charlotte Islands. One day in 1992, as Reimchen was sitting under giant Sitka spruce trees and looking at half-eaten salmon carcasses strewn about on the forest floor, he realized that the abundance of carcasses and the abundance of giant trees adjacent to the river was probably no coincidence. Ever since that moment, he has collected evidence that the autumn return of salmon from the Pacific Ocean to the streams of their birth is much more than just the annual migration of fish. The run of salmon constitutes a major flow of marine nutrients into estuaries and coastal watersheds.

Reimchen estimates that before the expansion of commercial fishing and industrial logging in the twentieth century, when salmon were more abundant throughout coastal streams, each of the 30,000 black bears living in the salmon watershed may have caught on average 500 fish a year. If half of each carcass was left uneaten on the forest floor (a reasonable estimate), he figures the nutrient transfer into the rainforest amounted to more than 25,000 tons a year, of which 3.4 percent was nitrogen.

And salmon carcasses are by no means the only way bears spread salmon-derived nitrogen to the terrestrial ecosystem. Other field biologists, such as Grant V. Hilderbrand, formerly of the Alaska Department of Fish and Game, and his colleagues, have documented two other major means: urine and feces. Hilderbrand, who studied brown bears in Alaska, maintains that urine is particularly important. Bears consume salmon in the later summer and fall to accumulate the fat reserves they will need to hibernate-and that females will need to birth and provide milk for their cubs. Although some of the nitrogen from the salmon goes into building muscle tissue and meeting other physiological demands, the bears' fat tissue is virtually nitrogen free. Consequently, much of the nitrogen in the salmon protein is excreted. " The bottom line," Hilderbrand says, "is that if the bears leave half of each carcass in the forest, the other, eaten half also is ultimately deposited in the forest as well."

Reimchen's boat carries us out of the salty estuary and up the Klekane River into the conifer rainforest of the coastal mainland of British Columbia. After the boat has been safely tied up at the bank, Reimchen leads me and two of his coworkers, Deanna D. Mathewson, also of the University of Victoria, and Daniel R. Klinka, a graduate student of Reimchen's, along a creek into the pitch-black woods. To avoid surprising any bears, Reimchen trudges steadily forward, uttering low guttural sounds. Then, at the edge of the creek we stop and wait quietly; I scan the forest on the opposite bank.

"There is a bear downstream walking towards us," someone whispers softly. The splash of the footsteps sounds closer than the animal appears through my night-vision goggles. The bear lurches forward, crashes through the water, but misses a fish. The bear moves upstream slowly, to within perhaps fifty feet of us, and takes another lurch. Again, no catch. On its fourth try, the bear succeeds. I hear the crunch of fish skull, and the bear disappears into the forest with a big chum salmon in its mouth.

As we come to the end of our nighttime observations, Reimchen speaks about how his work feeds into the formulation of conservation policies. "People act as if they harvest the surplus, and are the only harvesters. They think that all the dead fish in the stream are wasted." But the work of Reimchen and other investigators shows that not only do salmon replenish the forest; they also revitalize streams and estuaries with carbon, nitrogen, phosphorous, and other minerals. Among salmon themselves, the circle of life is particularly intimate: nearly half of the nutrients consumed by juvenile salmon comes from their dead parents. "In ecosystems there is no surplus," says Reimchen. "Everything is used."