The first decade of a new millennium is probably a good time to step back and whisper a word of thanks for some of the natural creatures and processes that underlie life for all of us here in the Panhandle of the Forty-Ninth State. If we were to hand out accolades, one of the biggest might go to salmon—the kings, cohos, sockeyes, chums, and pinks that are one of the most important resources in our Southeast region.

The Alaska Department of Fish and Game has identified more than 14,000 streams and 1,300 lakes that support salmon runs in Alaska, and there are probably many more. Southeast has its fair share—more than 400 lakes and 5,000 river and stream systems that produce salmon.

In 2002, commercial fisheries in Southeast Alaska harvested an estimated 57 million salmon, and fishermen received more than $50 million for their catch. Sport anglers in Southeast harvested about 458,000 salmon. Another 66,000 salmon were taken in Southeast for subsistence and personal use.

But salmon do more for us than provide food and income. According to a publication from the Pacific Northwest Research Station of the USDA Forest Service (“Fish and Forest: Ecological Links Between Water and
Land"), researchers are discovering a great deal about the way salmon knit together the ocean, fresh water, and the land. They distribute nutrients, promote the health and reproduction of other species, influence the winter survival of birds, mammals, and fish, and even affect vegetation along stream banks and in the forest.

Salmon not only feed saltwater species such as seabirds, seals, sea lions, porpoises, and orcas. More than 40 different species of animals forage on salmon in Southeast’s fresh waters as well. They eat salmon eggs, juvenile fish, and live adult salmon or their carcasses.

American dippers, several species of gulls, rainbow and cutthroat trout, and Dolly Varden feed on the eggs released into streams and lakes by spawning salmon, but it took Alaskans a while to understand that. In the 1920s to ’40s, for example, Dolly Varden were condemned as pernicious predators on salmon young and eggs, and for nearly 20 years the U.S. Bureau of Fisheries offered bounties of between two-and-a-half and five cents for Dolly Varden tails from Alaska streams. Since then, studies have shown that removing the Dollies did not benefit salmon populations. Instead we learned the Dollies may perform an important service.

When spawning salmon deposit their millions of eggs in stream bottoms, certain numbers of eggs always break free and drift away. Eggs deposited by early spawners also can be disturbed and washed free by later spawners. And during the critical months that eggs are incubating, storms and floods often wash great numbers of eggs out of the gravel where they’d been deposited.

Drifting eggs will not hatch, and when they die they can develop a fungus called *Saprolegnia* that can infect healthy salmon eggs in the gravel. Egg scavengers such as Dolly Varden, gulls, and sculpins help use an otherwise “wasted” resource and undoubtedly help prevent disease from infecting live eggs and killing them.

Fish-eating mergansers, kingfishers, and terns often nest in areas where they can feed on young salmon that have not yet gone to sea. Juvenile fish such as two-inch-long coho
salmon provide highly nutritious meals for these birds and their hungry chicks.

Bald eagles, bears, mink, and river otters feed on adult salmon and their carcasses when the adults return to Southeast rivers, streams, and lakes to spawn and then die. What's more, researchers are finding that the seasonal timing of the salmon runs is critical to the well-being and reproductive success of many animals.

Salmon return to their natal streams in late summer and fall—the time of year when bears must lay on fat to carry them through six or more months of winter hibernation. Female bears especially need to gain sufficient weight in order to reproduce and produce milk if cubs are born in the winter den. Hordes of returning salmon are a primary source of high quality food, especially in the fat-rich eggs and brains that bears selectively eat when they capture live salmon or scavenge carcasses.

Returning salmon also attract crowds of gulls and sometimes hundreds of bald eagles along a single stretch of river. Young bald eagles leave their nests at about the same time that pink salmon return to spawn in August, and the carcasses of salmon provide the immature birds with easily acquired food at a time when they are just learning to forage for themselves.

Along the Chilkat River a late fall run of chum salmon feeds thousands of eagles when food elsewhere is in short supply.

One of us experienced the importance of spawning salmon to mink at her cabin on Admiralty Island one September. When the pungent odor of dead fish prompted an inspection of the crawl space beneath the cabin, she excavated four and a half pink salmon carcasses that a mink had apparently dragged up from the beach and stashed in preparation for a delayed banquet.

A study in the Canadian Journal of Zoology suggests that mink have delayed the timing of their breeding cycle so that females are lactating (a time of especially high energy cost) when salmon carcasses are available.

Arctic terns often feed juvenile coho salmon to their young.
In 1998, three ecologists from the Juneau Forestry Sciences Laboratory—Mary Willson, Scott Gende, and Brian Marston—described these and other important ways in which spawning salmon (and other seasonally spawning fish such as eulachon, Pacific herring, and sand lance) are important to the health and productivity of streams, lakes, and forests and the many species of wildlife that inhabit them.

Because salmon die when they spawn, they provide a tremendous influx of nutrients to spawning streams. The authors wrote:

Their carcasses accumulate in streams, where they are stranded in the shallows or caught on logs and rocks, or along lakehores. A rich community of algae, fungi, and bacteria develops on the carcasses, and populations of invertebrates increase. These invertebrates then serve as food for fish in the stream, including juvenile salmon.

Stream invertebrates include mayflies, caddisflies, and stoneflies.

The three ecologists also described what they call ‘the potential fertilizer effects of salmon carcasses on land’:

Bears and other carnivores commonly haul salmon, living or dead, onto stream banks and back into the forest. Eagles sometimes move carcasses to the streamside, and ravens and crows cache salmon bits in trees and under grass and rocks. Decomposers then break down incompletely consumed carcasses and digested remains of fish in feces of vertebrate consumers.

In this way, nutrients from the sea pass from the bodies of salmon into the soil, near-stream vegetation, and animals within the forest.

Research results suggest that bird populations are denser on streams with salmon runs, and studies using isotopes as markers have traced nutrients from the bodies of dead salmon into the ecosystems along rivers. One study on the Snoqualmie River in Washington state found that salmon provided 18 percent of the nitrogen in streamside trees, 25 to 30 percent of the nitrogen and carbon found in insects, and 25 to 40 percent of the nitrogen and carbon in young salmon, which feed on the insects.

A study of phosphorus released from sockeye and pink salmon in the Karluk Lake system in southcentral Alaska measured amounts equivalent to the recommended application of a standard commercial fertilizer to evergreens and trees.
As the Juneau ecologists note, because nitrogen and phosphorus are often in short supply in Southeast environments, the addition of even small amounts of them can have large effects on productivity.

If salmon are even deeper at the heart of the Southeast landscape than we thought, and if quantities of fish and the timing of their arrival in spawning streams influence not only human harvests but the functioning of wildlife communities and the forest itself, people in Southeast Alaska have even more to consider in balancing decisions about fish, wildlife, and land uses. We are only beginning to understand the gifts of salmon that are integral to our lives here, it seems.

When we talked with Willson about what she and her colleagues found during their research, she said:

“It’s a whole network of interactions that ties land and sea together. Alaska may be the one place—other than Eastern Russia—where this reciprocal interchange between water and land is still happening on a large scale. It really enriches a walk through the woods to know about things like this—and to speculate about others.”

Pioneers

The gifts of salmon are expanding! While environmental problems are driving wild salmon runs to extinction in the Pacific Northwest, new salmon runs are being created naturally in Alaska as glaciers retreat.

In Glacier Bay, scientists estimate more than 300 new streams have been formed within the last 200 years. About 60 percent of them are now believed to have salmon runs.

Mendenhall Lake, in front of Juneau’s Mendenhall Glacier, did not exist 100 years ago when the glacier extended as much as two miles beyond its present location. Today the lake has populations of coho and sockeye salmon, and Steep Creek, which flows into the lake, has an impressive sockeye run.

According to Discovery Southeast naturalist Richard Carstensen, Steep Creek did not reach its present outlet on freshly deglaciated Mendenhall Lake until about 1955. It was probably sometime after that that sockeye salmon first colonized the area.

Nugget Creek falls, shown in the photo above, have recently been exposed by the retreat of Mendenhall Glacier.