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Ripple Marks

The Story Behind the Story

BY CHERYL LYN DYBAS

Ends of the Earth Ruled by Bears—and Salmon

The ends of the Earth.

They're ruled by salmon and bears, or bears and salmon.

The line where one begins and the other ends on Russia's Kamchatka Peninsula have flowed together, says John Paczkowski, Kamchatka field coordinator for the Wildlife Conservation Society (WCS) and an ecologist at Alberta Parks in Canada.

"That's especially true in late summer and early fall, when salmon migrate upstream to spawn by the thousands," says Paczkowski, "with just as many brown bears awaiting their arrival."

On Kamchatka, a 1,250-kilometer-long peninsula in the Russian Far East and one of the most remote places on the planet, spawning pink, sockeye, coho, chum, king, and cherry salmon fill the rivers to bursting beginning in June. By August and into September, one can almost walk on water: the rivers are so thick with salmon the fish form a bridge from one side to the other.

"Kamchatka has some of the best brown bear—and salmon—habitat in the world," says Paczkowski. Data from GPS-collared bears in a WCS study show that the bears will lumber up to 65 kilometers per hour and cross Kamchatka's central mountain range to find salmon runs.

Then, it's a free-for-all of bears and salmon, or salmon and bears. Kamchatka's coastal rivers become a sea of pinkish-red: salmon fighting their way upstream; open-mouthed bears standing on rocks in the river; and blood-stained droplets of water spraying everywhere as bears feast on fish.

The Kamchatka peninsula was once completely populated with brown bears, says Paczkowski. In remote protected areas it's still home to the highest density of brown bears on Earth.

But the ends of the Earth are no longer inaccessible. Increasing human access along roads constructed for mining is fragmenting the bear population.

Brown bear estimates for the Kamchatka peninsula range from 10,000–14,000 bears. Bear counts for the region, however, are based largely on the observations of hunters and forest workers and, says Paczkowski, are scientifically questionable. "More than a decade has passed since the last aerial bear survey of the region. We need to change that."

Female brown bears on Kamchatka may reproduce as early as four years of age, and usually have litters of two or three cubs. Some female bears with young avoid salmon streams to lessen the possibility of their cubs being killed by a bear in hot pursuit of fish. Then they're forced to survive on less-rich food sources, however.

Gaining enough weight to survive the long, cold Russian winters is crucial for female brown bears and their offspring, Paczkowski has found. "Pregnant bears that enter dens poorly nourished often can't reach full term."

Males are just as dependent on salmon. Their size is related to their social status—and access to food. For bears, salmon = finding mates = reproduction.

In areas smack in the middle of salmon runs, brown bears may maintain home ranges as small as 12 square kilometers. In areas where salmon are scarce, however, home ranges are as large as 1,100 square kilometers, requiring bears to expend more energy in search of meals.

On the rare but increasing occasions when salmon meets bear meets human along a Kamchatka river, who wins? "In such sudden encounters," says Igor Revenko of the Kamchatka Ecology and Environmental

Whether in the Russian Far East or along the Alaskan coast, bears and salmon go together like salt and pepper. The arrival of salmon season ignites a spawning and eating frenzy on both sides of the Pacific Ocean. Pictured here is the feast in Alaska. *Photos courtesy of Ilya Raskin*

Institute in Vladivostok, Russia, "bears rarely demonstrate threatening behavior."

On two occasions, however, Revenko was attacked by a bear. Both were near-misses, and happened along riverbanks during spawning season, one in September 1985, the other in September 1988. "The first time, an aggressive bear jumped out of the brush," he remembers, "but it didn't detect me because of the noise made by the rushing river."

In the second instance, a female was defending young. "The cub ran away," Revenko says, "but the mother came out of the trees and knocked me down, destroying my backpack before walking away. I played dead. Maybe it saved my life."

Perhaps the bears have had enough of interloping *Homo sapiens*. Exploitation of Kamchatka's mineral resources has allowed salmon poachers to get to areas of the peninsula once too remote, "leaving in their wake," says Paczkowski, "streams devoid of salmon and therefore bears."

In salmon season 2008, 30 "hungry bears" attacked and ate two workers at a platinum mining compound on Kamchatka. The remaining geologists holed up in buildings, too afraid to venture out.

It was a case of bears without salmon. A salmon shortage may have driven the bears to aggression as they sought out food near human settlements.

"Many Kamchatkans, even trained biologists and wildlife managers, have a strong fear of bears," says Paczkowski, "and the people of Kamchatka have little access to ecological information about the bears." WCS is working to distribute brown bear education materials to schools throughout Kamchatka, and to foster one of Russia's first interagency working groups.

Based on the successful management of grizzly bears in Yellowstone and Canada, WCS and the World Wildlife Fund (WWF)-Kamchatka are directing the Brown Bear Working Group. Members are from all branches of government and levels of industry. "The group is one of the brightest hopes for effective change in Kamchatka bear conservation," says Paczkowski.

With luck, that new direction will happen in time for a region with rivers turned pink with salmon—and brown with bears.

No Rest for the Weary: Kamchatka's Salmon Also Threatened at Sea

Before they start their difficult journey up rivers and streams to spawn, Kamchatka's salmon must elude ships lined up off the peninsula's coast. The boats stand at the ready, poised to scoop up the salmon in thousands of kilometers of driftnets.

"Hauling in driftnets," says Konstantin Zgurovsky, Marine Programs Coordinator for WWF-Russia, "brings prized salmon. But less-valuable salmon species are discarded. The impact of this type of fishing, and net sizes that have continued to increase, is being felt throughout the marine ecosystem." That's especially true off Kamchatka. This open-water driftnet fishery, more than any other, results in large-scale seabird and marine mammal mortality.

Russia is currently the only nation where large-scale commercial driftnet fishing is conducted by ships of another country, in this case Japan, says Zgurovsky.

Japan has a long history of driftnet fisheries in the region, according to the World Wildlife Fund (WWF)-Russia report, *The Driftnet Fishery for Salmon in the Pacific and its Influence on the Marine Ecosystem.* The report will soon be followed by a companion volume on the effect of driftnets on seabirds and marine mammals.

The Russian-Japanese Convention of 1867 granted citizens of both nations equal fishing rights, including the right to fish anadromous stocks like salmon off the Sakhalin coast. In 1885, the Russian government allowed the Japanese to fish in the Nikolaevsk-on-Amur region, and in 1899 off the Kamchatka coast. In 1908, the Russian-Japanese Convention on Fishing was signed.

"From that time," says Zgurovsky, "Japanese fishing vessels acquired large salmon fishing rights in Kamchatka and Sakhalin waters." Japanese ships now vie for the right to work in the eastern Kamchatka region, the best area for sockeye, or red, salmon.

In the early 1990s, Russia, which previously did not allow driftnetting by its own citizens, approved limited use of driftnets to conduct scientific research. The total annual quota for research, as cited in the report, was at the time 6.4 thousand tons of salmon, and was allotted to 16 Russian vessels. However, Russian scientific driftnet harvests have long since exceeded research quantities, many believe. In 1998, Russia officially reaffirmed that it would not participate in commercial driftnetting, but was silent on its sale of such fishing rights to Japan.

This year, the situation changed; Russian commercial driftnetting started for the first time, says Zgurovsky. "Before 2010, it was similar to the Japanese scientific whaling taking place in Antarctic waters."

Due to the selective nature of driftnet fishing, the large, older fish are harvested; the population structure is becoming younger. Species like sockeye are favored over pink and chum salmon, which are simply discarded when caught, among the biggest problems.

If driftnet fishing continues off Russia, the report recommends that the requirements include stricter limitations on the lengths of driftnets (not more than 2.5 km), and that the nets should be set close to shore. The presence of trained—and independent from shipowners—observers onboard vessels should be mandatory.

For now, the human winners in this high-seas, high-stakes fishery are the driftnetters. The losers: coastal Kamchatka fishers, who catch salmon using economically and ecologically sound gear—with fishtraps, for example. "They are trying to find ways," says Zgurovsky, "to avoid the kilometers and kilometers of driftnets blocking salmon from reaching spawning rivers."

The ultimate losers are the seabirds and marine mammals caught in driftnets—and the salmon themselves, which must run a gauntlet to reach their spawning grounds, starting far offshore in the Pacific.

Driftnets are all-encompassing, scooping up the intended salmon—and everything else in their paths. Orcas, seals, and waterbirds are but some of the animals that have experienced high mortalities from these kilometers-long nets. *Photos courtesy of Yuri Artukhin*

Last of an Inland Salmon: "Coaster" Brook Trout Still Cruise Lake Superior Shores

The ancestors of today's salmon were lake-dwellers, paleontologists believe. Fossils of the earliest salmon are found in the fine-grained sediments of fresh waters.

By the late Miocene, some 10 to 15 million years ago, salmon fossils appear in coarse gravel, suggesting that the fish had expanded their range out of lakes and into rivers.

Somewhere in that eons-ago time, an ancient member of the salmon family—an anadromous, lake-dwelling form of brook trout known as the coaster—began its reign in Lake Superior.

Coasters live part of their lives in the lake, then head upstream in fall to spawn. Named for their propensity to cruise along the shoreline, coasters were a valuable sport and food fish as far back as early settlement days, says Seth Moore, director of biology for the Grand Portage Band of the Ojibwe in Grand Portage, Minnesota, and an expert on coasters.

Before the Europeans arrived, says Moore, "these beautiful fish were abundant in Lake Superior's tributaries and along its shoreline. But extensive logging in the late nineteenth century destroyed a lot of coaster habitat with infiltration of sediment. Overfishing and the invasion of the sea lamprey didn't help."

The coaster population eventually collapsed.

Remnants of the original coaster brook trout population still remain, however, in the lake's cold, clear waters.

Like coho salmon, brook trout spawn only in streams where springs burble up through gravel, hence their scientific name *Salvelinus fontinalis*, or "little salmon that lives in springs." The low number of such tributaries along Lake Superior makes bringing back the coaster a tall order.

Not so tall, however, that Moore and Grand Portage Band biologists Jim Dahl and Roger Deschampe aren't up to the task. In 1992, the Grand Portage Band started stocking coaster fry in reservation streams. Today, in what some have hailed as the most dramatic coaster success in the United States, adult fish have returned to their natal streams to spawn.

Moore's efforts to expand the population continue. It's still a leap, though, to match the world record for a landed coaster brook trout: 14 pounds, 8 ounces, caught in Ontario, Canada, in 1916. The Minnesota state record for a coaster is six pounds, 5.6 ounces, from the Pigeon River in 2000.

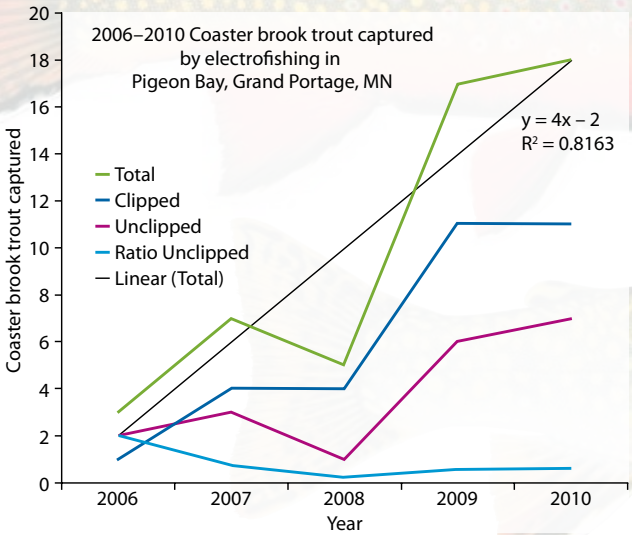
The Pigeon River, which flows along the US-Canada border and curves through the Grand Portage Reservation, drains a watershed of some 610 square miles (1680 square kilometers). It has a steep gradient, dropping more than 950 feet (290 m) during its 100-mile (161-km) flow to Lake Superior. In its final 20 miles (32 km), the river plummets down two high falls that block upstream fish migration. Beyond the falls, the lower Pigeon River and nearby Hollow Rock and Grand Portage Creeks are being stocked with coaster fry.

"Our goal is to establish self-sustaining populations of coasters in these three streams," says Moore, "as well as in the near-shore shoals of Lake Superior."

The Grand Portage Band stocks tens of thousands of coaster brook trout every year, many now reared at its own cold-water hatchery, which began operation in 2007. Moore conducts spring and fall electrofishing surveys in the three rivers. "Every season our numbers have gone up," he says.

Since 2006, coasters in Pigeon Bay, where the Pigeon River meets Lake Superior, have increased 75% each year.

If the trend continues, the words of fly-fisher Robert Barnwell Roosevelt, spoken in 1865, may once again hold true for Lake Superior's coaster brook trout: "Every river swarms with them, every bay is a reservoir of these magnificent fish."



Trout paintings courtesy of Joseph R. Tomelleri, co-author with Tom Dickson of The Great Minnesota Fish Book, *published in 2008 by the University of Minnesota Press. Graph courtesy of Seth Moore.*

Salmon Strongholds: Protecting the Piscine Wealth of the North Pacific

North America's John Day, Rogue, and Elk. Russia's Zhupanova, Opala, Kol, and Kekhta. Japan's Shiretoko and Sarufutsu.

These and other rivers are home to the last, best North Pacific salmon populations, according to scientists at the Wild Salmon Center, a nonprofit organization headquartered in Portland, Oregon.

The Wild Salmon Center's mission is to conserve salmon-laden rivers while they still fare well, says Mark Trenholm, the center's director of North American programs. "Salmon conservation efforts have focused on recovery of degraded watersheds and threatened species. But recovery efforts, while critical, are not enough, and often come too late."

The odds that salmon will survive over the long term, he says, depend on our ability to protect the North Pacific's healthiest watersheds—centers of abundance and genetic diversity. "These special rivers are what we call 'salmon strongholds.'"

The Wild Salmon Center hopes to conserve a network of such salmon strongholds, from headwaters to ocean, stretching from California to Alaska, from the Russian Far East to the Sea of Japan. "These rivers have the potential to sustain more than half the planet's wild Pacific salmon," says Trenholm.

Strong wild salmon populations reflect the health and vitality of our ecosystems and economies, says Brian Caoutte, sustainable fisheries manager for the Wild Salmon Center. "When we invest in salmon, the ecological benefits are not only abundant wild salmon populations, but clean water, healthy forests, a sustainable food source, biodiversity, and the cultural and economic strength of communities across the Pacific Rim."

Salmon migrations account for the largest transfer of nutrients among marine, freshwater, and terrestrial ecosystems on Earth, says Peter Rand, a senior conservation biologist at the center. "Hundreds of species, from brown bears to orca whales to macroinvertebrates, depend on salmon. Trees and other plants benefit from the marine-derived nutrients salmon provide."

Economically, Pacific salmon generate more than three billion dollars in income each year, and provide communities throughout the North Pacific with tens of thousands of jobs. In the coastal villages of Alaska, British Columbia, and Kamchatka, for example, "salmon are the primary source of subsistence," says Caoutte.

The center is working with state, federal, tribal, and nongovernmental organization biologists to assess wild salmon based on population abundance, life history diversity, and percent natural origin (a measure of hatchery influence). To date, the scientists have reviewed more than 500 wild salmon populations.

They hope to prevent what former Oregon governor John Kitzhaber and former EPA director William Ruckelshaus call the collapse of salmon stocks. In an editorial in the *Seattle Times* in June 2008, Kitzhaber and Ruckelshaus wrote that "to address these declines, we've focused on the important work of repairing damaged river systems, and recovering threatened or endangered wild salmon stocks. However, more work must be done. It's also vital to maintain the long-term integrity and productivity of our healthiest wild salmon rivers."

Wild Pacific salmon have proven remarkably resilient to natural calamities, Kitzhaber and Ruckelshaus stated, "surviving an ice

TOP. Wild Salmon Center Conservation Geographer Christina Friedle, Frying Pan Lake, Alaska. *Photo courtesy of Wild Salmon Center*
MIDDLE. Bristol Bay, Alaska. *Photo courtesy of Ben Knight*
BOTTOM/BACKGROUND. Sockeye salmon, Bristol Bay, Alaska. *Photo courtesy of Ben Knight*

age, volcanic eruptions, and large-scale ecosystem changes. By protecting the best remaining salmon ecosystems throughout their range, wild salmon will not only survive, but thrive, for generations to come."

Toward that end, the Wild Salmon Center is backing the Pacific Salmon Stronghold Conservation Act of 2009 (S. 817; H.R. 2055). "We hope it will establish a new US policy recognizing the need for conservation of salmon strongholds as a complement to recovery of federally listed [under the US Endangered Species Act] salmon populations," says Trenholm. It would create a grant program to support conservation efforts in healthy wild salmon ecosystems in Washington, Oregon, Idaho, California, and Alaska. On June 9, 2010, the US Senate Commerce Committee passed the legislation by unanimous consent, with no amendments offered.

Native American tribes call salmon "lightning following one another"—silver fish flashing through fast-running waters.

Piscine lightning will only arc across swift Pacific waterways as long as rivers flow freely to the sea.

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