Spring Chinook

First Salmon, Last Chance

4 PART SERIES

WILD SALMON CENTER

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Of all ocean-going Pacific salmon, spring Chinook are the first to return to freshwater each year.

They arrive in their home rivers as early as March, holding in their flesh energy reserves that allow them to fast for months before spawning.

This remarkable behavior stems from spring Chinook's unique genetic coding, which has survived for millions of years despite ice ages and floods, competition and predation. By hopscotching up river systems still swollen by meltwater and rain, spring Chinook travel into a watershed's highest reaches.

These early returners are the beating heart of complex food webs that sustain species like the Salish Sea's resident orcas and center salmon communities like the Yurok and Karuk people of Northern California. In the Pacific Northwest, spring Chinook transcend the iconic. They are our identity. And after 150 years of increasing, unprecedented threats, they are on the brink of extinction.

How we got here is a complicated story, full of dramatic roadblocks and scientific discoveries, hard realizations and reasons to hope. That's the story we explore below in *First Salmon, Last Chance*—our four-part investigation into what makes spring Chinook so special, and what it will take to save them, before it's too late.

KEY

PART 1

The Urgency of Now

A small group of scientists is unlocking the mysteries of spring Chinook—right as the species nears extinction. Can we still save a fish critical to the Northwest's future?

An estuary mixes with the Pacific, its channels braided in deep green, dun, and cobalt blue. In a long, glassy tail-out, one pool looks alive—churning and flashing silver in the bright May sun, drawing in curious cormorants, gulls, and a few still-distant seals.

These are spring Chinook, and they seem to be playing: slicing v-wakes, rolling purple-gray backs onto iridescent sides. The salmon move through the water with muscle, strong from years of marine forage. They weave like music, in no apparent hurry to start their final journey.

Perhaps they should. For millennia, spring Chinook returned in staggering numbers to rivers from central California north to the Fraser in British Columbia. Their inscrutable behavior—arriving early in the year and holding in freshwater till fall spawning—is part of a bold and unique survival strategy. Success depends on their ability to climb high in river systems, claiming distant spawning grounds unavailable to later salmon. This gamble takes time and energy, so spring Chinook return from the ocean plump enough to fast for months. To the Indigenous salmon people of the West Coast, this dazzling fish means everything: new life, health, vital sustenance, the annual physical and spiritual renewal of the world.


John McMillan

> *The inscrutable behavior of spring Chinook—arriving early in the year and holding in freshwater till fall spawning—is part of a bold and unique survival strategy.*

But not all humans living here have shown similar respect. More than 150 years after western contact, the pristine Chinook strongholds of the past are unrecognizable: dammed, ditched, and straightened, overfished and scarred by mining, made volatile and hot by deforestation. To complete their journey, these ancient, hardy travelers—whose ancestors survived ice ages and landslides, predators and floods—must now survive us.

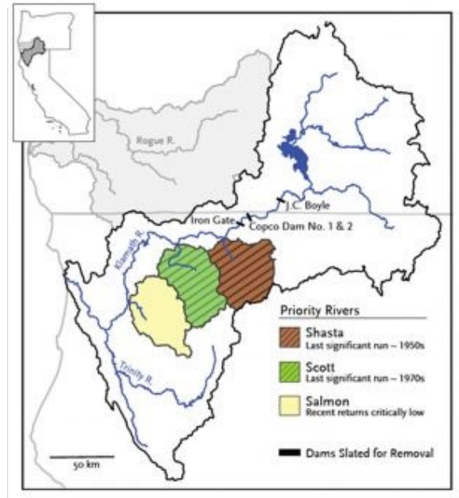
We're proving an existential threat. In recent decades, scientists and salmon managers have tracked a precipitous decline in spring Chinook runs across their range. In California's Shasta River, once a salmon stronghold, spring Chinook have been functionally extinct for decades. In the upper Columbia, they're driving a heated debate over hydropower dam removal. And in the Fraser, dwindling spring runs are linked to the heartbreaking starvation of coastal Southern Resident orcas.

In these dark days for spring Chinook, there is fresh hope: on the Klamath River, where springers still run, four massive dams are slated for removal. Here, Tribes and scientists are fighting to make sure we're not too late. The alternative is shattering: will we be the last humans to live with the first salmon?

9 a.m. on a storm-threatening morning in late July. Amy Fingerle stands knee-deep in the upper Salmon River, a tributary of northern California's remote Klamath River. She's heard people say that spring Chinook here once outnumbered all other salmon, but that's hard to prove without official records. None really existed until at least the 1960s—and none good, she stresses, until the 1990s, when the Salmon River Restoration Council began coordinating its annual fish dives.

Fingerle would know; for several years she helped run the dives. Now a doctoral student at UC-Berkeley, she's returned for the 2020 counts, this time as an expert volunteer. Spring Chinook are her passion, and she feels personally invested in their success.

Now, snorkeled and snug in her wetsuit, Fingerle wades to one side of the river and waves at her survey partner across the main channel. Today the pair will walk, swim, and stumble their way five miles down this canyon-walled river stretch, surveying for returning spring Chinook.



Several dams are scheduled to be removed in the upper Klamath above the Shasta, Scott, and Salmon Rivers, where spring Chinook runs were once abundant. (PC: Salmon River Restoration Council)


Will Harling, courtesy of Mid Klamath Watershed Council

It's the final day of the three-day dive, and Fingerle is excited; she worked this stretch last year and still remembers exactly where she saw each of the 11 fish she counted. Not many, she admits, but Fingerle reminds herself that if she sees even one springer—as fish folk call them—then maybe her fellow surveyors upriver and down are spotting more.

Two miles without sightings, and she remains stoic. Then hopeful: the pair is approaching a stretch of deep pools and the cool, aerated confluence of Knownothing Creek—all excellent habitat for spring Chinook riding out the summer heat.

"I saw several here last year," Fingerle says, recalling that moment. "The best part was that I was with someone new to the survey, and I got to watch her face light up—that's one of the true joys of doing this work."

She remembers being a bit chilly in her wetsuit then, but now, as she snorkels slowly by the creek confluence, she realizes she's far too warm. At these temperatures, fish struggle to breathe; they also burn too quickly through precious energy reserves, and are more vulnerable to disease. If they were here, they've fled; one after another, the pools are empty.

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Tamping down a growing unease, Fingerle presses on through the last mile. Water turbidity increases, making it hard to see, but now, more than ever, Fingerle and her partner are determined not to miss a single flash of bright silver. Their concentration is acute, even grim. And then, with the midafternoon sun riding high above them, a distant bridge becomes visible on the horizon—the endpoint of their survey stretch.

"That's when I started feeling panicky," Fingerle says later. "We'd seen mergansers, bald eagles, even a steelhead. I told my partner to go ahead; if there were any springers to be observed, this would be the place, and I wanted him to have that experience."

None. Defeated, the pair exited the river, wrote zeroes on their survey sheet, and reported back to survey headquarters. They were the first team to return.

"I had to hope that the fish had just gone higher in the watershed," Fingerle says. "I had to hope that if the water was too warm downstream, they'd moved upstream."

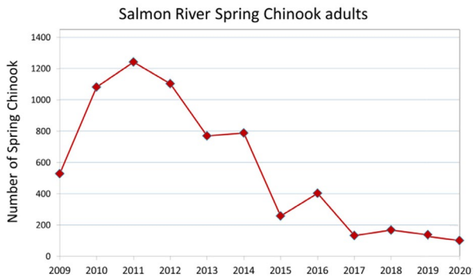
The next day, Fingerle heard the final total count for the 2020 Salmon River spring Chinook dive: **just 106 spring Chinook across 83 river miles**. The tally marks a staggering population decline in a river that saw more than 1,500 spring Chinook as recently as 2011—a number that itself represents a mere drop in the historical bucket.


Amy Fingerle on a recent spawning survey for fall Chinook–spring Chinook's later-migrating and more populous cousin–on the Salmon River. (PC: Deja Malone-Persha)

> *At these levels the risk of extinction becomes very real. You can feel it.*

For the fourth straight year, the annual dive had tallied fewer than 400 fish. At these levels, says Wild Salmon Center Science Director Dr. Matt Sloat, the risk of extinction becomes very real. You can feel it. Weeks after the dive, Fingerle fell into a deep, confusing depression. It took help from her friend Jason Reed, a Hoopa tribal member of Karuk and Yurok descent, to trace that funk back to her springerless swim.

Just 106 fish—and yet Klamath and Trinity River spring Chinook aren't listed under the Endangered Species Act, as some runs are in the upper Columbia and California's Central Valley.



On California's Salmon River, spring Chinook are in alarming decline, culminating in a four-year historic trough in returning salmon counted in annual dives. (PC: Salmon River Restoration Council)

Dr. Matt Sloat conducting fish surveys on Oregon Coast. (PC: Brian Kelley)

Matt Sloat ponders this reality from his home office in Corvallis, Oregon, between fielding calls from colleagues and "help" from his fish-crazed six-year-old daughter. In his own early years, Wild Salmon Center's senior fisheries scientist spent summers at a family cabin on the Trinity, fishing from Junction City downstream to Weitchpec. Now, he's casting for hope that its salmon and steelhead will survive to dodge his grandchildren's fishing rods.

> *"The situation on these rivers is dire. Yet it's been hard to get anyone's attention.*

"The situation on these rivers is dire," he says. "The annual dive counts seem to be chronicling a species nearing the brink. Yet it's been hard to get anyone's attention."

One problem, he says, is that it's tricky to compare today's salmon runs with the past. Oral histories, photos, and personal accounts from the early 20th century imply that 20-pound springers returned to the Klamath and Trinity in huge numbers. But the records to prove it are scarce. So salmon managers and policymakers set baselines from more recent data: runs already vastly dwindled, or even vanished.

"Springers are essentially gone from the Shasta and Scott, where they once numbered in the thousands," says Dr. Sloat. "In the South Fork of the Trinity, springer returns were close to 10,000 fish in the early 1960s. And this year they counted what, maybe 11 fish? We've got to recognize the magnitude of what's already been lost, or we won't meet the urgency of this moment."

Another problem, says Dr. Sloat, is how long it's taken western science to distinguish springers from larger fall Chinook runs. To the Karuk and Yurok Tribes, who have fished the Klamath for millennia, spring Chinook have always been their own, distinct animal. But federal and regional agencies often lump the two cousins in the same management schemes, muddying both the specifics and seriousness of springers' decline.

"Because spring Chinook arrive early, they can hopscotch up rivers in hot months," says Dr. Sloat. "Early return is their only competitive edge over other salmon, who've got just one shot to reach their spawning grounds. Springers lose that advantage the minute that fall Chinook can spawn with them—or worse, replace their run wholesale."

Now, scientific breakthroughs are unlocking the secrets of this amazing fish, and powerful, grassroots efforts are reasserting Indigenous knowledge in how we manage salmon rivers. From the Rogue River to Puget Sound, this new way of thinking is amplifying efforts to reopen and restore the upper river reaches that springers need. On the Klamath, it's driving a high-stakes campaign to recover spring Chinook while there's still time. Without spring Chinook, say the campaigners, the long-promised teardown of four dams on the California-Oregon border—the largest dam removal in history—will be a hollow victory.

Salmon River Chinook. (PC: Scott Harding)

"The science is finally clear on this: if you lose a spring Chinook run, it's gone for good," says Dr Sloat. "We're running out of time for the Klamath and many other rivers."

Those 106 Salmon River springers need our help, and fast. ■

Leaping Chinook. (PC: Will Harling, Mid Klamath Watershed Council)

PART II

If the Dams Fall

On Northern California's Klamath River, dams have brought spring Chinook to the brink. To save the species, Indigenous knowledge is key.

As a child, Charley Reed and his five brothers watched their father fish near their home on the Klamath River. Ron Reed, Sr., a Karuk ceremonial leader and cultural ecologist, balanced on slick rocks, working a traditional dip net—10-foot twin poles strung with a handmade net—through the pool below **Ishi Pishi Falls, the Karuk people's community fishery, a place they consider to be the center of the world.**

If the senior Reed caught a Chinook, he pulled the net toward one of his older boys, who clubbed the salmon, fast. The younger ones, next, sacked the fish and set it aside; later, they were responsible for carrying out the day's catch across the backwaters for cleaning and sharing with elders and families. This process wove fishing with childhood rites of passage, family life, and community values like reciprocity and hard work.

For the Karuk, Yurok, and Hoopa people of Northern California's Klamath and Trinity rivers, salmon fishing traditions have been passed down for countless generations. Each year, this starts with the arrival of spring-run Chinook, the first salmon, prized above all. "Traditionally, we wait for the return of the first spring Chinook salmon to begin the First Salmon Ceremony, the first World Renewal ceremony," says Reed, 25, now a graduate student at Humboldt State (and new father himself). "But the decline in spring Chinook returns makes this tradition hard to keep alive."

Charley Reed fulfilling his clubber duties during 2016 Chinook fishing at Ishi Pishi Falls, the Karuk Tribe's inherited community fishery on the Klamath River. Here, Reed transfers dip net poles to the next hole for his fisherman (and father) Ron Reed, Sr. (PC: Noel DiBenedetto)

Reed, a Hoopa Valley Tribal member, Karuk cultural practitioner, and descendent of the Yurok people, says life lived alongside spring Chinook is a nonnegotiable part of being a river person. **But for more than 150 years, key decisions impacting Klamath salmon runs—from destructive western mining and land use practices to the construction of massive dams—have been made by far-away state, federal, and private interests, largely without input from the Tribes.** For the Karuk, these impacts stem from the federal government's failure to ratify its own treaty with the Tribe in the early 1850s, precipitating a systemic denial of access to hunt, gather, and fish, and to manage their own watersheds, firesheds, and foodsheds.

Now, with the Klamath's spring Chinook runs in a tailspin, the Karuk are part of a national campaign **fighting to remove four upper Klamath dams—dams that, for a full century, have blocked springers from hundreds of miles of critical habitat.** But that dam removal process, codified in a 2016 agreement and supported by government entities including the states of Oregon and California, has stalled out in a series of procedural curveballs and delays.

"This is the last chance for a species that's about to go extinct," says Reed. "**Dam removal is one hopeful thing, and it's at a standstill. Yet another faulty promise. It's triggering, and it's unacceptable.** Tribal communities need to consistently be in this process. Protection needs to be secured for all time."

Ron Reed, Sr., (top) casts in while his son Jason Reed, waits with a second dip net in case a salmon evades his father's cast. According to Charley Reed, Jason's brother, "double dipping" isn't a fishing strategy that was commonly employed by the Karuk, but in the case of declining salmon runs on the Klamath River, maximizing probability is a must. (PC: Noel DiBenedetto)

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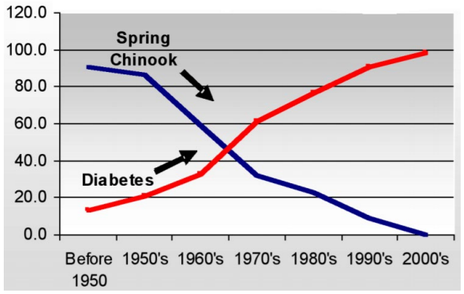
Once, Reed says, hundreds of thousands of spring Chinook returned to the Klamath every year. This summer, surveys on the Salmon River, the Klamath's last remaining spring Chinook stronghold, counted just 106 springers. (See *First Salmon, Last Chance – Part 1*.) For the Karuk, this staggering decline has left the community reeling, in a state of profound mourning.

"We need the people who make decisions to understand how this affects us not just scientifically but ecologically and culturally," says Reed. "The fish are the leading influence on the natural world for us, and they're not in the picture. The world is out of balance."

Klamath River salmon bake. (PC: Craig Tucker)



Graph showing the relationship between the decline in spring Chinook populations after the building of the Iron Gate Dam (one of several built on the Klamath River between 1917-1962) and the rise in the incidence of diabetes among the Karuk. (Graph courtesy Dr. Kari Norgaard and the Karuk Tribe.)

From the lack of salmon in Reed's community, a range of problems cascade: food instability and familial disruption, loss of livelihoods and social cohesion. Young Karuk men are particularly at risk: of mental health issues, substance abuse, incarceration. The impacts ripple, reaching the entire community.

Reed points to the work of a mentor, Dr. Kari Norgaard, a professor of sociology at the University of Oregon and frequent research collaborator with Ron Reed, Sr. In one project, Dr. Norgaard graphed Karuk diabetes rates rising since the 1950s, with a second line plummeting in mirror opposition: the Klamath's annual spring Chinook counts. Karuk **Tribal members consumed 1.2 pounds of salmon per person per day before Western contact; by 2019, they ate less than five pounds of salmon *per year*.**

Indigenous communities know how to recover these populations, Reed says; ask a Karuk elder, and they'll tell you. For millennia, salmon-centric Indigenous communities across the North Pacific have successfully managed sustainable runs through fish weirs, controlled burns and smoke, upslope maintenance, careful observation, and ceremonies that enabled salmon runs to reach spawning grounds before harvest.

Now, more than ever, Indigenous knowledge must inform state and federal salmon management practices, Reed says, if the Klamath's springers are to survive, along with a river people's foundational way of life.

"My biggest fear is that we as Karuk people, fish-loving people, that we'll lose the privilege to continue protecting and honoring our more-than-human relatives," says Reed. "I don't know if scientists recognize that if spring Chinook don't come back, that is a form of cultural genocide."

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The Williamson River, a tributary of Upper Klamath Lake some 250 miles from the Pacific Ocean, is spring-fed and highly productive for trout. Recent genetic analysis of salmon bones found in nearby middens proved that spring and fall Chinook migrated here before dams were built below the lake. (PC: Ken Morrish)

Two hundred fifty miles east of the North California coast, the sunbaked remnant of a giant Pleistocene lake pools just above the Oregon-California border.

Klamath Lake, from which the Klamath River flows, stretches 25 miles over the basin floor, a marshy paradise for migratory birds and rainbow trout. That's despite eutrophic summer conditions that can promote algal blooms and kill fish who linger here, rather than move into the lake's cold, spring-fed upper tributaries.

"Klamath Lake in summer is just a terrible place to be as a cold water fish," says Wild Salmon Center Science Director Dr. Matt Sloat. "But in other seasons, it's incredibly productive. Trout can grow ten pounds in a few years by gorging in the lake in spring and fall, then holding in the tributaries during summer. **It could be game-changing for spring Chinook, if they could get there.**"

Right now, they can't. Springers headed for paradise instead meet the eighty-year-old Iron Gate Dam some 25 miles northeast of Yreka. The 170-foot-high earthen wall is just the first of four hydroelectric dams run by PacifiCorp blockading the next 60-some river miles: Copco 1, Copco 2, and J.C. Boyle Dam a few miles south of Klamath Lake.

For twenty years, the Karuk, Yurok, and Klamath Tribes—along with a host of scientists, sport fishers, and conservation groups—have led the fight to remove these century-old salmon barriers, with support from Oregon and California. In 2016, the coalition came to

an agreement with PacifiCorp and its parent company, Berkshire Hathaway. The advocates have economics in their favor: the aging structures produce little hydropower, no irrigation water, and offer no flood control. Meanwhile, federal relicensing will require fish passage improvements projected to cost far more dam removal.

Under that agreement, the nonprofit Klamath River Renewal Corporation was created to obtain needed permits and assume sole responsibility for the project. A schedule was set for dam removal. Then, in July 2020, the Federal Regulatory Energy Commission threw a wrench in the plans, ruling that PacifiCorp, contrary to its wishes, must remain a liable co-licensee alongside the nonprofit. As PacifiCorp and Berkshire Hathaway Energy went quiet, dam removal advocates were again left without a timeline.

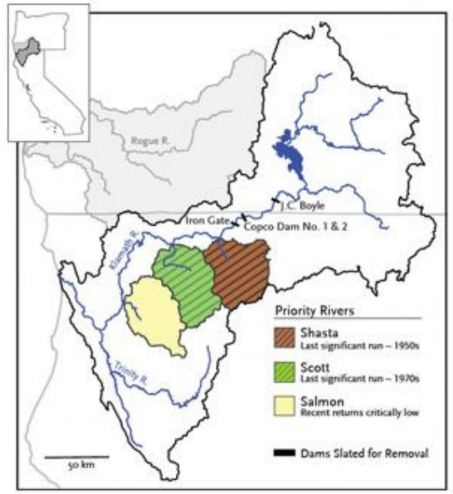
The dams' longevity, too, has muddied the salmon restoration argument for their removal. Since the 1910s, no ocean-returning fish on the Klamath River could climb higher than Copco 1. **Maybe, asked some opponents, salmon never reached Klamath Lake in the first place?**

> *"Indigenous knowledge was mostly ignored. And old newspapers, settler accounts, ethnographic accounts indicating that salmon migrated above the dams, the skeptics just dismissed. Then archeologists found the middens.*

The Iron Gate Dam soars 170 feet above the Klamath River. Built without fish passage, it blocks migrating salmon. (PC: Alamy)

"Dam removal skeptics found it easy to create confusion later, because the dams went in before western scientists had "hard data" on salmon numbers," says Dr. Sloat. "**Indigenous knowledge was mostly ignored. And old newspapers, settler accounts, ethnographic accounts, other sources indicating that salmon migrated above the dams, the skeptics dismissed as just anecdotes. Then archeologists found the middens.**"

Middens, or ancient mounds of human detritus—everything from old tools and artifacts to shells and bones—are common throughout the Klamath Basin. Various archeological sites on Upper Klamath Lake tributaries had found salmonid bones. But were these bones from rainbow trout, still present today above the dams, or ocean-going salmon like spring Chinook?



Map of the Klamath basin, dams scheduled for removal, and archeological site location of ancient salmonid samples. Dams: 1) Iron Gate; 2) Copco 1; 3) Copco 2; 4) J.C. Boyle. Archeological sites: a) Williamson River Bridge; b) Bezuksewas Village; c) Kawumkan Springs Midden; d) Beatty Curve. (Graph courtesy Dr. Tasha Thompson)

To solve this mystery, Dr. Sloat and a team led by Dr. Tasha Thompson of Michigan State University set out to take a fresh look. Supporting their 2017 research was a genetic breakthrough from Dr. Thompson's partner Dr. Mike Miller, of UC-Davis, who had recently discovered the precise gene that distinguished spring-run and fall-run Chinook.

The lab results proved it: Chinook were here. **At sites dating back some 5,000 years—and as recently as the 1860s—DNA identified both fall and spring Chinook bones in the middens above Klamath Lake.**

"It confirmed that springers were present, and had been for centuries before the construction of the dams," says Dr. Sloat. "This was amazing news. And it provides extra drive for salmon conservationists and Tribes like the Karuk to reconnect springers with the Klamath headwaters, one of the most climate-resilient freshwater habitats you could think of."

But for Tribes and salmon managers to have a shot at reintroducing springers to the upper Klamath, the dams must come down before this salmon run blinks out. **The crisis on the Klamath, says Dr. Sloat, has analogues across the Northwest: spring Chinook runs on the brink, as powerful entities drag their feet.**

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Ron Reed, Sr., scraping the contours of the rocks with a dip net, hoping to find a resting salmon in a pool beyond the turbulence of Ishi Pishi Falls. Charley Reed looks on, prepared to assist with a catch, and learning fishing techniques from his father. (PC: Danielle Anderson)

"There's this question: what exactly is a species?" For Craig Tucker, a policy advocate and former molecular biologist based in Arcata, California, **spring Chinook are clearly an animal apart from their fall-run cousins; something that's always been obvious to the Karuk Tribe**, Tucker's employer.

"The Karuk can draw on historical knowledge: they know spring Chinook look different, taste different, and show up at different times," says Tucker. "Problem is, we've done a lot of really dumb things."

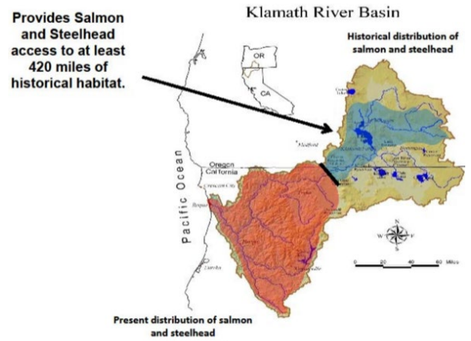
One of those dumb things, he says, is the decision by government agencies like NOAA to lump spring Chinook with fall-run Chinook in management decisions—a policy that for decades has overlooked both springers' distinct habitat needs and devastating decline.

"The idea was that if you lost all the springers but did some restoration work, you'd get springers again from the fall population," says Tucker. "We now know that this isn't the case, from Dr. Miller's genetic work."

> *"Endangered status for Klamath springers, and the resources and restrictions that unleashes, could be a powerful tool in overcoming dam removal inertia. And as a mighty precedent, dam removal here could energize countless other dam removal campaigns across the Pacific.*

Armed with this new insight—that once you lose a spring Chinook run, it's gone for good—the Karuk Tribe and the Salmon River Restoration Council are petitioning NOAA Fisheries to protect Klamath springers under the Endangered Species Act. Endangered status, and the resources and restrictions that unleashes, could be a powerful tool in overcoming dam removal inertia.

"It costs more to get a new license to continue operating these dams than to remove them," says Tucker. "But these are insurance agents, at the end of the day, and they're worried about precedent. We're talking about the biggest dam removal in the history of the world."



Present distribution of Klamath system salmon and steelhead (orange) and extent of their historic distribution (blue), currently blocked by dams. (Source U.S. Fish & Wildlife)

The stakes are high, on both sides. As a mighty precedent, dam removal could energize countless other dam removal campaigns across the Pacific. **For Tucker, dams are the single largest existential threat to springer survival on rivers from California's Sacramento north to the Columbia.** But bringing down dams is also symbolic on another level: in removing barriers that threaten Indigenous cultures and ways of life.

Removing dams, and rooting salmon management in Indigenous knowledge and conservation science: this is how we save spring Chinook and restore balance. Charley Reed's elders know this. It's time to heed their wisdom and bring the springers home. ■

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Salmon River spring Chinook hold in a cold pool. This past summer, divers counted just 106 springers here, one of the lowest counts on record. (PC: Peter Bohler)

PART III

The Key in the Code

On Oregon's Rogue River, genetic detectives take on shapeshifters, weird science, and an ancient mystery.

On the banks of Oregon's Rogue River, six children gawk at a very dead fish. Wriggling in oversize lifejackets, they cluster around a taller boy, who rolls the carcass onto a river rock.

The fish is mottled gray, probably stinky, and, from the kids' expressions, pretty fascinating.

From his passing raft, Wild Salmon Center Science Director Dr. Matt Sloat can just make out the buck's hooked kype, jaw hanging wide like the small fry around him.

"Looks like you found a salmon," he calls. "He came here all the way from the ocean. Pretty cool, huh?"

As his raft drifts past, the kids turn back to prodding their science experiment.

As spring Chinook populations decline across the Pacific Northwest, the spring run on Oregon's Rogue River—a popular destination for anglers—is considered one of the world's last, best, and healthiest. (PC: Ken Morrish.)

This is not, perhaps, the most dignified end for a salmon, whose hero's journey home likely spanned thousands of miles and myriad challenges. **But it might be a fittingly forensic one for the scientific mystery he represents.**

From the raft, everything here looks fine: spawning fish, happy fishers, curious kids. It's a beautiful, late September afternoon, but Dr. Sloat is worried.

> *"On the Rogue, something is shifting, just beneath the water's surface.*

Once, he might have told the kids that they'd found a spring Chinook. Because that was the salmon you'd typically find this far upstream. For generations, the upper Rogue's spring Chinook run has been its most prized, for anglers and salmon managers alike. Today, with springer populations in decline across the Pacific Northwest, the Rogue's spring run is considered one of the world's last, best, and healthiest.

Late September, 2020: examining a Chinook carcass on the north bank of Oregon's Rogue River.

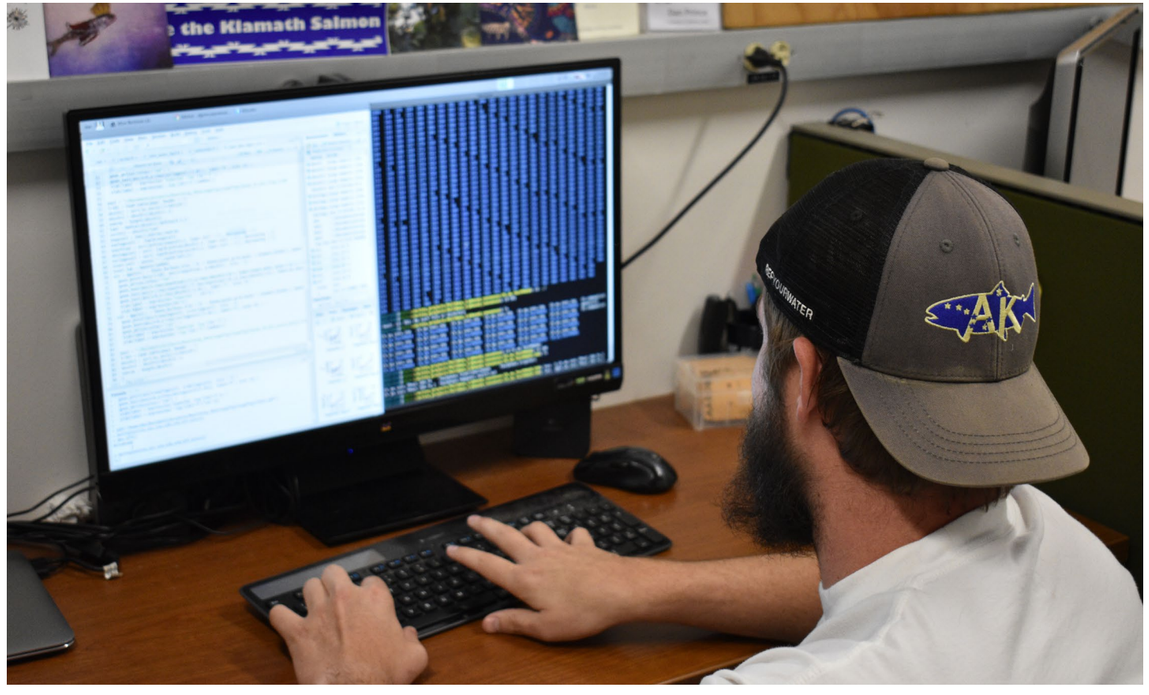
But Dr. Sloat knows something here is shifting, just beneath the water's surface. He can't be sure, any more, what run of salmon he's seeing. **It's a vexing mystery. And one we wouldn't know existed, if it weren't for the genetic detectives.**

Genetic science has come a long way since the mid-2000s, before Dr. Michael Miller earned his scholarly honorifics.

"A genome is like a big instruction manual that tells you how to make an organism," explains Dr. Miller, a genetics professor at UC-Davis. "At the time, we didn't have a fully decoded sequence. We didn't have the full book. Imagine that you have only certain sentences, and you don't know their order."

As geneticists cracked open those first sentences, Dr. Miller, then a doctoral candidate at the University of Oregon, focused on decoding snippets of steelhead DNA. **His goal was a career in conservation genetics, using insights from DNA to help protect threatened species. Species like the springers he hooked as a kid on Oregon's Molalla River.**

Dr. Michael Miller. (PC: Mikal Jakubal.)



Analyzing data in Dr. Miller's lab: Daniel Prince, a former graduate student of Dr. Miller's and the lead author of the team's groundbreaking 2017 paper. (PC: Gus Tolley.)

"Spring Chinook are most near and dear to my heart," says Dr. Miller. "But back then, doing high resolution genetic analysis on salmon wasn't feasible."

In those heady early days—when as he says, analyzing DNA was "thousands of times more expensive and time-consuming"—the field's limited tools could fuel some questionable correlations.

One leap, in particular, troubled the young graduate student. **Data showed that in individual rivers, spring and fall Chinook shared big chunks of DNA. From this, researchers came to a conclusion that still influences salmon management policies**. They argued that spring Chinook populations emerge from a river's fall Chinook population—and that they've always done so: splitting off many times, in many rivers. For managers, this created a sense of safety. If spring Chinook went extinct, the geneticists reassured, they could reevolve from a river's fall run.

> *"In those heady early days, the field's limited tools could fuel some questionable correlations. One leap, in particular, troubled the young graduate student.*

"You know, that argument was reasonable at the time," says Dr. Miller. Early genetic approaches could only look at overall relatedness, not specific genes. The two runs are related, he stresses; a river's spring and fall Chinook sometimes interbreed, but usually only at low levels in healthy rivers.

But this conclusion missed one important thing. "Relatedness," he says, "doesn't mean that they're not genetically distinct in critical ways."

Dr. Miller suspected that a critical divergence lurked somewhere in the springer genome—a hunch from growing up with this fish. When he started fishing for fall Chinook, too, the space between the two felt huge: run times separated by months, different spawning grounds, vastly different fat storage (and resulting flavors). Spring Chinook's uniqueness was a no-brainer, he thought—at least for anyone who'd ever handled one.

"When genetic methods mature," he thought, "I'm going to figure this out."

Still a graduate student, he began amassing genetic samples for this project—steelhead and Chinook from rivers ranging from California's Eel River to the Nooksack and Puyallup in Northern Washington. Then, in 2012, the new doctor was offered a professorship in UC-Davis's Department of Animal Science—and his own lab.

Adult summer steelhead. (PC: Reza Keikhaee.)

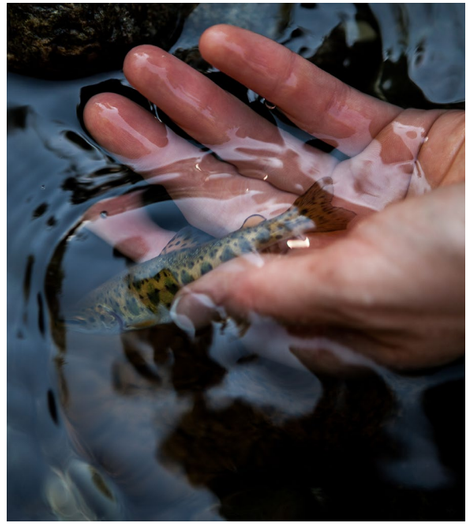
"Run timing was the first big question I wanted to ask," he recalls.

> *"Spring Chinook's uniqueness was a no-brainer, he thought—at least for anyone who'd ever handled one.*

In Dr. Miller's new lab, graduate students extracted DNA from his samples, generating millions of data points. **Computational techniques had progressed enough to decode the genome's characters, words, sentences, and paragraphs. Now, the team could read the whole instruction manual**. Four, in fact: one each for winter and summer steelhead, and spring and fall Chinook.

"At first, we didn't have the order of things, but we started to piece it together," Dr. Miller remembers. Word for word, the exact same locus—a genetic "paragraph" composed of hundreds of thousands of nucleotides—appeared in the genomes of both spring Chinook, and summer steelhead.

There it was: the gene for early return. **The team had proven a genetic divergence between spring and fall Chinook. And not only that; they'd also discovered**



Dr. Tasha Thompson sampling juvenile steelhead. (PC: Mikal Jakubal.)

that the same gene controlled run timing in two separate fish species. And this evolutionary split between early and late returners was ancient, they found, emerging just once in each species, sometime during the roughly 15 million years that separated them.

"This is the one paragraph that explains how to make spring Chinook and summer steelhead," explains Dr. Miller. The findings, which the team published in the journal *Science Advances* in 2017, spurred a wave of new research. According to Dr. Sloat, the team's discovery fundamentally changed the way scientists viewed the impact of genetics on run timing.

> *"There it was: the gene for early return. The team had proven a genetic divergence between spring and fall Chinook.*

Adult spring Chinook. (PC: Jan Jaap Dekker.)

For conservation scientists, this insight was particularly intense. **What we need to understand about springers, says Dr. Miller, is that their gene variant is also their major survival advantage.** By arriving early and hopscotching high into a river's upper reaches, spring Chinook have outlasted ice ages and floods, warming temperatures and changing predators. But because this gene emerged from just one evolutionary event, concentrated in one solitary gene, this advantage is also fragile.

Dr. Miller's work rocked the science on what it takes to be a spring Chinook, and also ratcheted up the pressure to save them. As springers struggle across their range, western science is now catching up with what the Pacific Northwest's Indigenous people have always known: help isn't coming from their fall-run cousins.

"Spring Chinook might already be protected if geneticists hadn't gotten involved," admits Dr. Miller. By claiming that fall and spring Chinook salmon were interchangeable, back in those early days, geneticists muted the urgency of the situation.

"Geneticists had a disproportionate influence on this issue, unfortunately," he says. "And because of that, managers didn't think springers needed general protection."

As scientists and salmon managers lost precious time, springers' genetic advantage has become increasingly challenged. Across the Pacific Northwest, populations are being decimated by dams, lost habitat, human development, and fast-changing rivers. That's why the Rogue River's seemingly robust spring and fall runs offer such hope.

Which brings us back to Dr. Sloat's worry. If the Rogue's spring and fall Chinook runs are healthy, why are so many now migrating right in the middle of summer? To answer that,

meet Dr. Tasha Thompson, our second genetic detective. **She, too, has a big question: who are all these shapeshifters, and where have the true spring Chinook gone?**

> *"If the Rogue's spring and fall Chinook runs are healthy, why are so many now migrating right in the middle of summer?*

For decades, August 15 was the day that officially ended the Rogue's spring run.

After that day, any Chinook passing the Gold Ray Dam fish counting station at river mile 127 were tallied under the fall-run column. **It's a system that the Oregon Department of Fish & Wildlife used from the 1940s until the dam came down in 2010. For decades, this system worked.**

"Summer is historically the worst time for Chinook to migrate in rivers like the Rogue," says Dr. Thompson, a Michigan State University geneticist whose interest in spring Chinook run times began with a stint in Dr. Miller's lab while getting her PhD at UC-Davis.

Historically, few fish passed the counting station in August. Sweltering temperatures and low flows in summer and early fall precluded fish passage in the middle and lower river. By August, spring Chinook should already be higher in the river, poised to spawn at the optimal time. Meanwhile, fall Chinook are still massing at the river mouth, waiting for fall rains.

Dr. Tasha Thompson collecting samples in the field. (PC: Mikal Jakubal.)

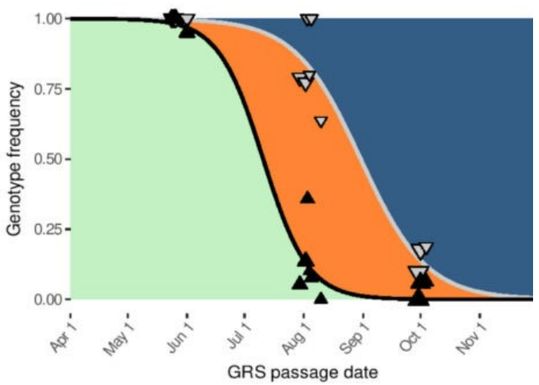
On the Rogue River, the William L. Jess Dam blocks some 30 percent of historic spring Chinook habitat. Summertime water releases from the Lost Creek Reservoir further complicate springers' natural advantage by raising water levels, allowing fall Chinook to access remaining springer habitat. (PC: US Army Corps of Engineers.)

Things began to shift in 1977, with work completed on the new William L. Jess Dam thirty miles upriver. In the decade prior to the Jess Dam, ODFW data showed peak Chinook migration on the Rogue occurring between May and June: clearly a spring run. But by the mid-2000s, peak Chinook migration was in August.

"More and more are running in the hottest months," says Dr. Thompson—risky behavior, as summer, with suffocating water temperatures and prohibitively low flows, is a very precarious time for migrating salmon.

These fate-tempting summer-running fish, she suspected, were hybrids: the progeny of both spring and fall Chinook. As Dr. Miller noted, most Chinook rivers have hybrids in small numbers. But on the Rogue, they were taking over: the product of a human roadblock.

> *"Spring and fall runs were stacking up, competing for the same spawning gravel, and interbreeding. In a battle between competing genomes, who would win?*



Plotting Dr. Thompson's samples by run time and genetic makeup, where 1.00 represents pure springer DNA, and 0.00 is pure fall Chinook. Samples collected in late May carry genotype markers associated with pure springer DNA; samples collected in August are largely hybrids (heterozygotes) and fall Chinook; by October, the run is almost entirely fall Chinook. (Graph courtesy Dr. Tasha Thompson.)

Built without fish passage, the Jess Dam walls off an estimated 30 percent of historic springer habitat. Complicating things further, the dam also releases reservoir water in summer, cooling the river and raising water flows—conditions that encourage fall Chinook at the river mouth to migrate earlier, and travel higher. Below the dam, spring and fall runs were stacking up, competing for the same spawning gravel, and interbreeding. **In a battle between competing genomes, Dr. Thompson wanted to know, who would win?**

"We wanted to know, if you have a mom spring Chinook and a dad fall Chinook (or vice versa), how exactly does the offspring behave?" says Dr. Thompson. The underlying question, she says, was whether hybrids would behave like the spring-run, the fall-run, or something else. **The answer meant nothing less than the survival of springers' unique genetic advantage.**

She got to work, analyzing some 269 Rogue Chinook tissue samples collected in three week-long intervals in 2004: late May, early August, and early October. For each sample group, she looked for which gene variation (spring, fall, or hybrid) were present in each individual.

The results, she says, were striking. The May-running Chinook had two copies of the springer gene. (Like us, salmon carry copies of each parental gene.) The October-running Chinook had two copies of the fall gene. And those carrying one spring copy and one fall copy—competing drives for early and late return—overwhelmingly split the difference with a hot, fraught, summertime migration.

> *"August 15 can't divide the Rogue's two Chinook runs anymore, says Dr. Thompson, because the river now has three runs.*

"On the Rogue, we have totally altered how natural selection works in the upper basin," says Dr. Thompson. "And the spring Chinook are losing."

August 15 can't divide the Rogue's two Chinook runs anymore, she says, because the river now has three runs. The Rogue's true springers, those migrating between early April and late June, are disappearing.

Since Dr. Thompson published her research in 2019, some claim to see a silver lining in her work. If a copy of that springer gene lives inside first-generation hybrids, say these people, perhaps hybrids could repopulate a lost springer run?

Dr. Tasha Thompson and Dr. Mike Miller conduct fieldwork. (PC: Mikal Jakubal.)

The problem there, says Dr. Thompson, is that this scenario requires hybrids to persist after spring Chinook are gone. The Rogue isn't the only river where Chinook populations have gone wonky. Consider two once-mighty salmon strongholds: Northern California's Scott and Shasta Rivers. Here, fall Chinook still run despite human impacts.

But on both rivers, says Dr. Thompson, springers are now extinct. And as summers heat up, making survival even tougher, the hybrids—like bad money following good—have vanished with them.

From his raft on the Rogue, Dr. Sloat spots another carcass. He hops into the water, drawn low by a dry, hot summer, and bends for a closer look.

> *We can work together to help restore spring Chinook's natural advantage.*

"On the Rogue, we're not going to go back to pre-dam conditions," he says. "But we can work together to help restore spring Chinook's natural advantage."

Dr. Matt Sloat (left) and WSC Southwest Oregon Program Manager Dr. Tim Elder run the Rogue River in search of Chinook.

Springers just need a reason to keep being springers, he says: their own space, their own time to spawn. With fishing gear like weirs and wheels, Indigenous salmon managers have long facilitated the separation of salmon runs during homeward migration.

Now, western science is starting to heed the wisdom of approaching fall and spring Chinook as different runs with different needs—and responding when something goes wrong.

"The hybrids are showing us that we've thrown this river system out of balance," says Dr. Sloat. "We created this situation, but we have a chance to help restore that."

Could the Jess Dam's controlled reservoir releases, for example, be tweaked to delay fall runs? Another way to thwart interbreeding, he says, could be focusing fishing on hybrids and early fall Chinook. As wild salmon face unprecedented challenges—a perfect storm of human interference and rapid climate impacts—we need creative solutions to protect spring Chinook's ancient, unique climate resiliency.

A spawned-out Chinook hen in the shallows of the Rogue. In late September, the Rogue's three overlapping Chinook runs make it hard to say whether she's a spring, summer, or fall-run fish.

Dr. Sloat guides the carcass to the shallows: a spawned-out hen, with beautiful black spots and a translucent tail shredded from digging her redd. **From here, we can't tell if she's a spring Chinook, fall Chinook, or a summer-running hybrid. But thanks to the genetic detectives, we have new tools to read her, and to write a better story.**

One where springers can climb high into rivers across the North Pacific, and thrive. ■

> *The hybrids are showing us that we've thrown this river system out of balance," says Dr. Sloat. "We created this situation, but we have a chance to help restore that.*

PART IV

Orcas and Actions

Southern Resident orcas breaching in the Salish Sea. (PC: Alamy)

In the Salish Sea, declining spring Chinook runs mean Southern Resident orcas go hungry. It's a simple supply-and-demand problem. But to fix it, humans must take actions as complex as any food web.

A baby orca rolls and breaches in the Salish Sea. It's 2019, and she's still wobbly, just a few months old, but her mother has to leave her and go hunting.

So little Tofino, or J56 as she's known to orca scientists, is being watched by her extended family. Drone footage from the Center for Whale Research captures their play: a fin slap against the surface, a couple lazy crescents, a collective dive, side-by-side, with three young orcas lined up by size.**using insights from DNA to help protect threatened species. Species like the springers he hooked as a kid on Oregon's Molalla River**.

Video also captures the moment her mother Tsuchi (J31) returns. Tofino instantly peels off and attaches herself to mama's right flank; her relatives trail behind as Tsuchi picks up the pace, slicing through water like a boss.

Then, a remarkable moment, one you could miss if you didn't know what to look for. With a jerk of her head, Tsuchi bites off a piece of the fish she's holding in her mouth, and lets it float back. **Is this what it looks like—Tsuchi rewarding Tofino's babysitters with a salmon snack?**

In the footage, one orca snaps up the salmon in an instant. But there's not enough for everyone. And that, her aerial observers fear, could be the story of young Tofino's life.

> *One orca snaps up the salmon in an instant. But there's not enough for everyone. And that could be the story of young Tofino's life.*

Southern Resident killer whales, says Cindy Hansen of the nonprofit Orca Network, have huge brains capable of empathy, critical thinking, judgement. **For Indigenous Coast Salish peoples like the Lummi, Samish, and Squamish Nations, orcas are literally family**, celebrated in naming ceremonies and in stories passed down through generations.

But the charisma of these mammoth salmon hunters reaches even those who've never seen one breach, or watched that black-and-white ripple streak beneath the water, as long as a yacht. Orcas make international headlines—as was the case in 2018, when the world watched Tahlequah, another J Pod member, carry her dead calf for 17 days in mourning.

> *The charisma of these mammoth salmon hunters reaches even those who've never seen that black-and-white ripple streak beneath the water, as long as a yacht.*

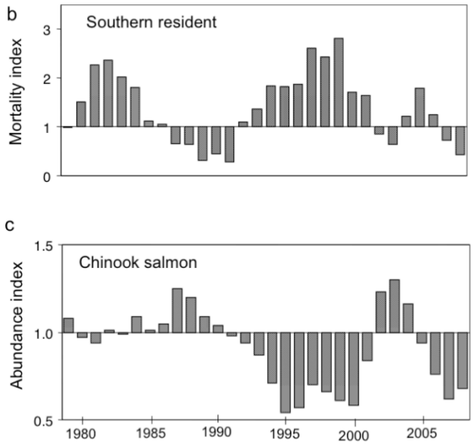
As with humans, orca family bonds last entire lifetimes, from Shachi, Tofino's great-aunt and one of J Pod's oldest matriarchs, to its newest surviving additions, two calves born in September 2020, ten months after Tofino—including a little boy, J57, born to Tahlequah.

"The day after J57 was born, the other two pods came in from the ocean for a huge cuddle puddle," says Hansen. **The pods had good reason to celebrate, with three new orcas babies since 2019, after years of miscarriages.**

Salmon comprise more than 90 percent of the diet of Southern Residents, with spring Chinook their mainstay. (PC: Center for Whale Research, taken under NMFS Permit #21238.)

If that sounds tragic, you're right. Southern Resident orcas are in trouble, plain to any whale watcher now lucky enough to see one. In recent years, some pod members have shown signs of "peanut head"—a deflated dip, behind the blowhole, that means malnourishment. **Even more heartbreaking are the infant mortality rates among female Southern Residents, now as high as 69 percent.**

> *At just 75 orcas, the pods currently need at least 500,000 Chinook per year—roughly the same as B.C.'s 2019 combined Chinook catch across commercial, recreational, and First Nations fisheries.*



From 1980-2009, higher-than-expected Southern Resident mortality rates largely tracked with lower Chinook salmon abundance. (Source: 2009 DFO study by J.K.B. Ford, B.M. Wright, G.M. Ellis, and J.R. Candy.)

A big reason why, says Hansen, is that they're starving. And on the surface, the solution sounds simple, too: **orcas need more salmon, particularly spring Chinook, the fatty, calorie-rich early returners that sustain these three pods from May through late summer**, composing some three-quarters of their total annual diet.

While K and L Pods forage elsewhere in winter—following Columbia and Snake River runs down the Washington Coast, and sometimes much further south—J Pod has traditionally stuck close to the Salish Sea, relying heavily on springers from British Columbia's Fraser River to refuel after winter.

At just 75 orcas, the pods currently need at least 500,000 Chinook per year—roughly the same as B.C.'s 2019 combined Chinook catch across commercial, recreational, and First Nations fisheries. **But we'd need to double that number for orcas to reach sustainable population levels, Hansen says.** With hard competition for that fish, from humans and other species, it's clear that this salmon problem is anything but simple.

For Hansen, who's lived in thrall to these creatures for the past two decades, we have a moral imperative to work this out. Starting with one place in particular.

"**The Fraser River is incredibly important for the orcas. Those are the salmon they should be eating in spring all through summer**," she says. "If orcas are going to have a future, it will be because we've recovered salmon throughout their range, including the Fraser."

From Hansen's home perch on San Juan Island near the U.S./Canadian border, she's watched J Pod stick it out, through births and deaths, feasts and now famine.

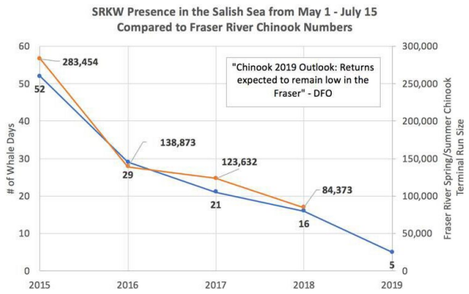
Orcas' rising mortality rates are tracked by Canada's Department of Fisheries and Oceans, and the agency's scientists have mapped an obvious overlap with declining Chinook abundance. (See above bar chart.) For Hansen, the Orca Behavior Institute created an even more personal visual: plummeting salmon runs tracking closely with Salish Sea "whale days," or sightings. (See above line graph.)

"It's a correlation, but a strong one," she says. "**To me, it's very clear why the orcas aren't here like they were in the past.**"

> *If orcas are going to have a future, it will be because we've recovered salmon throughout their range—including the Fraser."*

Marine and river conditions, recent catastrophic landslides, aging tide gates along with predators, pollutants, poaching, and poorly monitored fisheries—**ask people why the Fraser's spring Chinook runs are down, and you'll get at least as many answers as there are orcas.** (And hot debate.)

At the northernmost range for true spring Chinook, the Fraser's spring run is considered endangered by multiple government entities. Yet it remains unlisted under the Canadian Species At Risk Act (SARA), and thus not fully protected. Greg Taylor, a B.C.-based fisheries consultant and recovery specialist for organizations like SkeenaWild Conservation Trust and Watershed Watch Salmon Society, says that's still a bridge too far for the Canadian government, which has yet to list any species with commercial and recreational value.



Comparing Salish Sea orca sightings, or "whale days", and Fraser River Chinook runs. (Source: Monika Wieland Shields, Orca Behavior Institute; data from the Pacific Whale Watch Association, Orca Network, and the Pacific Salmon Commission Joint Chinook Technical Committee Report.)

> *The Canadian government has yet to list any species with commercial and recreational value.*

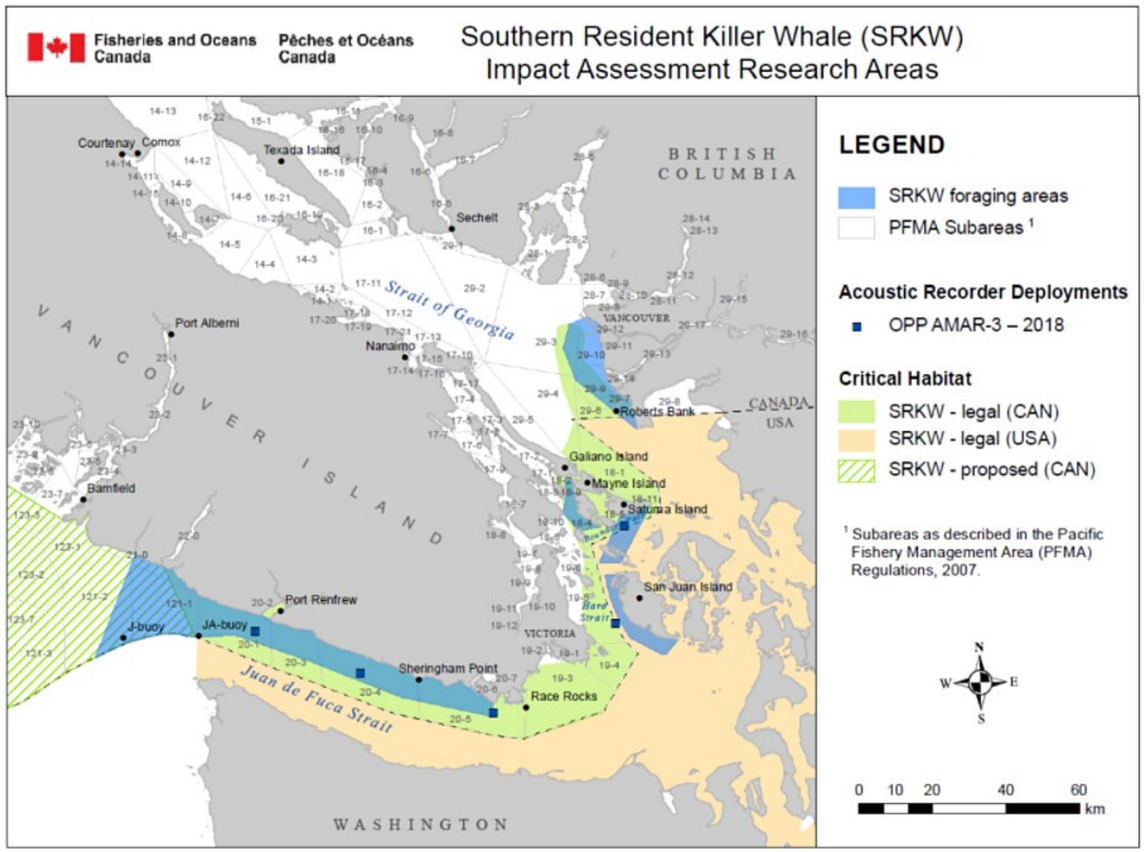
Southern Resident orca with a two-Chinook-salmon snack. (PC: J Hein)

Taylor thinks the government can't afford to wait. **Both spring Chinook escapement and overall abundance have hit historic lows in recent years, prompting grave concern among First Nations, conservationists, and others.** In 2019, just 14,500 Fraser spring and summer Chinook reached spawning grounds, well below target, despite a decade of reduced recreational catches and wholesale closures of First Nations fisheries.

Salmon managers still have the chance to recover the Fraser's spring Chinook. Here, unlike spring runs further south—on the Snake and Columbia Rivers, the Rogue and Klamath-Trinity—the big roadblocks aren't dams.

Even so, small, incremental decision-making won't cut it—say, a bit of habitat restoration here, or tide gate repair there. The first big step to save the Fraser's spring run, Taylor says, is to secure a national SARA listing. It's a tricky kettle of fish, politically; listing would likely mean even fewer fishing opportunities for humans in short term. Yet the long-term cost of inaction is far greater: the loss of these species, along with our fisheries.

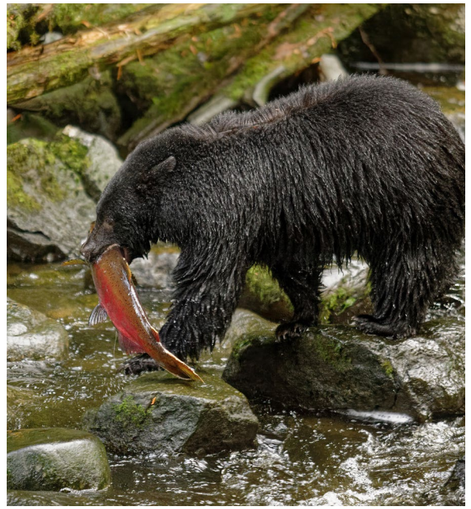
"**Right now, we have to get every spring-run fish possible to its spawning grounds**," Taylor says. "We have to have a vision of what we want in terms of Chinook and orcas 50 years from now, and begin to act. That's only 12 cycles for these salmon, remember."



Southern Resident foraging areas shaded here in blue track closely with the homeward migration path of the Fraser Rivers spring and summer Chinook runs. (Source DFO)

> *The urgency of this moment demands big, bold action. Because what's at stake isn't just the survival of one species, or even two. It's a multitude.*

Species protections are just one step. For Taylor, and Hansen, and a growing host of deeply concerned Pacific salmon advocates and conservation scientists, the urgency of this moment demands big, bold action in watersheds from California to Alaska—from tearing down dams to rebuilding habitat, from enforcing fishing regulations to rethinking the very way we fish. That's because what's at stake isn't just the survival of one species, or even two. It's a multitude.



British Columbia bear with spring Chinook. (PC: Alamy.)

Salmon are an ancient species, predating ice ages and floods, changing climates and natural catastrophes. **Over millions of years of resilient, creative adaptation, wild salmon have evolved into what zoologist Robert Paine called a keystone species**: an animal of such critical importance that it threads entire ecosystems. Across the North Pacific, more than 137 species depend on salmon, from grizzlies to fish owls and salamanders.

> *Over millions of years of resilient, creative adaptation, wild salmon have evolved into a keystone species: an animal of such critical importance that it threads entire ecosystems.*

Spring Chinook, historically the biggest, most nutrient-packed, and highest-climbing of all salmon, play an especially vital role in the complex food webs that link oceans to a river's uppermost reaches. In the Fraser, their carcasses literally feed forests as far east as the Alberta border. Extirpate the river's springers, and the impacts cascade: trout suffer, along with eagles and other raptors. Grizzly populations contract, collapsing inland predator-prey relationships. And in the Salish Sea, orca populations go hungry.

"You can't de-link orcas from salmon," says Greg Taylor. "They have evolved over thousands of years to take advantage of this wonderful food source. Salmon are absolutely core to the survival of Southern Residents."

For J Pod, Taylor can make this link explicitly clear. With a map of the Salish Sea in his head, he traces springers' return route from memory: south along the western edge of Vancouver Island to connect with the Strait of Juan de Fuca, curving north to San Juan Island, westward to Saturna Island, and then meeting the Fraser River just north of the Canada-U.S. border.

"Where do we find the orcas, but in those exact spots," says Taylor. "And yet, now they're talking about building a new port right on top of spring salmon habitat at the mouth of the Fraser River!"

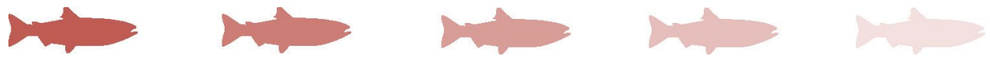
He pauses, takes a breath. He's devoted his whole career to ground-truthing B.C.'s relatively hands-off salmon management approach. At the most basic level, he's found it wanting.

"If you want a world with orcas," he continues, "you gotta start by not killing the fish."

An orca breaching the water's surface, white belly catching light. A spring Chinook at the river mouth, leaping high, grayish purple back and silver sides. A fisherman in a small boat, scanning the scene through polarized glasses, transfixed.

"Humans are animals, too," says Wild Salmon Center's Guido Rahr, a lifelong fly fisherman preaching the gospel of catch-and-release. "Chasing something around in nature is still a part of us. Our bodies, brains, and heart all want that—to be humbled and taught and challenged by a species like salmon, one that we've worshipped for millennia."

As orcas stalk spring Chinook in the ocean, fly fishers hunt them in freshwater, hoping to spot a pod, "like a big, silvery mirage," land one, and then (if it's a wild fish) tenderly let it go.



One sunny morning, the air salty near a river mouth on Oregon's North Coast, he remembers watching a convergence of nature from his small boat. Above, a swirl of cormorants, gulls, and geese. On the water's surface, the still, bobbing heads of harbor seals. All eyes fixed on a wide, flat tailout, and the nearly imperceptible wake of a pod of bright spring Chinook.

"They weren't trying to hide, they wanted to be out in the flat," Rahr says. "They wanted to be where they could outrun the seals, which had probably been chasing them all night."

Salmon fly fishing (or not) in coastal Oregon. (PC: Guido Rahr)

With threats on all sides, Rahr watched the springers simply swim through it, beautifully iridescent, swept with star-shaped black spots. **These days, he's content to simply watch a spring Chinook and ponder its mysteries.**

> *Rahr and like-minded fly fishers walk this careful line—catching and releasing, fishing selectively or not at all—because a new balance is called for in these difficult times.*

"I went maybe eight days without a strike this year, and that's completely okay with me," he says. "Nothing is as interesting as chasing an elusive traveler in my home waters."

Rahr and like-minded fly fishers walk this careful line—catching and releasing, fishing selectively or not at all—because a new balance is called for in these difficult times. **He believes that humans belong in the same food webs that link orcas and salmon, raptors and caddisflies. But he agrees with Taylor and Hansen that we must rethink our role in these systems.**

That starts with the outsized impact of marine salmon fisheries, Rahr says. **But he extends this challenge to the fly fishing community, where fish can be killed even when catch-and- release is practiced.** We can no longer shrug off high incidental mortality rates in recreational fisheries, he says, as simply the cost of doing business. Not when salmon, like orcas, are the red-blinking warning light of an ecosystem in decline.

"Something that every angler knows in his or her heart, is that with the privilege of fishing comes the obligation to protect your home rivers," Rahr says. "People who worship spring Chinook know this, too. They're the vanguard: the first to migrate up the river, the first to spawn. And they're our most important hope."

Like orcas, humans also evolved alongside spring Chinook over millennia. For Indigenous communities who consider salmon and orcas to be family, the struggle of these species to survive parallels their own communities' experiences since Western contact.

This empathy can help us. We have a role to play in our home waters, and a responsibility. We must recover spring Chinook, in the Fraser and beyond. That means we must act now, or lose our last chance to save the first salmon. ■

A Spring Chinook Action Plan:

- Remove the Klamath and Snake River dams
- Empower Indigenous knowledge in salmon management practices
- Increase endangered species protections for spring Chinook across their range
- Improve springers' access to exclusive spawning habitat apart from Fall Chinook
- Promote the use of selective fishing tools like weirs, wheels, pound nets, and dip nets
- Decrease incidental mortality rates in recreational and commercial fisheries
- Reduce competition from hatchery salmon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