

The Fall of the Yukon Kings

By Dan O'Neill

Another side of the story on the declining Yukon River Chinook salmon run

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The Fall of the Yukon Kings

DAN O'NEILL



*I first met Dan O'Neill in 2006 over lunch in a Thai restaurant in Fairbanks with a few friends, including Peter Matthiessen; Fran Mauer, a retired wildlife biologist of the Arctic National Wildlife Refuge; and Luci Beach, a former executive director of the Gwich'in Steering Committee. I had read and talked about in my lectures Dan's book *The Firecracker Boys*—an Alaska classic, and a classic of American history. The 1994 St. Martin's Griffin edition of the book's front cover reads:*

On July 14, 1958, "Father of the H-Bomb" Edward Teller arrived in Alaska to unveil Project Chariot, a plan to carve a new harbor out of the Alaskan coast by detonating up to six thermonuclear bombs.

The back cover continues with:

Thanks only to a tiny handful of Eskimos and biologists, who recognized the

grave environmental implications of this plan, was the United States government finally prevented from inflicting a catastrophe worse than Chernobyl on its own land and people.

In this volume, Caroline Cannon refers to The Firecracker Boys, and Maria Williams writes about Project Chariot. In another book, A Land Gone Lonesome: An Inland Voyage Along the Yukon River, Dan wrote about the majestic Yukon River and the inhabitants of the region. In 2010, I urged him to write an essay for Arctic Voices. I was lucky. He was just getting ready to write about the king salmon—like the polar bear and the caribou, the king salmon is a signature species of Alaska, yet we know so little about the politics that revolves around its use and survival. Dan's first draft came in at over twenty thousand words—you can say that he threw a curveball at me. Fortunately, I had crucial help from editor Christine Clifton-Thornton in selecting, in consultation with Dan, a little less than half of those words for the essay that follows. He is now working on a book on the subject.



IN SEATTLE, New York, London, and Tokyo, seafood marketers, restaurateurs, and retailers speak of sockeye, coho, pink, chum, and Chinook. But an Alaskan first learns the names of the state's five species of salmon in colloquial form. They say "reds" for sockeyes, "silvers" for cohos, "humpies" for pinks, "dogs" for chum, and—not without homage—they call the Chinook "kings."

Kings or Chinooks, they are the rarest and most highly prized salmon in Alaska, the most sought after by sports fishermen, the most commercially valuable. And they are enormous fish. In 1949, a commercial fisherman working near Petersburg, Alaska, hauled in a king salmon measuring more than five feet in length and weighing 126 pounds. That is just about exactly the size of an average twenty-year-old American woman—5'4½", 127 pounds. In May of 1985, a local man named Les Anderson, fishing in Alaska's Kenai River, landed what is said to be the largest king salmon ever taken on a rod and reel: 97 pounds, four ounces. In a snapshot, Anderson takes a knee holding the shining slab horizontally, like he's poised to fit a chrome bumper onto a tractor-trailer.

In evolutionary terms it is tautological to say it, but kings are big for good reason. Big fish have the power to hold their position in swift currents, to feed

and breed and otherwise occupy places that would tax lesser fish. They can push aside the cobble-sized gravel found in faster water and deposit their eggs deeper, better protecting them. A single large female can deposit more than seventeen thousand eggs. And eggs from a large king are themselves large. They are loaded with more nutrients in the yolk sacks, improving the survival chances of the emergent alevins (a kind of half fish, half egg).

Like all the Pacific salmon, Chinook migrate from the sea back into their natal freshwater streams to breed. They breed only once in their life and then die. From California to western Alaska, there are probably well over a thousand spawning populations of Chinook. But the largest runs tend to be in the big rivers. The immense Columbia River hosts a notable run of Chinooks. But greater still is the Yukon River, which draws into its mouth the largest migrating Chinook, chum, and coho salmon stocks in the world.

From its delta on the Bering Sea coast in western Alaska, the Yukon bisects a subcontinental landmass comprised of Alaska and Canada's Yukon Territory. The Chinook that ascend the Yukon all the way to its headwater streams, like the Teslin River that arises in British Columbia, will travel more than two thousand miles from the ocean, climbing twenty-two hundred feet above sea level. It is one of the longest fish migrations in the world. Because the kings will not feed once they enter the river, they must build up beforehand tremendous reserves of oil. Consequently, the Yukon kings are the richest salmon in the world, containing as much as 24 percent oil. Many epicures who know Yukon kings say they have no equal.

Archeologists think that ancient hunter-gatherers had begun pulling the monster fish out of the Yukon River by eight thousand years ago. No doubt the people marveled at so providential a miracle: all these behemoths, each one a banquet of succulent food, torpedoing upriver, delivering themselves right to the people's camps, every year, like a gift from the far-off ocean.

An archival photograph from 1913 shows a fishing operation on the Yukon and a gate-mouthed lunker hanging from a fish rack. The photographer's annotation notes that the fish camp had caught some seventy-five-pounders. Another old photo from 1924 shows a nattily dressed man posing beside a hook-nosed king hanging in front of a shop in Dawson City, Yukon Territory. This fish is said to weigh eighty-five pounds.

The long history of local people fishing for kings along the Yukon River continues today. One woman told a National Park Service interviewer recently about the big kings her father used to catch below the village of Eagle: "I remember one time my dad and I checked the net across from our old fish



Stan Zuray by fishcamp shack at Rampart Rapids, along the Yukon River. (*Photograph by Stan Zuray, 2011.*)

camp down there . . . the fish was giant, and it wasn't dead . . . and it almost flipped us!"

Stan Zuray, who has fished for kings near the mostly Native village of Tanana for thirty-eight years, has similar stories. "It was always like a game each year. When would we catch the first fifty-pounder, you know? You'd catch that first fifty-one-pounder, that first fifty-four-pounder! And that would happen every year. I don't ever remember not catching a fifty-pound king salmon in those years, say, prior to Ninety-six or something like that," he says. "And then of course that changed."

Indeed it did. In 2010, the average weight of a king salmon caught in fish wheels at the Rapids where Zuray fishes was 10.8 pounds. That year, a scant 14 percent of the kings were females. To a fisheries biologist, these are classic signs of a fish stock in peril. Except, apparently, if the biologist happens to be managing this fishery for the Alaska Department of Fish and Game or the US Fish and Wildlife Service. In any case, the slender thread connecting the people along the Yukon to eight thousand years of traditional fishing appears ready to snap.

Stanley Zuray has been a dog musher, trapper, and salmon fisherman since he came into the upper Yukon area in 1973. He was twenty-three then; he's in his sixties now. His ponytail and his stubble have turned gray. He's got a few laugh lines, a few worry lines, and a few creases the country chipped in. He would remind you of Russell Crowe, if you could extrapolate Crow forward fifteen years and dial up a Boston accent. The accent seems unattenuated, maybe because he and his girlfriend moved so abruptly from Boston straight into the bush that he didn't have much contact with others until the neural ruts had worn too deep. Nine days after they arrived in Alaska, as soon as the car sold, they chartered a bush plane in Fairbanks and that afternoon tossed their gear out on the banks of the Tozitna River, forty roadless miles north of the village of Tanana, two hundred mostly roadless miles west of Fairbanks. "We fished the chum and king run that first year and kept the dogs barely alive—at least the ones we didn't eat," he says, laughing at the crazy truth of it. He is easygoing, congenial, affirming in conversation, and as resolute as the current of the Yukon River.

Like probably every fisherman who ever scratched his beard, Stanley will analyze all the angles and aspects of fish, fishing gear, catches, runs, and trends over the years. But perhaps more than most, he is circumspect—he thinks before he talks. He thinks *while* he talks, actually, editing himself as he goes, sometimes half out loud in his Boston brogue: "Fawty years, maybe? Er, fawty-one? Yeeeah. Yup. Fawty-one." Listening to him is like watching a

driver hunting for an address in an unfamiliar city—he keeps hitting the breaks mid-block, backing up, and trying another street. But it is an indication of his care with facts: strange as it may seem, he is a fisherman allergic to exaggeration. “I’ve been writing it down,” he says. “Some of this stuff I’ve been writing down for, God, maybe twenty years now. Because I know that as the years go on my perception is going to change.”

In hindsight, Zuray was pretty well suited for the strange direction his life would take. But it was pure accident that had him sliding smack into the middle of the politics and science of fish sampling. It started when a US Fish and Wildlife Service man named Monty Millard came upriver one summer in the mid-1990s looking for a wheel fisherman who would catch chum salmon for the government as part of a salmon population study. None of the fishermen in Tanana were available. Ditto all the way upriver to the Rampart Rapids, a fishing hotspot forty miles above Tanana, until finally Zuray was about the last person he could ask. Stan said he could probably help Millard out. He would have his own dog fish caught by September first or so. Staying on at the Rapids until the run petered out could mean he was there into October. But he could do it—stay in camp a little longer, run his wheel for the biologists, make a little money. He guessed so anyway. Monty Millard was a “big boss,” Zuray says, the first federal manager of subsistence fisheries for the Yukon River. But Stan liked him, thought of him as “a friend, and good guy, old school, who said what he thought (unless the bigger guys were there). He’s gone now.” Before his premature death in 2002, Millard helped to stir into motion a dust devil that became a williwaw, that became if not a storm system visible from space, at least a regional disturbance—Stanley.

Some of the upper Yukon people fish with gillnets tied to shore. These are called set nets. A salmon pokes its head in through the mesh, past its gills, and can’t back out again. Other people use fish wheels, which have been catching salmon on the Yukon River for a hundred years. A fish wheel is a big gangling contraption something like a paddle wheel with four arms. It’s perhaps twenty-five feet in diameter, mounted on a log raft, and turned by the current. Log spars and heavy cables keep the wheel positioned just off shore. Two opposed baskets project from the axle, and as the current sweeps them downstream, they strain the water intercepting fish migrating upstream. At right angles to the baskets, two paddles keep the wheel rotating during the moment when neither basket is submerged. As a basket rises in its rotation, it drops any fish onto a slide that sends it into a box alongside. It may seem like an artifact from some prehistoric stick culture, but when made the old-time

way, with the sweeping curves of peeled and bent tamarack and spruce poles, it is a thing of beauty, graceful in motion, ingeniously practical.

At grayed plywood tables along the gray stony beaches of the Yukon, the people cut the fish in different ways depending on the intended use. Most people will head and gut and fillet the fish, taking out the backbone and ribs. But they will leave a connection at the tail so that both fillets can be flipped flesh side out and hung over a pole to dry. Sometimes the meat is carefully slashed crosswise to facilitate drying. The guts go into the river, and the head and backbones go into the dog pot, which is half an oil drum set over a driftwood fire. A stinky stew is cooked every other day, enough for two days. At feeding time, up to thirty dogs will spin in orbits at the ends of their chains, stirring up the silent country with manic barking.

One way the people like to handle the kings is to make what they call “strips,” a kind of jerky, redolent of smoke and fish oil, eaten like candy by people all over Alaska, especially Alaska Natives. Strips are so highly prized, they are treated like money. Since antiquity, they have been a traditional medium of barter. What strips aren’t eaten by fall are put up in canning jars or frozen. Banked, you might say.

Generally, the smokehouse is a tall structure built of spruce poles. The roofs and siding show a patchwork of corrugated roofing panels differentially rusted. When you open the door, the light reveals thousands of strips dangling from racks rising far up to the ceiling, red-orange ribbons glistening against the smoke-blackened ceiling.

The creeping signs that the kings were in trouble first showed up in smokehouses. Stan had built his tiers of racks too close together, and that was a nuisance because the strips above were always touching the ones below. Then one year they weren’t. Every year, the gaps between the fish grew.

Actually, Zuray credits fishermen farther upriver in Canada with first pointing out the shrinking size of the kings. “Long before we experienced a decline in size and amount of fish and female rates, the Canadians noticed it. They talked about little fish, but it didn’t hit home. Then the problem moved down to the US side, into the Eagle area, and then the Fort Yukon area, and then it started hitting us. Because as the runs get smaller and smaller and smaller, the problem just moves closer to the source.”

The shrinking fish problem, as Zuray and his fellow upriver fishermen saw it, was abetted by the managers of the two agencies—the Alaska Department of Fish and Game (ADF&G) and the US Fish and Wildlife Service—that have jurisdiction over the Yukon River salmon runs. There were some excellent

field biologists working on the river, but their superiors, the fishery managers, seemed oblivious to all the warning signs of a fish stock in serious decline—perhaps on the brink of collapse—while obstinately accommodating the downriver commercial fishing interests. Reciprocally, managers' policies that favored the commercial industry necessarily short-change the upriver subsistence users. And that is to say nothing of the hapless Canadians, who are generally content to watch politely as the Yanks eat their lunch.

For example, Stan and other upriver fishermen had for years pointed out that a particular downriver method of fishing called drift netting was hammering the king salmon stocks. Fred Andersen, a retired fisheries biologist who worked in the Yukon fishery for more than twenty years, explains: "Traditionally, people along the lower river deployed set nets in eddies, and there are a limited number of eddies. So, the lower river fishery was pretty low key and slow paced." Then people discovered drift netting, where a net was stretched out from a boat drifting down the middle of the river. "And it was highly successful," says Andersen. "That gear was able to catch fish—is able to catch fish—that were completely out of reach of those shore-based nets," he says. "Now, 80 or 90 percent of the fishing in the lower river is by drift net. All of a sudden, the people are drifting fifty-fathom nets through these channels—fifty fathoms is three hundred feet—that's a standard piece of gear down there."

The result was a dramatic increase in catch compared with the time spent fishing, or the "catch per unit effort" (CPUE) in the parlance of fishery management. While the department looked at test nets, sonar counts, and the catch rates of subsistence fishermen, it was also managing the fishery partly on the basis of CPUE. "Then, all of a sudden—with drift nets—the gear was more efficient, and the CPUE went sky high." To any objective observer, the instantaneous rise in CPUE was because of the introduction of the new, more efficient fishing method. But to ADF&G, the harvest was higher because suddenly and inexplicably there were more fish in the river. And the miraculous multiplication of the fishes just happened to coincide with the appearance of drift netting. "They weren't stupid. They knew that drift nets were more effective. But it seemed to me that they never fully compensated for that increase in efficiency. It was crazy."

Crazy as in reckless, but not crazy as in incomprehensible. "It frequently seemed to me," says Andersen, "that there was and is a tendency to favor whichever data source was indicating greatest run strength, hence justifying lower river commercial fishing openings, and to downplay the other indicators that might be suggesting a run of lesser size."

One thing the department did accomplish over the years, says Andersen, was to substantially reduce the amount of allowable fishing time. But they also increased the allowable harvest. In 1980 a genuine bumper run occurred, with the Alaska commercial harvest topping 150,000 kings, a record that still stands today. In response, ADF&G proposed that the allowable commercial harvest for the lower river districts be increased from a fixed quota of 90,000 kings to a “range,” the upper end of which was 120,000.

“When you raise the quota, you raise the expectations of the fishermen—and the staff too, I suppose,” says Andersen. “So in the minds of a lot of lower river fishermen, that became the goal: 120,000. And they were relentless in their pressure on the managers to take as many fish in a given season as possible.” The lower river fishing districts have, since statehood, been managed from an office in Emmonak, near the mouth of the Yukon, and they still are. “So the managers were there. They were accessible. They were there to be beat on by the local guys who wanted more fishing time, longer fishing periods and more of them. Just a lot of pressure on these guys to capitulate and allow more harvest than they might have done absent that pressure.”

The larger harvests might not have been a problem while the runs were strong during the 1980s and through most of the 1990s. But then, starting in 1998, the runs plummeted. And people like Stan Zuray began to press the Alaska Board of Fisheries to do something to control overfishing in light of poor returns. In this, Stan wasn’t the lone campaigner, nor even the first. Virgil Unphenour, a highly knowledgeable fish processor from Fairbanks, had been paying attention and speaking out years before Stan. Mike Smith of Fairbanks, and Andy Bassich and Don Woodruff from Eagle, were showing up at meetings and testifying. Singly and severally, they submitted conservation-minded proposals to the Board of Fisheries and applied what pressure they could. Unfortunately, it wasn’t much of a contest. The upriver people would typically be represented by Zuray and a few other guys in their jeans, flannel shirts, and go-to-town sneakers, doing the best they could. But the downriver commercial fishing interests were organized by a professional consultant; they occupied a large section of the hotel lobbies where the meetings took place; they had secretaries staffing tables stocked with position papers and equipped with laptop computers. One year, the commercial-fishing interests chartered a fifty-seat airplane to bring lower river people in to testify at a Board of Fisheries meeting in Anchorage. “They packed the room full of people,” says Zuray. “Seventy-six people, I believe, testified at that meeting. And four of them, me, Virgil, Andy Bassich, and Mike Smith [all from upriver] testified

that there's a problem on the Yukon River, and nobody's admitting it, and here's the data. And the other seventy-two of them testified basically that they were going to starve to death, you know—I'm joking about that—but basically, 'We're going to starve to death if these proposals pass.'" None of the conservation proposals submitted by the upriver people passed.

The Board of Fisheries consists of a group of citizens—political appointees—who rely on technical advice provided by the ADF&G. Every third year the board hears proposals dealing with the Yukon area, and at each such meeting for over a decade the upriver people submitted proposals urging regulation to address the decline in king salmon size and the loss of big females. They called for the river-wide elimination of drift net fishing; they proposed a river-wide reduction in the depth of the nets; and they asked that the maximum allowable mesh-size for all gillnets be reduced to six inches.

Prior to 2010, the mesh size allowed on the Yukon River was by regulation . . . unregulated. A fisherman could use as large a mesh size as he wanted. Some biologists say that the Yukon, as of last year, was probably the last large-mesh commercial fishery for salmon in the world. In any case, the fishermen were using very large meshes, usually 8 to 8.5 inches (measured between diagonal corners when stretched). Smaller fish could go through such a net, but the bigger ones are caught very effectively. The females tend to be larger than the males, so the large-mesh nets effectively target the large, highly fecund females.

Essentially, large-mesh nets selected the larger, older fish, especially females, and removed them from the population before spawning. If smaller-mesh nets were used, most of the larger kings could bounce off and swim around it. But use of the large mesh amounted to a combination punch: first, the genes for large fish were being disproportionately removed from the gene pool; and second, small-fish genes were amplified, because fish with those genes were more likely to go on to spawn. Consequently, all of the environmental forces that had favored king salmon to evolve into a very large fish now would be out of phase with the actual size of the fish. Whatever other environmental forces may also be at work, this particular gear type was, in effect, changing the genetics of the Yukon kings.

Not until 2010 did the Board of Fisheries finally agree to establish a maximum mesh size. Unfortunately, the board put the limit at 7.5 inches, which Zuray and the upriver fishermen felt was the worst possible move. They wanted a 6-inch maximum or no change at all. The forty- and fifty-pounders had been essentially fished out, and a 7.5-inch mesh, they felt, would simply

target the next-largest fish remaining: the thirty-pounders. Fish and Game's commercial fish managers quietly supported the change, tacitly conceding a point they had ardently denied for years: that there was a problem with the size of the Yukon kings. But it was not the come-to-Jesus moment it might appear to be because a Fish and Game study suggested the most effective net size for catching king salmon was the 7.5-inch mesh. In Zuray's view, Fish and Game's new regulation likely will not enhance the run by putting sufficient large fish on the spawning ground, but rather better ensure that the largest remaining kings are caught by fishermen before they can breed.

Of course it makes sense—so long as the run is healthy—to have a significant commercial fishery at the mouth of the river. There, the kings are just in from the sea, dime-bright, and plump with their maximum oil content. They have their greatest market value in the lowest portion of the river and, as Fish and Game frequently points out, the people in this part of Alaska are very poor. The US census data for the district that includes the Yup'ik Eskimo villages of the lower Yukon River show the residents to be 90 percent Alaska Native, with a very low level of formal education, and to be one of the most impoverished districts in the nation. Twenty-nine percent of the residents have incomes below the federal poverty level. On the other hand, the census district next door, which includes nearly all of the upriver Athabaskan villages almost to the Canadian border, itself has a poverty level of 25 percent. And because the fish arrive in somewhat poorer condition at upriver locations, the fishermen there have less of an opportunity to sell their catch. Thus the upriver people's need for salmon is based more on traditional fishing for food, rather than on sales and exportation to the fish-hungry Japanese or the lox market in New York. Even though subsistence fishing has priority in law over commercial fishing, the messy business of allocation does not generally favor the upriver subsistence fishermen. In effect, the upriver fishermen get the least desirable fish, courtesy of nature, and have no clout either, courtesy of politics.

In a state where the phrase "economic development" has become a mindless mantra guiding all decisions on resource development, it is tempting to assume that political pressure directly influences agency policies favoring commercial fishing. But Fred Andersen says that's an oversimplification. Andersen's twenty-eight-year career with the ADF&G includes sixteen years managing the middle and upper Yukon fishery and seven more years monitoring subsistence fishing on the Yukon for the federal government. "In general, Fish and Game does a great job managing the state's fisheries. The problem

is with the parochial Yukon River managers whose decisions turn out to favor lower Yukon commercial fishing interests over those of conservation and subsistence users and Canada.” The federal government is charged with protecting subsistence fishing, and they could weigh in. But, since Monty Millard’s death, “they are not inclined to intervene,” says Andersen,—especially for most of the last decade, when a strong states’ rights message was coming down from the George W. Bush administration. “The Fish and Wildlife Service just waits for the state to do something and they follow suit. They will not oppose or get out in front of the state, even when they have the authority.”

To be fair, those who manage this fishery face an almost impossible task. Management decisions are based on a dog’s breakfast of science, politics, ideology, and money interests. They are made in the context of a rolling crisis that sometimes can only be met with wild-ass guesses (blow twice into your fist and throw the dice). The degree of disarray belies the degree of importance. A lot of people have a lot at stake—not to mention a culture, not to mention an extraordinary animal. “I have heard it said, and I agree,” says Andersen, “that the Yukon is probably the most complex salmon fishery in the world. You’ve got an immense and muddy river essentially two thousand miles long.” You cannot see the fish at all until they leave the silty main stem for clear water tributaries. “You’ve got a run of fish that may take six weeks from the mouth to the upper spawning streams.” And there are four separate runs of salmon in the Yukon: kings, summer chums, fall chums, and a run of coho in the fall. In turn, each run in is usually made up of several discrete pulses.

“The managers are asked to divine not only run strength,” says Andersen, “but stock composition—how many of that total run are going to what region of the drainage. And there’s on the order of probably three hundred or more spawning streams there.” *Divine* is the right word, because the counting techniques employed are fairly primitive, notoriously wrong, and in part extrapolated from data that ADF&G withholds. A sonar unit near Pilot Station in the lower river detects some of the fish, but not all. And it cannot distinguish between small kings (most kings are small now) and similarly sized chums or whitefish, all of which may be mixed in together. At one point ADF&G acknowledged their sonar Chinook counts had been high by 40 percent for many years. “Pilot numbers have been all over the board with respects to actual abundance,” says Andersen, “which is pretty much unknowable anyway.” In 2005, ADF&G replaced one of its two sonars with another type that presumably detected kings not picked up by the older one. This

convenient presumption instantly boosted the run estimate by 30 percent, allowing managers to suggest the run was improving.

Once the strength of the run is divined, says Andersen, the managers must put sufficient breeders onto the spawning grounds while giving a reasonable allotment to both commercial and subsistence fishers. To do that, they alternately open and close commercial and subsistence “windows.” And because several species of salmon are moving up the river at once, in multiple pulses, for up to a month and more, strung out over hundreds of miles of river, the managers must choreograph commercial and subsistence openings and closings in six fishing districts and ten subdistricts concurrently.

If that hasn’t given you a headache, consider this. In Alaska, the Yukon River passes through both state and federal land. Subsistence fishing is treated one way under state law, differently under federal law. So a given fish heading upriver repeatedly crosses jurisdictional boundaries, alternating subjection between state and federal regulations. While ADF&G regulates four different kinds of king salmon fisheries on the Yukon (subsistence, commercial, sport, and personal use), most of the kings caught in Alaska originate in Canada. And that country’s Department of Fisheries and Oceans applies *different* regulations to four *differently* defined fisheries (First Nations, domestic, sport/recreational, and commercial). Naturally, there’s an international treaty to throw into the bouillabaisse, so add the State Department and the Pacific Salmon Treaty (1985), to which the Yukon River Salmon Agreement was appended after seventeen years of contentious negotiation.

Finally, list among the parties of interest a welter of non- or quasi-governmental organizations in the form of aboriginal tribes, Native corporations, tribal councils, village councils, fishermen’s associations, several federal subsistence advisory councils, and state advisory committees. “The Alaska Department of Fish and Game has a very, very tough task,” says Anderson. “But the complexity itself is an argument for conservative management—for backing off and for erring on the side of conservation.” And this, says Andersen, the agency has not done. His review of the ADF&G’s management oscillates between the genuinely sympathetic and, as he says, “pretty goddamned critical.”

Brushed off by ADF&G, ignored at the Board of Fisheries, Stan Zuray and his friends tried the Yukon River Drainage Fisherman’s Association (YRDLA), on whose board Stan sat. Like nearly every other party to the discussion, YRDLA is heavily influenced by the powerful commercial interests of the lower river. Still, Zuray made his case each year, recounting how the king buyers who came upriver in the 1980s refused to buy a fish smaller than fourteen

pounds. In a few years, the minimum was twelve pounds. Then ten. “The last half dozen years,” says Zuray, “up to 2007 when upriver commercial king fishing ended, they’d take anything we got.” But the downriver fishermen were hard to convince that something was seriously wrong. “And YRDEFA operates by consensus,” says Zuray, “so any disagreement means no action is taken.” Twice in 2007 he insisted the executive committee vote on the question of whether or not there was a problem with Yukon king salmon declining in size. Twice the result was one vote shy of unanimous—Stan’s being the only affirmative vote each time.

Still, he had hopes that at least science would be on his side, that objective research would validate his observations. But somehow, none of the agencies ever quite managed to conduct a study capable of answering the pertinent question. There was always some reason to consider the scientific research to be inconclusive, especially as to whether fishing practices might be involved in the kings becoming smaller. Reading the studies, one gets the sense that the writers are working awfully hard to *keep* from saying something. Many resort to evasive formulations, noting that none of the studies “has been able to exclude the possibility that other factors,” such as environmental conditions, are the cause. Of course, we may never be able to “exclude the possibility” of some environmental factor at work, while it still may be possible to prove statistically that a given fishing practice causes size decline. Statistics prove that smoking causes lung cancer, even if we cannot prove that a particular lung cancer was caused by smoking. Yet it is *known* that reducing smoking in a large population *will* reduce the incidence of lung cancer.

Some biologists, too, express frustration with the lack of focused research. University of Alaska fisheries biologist Chris Stark says, “They can’t see anything yet—that’s correct. And if you don’t look you can’t see anything.” Fred Andersen goes further. “I don’t think they wanted the answer. I really don’t,” he says, speaking of the fishery managers. “I think that the very essence of this is that those guys just didn’t want to deal with the shitstorm of protest that would blow up if they took the draconian measures that were required.”

Neither was Stan, who was gradually absorbing the sensibilities of a scientist, much impressed with the seriousness of the agencies’ approach. For one thing, the sampling was pretty haphazard. “There’s all these data sets. This one’s from 1979 to 1984, then that project ended. Then there’s another one from, you know, ’77 for three years, then that one ended. Then there’s a weir project. There’s just not much consistency. I thought to myself, *Nobody’s monitoring this.*”

Zuray was likewise underwhelmed with the agencies' experimental technique. Some of their data were not randomly sampled. Sometimes sampling did not extend for the full duration of the run. Or the size data was a mixture of samples taken from both fish wheels and nets. Or the nets were of different sizes. By now Stan knew all these things made a difference. "I mean, it just wasn't good data, not as far as assessing the size." For him there was really only one option. He would get his own data, and he would do it properly. He would build the most reliable database on Yukon king salmon in existence and one that directly addressed the problems affecting fishermen.

At first, Stan had no idea how wholeheartedly he would take to the science of fish data collection, or how far into these dark arts he would stray. The chum tagging he'd agreed to do for Monty Millard in 1996 was actually directed by a young biologist named Tevis Underwood. A few years into the project, Underwood noticed that tagged fish were not showing up in recapture wheels upriver. In fact, sometimes they showed up many miles *downriver*. They seemed injured, disoriented, even dying en route. Underwood thought it likely the fish suffered too much trauma banging around in the wire mesh of the fish wheel baskets, being jammed together in the submerged "live box," and finally getting scooped out, measured, tagged, and heaved back into the river. He asked Stan to help redesign the fish wheel to be more fish friendly. After all, the scientists didn't want to eat the salmon; they just wanted to take some measurements and leave the fish to go spawn. In particular, Underwood wondered if a video camera might be employed to count fish.

The wheel that Stan Zuray designed and built with Tevis Underwood's help (and in consultation with Dave Daum, a computer whiz at Fish and Wildlife) was a wonder, a Buck-Rogers-meets-Fred-Flintstone machine incorporating, among other things, springy webbing for the baskets, a slippery plastic slide, an on-board computer, a waterwheel generator, a solar panel, deep-cycle batteries, an infrared sensor, lights for nighttime operation in the fall, and a 7-Eleven-style surveillance video camera. The "capture" took place on camera as the fish slid straight back into the river. Hundreds of short movie clips showing sliding fish was saved on a small removable disk in the laptop. At day's end, Zuray could run his boat over to the wheel and retrieve the disk—both fish and man much less worse for wear. (Later on, Stan reduced the labor further with a wireless transmitter beaming the data across the river to his camp.) This system was adopted at other sites on the Tanana and Yukon Rivers and became the standard for research fish wheels thereafter.

The only real problem came when Underwood gave Stan his laptop computer and told him, "It's your project, go write the report." For all his mechanical competence, Stan had never used a computer or even a typewriter. Nor did composition come easily. When the laptop's battery ran out five hours later, Stan had produced his name, address, and the word *Introduction*.

But, encouraged by Tevis Underwood and some of the other Fish and Wildlife Service field biologists (like Dave Daum and Randy Brown), as well as visiting scientists from the States, Zuray banged out his first grant proposal in 2000. He became an independent contractor, catching and measuring fish, assessing such things as the size, health, and abundance of the salmon runs. With something like a convert's zeal, he became devoted to the collection and purification of data. The next year he landed another grant to utilize a locally available pool of nascent scientific talent: the high school-age bush kids scattered along the river at various fish camps. The kids already knew a great deal about handling fish, and the older ones could run boats. Now Zuray and various scientists trained them to carefully and consistently record good data—data that could stand up to any challenge. "I worked for him for seven summers," says one young man, now a biology major in college. "And he's a Nazi when it comes to making sure that the data is accurate and unbiased. He's always all about getting good dater," he says, cheekily imitating Stan's New England-bred intrusive *r*.

"That's why we started doing what we are doing," says Zuray. "We started dabbling in 2001. And by 2004 we had the protocols down. We knew what we had to do. We'd worked with enough experts. By 2004, our Student Data Collection Project was now a database that to this day is recognized as some of the best data that's taken on the Yukon River. Even by ADF&G, who a lot of times didn't really appreciate what we were doing."

What Stan and the kids did over the years—with the significant cooperation of the other subsistence fishermen at the Rapids—was to collect meaningful data that were beginning to prove what ADF&G had steadfastly discounted: that there was, among other things, a decline in size in Chinook salmon, a decline in the percentage of females, and the prevalence of a lethal disease called Ichthyophonous. Of 5,806 kings Zuray has randomly sampled between 2004 and 2010, none weighed fifty pounds. Only two exceeded forty pounds. Thirty-pound fish have become rare. In 2010, the average weight of a Yukon king caught in fish wheels at the Rapids was 10.8 pounds, with a scant 14 percent females. In the five years prior to 2009, only a single fish was caught in the forty-pound range. Of the 1,002 kings Zuray sampled in 2010, only 6

were more than thirty pounds. It is almost to the point, says Zuray, where the number of fish caught in the thirty-pound range equals what they used to catch in the fifty-pound range. "We've probably lost *twenty pounds* off the top end."

All the data are public information, obtained with public funding, so Zuray makes use of it on his personal website (www.rapidsresearch.com), which he constructed himself. Here he has organized an enormous array of Chinook and chum salmon data, technical information, annotated spreadsheets, charts and graphs, government reports, professional papers, photos of his troop of student-technicians in action, videos of fish wheels in motion, and links to other pertinent sites. At a time when the ADF&G's reports were fairly plainly illustrated, Stan's were festooned with full-color bar charts and multi-axis graphs showing complex run timing comparisons. "I heard that people were asking Fish and Game why their charts weren't as good as mine," Stan says with a cackle. Not long ago he was in Fairbanks at the Fish and Wildlife Service offices helping Tevis Underwood learn to do double-axis graphs, and they laughed at how roles had reversed.

He also posted his own daily fishing report that anyone who signed up could receive via e-mail. Where he offered opinion, he generally wrote in a polite, understated way, though irony and sarcasm were tools in his kit. Sometimes he proposed steps that might be taken to restore the run. It was his own site; he produced it on his own time. Nobody paid him anything to do it, as his elaborate disclaimers assert. Biologists from all over the greater Northwest noticed his work. Jim Winton, Supervisory Research Microbiologist at the Western Fisheries Research Center (Seattle), wrote to say, "Your student project is the best long-term disease project I know of in terms of data quality, data access and value for money." Dick Kocan, a research professor at the University of Washington says, "I know a lot of scientists here in Seattle who follow his web site on a regular basis; it's a fundamental part of their everyday education." Larissa Dehn, a professor at the University of Alaska, wrote, "Long-term data sets are invaluable in this effort and Stan has an uninterrupted time series dating back to 1999 . . . I have come to respect Stan as a great scientist. . . ." In a word, Stan's data really *was* the best data on the Yukon.

But where support for his work splits, Zuray says, "is where the biologists and the managers separate." As Stan's records grow into a significant database, and as he got better at sharing his information, managers at ADF&G seemed to become nervous. One e-mail from the ADF&G notes that "everyone appreciates the quality and timeliness of information your project provides," but goes on to say that some ADF&G managers consider his comments to be



Boys taking king salmon data at Rampart Rapids, along the Yukon River. (Photograph by Stan Zuray, 2004.)

“egregious” and asks that he “tone your run assessments down a little.” When Stan advised his readers that he would begin offering “positive ideas to help the king runs,” an ADF&G manager named Steve Hayes responded within half an hour: “May be a better idea not to use the rapids test fish wheel project for this. I am not sure it is in the funding guidelines.”

But soon he got a tip from a pal within one of the agencies that certain managers were “pissed off” about his dispatches. They intended, said the informant, to press the Yukon River Panel “to limit what you can say while being paid by Panel funds.” The Panel is the US and Canadian body established under the Pacific Salmon Treaty to jointly set harvest and escapement goals and to fund research. Actually, Zuray’s critics went further than trying to restrict his commentary. Despite excellent reviews from field biologists, a virtual who’s who of top ADF&G and Fish and Wildlife Service managers all sent comments to the Yukon River Panel in late 2002 that seemed aimed at cutting Zuray’s video wheel project all together. The project was “obsolete in the face of increased mortality from excessive handling of fish,” said Bonnie Borba from ADF&G. It would only be providing “run timing and river conditions,” said Russ Holder from the Fish and Wildlife Service. Gene Sandone, the regional supervisor for Arctic-Yukon-Kuskokwim commercial fisheries, who supervised just about everybody working on Yukon River salmon for the ADF&G, noted that the efficiency of Zuray’s wheel in 2002 “increased during times of high water and this was not corrected for in-season.” Zuray scrambled to collect some responses into a letter he sent to a supportive panel member, but as it turned out, that member did not attend the meeting, and Stan’s rebuttals were not heard. If there was a coordinated effort to eliminate Zuray’s funding, it worked. With ADF&G’s recommendation, the Yukon River Panel ended its support of the video fish wheel project.

At that time, Stan had two grants underwriting his video work. The Yukon River Panel paid for counting fall chum, and the federal Office of Subsistence Management (OSM) paid for counting Chinooks. To an unwholesome extent, there is a great deal of interlocking membership on the various fisheries advisory boards and commissions. OSM’s technical review team was dominated by the same people who sat on the Yukon River Panel. “I was told to not even waste my time trying to renew my OSM grant in 2003,” says Zuray, “so I didn’t.” He collected king data for 2003, but after that Zuray was out of business, his fish sampling operation had been totally shut down, his rise as a credible spokesman for conserving the king salmon had been blocked.

But not for long. Riding to the rescue—quietly, not wanting to make a fuss—came the Canadians. “In the spring of 2004 I was told through back

channels that the Canadian portion of the Yukon River Panel would like to fund me again, and that they would stand behind me if I put in for funding. So I did, and they have backed me ever since.”

Incredibly, the “increased mortality from excessive handling” reference in Bonnie Borba’s disparaging comments referred to Tevis Underwood and Zuray’s early work showing that fish held in “live boxes” were being harmed. ADF&G had been using live boxes on its research wheels for thirty years with no one picking up on the problem. Then Tevis and Zuray started tagging, and within two years they identified the trouble and pioneered the fish-friendly modifications that have become standard practice. All of this Borba knew before performing the intellectual contortionism necessary to hang “increased mortality” and “excessive handling” on them.

Russ Holder apparently did not notice that Zuray’s wheel provided more than “run timing and local river conditions.” Among the things Holder overlooked was that the data from Stanley’s wheel better predicted the actual number of Chinook delivered to Canada than did ADF&G’s analysis that drew on a vastly more extensive and costly censusing apparatus. (Not for nothing the Canadians liked him.)

Mr. Sandone criticized Zuray for not applying a correction in season (Summer 2002) when the water levels were high. The idea is that the catch rate of a given fish wheel might vary as water levels rise and fall, even if the passage of fish was constant. The variance might be in a known relationship to water level, and so a correction factor might be devised and applied to the catch figure. Two things struck Zuray as especially amazing about Sandone’s statement. One is that such a correction formula had not been invented until *after* the 2002 season, so it could hardly have been applied “in season.” The second is that the formula, now a standard tool on research wheels, was invented by Stan. Though one person might see the formula as a fisherman’s gift to the scientific community, Mr. Sandone apparently faults him for not having invented it earlier.

Stan was back in business. But as late as 2010, ADF&G advanced the notion that if there was a problem with the king run, it might be that management was allowing *too many* kings to reach the spawning grounds. At one point, an ADF&G statistician concluded that the fish were actually getting bigger. But the truth was the size of the kings making it upriver declined every year, except in 2009, which was a special—and very interesting—case.

The 2009 run was projected to be poor. So there were lots of meetings around the state that winter, says Zuray, and everybody knew there would be

significant closures to fishing during the summer of 2009. There was even talk of “whole pulse closures,” meaning that a pulse of kings would be protected all the way up the river. Fish and Game would close off fishing in a particular district just as that pulse of fish was about to enter it, and open it again only after the pulse had passed through. By doing this, district after district, all the way to the Canadian border, they could ensure significant border passage.

This, as one of Stan’s several confidants within ADF&G suggested, presented a unique opportunity to collect a special kind of data. Zuray should get a new permit to catch and weigh fish during the closure, suggested his friend, and he would be wise to do so without anybody knowing about it. “Because if they knew what I was up to they’d stop me from getting the permit,” he says. The permit he already held for catching fish for the video project did not allow him to actually handle the fish—the fish slid immediately back into the river. He did weigh other fish, but they were either his own subsistence harvest or that of the other subsistence fishermen around the Rapids, and he didn’t need a permit to weigh people’s catch. But because no one could fish at all during the closure, and because his video permit didn’t allow him to handle the fish, he needed a new research permit. “So that winter I just tucked it into my video permit application—the permit I send in every year.” Though it is likely nobody in management noticed, Zuray had added to the terms of his annual permit that he would be allowed to catch and handle three hundred Chinook salmon during any closure that might be ordered.

“I figured the managers knew that if they were to restrict fishing that much—like a whole-pulse closure—that a lot more big fish would make it to the upper river. And that was not the kind of information they wanted put out, because they had denied in the past—at lots of meetings everywhere—they had always denied that closing fishing to that extent would have that effect. They had always said that the problem is out in the ocean; they said the problem is with the Bering Sea pollock fishermen taking too many Chinooks; the problem was *not* large-mesh gillnets in the lower river. And they did not want to have definite, stark, in-your-face data about how much better off the fish are going to be if they managed the fishery this way.”

The little drama played out exactly as the co-conspirators anticipated. A whole-pulse closure was indeed declared on the first pulse of Chinooks, and when that pulse reached the Rapids, having been protected all the way upriver from the mouth, Zuray saw what he expected. Big fish. Lots of them. When he passed this information on, his inside man said to him, “Well, maybe it’s time to flush the crooks out.”

That night, Zuray posted his update and included a picture showing his student techs at the fish wheel, weighing kings during the closure. The next day he presented a little summary of his data, showing a whopping 50 percent increase in weight over the previous year's pulse-one. The percentage of females shot up from a miserable 7 percent the previous year to 29 percent. Even though the run was not yet half over, he had already sampled as many greater-than-twenty-five-pound fish as he would ordinarily see in two to three years' complete runs.

When Zuray checked his e-mail the next morning, he had a message from ADF&G requesting he call "before the bureaucratic brush fires start to flare up." People at ADF&G's commercial fishing division were not happy and were demanding to know what the hell Stan Zuray was doing weighing fish during the closure and under what authority. Stan was asked to send off to ADF&G a more detailed description of his weighing methodology, but, no matter how upset commercial fishing managers were, it was too late. Stanley had the data, and he would publish it. It would show a significant jump in the size of king salmon for 2009. The 2009 fish were 22 percent larger than the average weight of fish sampled over the previous four years. And in 2009 there were 440 percent more fish over thirty pounds compared to the previous four years' numbers. A little bit of guerilla data gathering had pierced the agencies' inflexible public position and shown exactly how to put larger (and hence more fecund) fish onto the spawning grounds. The data demonstrated to the satisfaction of many that at least part of the problem with the declining size of king salmon was *not* due to uncontrollable environmental conditions in the ocean, but because of overfishing on the lower river. And that was a condition ADF&G *could* control, if they only would. "We took one of the poorest runs recorded at the mouth and made it into one that not only met border escapement but did it with some of the best female rates and sizes in years," he says. "Just think what we could have done with some of those larger runs of the past when problems were just starting."

It took a decade of argument and, above all, a decade of data, but by 2009 YRDEFA finally and formally agreed unanimously with Zuray that the king salmon were shrinking and the run was in trouble. Even the Alaska Department of Fish and Game's John Linderman (Gene Sandone's replacement) vouchsafed in an interview that "there's definitely a strong indication, and pretty conclusive, that we have seen . . . a decline of older and larger king salmon within the Yukon." Still, ADF&G not only comes late to the party, it comes empty-handed. Its policies follow a familiar pattern: the upper limits on harvest are pushed up and the lower limits on escapement are pushed down.

In 2010, the ADF&G members of the Yukon River Panel pressured the far too-complacent Canadian members into accepting a lower Chinook escapement goal into Canada. The 2010 escapement did not meet even this lowered goal.

Moreover, ADF&G continues to attempt to publish in the scientific literature unsupported claims that tend to discredit Stan Zuray's data. On each of multiple occasions, these papers have been rejected in the peer-review process. Recently, Stan and two distinguished scientists from Washington state collaborated on a paper that challenges the Alaska Department of Fish and Game's allegations. That paper has been accepted for publication by the lead journal of the American Fisheries Society. The lead author is Stanley Zuray.*

In its biased accommodation of lower Yukon River commercial fishing interests, ADF&G—with the US Fish and Wildlife Service passively in attendance—has presided over the near extinction of the Yukon kings. Partly in consequence, an ancient human culture dependent on that fish slides closer to extinction as well. Meanwhile, Stan Zuray collects and interprets his data and waits for the day when the agencies charged with fish conservation awaken to their mission.

NOTE

* Zuray, Stanley, Richard Kocan, and Paul Hershberger. "Synchronous cycling of ichthyophonia with Chinook salmon density revealed during the annual Yukon River spawning migration;" *Transactions of the American Fisheries Society* (in press).