Salmon Nation

People and Fish at the Edge

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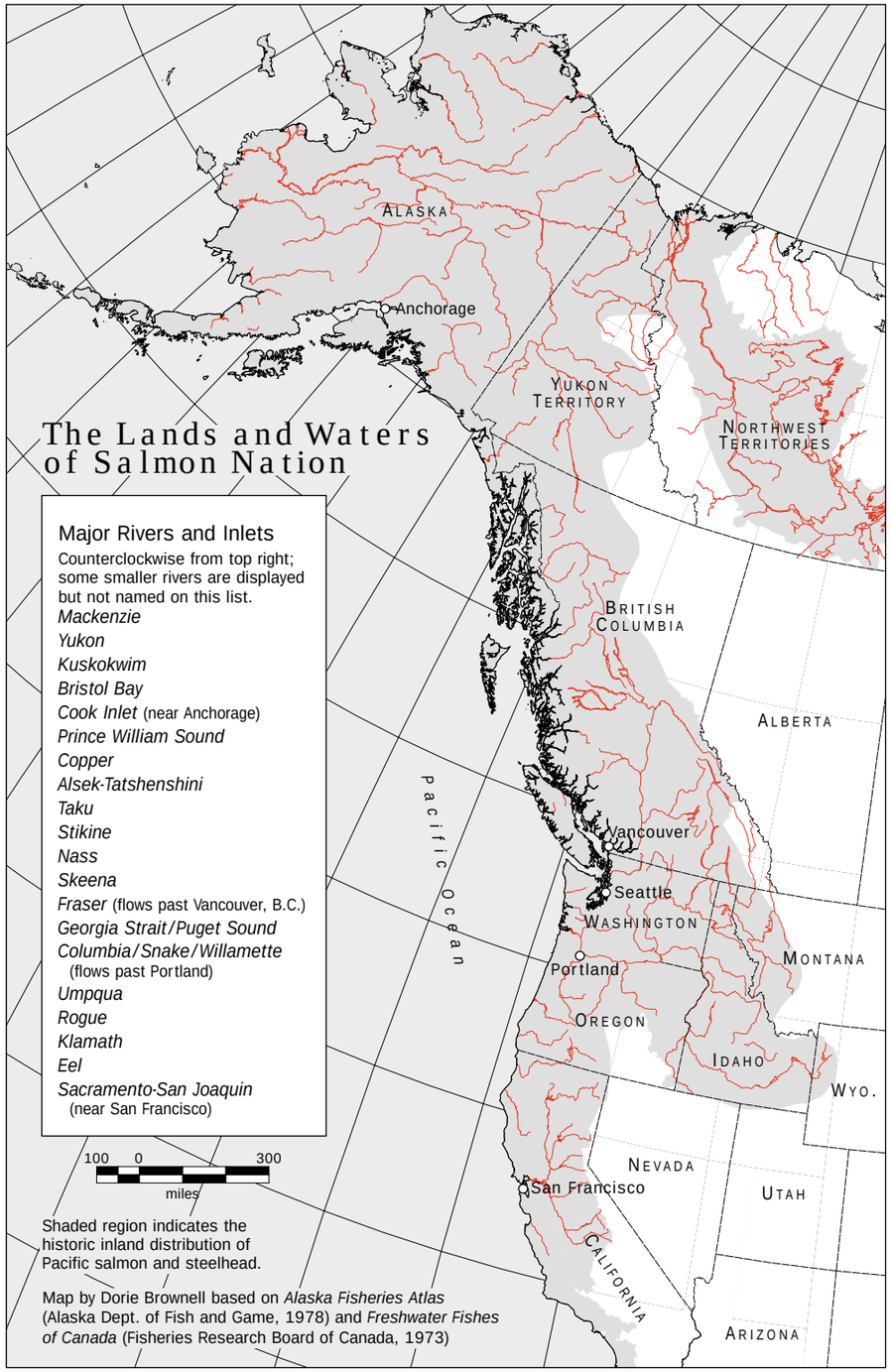

Salmon Nation

People and Fish at the Edge

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Ecotrust
Portland, Oregon

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First Edition
Printed in Portland, Oregon, United States of America

Library of Congress Card Number: 99-68310
ISBN 0-9676364-0-X

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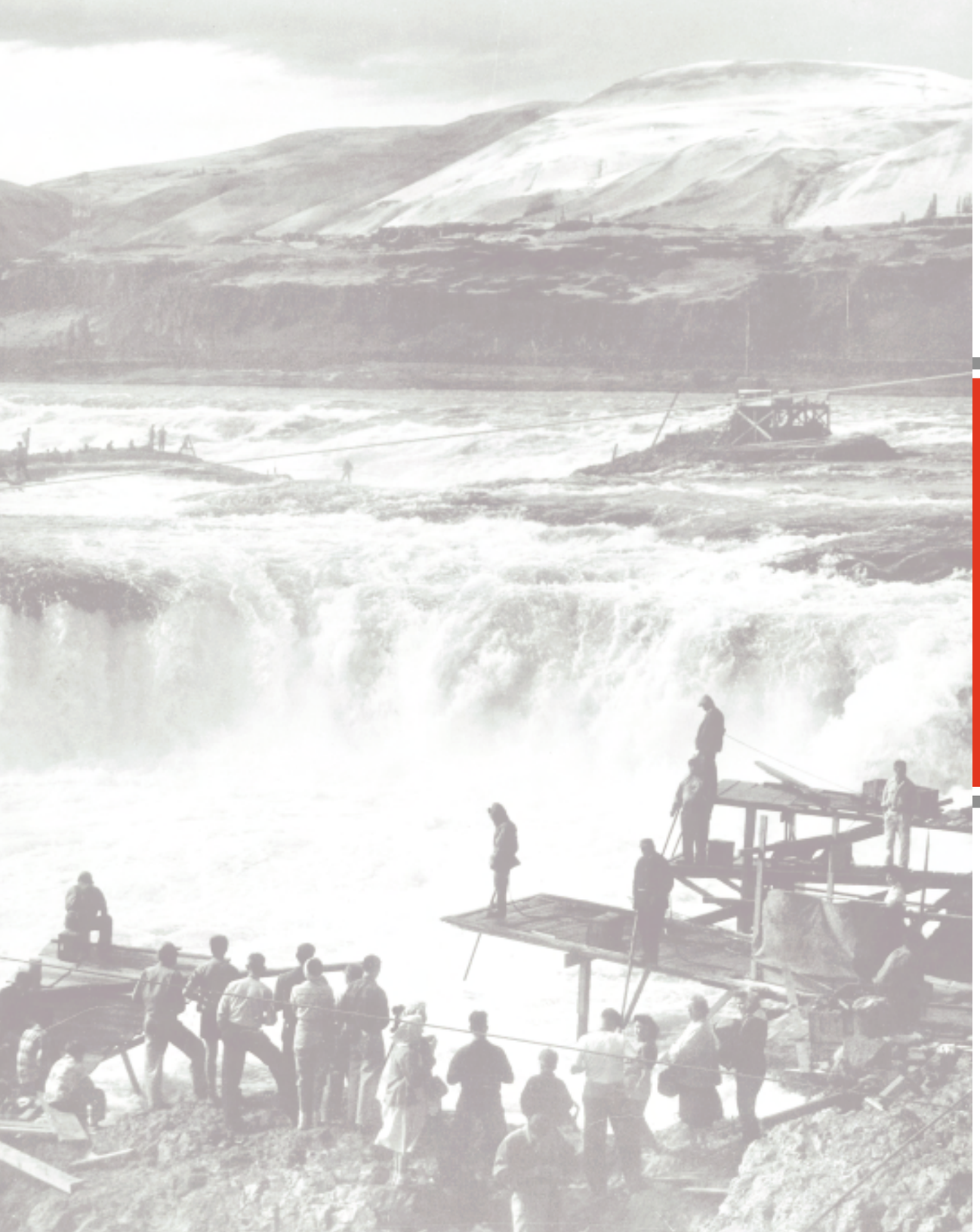
Introduction

All along the West Coast, the salmon controversy fills the airwaves and newspapers. From Alaska's Bristol Bay to the central California coast and inland to the Sierra Nevada and the Rockies, we have so much salmon news thrown at us that sometimes we can't see the school for the fish.

This book steps back a few paces to put the situation in context. The story begins with the way life with salmon used to be in aboriginal times, explores the sources of the salmon's present straits, and concludes by surveying the prospects for creating a fresh connection between people and fish, tailored to our times. It includes maps that show where the salmon are in trouble, where they've gone extinct, and where they're thriving. You'll discover the difference between wild and farmed salmon fillets, and learn to name the different kinds of fishing boats that you see along the dock. You'll meet people at the frontiers of a new salmon economy, who are devising a livelihood that benefits the fish and themselves.

There was a time when salmon were central to everyone who lived in salmon territory. For a few recent decades, however, the business of salmon became the concern of just a narrow slice of the population — only those who caught or hatched or processed them — and was taken for granted by those of us who simply ate them. Now, with the listing of salmon as threatened or endangered species in much of the Northwest including metropolitan Seattle and Portland, salmon are playing a larger role in our lives.

We offer this book as a guide to becoming better informed citizens of Salmon Nation.



For as long as people have lived along the north Pacific Coast, the salmon have been here. Aboriginal people lived with the fish for centuries, respectfully catching what they needed and taking care of the streams that produced a harvest essential to their way of life. Native American writer Elizabeth Woody takes us to Celilo Falls on the Columbia River, a place where indigenous relationships with salmon prospered for at least twelve thousand years; she introduces us to what was, and what remains.

Recalling Celilo

BY

Elizabeth Woody

Along the mid-Columbia River ninety miles east of Portland, Oregon, stand Celilo Indian Village and Celilo Park. Beside the eastbound lanes of Interstate 84 are a peaked-roof longhouse and a large metal building. The houses in the village are older, and easy to overlook. You can sometimes see nets and boats beside the homes, though some houses are empty. By comparison, the park is frequently filled with lively and colorful wind surfers. Submerged beneath the shimmering surface of the river lies Celilo Falls, or *Wyam*.

Wyam means “Echo of Falling Water” or “Sound of Water Upon the Rocks.” Located on the fourth-largest North American waterway, it was one of the most significant fisheries of the Columbia River system. In recent decades the greatest irreversible change occurred in the middle

Columbia as the Celilo site was inundated by The Dalles Dam on March 10, 1957. The tribal people who gathered there did not believe it possible. The Dalles is one of nineteen dams on the mainstem of the Columbia River built to generate the cheap electric power celebrated by Woody Guthrie in "Roll On, Columbia." Concerns about drowning Celilo carried little weight against the overwhelming public support for the dams and the jobs their construction entailed.

Historically, the *Wyampum* lived at *Wyam* for over twelve thousand years. Estimates vary, but *Wyam* is among the longest continuously inhabited communities in North America. Estimates will always vary, as our tenure in the Western Hemisphere is disputed due to changes in the belief system of the stolid science of archaeology. The elders tell us we have been here from time immemorial.

Today we know Celilo Falls as more than a lost landmark. It was a place as revered as one's own mother. The story of *Wyam*'s life is the story of the salmon, and of my own ancestry. I live with the forty-two-year absence and silence of Celilo Falls, much as an orphan lives hearing of the kindness and greatness of his or her mother.

The original locations of my ancestral villages on the *N'ch-īwana* (Columbia River) are Celilo Village and the *Wishram* village that nestled below the petroglyph, She-Who-Watches or *Tsagaglallal*. My grandmother, Elizabeth Thompson Pitt *(Mohalla)*, was a *Wyampum* descendent and a *Tygh* woman. My grandfather, Lewis Pitt *(Wa Soox Site)*, was a *Wasco*, *Wishram*, and *Watlala* man. But my own connections to Celilo Falls are tenuous at best. I was born two years after Celilo drowned in the backwaters of The Dalles Dam.

My grandfather fished at Celilo with his brother, George Pitt II, at a site that a relative or friend permitted, as is their privilege. They fished on scaffolds above the white water with dip nets. Since fishing locations are inherited, they probably did not have a spot of their own. They were *Wascopum*, not *Wyampum*.

Catching a fish, the fisher hollered "HO!" He would lift the dip net with its wild, powerful fish. My mother and aunt, Charlotte and Lillian, recall riding the dangerous cable cars back and forth over the white water of the falls. This, I imagine, was to my great-uncle's spot. Andrew David *(Tuutawaīsa)* fished on Big Island. My Uncle Lewis, who was preschool age at the time, recalls the hot sands and the indescribable smell of the falls — a smell for which he can find no equivalent today.

When the fish ran, people were wealthy. People from all over the country would come to Celilo to watch the "Indians" catch fish. They

would purchase fish freshly caught. It was one of the most famous tourist sites in North America. And many long-time Oregonians and Washingtonians today differentiate themselves from newcomers by their fond memories of Celilo Falls.

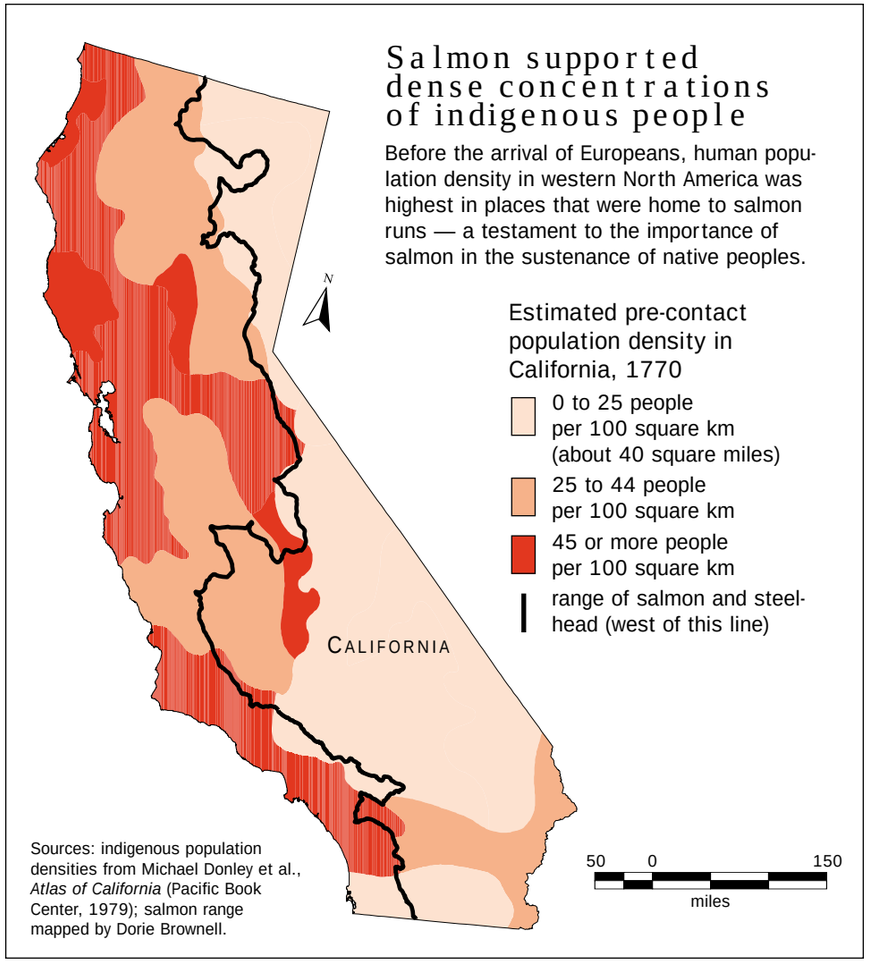
What happened at *Wyam* was more significant than entertainment. People gathered here by season through generations across millennia to catch *nusoox* (salmon) and news of relatives from across the river or far away. People celebrated their happiness with horse racing and gambling. Women played card games like *Wa-look-sha* and *Montee* in their free time. People played stick games in the evenings.

During the day, women cleaned large amounts of finely cut fish and hung the parts to dry in the heat of the arid landscape. We ate all of the fish, except for the guts. Nutritionally complete, the fish provided essential nutrients, dried or fresh. Coupled with fruits and roots, the diet was high in calcium, iron, vitamin C, healthy oils, and minerals. Before the upriver dams were built, fishers caught Chinook salmon known as "June hogs." These salmon were unbelievably large, fat and strong for their long journey to distant spawning grounds. I have heard of women who packed these fish four at a time, dragging their tails on the ground behind them. Imagine one seventy-pound fish — and then imagine carrying four of them up a hill! The people at *Wyam* were healthy and strong.

So abundant were the fish passing *Wyam* on their upriver journey that the fish caught there could feed a whole family through the winter. *Chahlīe*, finely pounded dried flesh of the salmon mixed with dried berries, could store for up to two years. The expertly cut dried salmon flesh in drying sheds looked like spread kites. The women dried the heads and gills. Even the spines and tails, with small orange windows of dry flesh between the bones, went eventually into soup. Many families had enough salmon to trade with other tribes or individuals for specialty items. We had Klickitat baskets from such trades. My grandfather's mother, Charlotte Edwards Pitt *(Y-yuten)*, traded her fine pictorial beadwork at *Wyam*, for example.

No one would starve if they could work. Even those incapable of physical work could share other talents. It was a dignified existence. Peaceful, perhaps due in part to the sound of the water that echoed in people's minds and the negative ions produced by the falls. Research has shown this to generate a feeling of well-being in human beings. It is with a certain sense of irony that I note companies now sell machines to generate such ions in the homes of those who can "afford" this feeling of well-being.

Children had a wonderful time at *Wyam*. They would climb the rocks



behind the falls, walking above the chutes that bordered the edge of the river. You became everyone's child when you left your lodging. Relatives and villagers instructed, and occasionally scolded, the children. You had to behave. Every day was school for the young, learning by observation and eventual full participation in the day's activities and work. Young boys began to fish at safer locations in the chutes to learn the skills they would need to move to the more dangerous spots.

It had its risks. The rocks were wet and slippery. One photo from the period shows a boy being fished out of the falls. He had fallen into one of the chutes, and miraculously, he appeared in one of the fishers' dip nets.

Pulled to safety on the platform, he saw another day. Other unwatched children and unlucky fishers were not so fortunate.

An elder woman explained that if my generation knew the language, we would have no questions. We would hear these words directly from the teachings and songs. From time immemorial, the Creator's instruction was direct and clear. Feasts and worship held to honor the first roots and berries are major events. The head and tail of the first salmon caught at Celilo is returned to *N'ch-īwana*. The whole community honored that catch: *One of our relatives has returned, and we consider the lives we take to care for our communities.*

Prayer may no longer be enough to restore the wild runs of salmon. But prayer is neither superficial nor insignificant, as the Columbia River Inter-Tribal Fish Commission has pointed out:

> ". . . great spiritual comfort is derived from the first salmon whose journey ends with a feast held in its honor. Together, tribal members and salmon weave a unique cultural fabric designed by the Divine Creator. What the mind cannot comprehend, the heart and spirit interpret. The result is a beautiful and dignified ceremonial response to the Creator in appreciation for the willingness of Nature to serve humankind."

The songs in the "ceremonial response to the Creator" are repeated seven times by seven drummers, a bell ringer, and people gathered in the Longhouse. *Washat* song is an ancient method of worship. Before the singing, dancers line up from the eldest to the youngest in a circle around the rim of the open floor — a space Chief Thompson called "the open heart of Mother Earth." By wearing the finest Indian dress, the dancers show respect to the Creator. Some have beaded and woven family heirlooms mixed with modern cloth ribbon shirts and bright wing dresses. Those who can do so, stand and rhythmically move their bodies with a bend of their knees. The swinging of cupped hands to hearts signifies the gathering of the songs into their hearts. Some people swing large eagle feathers.

Men on the south side, women on the north, the dancers begin to move. In a pattern of a complete circle they dance sideways, counterclockwise. Some dancers leap high. When they stop, they are north and south again. The drums are in the west, while the east remains open toward the rising sun. The north holds seven stationary drummers and the bell ringer. This ceremony symbolizes the partnership of men and

women, the essential equality and balance within the four directions and the cosmos. We each have our place and our role. As a result, the Longhouse is a special place to learn.

Meanwhile, in the kitchen, women prepare the meal. Salmon, venison, edible roots, and the various berries—huckleberries and chokecherries—are the four sacred foods. More common foods are added to these significant four on portable tables. Tule mats on the floor await the people. Long hours have gone into the preparation of the meal. Those who gather the roots and berries are distinguished. Their selection to gather the foods is recognition of good hearts and minds. Tribal men who have hunted and fished are likewise acknowledged. One does not gather food without proper training, so as not to disrupt natural systems.

A prayer is led in song. With instruction in *Sahaptin*, the people take one of each of the sacred four foods to their plates with a cup of water beside. In turn, we take a sample of each and eat a small piece: salmon, venison, roots, and berries. Finally, the water is called for with a loud and long *"Chush!"* We drink and the ritual is complete.

As my uncle explained to his children, "we travel from the river to the mountains with these foods." Even the order in which we taste them travels from *N'ch-īwana* to the white peaks of the volcanic Cascade range. Part of my ancestral geography, these are the mountains now known as Adams and Hood.

What has happened to Celilo Falls illustrates a story of inadequacy and ignorance of this land. The story begins, of course, long before the submergence of the falls with the seed of ambitions to make an Eden where Eden was not needed. One needs to learn from the land how to live upon it.

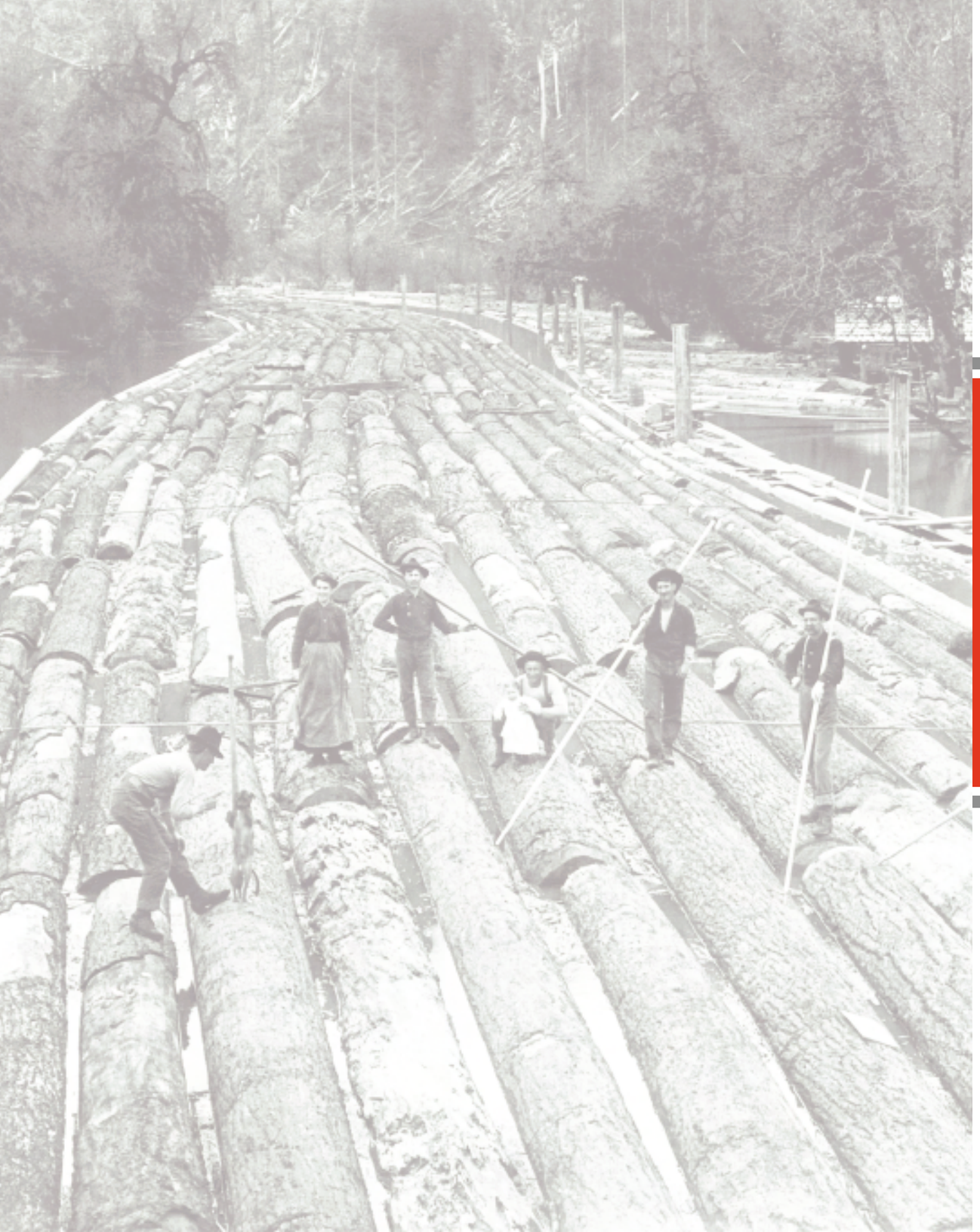
The mainstem *N'ch-īwana* is today broken up by nineteen hydroelectric dams, many planned and built without a thought for the fish. Nuclear, agricultural, and industrial pollution, the evaporation of water from the reservoirs impounded behind dams, the clearcut mountainsides—all are detrimental to salmon. Since 1855, the *N'ch-īwana*'s fourteen million wild salmon have dwindled to fewer than one hundred thousand.

Traditional awareness counsels in a simple, direct way to take only what we need, and let the rest grow. How can one learn? My uncle

reminded me that we learned about simplicity first. He said, "The stories your grandmother told. Remember when she said her great grandmother, *Kah-Nee-Ta*, would tell her to go to the river and catch some fish for the day? Your grandmother would catch several fish, because she loved to look at them. She would let all but two go. Her grandmother taught her that."

A larger sorrow shadows my maternal grandmother's story of the childhood loss of the material and intangible. What if the wild salmon no longer return? I cannot say whether we have the strength necessary to bear this impending loss.

The salmon, the tree, and even Celilo Falls *(Wyam)* echo within if we become still and listen. Once you have heard, take only what you need and let the rest go.



Where fish once ran so plentifully that they are said to have spooked horses with the noise they made splashing upstream, now their sound is muted and in some places completely stilled. Commercial fishing has played a part in that loss, described in the next chapter. This chapter explores other reasons for their decline—the direct causes that have made streams less hospitable to salmon, as well as the roots of those causes in the values and predispositions that the West's new settlers brought with them.

Muddied Waters, Muddled Thinking

BY Jim Lichatowich & Seth Zuckerman

The huge trees and untamed landscapes of the Pacific Northwest impress newcomers and long-time residents alike as miraculous gifts of nature. Not the least among the region's gifts are its salmon runs: Consider that close to a million wild and hatchery-bred salmon each year make their journeys up the Columbia River to spawn, and the number sounds impressive.

Today's fish runs pale, however, compared with the abundance that greeted the first white settlers in the nineteenth century. Not one million, but ten to sixteen million salmon used to run up the Columbia annually. And that is just a small part of the tale of decline that salmon fisheries have sustained in California, Oregon, Washington, and parts of British Columbia for more than one hundred years.

The problem first attracted attention when the region's production of canned fish began to drop early in this century. Now it has worsened to affect not only commercial and sport fishing, but also the very survival of many runs of fish. From the redwood-covered hills of coastal California through the waterways of metropolitan Portland and Seattle to the arid country east of the Cascades, salmon populations have been listed as "endangered" or "threatened" under the Endangered Species Act. For some runs, however, this level of concern has come too late. At least 232 genetically unique groups of Pacific salmon and steelhead are known to have disappeared entirely, losses that have occurred across a startlingly large portion of the salmon's natural range.

Discussions of the causes of this decline often seem like a sort of lunatic firing squad in which people form a circle and shoot at whoever's across from them. City folks blame the dams, and upriver farmers with irrigated fields blame commercial fishermen. The fishermen blame recreational anglers and loggers, loggers blame climate change and cattle in the creeks, and cattle ranchers blame predatory sea lions and merganser ducks. Everyone blames the deep-ocean trawlers and drift-net fisheries for scooping up immature salmon and the sea-life on which they feed. Each of these actions has hurt the salmon, but they are all manifestations of a more profound failing that has driven the Pacific salmon into a tailspin.

Like people everywhere, the Euro-American settlers who began to arrive in the Pacific Northwest two lifetimes ago displayed the whole range of human nature. Some proved capable of wanton damage to their new home, while others were concerned by the toll their presence seemed to take. The impacts of the worst were amplified, and the moderating influence of the best was muted, because so few glimpsed the connections among the parts of the system — fish, trees, rivers. Even those who did could scarcely envision the losses in store, as the trickle of early settlers turned to a flood swelled by the power of industrial development.

In the nineteenth century, human use of the land and its resources in the near term seemed more important than protecting ecological bounty in perpetuity. Surrounded by native abundance, those settlers acted as though the riches of nature were put there expressly for people — an attitude that recurs throughout the history of the West.

Even when the early white settlers and their descendants took steps to improve conditions for the salmon, the effects often fell short of what was intended. Quick to assume that we understood how nature worked, we have sometimes hurt what we were trying to protect. Salmon have

Natural History of the Pacific Salmon

Although the six species of Pacific salmon (like their distant relatives the Atlantic salmon) spend most of their lives at sea, they spawn in freshwater, homing in on the rivers of their birth. They swim upstream, often traversing hundreds of miles en route to small waterways where their size as full-grown returning adults makes them seem out of proportion to their surroundings. The female uses her body to dig a depression in the gravel, where she lays her eggs while a male hovers at her side to fertilize them. She then moves upstream and flaps her tail against the stream bottom, covering the eggs with a protective layer of gravel. The eggs incubate in this nest, known as a "redd," where they depend on the flow of water through the spaces between the rocks to carry vital oxygen to the developing embryos.

After a couple of months, the fry swim up through the gravel and begin to feed on small aquatic insects. Salmon are most at home in water colder than 60 degrees F. Depending on the species and race of fish, temperatures of 65 to 70 degrees can be stressful or even lethal at this age. After a period ranging from a few days (in the case of pink and chum salmon) to as much as a year and a half (in the case of steelhead or coho), the fingerlings swim downstream to the ocean, where they spend between one and five years migrating and feeding across thousands of miles of open water before returning to their home rivers to spawn. The salmon's ability to find their natal streams was a mystery for many years. Although their ability to navigate to the mouths of the rivers is still not perfectly understood, we know that their sense of smell guides them once they enter fresh water.

Because salmon return to their native streams to reproduce, they divide naturally into distinct populations that rarely interbreed with their neighbors. Each population, or "stock," adapts to the conditions of its home river.

The salmon's sense of direction is not perfect, however, and some fish do stray from one river system to the next — which enables surrounding healthy populations to recolonize streams where the salmon runs have been extinguished. This straying tends to take place within certain bounds. Straying behavior, plus other factors including life history, geography, the geology of home streams, and genetics, is involved in the designation of "evolutionarily significant units" by regulators applying the Endangered Species Act. For instance, the coastal rivers from the mouth of the Columbia River south to Santa Cruz, California, are divided into four such units and the rivers of the Columbia Basin into five.

been raised in hatcheries and released into streams where, as we will see later, they have done more harm than good. Well-intentioned people restoring salmon habitat in the 1970s dismantled logjams and dragged wood out of streams, only to find twenty years later that the creeks need some of that wood back in the channel.

Despite the best intentions, our actions on behalf of fish have time and again reflected a readiness to tinker with an ecosystem we did not fully understand, and a failure to comprehend the results. No amount of hard work or money can overcome the shortcomings of an approach to salmon management built on such shaky foundations. If we are to coexist with wild salmon, it is up to this generation to figure out how.

The first unprecedented impact on salmon, less economic than political, emerged during the fur trade era in the 1830s. Trappers in the employ of Britain's Hudson's Bay Company attempted to trap beavers to extinction as far south as Oregon's Willamette Valley. Seeking to deny the fledgling United States an economic base in a region the Americans intended to possess as part of their Manifest Destiny, the trappers inadvertently hurt the region's fish in the process. Beaver dams, once ubiquitous throughout the Pacific Northwest, provide critical nursery habitat for young fish, particularly in the dry intermountain region.

The salmon's troubles escalated when white settlers from the East Coast introduced a new technology for preserving fish. The first cannery was established on a raft in California's Sacramento River in 1864. Two years later, the canners moved north in search of a steadier supply of fish, which cannery operators found on the Columbia River. By canning the fish, these early entrepreneurs gained access to markets for virtually unlimited quantities of salmon in the eastern United States and Europe. Fishing was not managed to ensure the perpetuation of the species. In their rush to catch as many fish as possible, commercial fishermen often delivered far more salmon than canneries could process, and workers simply shoveled the excess back into the rivers. It wasn't long before the catch in the Columbia and other rivers peaked and began its long decline, interrupted only by particularly fecund years.

In the eastern and southern parts of the salmon's range, irrigation played a large role in the salmon's decline. Streams in the dry interior valleys such as the Yakima and the Sacramento once harbored huge

populations of salmon, which thrived in the region's snow-fed rivers. With the advent of irrigated agriculture, the fish suffered a series of insults. Many fingerlings strayed into gravity-fed ditch systems on their way downstream where their lives ended in a furrow; countless others were sucked out of the streams by irrigation pumps introduced since the nineteen thirties. In the delta of the Sacramento and San Joaquin rivers, the power of pumps sending water south is so great that it changes the direction of flow, tricking fish into migrating toward the pumping stations instead of toward the ocean. In Oregon, the National Research Council estimates that fewer than one thousand of the fifty-five thousand stream diversions are properly screened to keep fish from being diverted along with the water.

As farmers shunt more water to their fields, less remains in the stream. Natural pools become shallower and in some cases dry up entirely. The less water, the less protection the fish have from predators, and the quicker the water warms. Yet the infrastructure for irrigation was put in place before anyone considered the effects of water diversion. As we come to understand its implications, we realize that people have built their lives and expectations around the use of that water, making it difficult to accommodate the fish.

Livestock grazing has also had a serious impact on fish. In much of the arid West, cattle prefer to spend their time along streambanks, where they eat the young willows and cottonwoods that would otherwise shade the stream and contribute to its stability. Even their foot-traffic, up and down the banks, tends to increase erosion. Rendered bare and silty, streams are less hospitable to salmon. This was rarely the ranchers' intention; few considered the possibility that cattle would harm fish. Initially, at least, it would have been seen simply as part of the price of settling the West.

By the latter decades of the nineteenth century, commercial loggers moved into the coastal valleys. They logged the riverbanks first, rarely ranging more than a mile away from the water — about as far as oxen could economically haul giant old-growth logs. Lacking the technology to easily build roads to haul timber to the mill, early loggers used "splash dams" instead. They would dam the stream with a temporary wooden structure, then drag the logs into the pool that built up behind the dam. Later, the dam was blown with explosives, flushing water and logs downstream in a wall of debris. These man-made torrents scoured the channel clean of the vegetation and naturally fallen logs that provided habitat for the juvenile fish and their insect prey. They also gouged the stream bot-

tom down to bedrock, removing the gravel needed by salmon to spawn. Coastal streams in California, Oregon, and Washington are still recovering from the effects of this practice, many decades after it ceased.

As logging technologies modernized, their effects spread further from the waterways. The invention of the bulldozer and the gasoline-powered chainsaw, coupled with the building boom that followed World War II, spread logging across the landscape, leaving a web of roads behind.

Roads tend to concentrate run-off from its many natural pathways into muddy roadside ditches, which eventually dump their dirty water into streams. Poorly designed roads wash out easily, sending even more sediment into creeks. Although road-building practices have improved somewhat, hundreds of thousands of miles of logging roads, some of them abandoned, continue to threaten salmon habitat. (Roads used for residential access, recreation, mining or ranching can be equally destructive if not well built and maintained.)

Aggressive logging itself can cause erosion. Trees shield the ground from the harsh impact of rainstorms, and their roots bind the soil together. A few landslides below clear-cut logging (where all the trees are removed from a site) have gained notoriety when they killed downslope residents or demolished their houses, but hundreds more take place in the backcountry without attracting much human attention. Salmon notice them all.

Whether from road-building, other human causes, or natural landslides, erosion deposits sediment in the streams. Sand and silt cloud the water and can damage the gills of fish, while the larger particles — from gravel on up — fill in the pools that provide good habitat for fish. Some of the worst erosion occurred when miners washed whole hillsides through their sluiceboxes in pursuit of gold during the nineteenth century. The rivers of the Sierra Nevada and the Klamath-Siskiyou (among others) still bear the effects of that era.

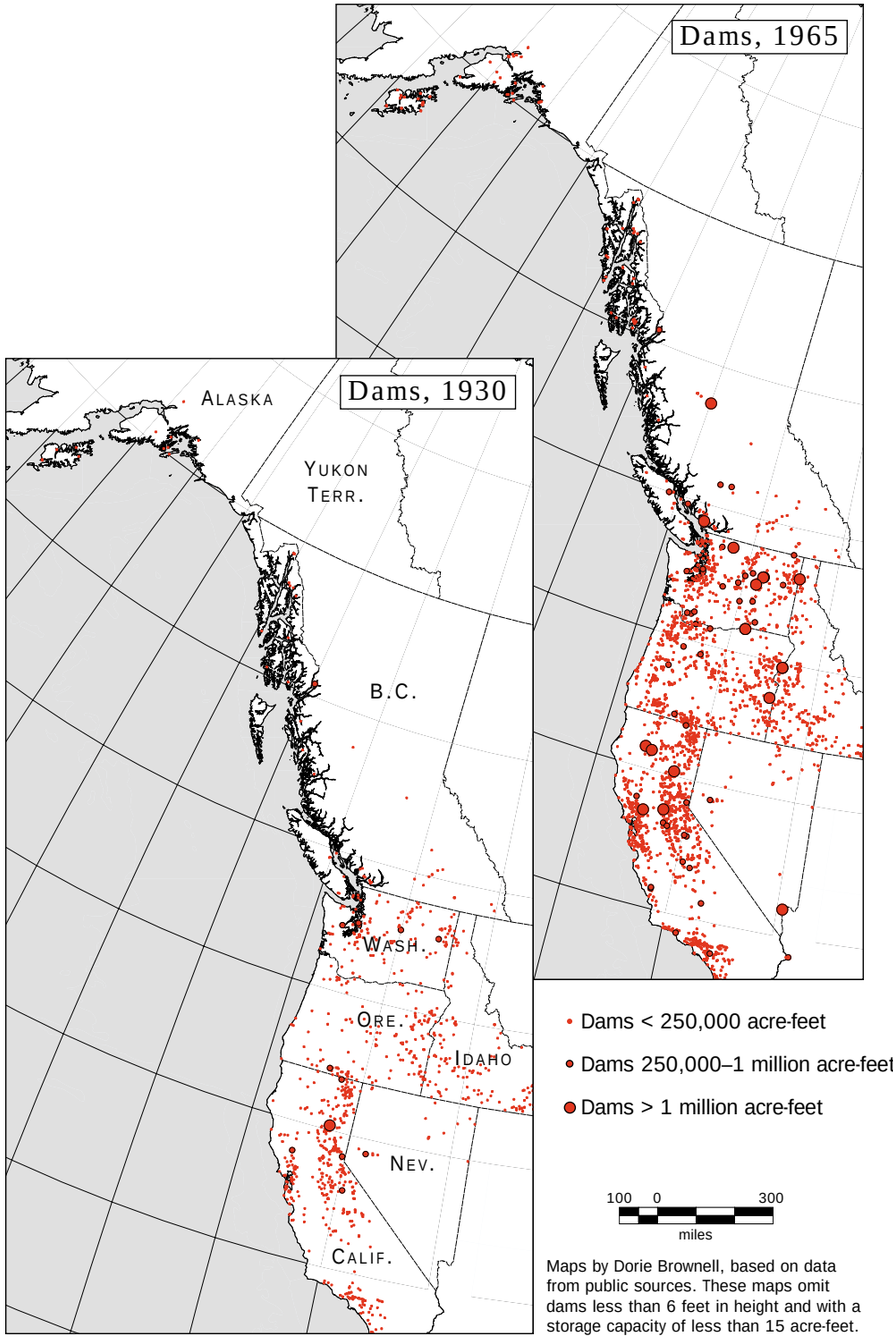
Dams present another set of problems — obstacles to fish passage up or down the river. High dams such as Grand Coulee on the Columbia River and Shasta on the Sacramento were built without provision for the salmon to get around them, choking off thousands of miles of spawning habitat upriver on the Snake, the upper Columbia, and rivers of the Sierra Nevada. Even where access was provided with fish ladders (a series of stair-stepped pools), the tamed rivers often became inhospitable to the juvenile salmon headed downstream. Long slack-water lakes lack the current that cues the fingerlings about which direction to travel, and the floods of spring snow-melt, bottled up behind the dams, no longer

speed the young fish to the sea. Some fish are killed by their passage through hydroelectric turbines. Others suffer a bends-like syndrome when spilled over the top of high dams to the churning waters downstream. These dam-related problems are so severe that federal agencies on the Columbia River have taken to transporting fingerlings downstream by barge — perhaps the ultimate human attempt to substitute for the natural functioning of the salmon system.

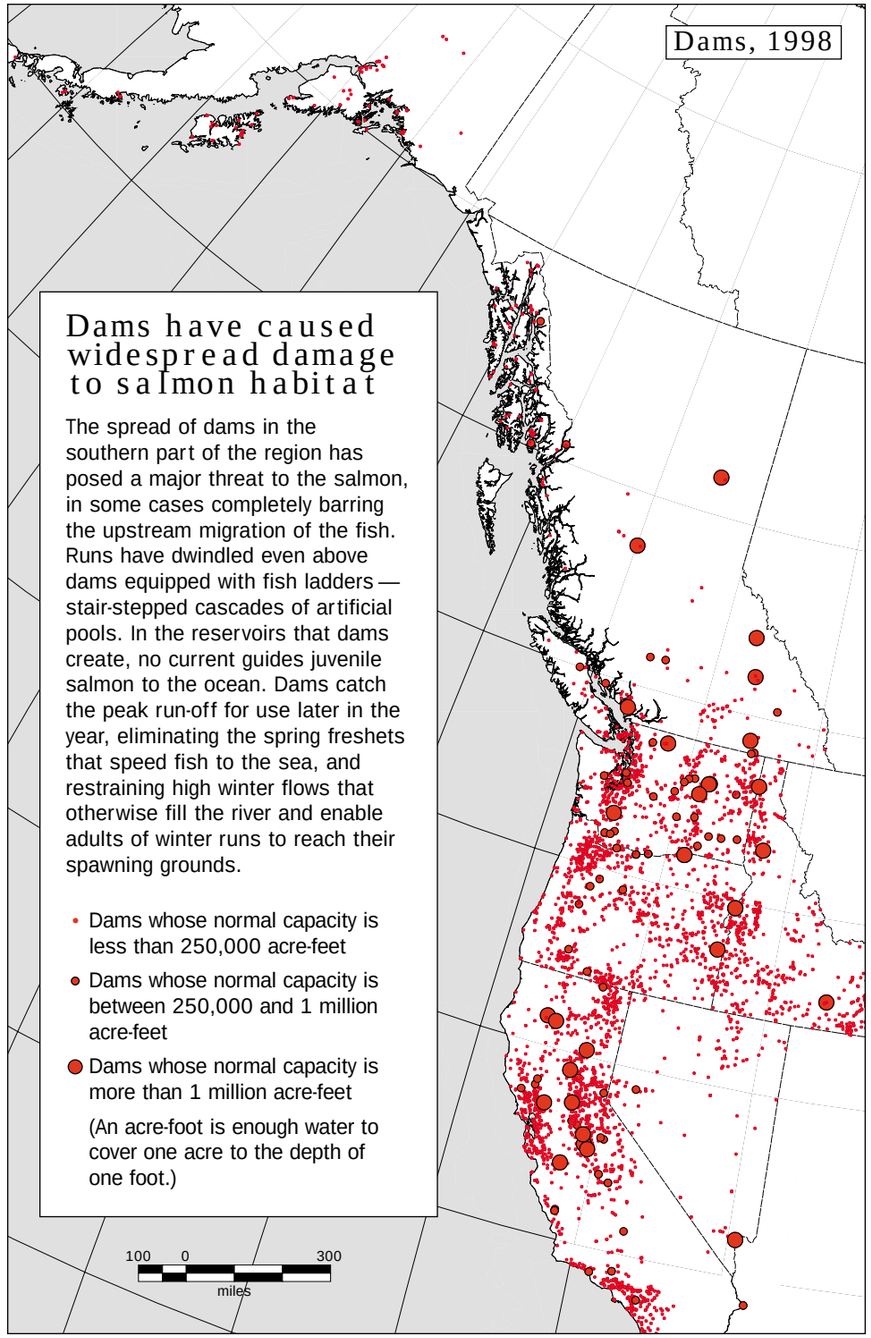
As urban centers have grown and the suburbs sprawled beyond them, the threats they pose to fish have become more significant. Rain carries the taints of used motor oil, tire rubber, and other effluents of industrial life from city streets into the waterways. Homes, offices, and factories are constructed right up to the edge of streams, clearing the shade that keeps the water cool in summer, and stripping away the plants that contribute to a creek's food chain. Invasive ornamentals such as English ivy displace native plants that contribute to the salmon's habitat and nourish its prey. Flood-control agencies straighten streams and developers fill wetlands, destroying important fish nurseries. Thirsty cities draw on surrounding rivers for their water supply, reducing the flow in local streams. Ironically, this dependence is a two-sided coin. Erosion that threatens to muddy the water for fish also clouds municipal water supplies and fills reservoirs with sediment. So the cities' reliance on rivers can create a powerful political constituency to protect urban water supplies, thereby protecting salmon habitat.

All of these factors make a point about salmon that is hard, even today, for many people to appreciate fully: though waterborne, salmon don't just live in streams, they live in watersheds. Everything that happens to flowing water, from ridgetop to rivulet to river itself, affects the health of salmon. For decades, many of these connections were unknown; land managers treated elements of the forest-and-fish system as isolated parts. Now we know better, but we battle the inertia of more than a century of treating the Pacific Northwest as a warehouse of provisions instead of a living system of which we are but one member.

When commercial fishing for salmon began on the West Coast in the 1860s, fishermen took advantage of a natural abundance that had sustained the indigenous people for thousands of years. Astonished early observers described enormous quantities of salmon that spooked horses



Maps by Dorie Brownell, based on data from public sources. These maps omit dams less than 6 feet in height and with a storage capacity of less than 15 acre-feet.



as fish splashed their way up creeks, and whitened stream banks with their spawned-out carcasses.

Less than a decade after the first canneries opened, business and political leaders wondered whether this industry could sustain itself. They petitioned Spencer Baird, the first head of the newly formed U.S. Fish Commission, for his advice about how to maintain salmon supplies. With what may strike us as remarkable foresight, Baird warned in 1875 that habitat alteration, dam construction, and overfishing would eventually destroy the Pacific salmon industry.

Despite the future he foresaw, Baird believed that it could not be averted by restrictive regulations. He'd seen such rules fail to save the Atlantic salmon on the other side of the continent. His advice? An investment of $15,000 to $20,000 in artificial propagation to make salmon so abundant that no regulation would be needed. Baird made this recommendation just three years after the first Pacific salmon hatchery had opened on the Sacramento River, before its first complete brood of juvenile chinook salmon had even returned to spawn.

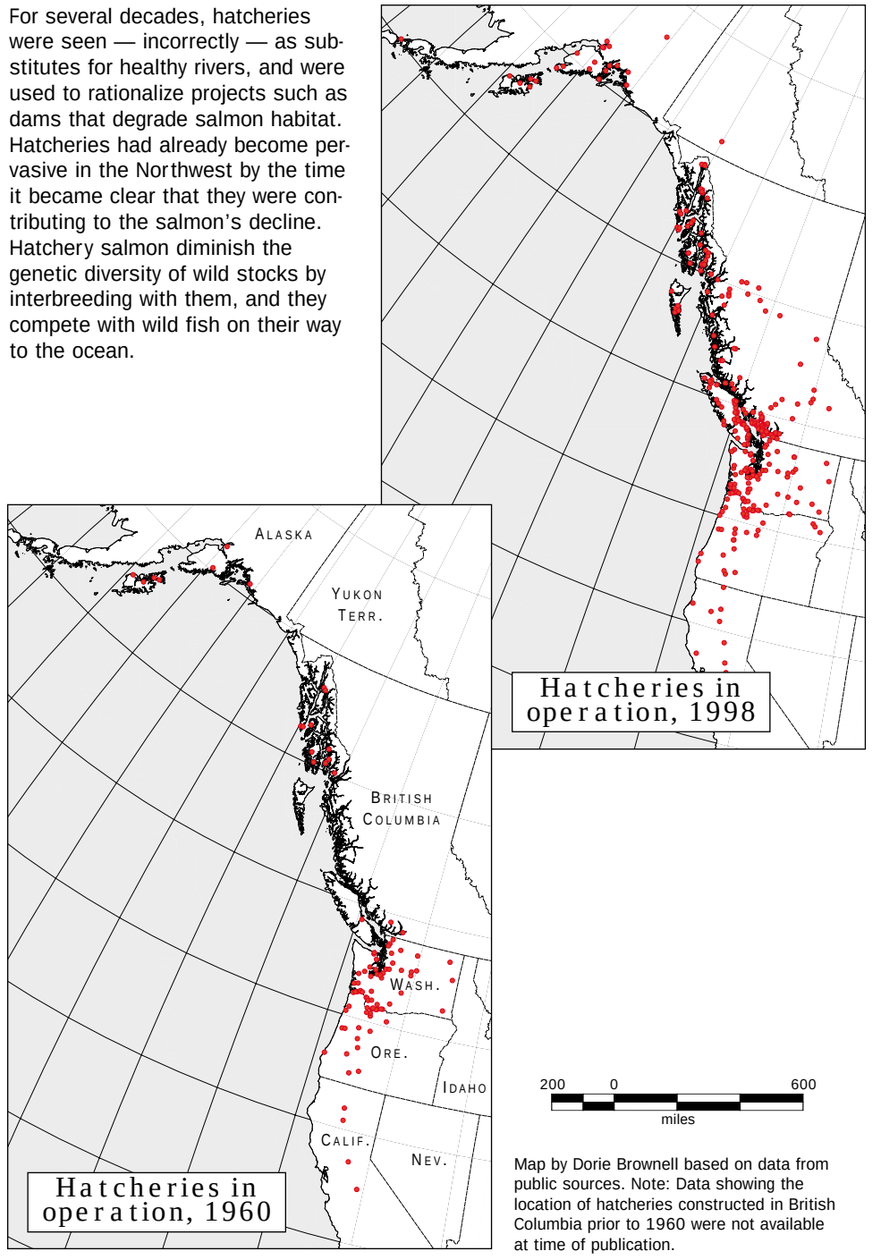
Within decades, salmon hatcheries had become central to decisions made about many West Coast rivers. Their popularity was not based on scientific evidence, because such evidence had neither been sought nor found. Instead, hatcheries were popular because they fit with prevailing social and economic values. In the second half of the 19th century, unfettered access to the resources of the American West was endorsed, encouraged, and subsidized by the government. Hatcheries justified this unregulated access.

The new states of the Pacific Northwest embraced hatcheries and established bureaucracies to build and manage them. The assumptions they embodied amounted to a dogma: that nature is wasteful and profligate, that humans know better, that we should manage nature for the benefit of our own species, and that we can tinker with it as one might adjust an engine or a wind-up clock. By 1910, 500 million artificially propagated salmon were being planted in Pacific coastal streams each year. Fisheries managers counted on hatcheries to maintain future supplies; the fate of the canning industry rested on artificial propagation. But still managers did not evaluate the hatcheries' success, preferring what one writer called in 1930 an "almost idolatrous faith" in this technological fix.

This faith stemmed not from an absence of science, but from a predisposition rooted in the worldview of the time, which held that scientific knowledge granted humans control over nature. Left to her own

Fish runs throughout the region are influenced by hatcheries

For several decades, hatcheries were seen — incorrectly — as substitutes for healthy rivers, and were used to rationalize projects such as dams that degrade salmon habitat. Hatcheries had already become pervasive in the Northwest by the time it became clear that they were contributing to the salmon's decline. Hatchery salmon diminish the genetic diversity of wild stocks by interbreeding with them, and they compete with wild fish on their way to the ocean.



Map by Dorie Brownell based on data from public sources. Note: Data showing the location of hatcheries constructed in British Columbia prior to 1960 were not available at time of publication.

devices, nature was inefficient and wasteful; it was human responsibility to control the natural world, make it more efficient, and harness parts of it, like salmon, fully to human use. Here's how Livingston Stone, an early and enthusiastic advocate of fish culture, explained in 1884 the surplus of wild salmon eggs laid each year in the gravels of the Columbia River: "Nature . . . produces great quantities of seed that nature does not utilize or need. It looks like a vast store that has been provided for nature, to hold in reserve against the time when the increased population of the earth should need it and the sagacity of man should utilize it."

By 1910, "conservation" had joined the political lexicon, but with a rather different meaning than it has today. Conservationists of the early twentieth century devoted little effort to curtailing development or resource exploitation. Instead, they focused on using newfound scientific knowledge to control and thereby improve natural systems through technical expertise and bureaucratic organization.

Hatcheries fit this attitude, as part of a plan to make full use of a watershed or river basin. Up and down the river, crops could be irrigated, cattle grazed, trees cut, power generated. Thanks to artificial propagation, all of this could be done without diminishing the fishery. Hatchery-raised fish no longer needed an ecosystem or watershed, according to this thinking — all they needed was a simple conduit to the sea.

About the same time that questions about the efficacy of hatcheries began to emerge in the 1930s and 1940s, fisheries biologists faced the prospect of massive irrigation and hydroelectric power development in the major salmon rivers of the Pacific Northwest. By that time, biologists understood what the dams would do to fish runs, particularly on the Columbia River. But the social momentum behind the dams and the promise of electric power was unstoppable. State and federal fish agencies once more chose to maintain the status quo — nearly complete dependence on hatcheries to offset lost natural production of fish.

In time, these juvenile salmon factories came to be seen as a public utility just like the electric power grid and the shipping locks, each producing goods and services for public consumption. Nearly forty years would pass before the biologists' fundamental doubts about hatcheries resurfaced. In the meantime, fish produced in captivity were beginning to weaken wild stocks.

It might seem counter-intuitive that hatcheries could actually harm the species being propagated. After all, if the problem is too few fish, why not simply hatch some more? The reason lies in the subtle connections between elements of the salmon system.

The earliest hatcheries were simply egg-incubating stations that released tiny fry into the streams, hoping to increase fish populations by reducing the mortality of eggs incubated in stream-bottom gravels. By the second decade of the twentieth century, managers began to feed the fry and raise them to fingerling size before turning them loose. But the diet they received — a mixture of fish offal, horse meat, tripe, and condemned pork and beef — was ineffective, and even spread disease through the tightly packed schools of fish.

It wasn't until 1960, with the advent of pelletized feed made from fishmeal, that hatcheries had significant success in raising large numbers of fish to large fingerling size or even to the smolting stage, when the fish begin to adapt to salt water for their adult lives.

Even as they became more proficient at raising juvenile fish, the hatcheries were actually undermining the vitality of the wild stocks of salmon that they hoped to supplement. One problem was rooted in "carrying capacity," the maximum number of fish that a particular stream can support. As hatcheries infused rivers with millions of fingerlings for their journeys to the sea, the hatchery fry came to compete with the wild fish traveling oceanward at the same time. At times, there simply wasn't enough food to nourish all of the young fish, to the detriment of both wild and hatchery stocks.

When hatchery-bred fish return as adults and interbreed with wild salmon, they produce offspring that are less hardy than their purely wild counterparts. Each river and tributary has a distinct strain of fish, the product of generations of natural selection in which the fish that best fit a particular environment were the most likely to return and reproduce, passing on their genes to the next generation. For instance, fish whose spawning journey takes them just a few miles from the ocean enter the river nearly ready to mate, while their cousins destined for spawning grounds far inland will not be ready to lay their eggs until months after they re-enter fresh water. In addition, wild fish often possess resistance to the parasites and diseases of their native streams.

Sometimes the genetic wires get crossed accidentally, as when hatchery fish stray into another stream upon returning to spawn. In many other cases, managers transplanted fingerlings from one river system to another. Either way, the hatchery-bred salmon mated with wild native

fish and diluted their local adaptations. For example, native coho salmon possess resistance to a particular parasite that is present in coastal Oregon's Nehalem River. Young hatchery coho from another river, where the parasite isn't prevalent, were planted in a tributary of the Nehalem for several years. Later, when adults were collected there, their offspring proved less resistant to the parasite than the wild stocks but not as susceptible as the hatchery transplants. Researchers concluded that the mixing of the stocks had reduced the population's resistance to the parasite. In another case, scientists found that eggs laid by coho of hatchery descent that spawned in the wild were less likely to survive than the eggs of wild fish. The reason? Apparently, the hatchery fish were spawning earlier in the year, which was not as well matched to the conditions of that river as the native salmon's timing.

Finally, even if the hatchery program yields many adults, if those adult fish are targeted by a commercial fishery that captures fish from a combination of stocks — in the ocean where fish from many rivers mingle together, or in the lower reaches of a large river system like the Columbia, for example — the weaker wild stocks will be overharvested. Regulators will devise rules that will allow, say, two-thirds of the stronger stocks to be taken. But those rules will result in a two-thirds harvest of the weaker stocks, whose population will be harmed by such a large loss. Currently, some 80 percent of the adult spawners returning to the Columbia River are the product of hatcheries. Regulations that serve the majority of salmon are unlikely to match the needs of the wild 20 percent.

An indiscriminate hatchery program treats fish like interchangeable parts in a large machine. The first precaution of intelligent tinkering, counseled conservationist Aldo Leopold, is to save all the parts. Neglecting this precaution, we have unbalanced an intricate system and placed the salmon in danger.

Through the lens of history, we can understand our predecessors' decisions that led to the salmon's current straits. But for the last decade or two, we have known better, and some salmon advocates are trying to craft a new approach that runs counter to the assumptions that led to the decisions and choices of the past. The new approach seeks to:

- Restore and protect natural ecological processes, rather than circumventing them with artificial substitutes.
- Control human behaviors that destroy ecological processes, rather than trying to control nature.
- Promote biological and habitat diversity, rather than seeking to improve the production process by simplifying it.

For the first time in a century, many northwesterners openly question whether we ought to exert complete control over the region's rivers. The possibility of removing or breaching mainstem dams on the Columbia and Snake Rivers to restore the fish is now debated in public, a debate that would have been unthinkable as recently as five years ago.

However, it is time-consuming and difficult to change deeply held values and assumptions. Often they become enshrined in laws and institutions that perpetuate old thinking. They bolster accumulations of economic power, which spill over into the political arena and make it difficult to adopt policies that will change our relation to rivers and the landscape. We can still only speculate whether we have the ability to move quickly enough to save Pacific salmon over a significant portion of their natural range.

No one set out to destroy these fish. As a group, salmon regulators, hatchery managers, and fish biologists are hard-working professionals dedicated to maintaining the "supply" of salmon. But their intentions went awry because of the beliefs behind their actions. No amount of good intentions and hard work can overcome the limitations of programs based on faulty assumptions.

Why has it proved impossible to protect the salmon resource, to prevent a century of decline and extinction even though the causes of decline were known and acknowledged from the outset? Politicians, scientists, and most citizens believed in reshaping and managing the landscape to meet our short-term needs. We believed we had the wisdom and ability to simplify and control ecosystems, to make them more productive. We held these beliefs deeply enough to overlook signs of failure even as they clamored for our attention.

Can we think differently about nature in time to make a difference?

The decline of salmon has affected more than just the fish – it has touched the human communities that grew up around an abundance of salmon. Until the 1970s, numerous towns, cultures and ways of life revolved around these fish. A few still do. Environmental writer Richard Manning guides us to a place where the human economy was once tied to local salmon runs, and charts the shifting economic tides – and changes in the nature of commercial fishing itself – that have stranded fishing towns from California to British Columbia.

Ghost Town

BY

Richard Manning

Bad policy prints out in ghost towns. Namu, British Columbia, is one such town, a proper place for considering the consequences of economic decisions. Namu is especially appropriate for our consideration, because it is especially haunting. It looks as if it was abandoned just a few months ago: its post office, café, and pub on piers still appear ready for business, its machine shop still workable, its rows and racks of machinery only rusted some. Namu was a cannery town, one of more than eighty such sites now strung the length of the coast of British Columbia north of Vancouver Island, once vital, now all abandoned. Once its residents packed salmon. Now the salmonberry tangles and sprouting cedar lap at its edges, ready to suck it beneath the waves of forest.

Namu haunts especially because of the houses, rows of them stretched up the hills, the school and the gutted gym, the segregated housing of Chinese, Japanese, and native cannery workers: segregated, but houses nonetheless, all now empty. Homes, more than machine shops, give evidence that people made lives here, livelihoods now gone.

Ghost towns are no anomaly in North America's cut-and-run resource west. We explain their existence by saying that progress entails change. A mine plays out, a mill closes, a fish run goes to ruin and we move on. Namu, however, harbors a more unsettling set of specters than our mythology has prepared us to confront.

At the mouth of the Namu River, just below the now-crumbling row of shacks that housed native families, a line of rocks reveals itself with each day's ebb tides. These rocks are famous among archaeologists, the remnants of a fish trap six thousand years old. Just above the river's mouth, only fifty feet or so up a bank on a bit of hill, there lies a pit that yielded a worked block of stone, artifice half again as ancient as the fish trap. The stone was most likely a sinker, a fisherman's sinker, at nine thousand years old one of the oldest pieces of tackle on our continent. People — aboriginal, European, and Asian — have made a living fishing at Namu for at least nine thousand years, from the day some fishermen dropped that stone sinker until the late nineteen-eighties when Namu's corporate owners, Weston Foods, closed the cannery and hence the town. Community here spanned the chasm of European colonialism. Something else unsettled it much later.

It would be easy to take the customary exit from this argument, to cite not people but numbers of people, and suggest that the crush of human population worldwide fished out Namu and in the name of efficiency had to move on. Not so fast. To begin with, there are still salmon at Namu, but a different sort of system hauls them away. A system that doesn't need people constituted in small communities.

More importantly, however, the archaeologists tell us that coastal British Columbia and Alaska, the foothold of human population in North America, likely supported one of the densest populations of native peoples in this hemisphere, certainly the densest in what is now Canada. This coast did so almost solely on salmon and cedar. Further, these people annually harvested, for periods of thousands of years, as much salmon as are caught today from the same areas. Most of the world's wild-caught salmon still comes from these areas. In our time it is the fashion to endlessly debate definitions of sustainability, yet the history of the Pacific's northern coast until only just recently stands as a definition

for anyone to read.

This argument is not about Namu. Rather, it is about efficiency, about making a living, and about what we mean by progress. We worry that all of the fish will be gone, but the lesson of Namu is that the people are gone, and it is worth examining the connection.

One could not design a better creature on which to base culture than the salmon. It does an enormous amount of work. It hatches from pea-sized eggs in rain-forest streams, migrates to the oceans when it weighs about an ounce, ranges thousands of miles over the course of three to six years, then returns precisely to its native stream weighing ten, fifteen, thirty, even sixty pounds. In terms of raw biological economics, the salmon focuses enormous energy with pinpoint accuracy on a given place. We can think of this, as native peoples did, in terms of food, but First Nations fishers took only a small portion of the fish that migrated annually to streams. Most spawned, died, and rotted, feeding new rounds of fish, animals, and trees. Up to sixty percent of the nutrients of young fish and seventeen percent of the nutrients in streamside rain forest vegetation comes from spawned-out salmon. The basin of the Columbia River alone was once fertilized by the return of nearly two hundred million pounds of fish each year in salmon runs now gone.

The service here is importation: a given community of salmon concentrates this energy, this mass derived from a wide range of sea to a single, predictable point, a place, a Namu. This motion is the engine that drives an entire ecosystem, the power to pull community.

It is as if a rancher in Alberta could release his calves at two hundred pounds each, to range unattended and free (in the economic sense, too) for a few years as far south as Texas and Oklahoma. Imagine that some would return to the rancher's front gate on a given and predictable day. True, not all would return, but those that did, had they undergone the same proportional weight gain as a salmon, would each weigh about fifty thousand pounds. An Alberta rancher would suggest this is a formula for wealth and leisure, and the record of native art along the coast from Northern California to Alaska would suggest the same.

Accounting for the squandering of this wealth begins with the fact that fish traps, the predominant system of harvest for First Nations people and for whites in the early days of the commercial canneries a

century ago, are now all relics. The gill net boats, the one- and two-man putt-putts that worked the river mouths and sloughs ever since, are fast becoming antiques as well. They in turn are being replaced by multi-million-dollar aluminum seine net boats that range the offshore waters, and trollers that catch the salmon far at sea. To climb aboard one of these boats is to understand the tenacity of predation. Scramble over a tangle of nets and floats, oil jugs and tools into a cluttered cabin to see sonar, computer monitors, satellite-based guidance systems, and digitized maps recording fish runs and ocean-floor topography.

All this technology catches no more fish than a six-thousand-year-old fish trap once caught. Satellites are not needed to catch salmon, not even to catch a declining number of salmon. The fish would still come back to community, if we would wait. Technology is needed not to beat the fish, but to beat other fishermen. In this race from riverfront fish trap to gill-net boat to troller, each move takes us ever further to sea. One is reminded of the old joke about two men entering grizzly bear country. One of them stops to put on a pair of extra-fast running shoes. The other laughs and says, "You can't outrun a bear," to which his companion replies, "I don't have to. I just have to outrun you."

Fishing boats are sleek machines that seem elegant only in isolation — just one of the many types of machines that run the modern salmon system. Hatcheries are another, in a network of more than three hundred such facilities stretching from California to Alaska, mostly clustered in the south of that region.

The hatchery program predates large dams, and even predates the overfishing that occurred as canneries began exporting the region's biomass to feed the industrial workers of England. Hatcheries spread as salmon runs were over-harvested and depleted, and spread further as habitat was lost to logging, dams, and development in general. We have traditionally blamed catastrophic declines in salmon numbers on the latter causes and viewed hatcheries as a solution. The beneficence of hatcheries was an article of faith, untested until only very recently. Now evidence has mounted that the opposite is true, that streams with hatcheries, when compared to those without, showed a decrease in overall production of fish. Ill-conceived solutions become problems.

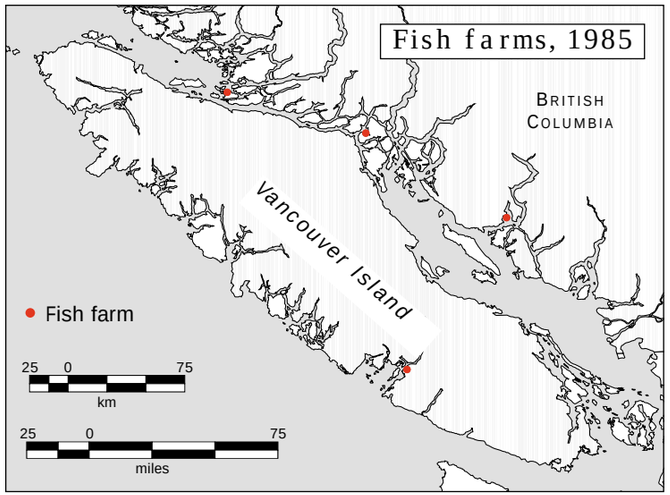
Evolution has finely tuned native salmon to the conditions of each

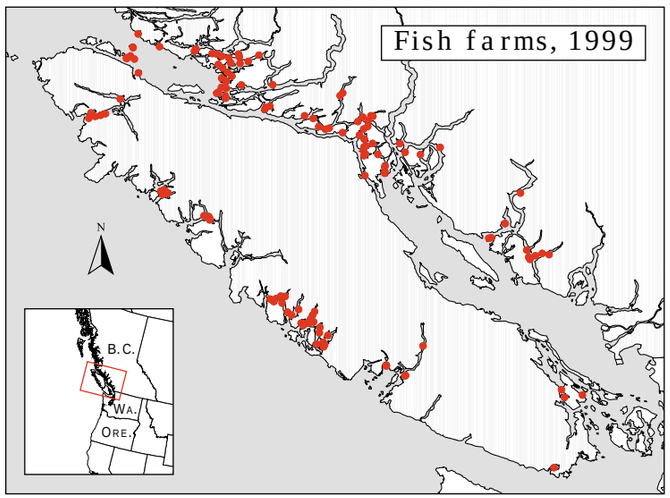
particular river, each particular community, and a glut of imported hatchery fish without benefit of this sophisticated tuning greatly skews the picture. So does the release of millions of hungry young mouths without regard for natural food cycles. Simple machines go awry in complex situations.

The question "How awry?" is best answered in simple economics. Remarkably, the question went unasked until recent research by Oregon fisheries economist Hans Radtke. Historically, hatchery managers have been overly optimistic about survival rates. In fact, survival rates for hatchery-raised fish are stunningly low, especially when compared with rates for naturally spawned fish. As this became apparent, hatchery managers compensated by turning up the volume, releasing even more fish to yield a desired final number, which generally further suppressed survival rates as a result of competition. The net result: at present, an average of less than one percent of coho and chinook smolts released from hatcheries survive to adulthood. Radtke applied those survival rates against costs, both fixed and variable, to raise each young salmon, then set those against average harvest rates to find that each harvested hatchery fish costs about $62.50 to produce. A fisherman who catches a hatchery fish sells it for considerably less than half that amount. Hatchery salmon now account for about thirty percent of all salmon produced worldwide, most of which come from the North Pacific.

These numbers help make sense of the emergence of criticism of the hatchery program from quarters beyond the usual environmental protests over the welfare of the fish. For instance, a report commissioned by the Oregon Business Council called the hatchery program a failure, in that despite its best efforts, salmon stocks were extinct or at least in deep trouble in precisely those areas — the southern half of the region — where hatcheries had been most active. The report's authors wrote: "While the machine model was ineffective, it has not been inexpensive. Prior to 1980, the salmon program, which was originally set for $20 million, consumed about $400 million and in the next ten years, $1.2 billion was spent."

These numbers are sufficiently large to attract a pro-business group's attention, and Radtke's fundamental calculations lie at the base of them. Behind these numbers, however, lies a fact even more fundamental than markets. Radtke also applied those survival rates to average weights of hatchery-reared salmon. His calculations showed that hatcheries dump more biomass into the system as juveniles than the biomass returned by spawning adults. Hatcheries have reversed the





Clusters of fish farms pose risks to salmon runs near Vancouver Island

Salmon farms face criticism for their local environmental impacts: Concentrated fish excreta and uneaten fish meal flow right into the water from net pens, non-native Atlantic salmon periodically escape into Pacific waters, and fish farmers kill sea lions and seals that try to eat the penned fish. Under pressure from environmentalists and some First Nations, the Province of British Columbia imposed a moratorium on new fish farms in 1995, but approved some expansion in fall 1999. Existing farms continue to operate and even expand all around Vancouver Island. A handful of farms are located in nearby Puget Sound, in Washington state waters.

Map by David Carruthers (Ecotrust Canada) based on data from the BC Ministry of Fisheries.

design of the system: they cause fish to export land-derived energy to the sea, instead of importing it from the pastures of the North Pacific to support communities like Namu.

Thirty percent of the world's salmon now come from hatcheries, but wild fish account for only another twenty to thirty percent. Almost all of those wild fish come from waters around Alaska and British Columbia, northern waters where runs are mostly intact. These are the waters from which we harvest volumes comparable to those native people caught for thousands of years, that is, in those places largely unmanaged. The biggest share of the world's salmon consumption, however — now forty to fifty percent — comes from farmed fish, salmon raised and fed artificially in net pens their entire lives. Salmon farming, or aquaculture, is the system's other big machine.

The rise of salmon farming worldwide helps explain the puzzling paradox in the economic picture. We understand that salmon runs are troubled, even endangered in some places. Scarcity ought to dictate a high price, yet salmon fishermen, especially in recent years, have faced catastrophically low prices. Chinook salmon, for instance, have fallen from $5 a pound in the seventies to as little as $1 now. In recent years, Alaskan waters have been producing well, an increase in supply that is one factor in the low price, but not the dominant one. The biggest factor is that fish farming is flooding the market. In 1980, farmed salmon accounted for about 1 percent of all production, yet now we see it approaching fifty percent and climbing. The boom in farming has largely occurred in Norway, Scotland, and Chile, but is gaining a firm foothold in Washington's Puget Sound and north along the southern B.C. coast in the waters surrounding Vancouver Island.

Like the hatchery boosters who preceded them, the fish farmers tell us aquaculture is good because artificially raised fish take pressure off the beleaguered wild stocks and at the same time provide a hungry world with more food. Environmentalists have countered that the farms pollute, and that escapees (mostly Atlantic salmon) spread disease to and compete with wild runs. The environmentalists are right, but set aside their argument for a second. This is not, as the farmers would have it, a matter of a conflict between the environment and the economic realities of feeding the world. Salmon farming fails the economic test as well.

Behind that farmed salmon steak

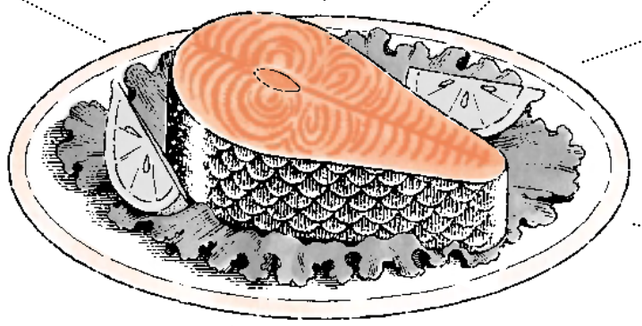
It's tempting: salmon fillets in the supermarket seafood case for just $3.99 a pound. Or a salmon entrée on the menu at a chain restaurant for under $10. This at a time when salmon catches are erratic from British Columbia southward, and you might have expected scarcity to have driven up the price. The explanation is simple: a glut of farmed fish — amounting to roughly half the world's supply of salmon — has flooded the market. Farmed salmon are raised in net pens in a number of cold-water locations, including Norway, Scotland, Chile, Washington state, and British Columbia. But the ingredients in a farmed salmon steak are quite different than what goes into its free-ranging cousins captured by nets or hooks. Take a look:

The straight poop

The excreta from one large B.C. fish farm are estimated to equal the sewage of a city of ten thousand people — all of it flowing straight into the surrounding waters, fouling nearby clam beds and other sea habitat, at too high a concentration to be assimilated easily by natural forces. The David Suzuki Foundation estimates feces emissions at more than 40 percent of the live weight of the fish raised in pens — so an eight-ounce salmon steak represents a pile of feces about as big as the scoop of rice placed next to it on the plate. Salmon excreta are one reason that environmental activists are pushing for fish to be raised only in closed-containment systems, allowing the wastes to be treated before being discharged into the water. A recent B.C. ruling will allow ten such farms to be established in the province — where they will still be outnumbered by traditional farms ten-to-one.

Netting Peter to feed Paul

Salmon are carnivores. In captivity, they are raised on a diet of oily brown fishmeal pellets made from inexpensive fish such as anchovetas, sardines, and mackerel. To grow each pound of farmed salmon takes four pounds of those smaller fish, reducing the quantity of edible fish protein by 75 percent. In this way, B.C. farms alone account for a loss of nearly 90 thousand tons of protein each year.



Aliens on the loose

Atlantic salmon have become a favorite of West Coast fish farmers, in part because they can be raised at higher densities than native chinook. These fish frequently escape from their pens into the wild. In 1997, one Washington state farm lost 360,000 Atlantic salmon in a single incident. Alien Atlantic salmon have been found to spawn successfully in Vancouver Island streams, and fishery advocates are concerned that they will compete with threatened populations of native Pacific salmon.

Tracks leading in, but no tracks leading out

Most net pens are located in inlets, on the migration routes of many fish to and from their spawning grounds. Salmon are natural-born predators, so smaller fish that stray into the farms, including juvenile wild salmon, don't stand a chance. Salmon farmers notice that when young oolichan (minnow-sized smelt) pass by the pens, the salmon stop eating their fishmeal pellets but "mysteriously" continue to gain weight. The net pens are illuminated at night; farmed fish snap up the herring attracted by the lights.

My, how pink your steaks are!

The better to fool you, my dear. Wild salmon flesh gets its color from the fish's prey, particularly krill, tiny shrimp-like crustaceans. But farmed fish eat pellets of fishmeal which would leave their flesh a pale gray instead. Fish farmers know that gray salmon won't sell well, so they add a dye called astaxanthin to their feed.

Salmon on drugs

Farmed fish are so densely confined that a typical one-pound Atlantic salmon is within fifteen inches of its neighbors. Diseases can spread rapidly through such packed quarters, so the fish are fed antibiotics including oxytetracycline and sulfa drugs, just like most domestic chickens or cattle. About 30 percent of the medicated feed goes uneaten; from uncontained net pens it enters the sea's food chain, where it has been found to kill natural marine algae and bacteria and cause deformities in halibut larvae.

Nonetheless, the farmed fish still contract infections and parasites. Wild stocks pick up those diseases in two ways — either from escapees, or as they pass by the fish farms en route to or from their spawning streams. Norwegian authorities have opted to poison twenty-four rivers with rotenone — which kills all aquatic life — in an attempt to eradicate sea lice and a lesion-causing disease spread there by farmed salmon.

They shoot seals, don't they?

When seals see fish farms, they think "free lunch." To control their losses, fish farmers shoot seals that frequent their farms, killing an average of five hundred per year in British Columbia in the early 1990s. They also try to scare them off with "acoustic deterrent devices," which emit a screamingly loud underwater sound. That racket also keeps orcas and humpback whales far at bay, excluding them from valuable habitat.

Written by S. Zuckerman based on *Net Loss: The Salmon Netcage Industry in British Columbia* by David W. Ellis and Associates (Vancouver, B.C.: the David Suzuki Foundation, 1996) and on personal communications with Suzuki Foundation staff.

Does salmon farming take pressure off wild stocks? A commercial fisherman is not so much interested in the number of fish caught as the total income the catch generates. If a fisherman gets one-fifth the amount per fish, he must catch five times as many to maintain income, which regulations, of course, forbid. So there is increasing pressure on the regulations, increasing violation of them, and more broke fishers than there were a decade ago.

Yet this supply-demand-price haggle is but a small part of this picture, a narrow view of economics. Despite what you may have heard in the incessant jobs-versus-environment debate, biology respects an economic logic, ordering its market with the food chain. Species use resources according to their position in the chain. The chain serves no free lunch, particularly a free protein lunch, which is to say the protein of a farmed salmon does not come out of thin air. Animals low on the food chain eat plants. Cows eat carbohydrates in grass to make protein. Animals higher on the chain eat animals; they eat protein to make protein, losing as much as 90 percent of it in the process of maintaining life forces. This is why we don't, as a rule, raise predators for food.

But we do farm salmon, and salmon are predators; they eat fish. Estimates of the metabolic loss vary, but there is always a loss. For instance, the Worldwatch Institute says it takes about five grams of fish protein—converted into fishmeal—to make a gram of farmed fish protein. Fishmeal is produced globally, especially from sardines and anchovies of South America and especially from herring from the North Pacific.

Worldwide, salmon aquaculture is sponsoring a secondary fishery that vacuums the ocean floor like a Shop Vac. Ocean fisheries historically have been damaging enough to the environment, but were typically at least somewhat selective to marketable species. However, when the end product is fishmeal, virtually everything that shows up in a net can be ground into the mix, setting the stage for a decimation of the system the way pulpwood set the stage for clearcuts. Wild salmon know how to graze this ocean system selectively, efficiently harvesting its protein for us. Our blundering nets know only how to destroy it and move on.

Fish farming takes relatively low-cost protein, species once consumed directly by the world's poor, reduces its volume by a factor of five, and sells it to the world's wealthiest consumers. Meantime, wild fish, the few that are left, hatch to fingerlings and migrate to oceans only to find that the fishmeal trawlers have beaten them to their prey. This is the same logic that sent salmon fishers further to sea, but in this case, the trawlers are beating fish to fish, not other fishermen to fish.

We pay for this inefficient system in two ways. First, by relying upon a heavily capitalized, mechanized system that no longer uses the community labor of places like Namu. The system renders them redundant; they become ghost towns as the few jobs that remain move to factory trawlers and centralized processing plants.

Second, most of the cost of this Rube Goldberg machine that has replaced nature's intricate web comes by diminishing the productive capacity of nature. We live off the capital, not the interest. As market economists tell us, these are difficult costs to measure, these natural services that do nothing so much as make the world what it is. Difficult to measure, so we don't really feel the loss—until they are gone.

All of this converges on an emerging school of economic thought that seeks to assign dollar values to intact natural systems, a topic that has come to be known as "ecosystem services." The salmon offer a classic case. Pacific salmon gave us a primary product—food—but in the bargain, they imported nutrients sufficient to feed a whole system. That system, in turn, raised more fish, an ecosystem service to which we could easily assign a dollar value today simply by adding up the costs of the hatchery system that replaced it. Except that the natural system worked.

In considering Namu, though, it seems there was another, subtler, service at work.

Modern salmon politics are politics above all, spawning even cross-border diplomatic wars, seizures of vessels, lawsuits, and violence. All of this is about allocation. To read the headlines, one could believe that allocation is the sole problem of the salmon system. We committed ourselves to this path when we abandoned village-front fish traps and headed out to sea to try to beat other fishermen.

How much better did the salmon handle this job when allowed to return to their home streams? Their entire life cycle centered on a place. This was allocation, a system that assigned a volume of fish to a community, and in turn made the people who lived there responsible for maintaining the health of the watershed that would return that volume in all the years to come.

Salmon once sorted us into places like Namu, gave us fidelity to those places and a reason to protect them. Now we haven't the slightest notion how to do that for ourselves.

Chinook

(also known as king, Tyee, or spring)

Oncorhynchus tshawytscha

Endangered Species Act status as of October 1999

Endangered: upper Columbia spring run and Sacramento winter run

Threatened: Snake fall and spring/summer run, Central Valley (Calif.) spring run, California coastal (south of the Klamath River), Puget Sound, lower Columbia, and upper Willamette

Not warranted: Deschutes summer/fall run, Central Valley (Calif.) fall and late-fall run, southern Oregon and northern California (between Oregon's Elk River and the Klamath River), upper Klamath-Trinity, Oregon coast, Washington coast, middle Columbia spring run, and upper Columbia summer/fall run

Chinook

Chinook runs have been increasing throughout Alaska. Commercial harvests are relatively high, though not as high as in the late 1970s and 1980s.

In much of British Columbia, escapement (the number of fish arriving at the spawning grounds) is declining, and seventeen stocks have been identified as extinct. On the Fraser River, however, escapement has been increasing, largely due to conservation measures initiated in the early 1980s.

Coastal stocks in Washington are listed as healthy, while Puget Sound stocks are declining, and five stocks are currently in critical condition. Along the Oregon coast, fall chinook runs are relatively stable except for declining runs in the southern region — a trend that continues down the California coast.

Large populations of chinook salmon once inhabited the drier interior regions, including the upper Columbia, Snake, and Sacramento-San Joaquin rivers. The majority of these runs are now extinct, while others are listed under the federal Endangered Species Act.

- Extinct
- At Risk of Extinction
- Special Concern
- Low or No Risk of Extinction
- Status Not Evaluated

100 0 300

miles

ALASKA

Kodiak Island

YUKON TERRITORY

NORTHWEST TERRITORIES

BRITISH COLUMBIA

Haida Gwaii

ALBERTA

Vancouver Island

WASHINGTON

MONTANA

OREGON

IDAHO

NEVADA

UTAH

CALIFORNIA

Chum

(also known as dog or keta)

Oncorhynchus keta

Endangered Species Act status
as of October 1999

Threatened: Hood Canal summer run and Columbia River

Not warranted: Puget Sound/Strait of Georgia and Pacific coast

Chum

Catch levels of Alaskan chum are high, though they have been declining since the record commercial catch of 13 million fish in 1984. Hatchery fish make up an increasing share of the commercial catch, amounting to more than one in four fish.

Of the 1,625 stocks identified in British Columbia, 141 (9 percent) were at high risk of extinction, and twelve stocks showed moderate risk. Most of the imperiled stocks occur in the Nass River, followed by basins on the north coast, Haida Gwaii (Queen Charlotte Islands), and the central coast. Of twenty-two chum stocks extinct in the province, seventeen had been found in the Vancouver area.

Most Washington chum runs are healthy, with the exception of two Puget Sound stocks in critical condition and lower Columbia River populations, which are declining. Chum are in critical condition in Oregon, where many populations are already extinct. Few chum remain in California.

- Extinct
- At Risk of Extinction
- Special Concern
- Low or No Risk of Extinction
- Status Not Evaluated

100 0 300

miles

ALASKA

Kodiak Island

YUKON TERRITORY

NORTHWEST TERRITORIES

BRITISH COLUMBIA

Haida Gwaii

Vancouver Island

ALBERTA

WASHINGTON

MONTANA

OREGON

IDAHO

NEVADA

UTAH

CALIFORNIA

Coho

(also known as silver)

Oncorhynchus kisutch

Endangered Species Act status
as of October 1999

Threatened: Oregon coast, southern Oregon/northern California, and central California

Candidate: Puget Sound/Strait of Georgia, lower Columbia/southwest Washington

Not warranted: Olympic Peninsula

Coho

Data on coho in Alaska are sparse, except in the south-central part of the state. In general, escapement (numbers of fish reaching the spawning grounds) is increasing throughout the state, with the exception of southeast Alaska. In recent years, Alaska has seen record commercial catches of coho.

In British Columbia, coho runs are declining. By 1992, escapement had reached the lowest levels since the 1950s. On the Fraser River, coho have shown the most dramatic decline (by a factor of eight) of any of the species of salmon. Conservation measures put in place to protect coho have curtailed the B.C. commercial fishery and led to controversy over how many B.C.-bound salmon are intercepted by Alaskan fishing boats.

Most stocks along the Washington coast and in Puget Sound are rated as healthy. However, sixteen out of forty-six Puget Sound stocks were listed as depressed, and one was listed in critical condition.

Coho were once widespread throughout the Pacific Northwest and northern California. Now they are extinct in more than half of their historical range — in the upper Columbia and inland basins of Washington, Oregon, Idaho, and California. Nearly all remaining coho runs in Oregon and California are very small. Juvenile coho stay in fresh water for a year or longer, making them particularly vulnerable to the disruption of stream habitat.

- Extinct
- At Risk of Extinction
- Special Concern
- Low or No Risk of Extinction
- Status Not Evaluated

100 0 300

miles

ALASKA

Kodiak Island

YUKON TERRITORY

NORTHWEST TERRITORIES

BRITISH COLUMBIA

Haida Gwaii

Vancouver Island

ALBERTA

WASHINGTON

MONTANA

OREGON

IDAHO

NEVADA

UTAH

CALIFORNIA

Pink

(also known as humpie)

Oncorhynchus gorbuscha

Endangered Species Act status
as of October 1999

Not warranted: even-year and odd-year runs. (Pink salmon return to spawn after exactly two years. Thus, stocks that breed in even years are reproductively separate from those breeding in odd years.)

Pink

In Alaska, catches of pink salmon have reached record levels, and escapement (numbers of fish reaching their spawning grounds) has been increasing as well. More than a quarter of the commercial catch in Alaska is the product of hatcheries.

On the Fraser River, escapement by pinks has risen from less than 1 million at the beginning of the 1990s to more than 3 million today. For comparison, historic runs averaged 50 million fish. Pink salmon populations have also increased in other basins throughout British Columbia.

In Washington, nine out of fourteen Puget Sound pink stocks are considered healthy, while two are in critical condition. One run, on the Elwha River, is considered extinct.

Self-sustaining populations of pink salmon apparently never occurred in Oregon. All California pink runs have become extinct.

- Extinct
- At Risk of Extinction
- Special Concern
- Low or No Risk of Extinction
- Status Not Evaluated

100 0 300

miles

ALASKA

Kodiak Island

YUKON TERRITORY

NORTHWEST TERRITORIES

BRITISH COLUMBIA

Haida Gwaii

Vancouver Island

ALBERTA

MONTANA

WASHINGTON

OREGON

IDAHO

NEVADA

UTAH

CALIFORNIA

Sockeye

(also known as red)

Oncorhynchus nerka

Endangered Species Act status as of October 1999

Endangered: Snake River

Threatened: Ozette Lake (Washington)

Not warranted: Baker River, Okanogan River, Lake Wenatchee, Quinault Lake, Lake Pleasant (all in Washington)

Sockeye

Alaskan sockeye runs have varied in recent years, with the Bristol Bay run falling far short of expectations in 1997 and 1998, and rebounding in 1999. Trends of escapement (fish reaching their spawning grounds) have increased elsewhere in the state, except in southeast Alaska.

In British Columbia's Fraser River, sockeye escapements have risen in the past decade from 1.5 to 2 million fish — a figure that pales next to historic runs that may have reached 100 million fish. Sockeye numbers elsewhere in the province have also increased in recent years.

Runs of sockeye in the Columbia and Snake rivers are severely depleted or have been completely destroyed. Puget Sound sockeye declined in the 1990s, although a few runs have rebounded in response to restoration efforts. On the Washington coast, one run is healthy while others are at risk.

With the exception of a few sockeye that return to the Deschutes River in Oregon, there are no longer self-sustaining populations of sockeye in Oregon or California.

- Extinct
- At Risk of Extinction
- Special Concern
- Low or No Risk of Extinction
- Status Not Evaluated

100 0 300

miles

ALASKA

Kodiak Island

YUKON TERRITORY

NORTHWEST TERRITORIES

BRITISH COLUMBIA

Haida Gwaii

ALBERTA

Vancouver Island

WASHINGTON

MONTANA

OREGON

IDAHO

NEVADA

UTAH

CALIFORNIA

Steelhead

Oncorhynchus mykiss

Endangered Species Act status as of October 1999

Endangered: southern California and upper Columbia

Threatened: upper Willamette, middle Columbia, south-central California coast, central California coast, Snake River, lower Columbia, and Central Valley (Calif.)

Candidate: northern California, Klamath Mountains, and Oregon coast

Not warranted: Washington coast, Olympic Peninsula, Puget Sound

Steelhead

Data on Alaskan steelhead stocks are very sparse. Only two out of 336 identified stocks were well enough documented that their status could be evaluated. Both appeared to be stable.

About 40 percent of steelhead stocks in British Columbia are of special concern or at risk of extinction.

The health of stocks in Washington varies. Winter and summer steelhead populations in Puget Sound have declined, primarily due to habitat damage. With a few exceptions, coastal stocks appear to be healthy. Stocks that once inhabited the upper Columbia, Spokane and Pend Oreille rivers are now extinct.

Stocks along the Oregon and California coasts are in critical condition, with escapements declining. These declines have been attributed to poor ocean conditions, predation, habitat damage, and widespread operation of hatcheries.

In the southern and inland portions of the steelhead's range, its situation is the most dire. Stocks in the interior basins of Oregon and California have become extinct largely due to dams, water diversion, and habitat damage.

- Extinct
- At Risk of Extinction
- Special Concern
- Low or No Risk of Extinction
- Status Not Evaluated

100 0 300

miles

ALASKA
Kodiak Island
YUKON TERRITORY
NORTHWEST TERRITORIES
BRITISH COLUMBIA
Haida Gwaii
Vancouver Island
ALBERTA
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MONTANA
OREGON
IDAHO
NEVADA
UTAH
CALIFORNIA

Shrinking salmon runs, faltering fish prices, and inefficient fish farming operations are all components of today's senseless salmon system. Amid the loss and absurdity, however, a new kind of relationship between humans and salmon is being tested in communities scattered across the Northwest. Writer Seth Zuckerman introduces a few of the artists and activists, anglers and actors who are crafting this relationship.

Toward a New Salmon Economy

BY Seth Zuckerman

For all the troubles they face, salmon still inhabit the soul of the Pacific Northwest. Even though humans play awkward midwives to many salmon — barging them around dams to reach the ocean, or slicing them open to incubate their eggs in plastic cages — the fish leave their imprint on the place where we live. In diminished numbers they nonetheless connect ocean denizens and land dwellers in a bond that has been recognized since the days of the first peoples. Just as salmon once brought food for bear, human, and fir tree to the furthest reaches of our watersheds, they tantalize today with the dream of a place in which people can harvest what we need and stand back while the rest of the wild fulfills its own destiny.

That dream of living with the salmon and healing the relations

between our species has motivated hundreds of initiatives by citizen groups and entrepreneurs throughout the fish's range. It has spawned watershed councils, fish-rearing projects, and bronze sculptures, and led otherwise sedentary individuals to spend Saturdays pulling brush and planting trees. It has moved some fishermen to handle their fish like gifts instead of cargo, and fish-buyers to value the difference between a factory fish and a wild fish. These broad-based efforts offer the most hope that humans can again show respect for the salmon in the fabric of our way of life, and work out mutually beneficial terms for sharing the North Pacific basin with them. By doing so, we can begin to develop the principles for cooperation with one another and the rest of creation that will allow not only salmon but salamanders and spruce trees to make their way in the world on a fair footing with *Homo sapiens*.

I first became aware of this promising approach to salmon in 1984, when I visited the remote Mattole valley in northwestern California. The chinook and coho salmon runs in this 300-square-mile watershed were in steep decline, and state agencies had not made the Mattole a priority because it is a small river, sparsely inhabited and far from population centers.

Nonetheless, a small band of local residents determined to do what they could in hopes of bringing back the fish. The first problem they identified was the lack of clean spawning gravel: salmon lay their eggs in streambed nests (called "redds"), where they are kept alive by oxygen in the water that flows through the spaces between the stones. But in the Mattole (as in many other watersheds), mud eroding into the streams because of clearcut logging and careless roadbuilding was smothering the eggs before they could hatch. Resident salmon-keepers launched a small hatchery project to boost the eggs' chances of survival by incubating them in troughs supplied with clean water. They set hand-built traps in the river and tended them through winter storms, hoping to catch fertile adult salmon before the river rose too high for them to continue fishing. Unlike an industrial hatchery, they took only wild fish, and just a fraction of those. They didn't rebreed the offspring of their project if they caught them as adults, because they sought to provide an insurance policy against extinction, not to create a population forever dependent on human intervention.

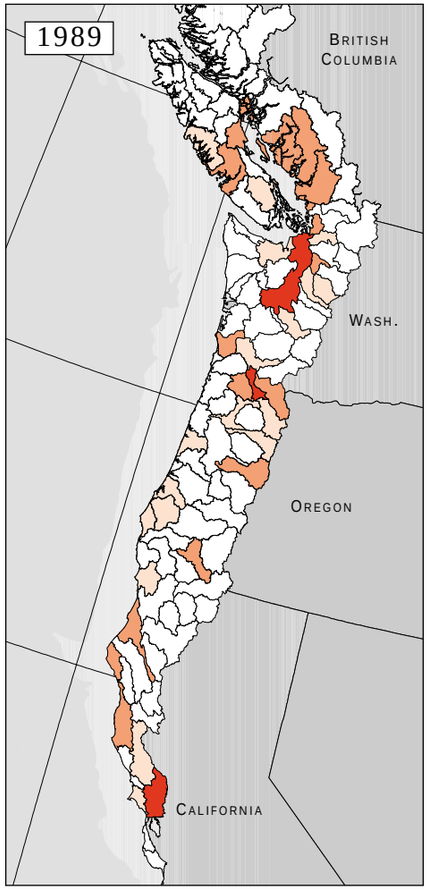
I was captivated by the élan these inhabitants brought to their work and by their vision of renewed plenty in which salmon feed people and the spirit of the land. They weren't waiting for anyone to solve the problem for them, they were doing what they could to address it head-on. I visited as often as I could, making the six-hour drive from San Francisco over tortuous roads to a place where, I felt, the people and their enterprises were in the right proportion to the terrain.

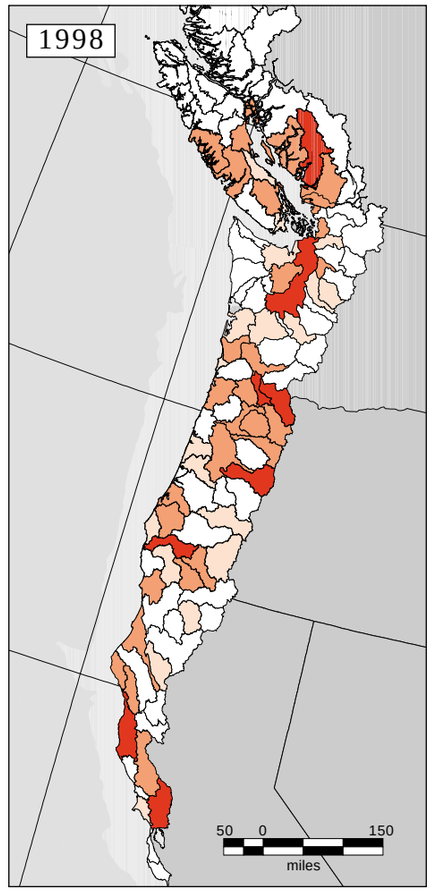
For the Mattole's fish runs to become self-sustaining again, the spawning habitat would have to improve. That meant preventing new insults from being inflicted on the landscape, and helping the older ones to heal. So the Mattolians' work branched out to include mapping the old-growth forest that still sheltered the best spawning grounds and seeking to protect it; finding out where erosion was coming from and working to stanch it; locating barren old clearcuts and reforesting them. It was four years after my first visit that I moved to the Mattole and became a participant in this work, shouldering a planting hoe and hoisting bags full of Douglas-fir seedlings onto my hips to establish trees where none had grown back in twenty years.

Since then I have planted fir, redwood, and willow trees, taken part in early winter counts of spawning salmon, and surveyed the young fish migrating to the ocean in late spring. I have sat in council with fifty of my neighbors — ranchers and restorationists, fishing outfitters and foresters — as we determined that the coho and chinook runs in our river had dropped so low that we oughtn't be fishing for the time being. Concern for the fish brought us all together as nothing before or since. We unanimously asked the state Fish and Game Commission to close our river to anglers during salmon season, a request which the surprised commission granted. And I have watched in frustration when we landowners couldn't agree on measures to keep the watershed's recovery on track.

For each of our missed opportunities, I am inspired by groups elsewhere along the coast that have notched successes where we have failed. On the southern Oregon coast, lawyer-turned-organizer Anne Donnelly leads the Coos Watershed Association with great subtlety, working with large industrial landowners, public foresters and ranchers who between them control almost all of the basin's 600 square miles. She concluded early on that little was to be gained by forcing people to protect the streams and fish runs if they didn't want to. "A lot of [the practices that harm the fish are] a matter of local custom," she says. "We're trying to effect cultural change, and you don't do that with a stick." Instead, Donnelly has organized field trips so landowners can hear from outside

Watershed restoration groups have spread through the Northwest





Rising with the tide of public concern for salmon and the watersheds they inhabit, the number of civic groups organized to protect and restore the fishes' habitat continues to grow. These maps show the rapid growth in the formation of such groups in the area west of the Cascade Range, from 94 in 1989 to nearly 200 in 1998. In Oregon, this growth has been driven in part by a state-sponsored drive to organize watershed councils.

Number of watershed and restoration groups, by drainage or group of drainages

- none
- 1
- 2 to 5
- 6 or more
  (1989: max 15)
  (1998: max 33)

Map by Debra Sohm based on a telephone survey.

experts what makes a culvert impassable to fish, for example, and find out what can be done about it. She also brought in crews to help timber companies spot places where their roads were bleeding sediment into the creeks during winter storms. A few years into the effort, she is starting to see the effects, both through projects to improve habitat with private and public funds, and through changes in how companies like Weyerhaeuser maintain their roads. "The most cost-effective way to do things is to create a social climate in which people do it themselves," says Donnelly. "I'm trying to get these guys to want to do the right thing."

Peppered up and down the coast are groups like the Mattole's and the Coos's that have arisen to aid the region's faltering fish populations, coalitions rather different than those formed around endangered creatures that people don't typically catch and eat, such as the marbled murrelet, the northern spotted owl, or the Olympic salamander. From Porcher Island off Prince Rupert, B.C., to Port Townsend, Wash., and Briceland, Calif., residents are raising fish in streamside hatchboxes. They are cabling logs into creekbeds to provide shelter to fish, buying irrigation rights to put water back into streams in dry summer months, and fencing livestock away from streambanks which then revegetate and offer shade and protection to juvenile fish. Each river — each pool and riffle — is unique, and teaches us that there is no one way to save salmon. This work challenges us to discover the particulars of our homeplace and our fish, and adjust our actions to their needs.

The support of salmon is not merely a rural pursuit. In cities from San Francisco to Vancouver, neighborhood associations are trying to keep remnant fish runs alive, or to resuscitate populations pushed over the brink by the destruction of their habitat. Under pressure from urban activists, creeks formerly encased in storm sewers have been "daylighted" — exposed to the sun and air again, meandering between replanted banks. Steep culverts have been equipped with baffles to allow adult fish to migrate upriver in the face of torrential flows that would otherwise flush them downstream. And spawning populations, once taken for granted and largely ignored, have begun to be celebrated.

The effects are beginning to be felt, not only in the modest impact on the numbers of fish, but in the attachment to place that the fish awaken in people. Whether you live in the tiniest village or the largest metrop-

olis, you live in a watershed, an area whose run-off flows via a network of streams through one outlet into a larger body of water such as a river, bay, or ocean. If that watershed drains more than a couple of garden hoses' worth into the North Pacific, at least one of the six species of Pacific salmon is probably native to it. A concern with salmon transforms residents of Fremont, Calif., into inhabitants of the Alameda Creek watershed, alert to the activities and phenomena there which affect the fish with whom they share the neighborhood. It helps when, as at Willamette Falls outside of Portland, or beside Ballard Locks in Seattle, city-dwellers can watch as the fish struggle to make their way upstream.

Concern for the fish isn't just about muddy work and political organizing. The annual return of the fish is occasion for celebration, as nourishing for the soul as their flesh is for the body and as their carcasses are for the streams and forests. One group that understands this more than most is Wild Olympic Salmon in Chimacum, near Port Townsend, Washington. Since 1989, these salmon aficionados have held a Wild Olympic Salmon festival every other autumn to mark the fish's return. Complete with pageantry, theater, and fish barbecue, the festival is a way for local residents to fête the salmon as they return to spawn.

Two of the founders of the festival, Tom Jay and his wife Mall Johani, are visual artists and carry the same fishy focus into their art as well. Jay's cast bronze sculptures are found all over the Northwest. In the Chimacum area, one of the most striking is Heroic Chum, a chum head bursting forth out of the earth in the parking lot of a strip mall and symbolizing the return of the fish. Johani's work tends more toward folk art — salmon-shaped throw pillows, glass beads in the form of a salmon egg, and even a curved Australian-style throwing stick with the legend "Salmon Come Back," which she calls a "salmorang". The couple's most ambitious project is yet to be realized: a 500-foot-long outline of a salmon drawn in oyster shell on a treeless hill across from the airport. "It would mark this forever as a place of salmon," Johani says.

Salmon biologists tell us that the unique characteristics of each place shape the life history of each population of fish. Chinook are known as spring salmon in much of their northern range because that is when they return to spawn. But in the coastal streams of California, they don't enter the streams until the freshets of fall signal the beginning of the rainy season. On the Columbia, one run of chinook was known as "June hogs" because of their mammoth size — up to 100 pounds — which enabled them to endure a thousand-mile upriver migration to the headwaters of the Columbia in Canada. Even within my own tiny watershed,

the fall-running chinook spawn some young that swim out to the ocean in the spring and others that exit to the ocean after spending their first summer in the estuary.

Wherever fish-centered culture occurs, it too has an equally distinct local flavor. Long nights on the salmon trap in the Mattole spawned a series of songs about the fish and the humans awkwardly trying to help them. "I'm the queen of the pool, queen of the river," proclaims a female chinook in a doo-wop tune. "This is my valley, here's where my heart's at home," sings a well-meaning logger. Spurred on by talent shows on rainy winter evenings, the songs became skits and eventually a full-blown musical comedy, *Queen Salmon*, which toured the Northwest three times in the early to mid-'90s.

For as long as people have made art about salmon and for much longer than they have been restoring fish habitat, people have been eating salmon. That visceral connection — all of us who have eaten that pink flesh are at some molecular level part-salmon — makes many of us care about these fish even more than other endangered species. We sense that if the fish are in trouble, so are we, that their disappearance threatens to evict us from an Eden in which wild protein made its way to us on a regular basis.

It came as a shock to many inhabitants of the North Pacific Rim to learn that some salmon stocks were seriously depleted. Several groups found the news of particular concern: commercial fishers, anglers and their guides, and native peoples who have depended on these fish for thousands of years. Their responses vary. Early reactions tend toward blame: fishers condemn their colleagues who use different kinds of gear, whose ships fly different flags, or whose skin is a different color. Shifting weather patterns and deep-sea trawl and drift-net fisheries are often cited, and no discussion of salmon decline is complete without pointing a finger or a 30-30 at sea lions. Their anger comes from an understandable sense of loss: As recently as the late 1970s, commercial ocean salmon fishing in Washington, Oregon and California brought in an average annual catch valued at $180 million, and was responsible for 7,200 jobs in fishing, fish processing, and supporting industries. By 1997, estimates fisheries economist Hans Radtke, the income generated by the ocean catch had dropped to $26 million, and about six thousand jobs

had been lost. But after tempers cool and reality settles in, people of a constructive bent try to salvage what they can and adapt their fishing to the current situation in which farmed fish glut the market while wild stocks face an uncertain prospect.

The perversity of the global economy is that it treats those farmed McFish as if they were the equivalent of the wild fish — fungible commodities, in the tongue of economists, like so many aluminum ingots or hundredweight of hard winter wheat. But they are not the same. A pen-raised Atlantic salmon from Chile or Puget Sound is made of different stuff than a wild sockeye or chinook, as significantly different as orange soda and orange juice. As importantly, it is a tendril of an entirely different system of provision and exchange, one which ignores the distinct qualities of local varieties and cultures and instead seeks to produce More of whatever Product can be sold at a profit. In an economy rooted in conservation, those differences between local strains of salmon — and apples and timber — are noted, celebrated, sought after, and accounted for. We see beginnings of that appreciation in the media barrage surrounding the Copper River kings, an early-season run of Alaskan chinook that have captured the attention of gourmet chefs and upscale supermarkets, with attendant high prices to the fishers who net them.

Consideration for the particulars of individual runs can help not just the fishers, but also the fish. One couple whose work demonstrates that possibility is Fred and Linda Hawkshaw, who fish for salmon out of Prince Rupert, B.C. While some of their hot-headed neighbors were blockading the Alaska ferry in 1997, the Hawkshaws were developing a new technique for catching sockeye that relied on snagging the fish by a flap of cartilage on their jaws, rather than trapping them by the gills. Fishing out of Prince Rupert was restricted because coho salmon were scarce that year, and setting nets to catch the more plentiful sockeye would inevitably capture some coho as well. But with the Hawkshaws' method, those coho could be released unharmed. Since the fish were alive when they were removed from the net, another advantage was that the fish could be bled and gutted as soon as they were killed, yielding a higher-quality product than most gill-net boats produce. With marketing help from Ecotrust Canada (a Vancouver-based nonprofit), the Hawkshaws began to ship their fish to high-end Vancouver markets, realizing more than $3 a pound for their fish (compared with under a dollar for their fellow fishers), compensating them for the extra care they put into the process.

Yankee fisherman Fred March took another tack. The 60-year-old

March fished as a young man in Puget Sound, and later off Alaska's Copper River Delta. He now makes his home near the headwaters of the North River, which flows into Washington's Willapa Bay, and gill-nets there as well as in Alaska. But fish runs in Willapa are faltering, in part because of damage to spawning and rearing grounds on the North. So March turned part of his 93-acre homestead into a salmon-rearing complex, with a sinuous network of channels and ponds where young fish can hatch and grow. At first he stocked it with surplus eggs from a state hatchery which he layered in gravel and tended until the fry emerged. After a few years his supply of eggs was cut off, so he dug an extra thousand feet of channel, filled it with gravel and flowing water, opened a fish ladder between his waterways and the river, then watched as adult salmon swam up, mated and laid eggs in the space he'd prepared. In 1996, his best year, this prosthetic habitat was home to 300 thousand eggs of chum, chinook, and coho salmon and steelhead trout. March still fishes at the mouth of the North River, but he lets the fish runs dictate his fishing. In 1995 and 1996, he took about a thousand fish a year, but in 1997 when it became apparent that the coho run was weak, he pulled his nets out of the water to let as many fish make it upriver as possible.

March's operation is much less invasive than a hatchery: fish that use his site do so because they have chosen it. They select their own mates, and the young feed on the aquatic insects that thrive in March's ponds and channels until they decide to swim down the fish ladder to the river below. His approach bears the mark of a properly humble salmon project: it minimizes human interference with what ought to be the fish's own business.

In each location, that principle plays out differently. In Young's Bay near the mouth of the Columbia, technicians raise fingerlings in pens in a watershed where the native fish runs were extinguished long ago. The fry imprint on the bay as their home place, so when they return as adults, they mill around the estuary and provide easy targets for a small gill-net fishing fleet that can seek them without fear of incidentally entangling fish from endangered stocks. This project avoids some of the pitfalls of an upriver hatchery, because the fish it releases don't compete with wild stocks in the river en route to the ocean. They home in on a watershed that lacks wild spawners, so they separate themselves from their wild cousins when they return. It's not like a fish farm, because the fingerlings are raised only for a few months, then turned loose to roam the ocean for two or three years. They feed out there, sparing the bay the impacts it would suffer from the untreated excreta of large penned fish.

At the same time, it limits demand for fish meal that would be produced by a deep-sea trawler fleet scooping up fish indiscriminately, thereby putting ocean food webs at risk.

Because the Young's Bay fishery is selective, some of the fish from it — bled and iced to preserve freshness — have been marketed as environmentally benign: salmon that can be consumed without the fear of accidentally eating the last spawner of a run. This selectivity is a hallmark of fisheries that care as much for posterity as for profit — a quality appreciated by a small but growing number of fishmongers and their customers. "There are a lot of people really interested in being as low-impact as possible when they buy seafood," says Seattle-based fish dealer John Foss. "We market our fish as harvested from intact, healthy runs." Makers of products whose production affects fish — from electricity to wine — cater to this concern, too, with labeling programs called "Salmon Safe" and "Fish Friendly."

Perhaps the ultimate in the precise harvest of salmon is a tribal fishery on the Nass River in British Columbia. Members of the Nisga'a First Nation make use of fishwheels, an elegant and ancient technology. The river current spins the curved paddles on the wheel, which scoop up fish and deposit them alive in pens at either side of the trap. Rarer species, such as steelhead, can be released. And since the Nisga'a operate traps both high and low in the river, biologists can tag fish near the mouth and learn about the population size by the number of tagged fish caught upriver. This sort of precise information allowed Alaska to rebuild its fisheries after they were decimated in the 1950s by overexploitation, and now enables state biologists to manipulate the openings and closings of the fishing season to achieve their top priority: that enough salmon make it to the spawning grounds to perpetuate the runs.

These salmon stories are part of an emerging segment of the economy that is rooted in conservation rather than depletion. This part of the conservation economy draws our attention because as inhabitants of the North Pacific basin, we are acutely aware of these fish. Efforts are underway in primary industries such as forestry and agriculture to develop analogous new-old ways that yield a harvest while rebuilding the productive capacity of the land. In fields such as construction and food preparation, innovators are learning to make the highest use of the raw materials that come from the hinterland, and to value the natural abundance and human craft that converge to provide them.

Three qualities stand out in all of these endeavors:

- Treating the gifts of this good place with respect, and using them to create products of high quality and high value;
- Taking care of the natural capital that is the source of these gifts — the integrity of the watershed, the health of the forest, the conviviality of the city;
- Celebrating the unique qualities of this region we have made home.

People committed to the recovery of the salmon are practicing these principles, in part because the fish show us so plainly the benefits of adhering to them. As a culture, we may be slow learners, somewhat clumsy and unpolished in our studies. But with the salmon's guidance, we can figure out how to reshape our relations with the landscape to which we, no less than the fish, belong.

Resources

For readers who want to delve more deeply into salmon issues, we offer a few suggestions of how to find out more; for readers inspired to act at the seafood counter, on the streambank, or in civic life, we offer leads that we hope will help you to connect with an endeavor you find worthwhile.

Becoming more informed

Find news on-line in Tidepool
Ecotrust's daily news digest, Tidepool *(www.tidepool.org)*, provides summaries of and access to newspaper articles about environment, community, and economy along the coast from Anchorage to San Francisco. Key articles about salmon are archived at *www.tidepool.org/id.salmon.html*

Catch salmon data at Inforain
A project of Ecotrust, Inforain makes available data about the region on-line at *www.inforain.org*. The data used to create the map portfolio on the status of salmon stocks can be found at *www.inforain.org/salmon.htm*, where you can look up the status of salmon stocks by watershed. One caveat: as on the printed maps in this book, small watersheds are lumped together, and large watersheds are broken up for purposes of data collection and display.

Hear from the public agencies
Current information about the Endangered Species Act status of salmon in the United States can be found through the National Marine Fisheries Service at *www.nwr.noaa.gov/1salmon/salmesa/index.htm*. British Columbia makes available detailed information about salmon stocks through its website, *www-heb.pac.dfo-mpo.gc.ca/heb/home.htm*. One First Nations perspective can be heard from the Columbia River Inter-Tribal Fisheries Commission, a collaboration of four Columbia River tribes (Yakama, Umatilla, Warm Springs, and Nez Perce), on the web at *www.critfc.org*.

Read all about it
The catalog of salmon books is long and rich. We will mention just a few:

Reaching Home: Pacific Salmon, Pacific People pairs Natalie Fobes' exquisite photographs of the salmon's life cycle with eloquent essays by sculptor and watershed worker Tom Jay and Brad Matsen, former editor of *National Fisherman*. Alaska Northwest Books, 1994, 143 pp. $37.95.

In the finely crafted *Totem Salmon: Life Lessons from Another Species*, Freeman House tells the story of his and his neighbors' work to restore salmon runs to the Mattole River in northwestern California, and relates it to a broader context ranging from indigenous ritual to contemporary beliefs about property rights. House's essay in Chapter 4 is adapted from this book. Beacon Press, 1999, 224 pp., $25.

First Fish, First People: Salmon Tales of the North Pacific Rim is a collection of essays, stories and poetry from native people around the North Pacific Rim, describing their relationship with salmon. Besides people of North America, this book includes work by the Ainu of northern Japan, and indigenous people from Kamchatka and Siberia. Elizabeth Woody's essay in chapter 1 is adapted from one of her contributions to this book. One Reel and the University of Washington Press, 1999, 204 pp. $24.95.

Jim Lichatowich's book *Salmon Without Rivers: A History of the Pacific Salmon Crisis* shows how attempts to manage salmon populations and substitute for the natural qualities of their habitat have failed to stem their decline. Island Press, 1999, 352 pp. $27.50.

Terry Glavin's book *Dead Reckoning: Confronting the Crisis in Pacific Fisheries* puts salmon issues in a broader context of the destruction of community fisheries, the processing companies' increasing control over boats and fishing licenses, and the widespread impacts on marine life up and down the West Coast. Mountaineers Books, 1997, 181 pp. $15.95.

An artful children's book about salmon is *Swimmer*, by Shelley Gill with illustrations by Shannon Cartwright. It describes the adventures of a salmon's migrations as told to a young Alaskan girl. Paws IV Publishing (Homer, Alaska), 1995, 32 pp. $15.95 hardbound, $8.95 paperback.

For more detail about the salmon's life cycle and suggestions of where and when to observe salmon migrations and spawning, try *Field Guide to the Pacific Salmon*, by Robert Steelquist and the Adopt-a-Stream Foundation. Sasquatch Books, 1992, 64 pp. $5.95.

Fish on Film
The Return of the Salmon uses historic footage and contemporary interviews to explain the natural history and current state of the salmon in the Pacific Northwest. For more info about this half-hour documentary by Joseph Cone, produced in 1995 by Oregon Sea Grant, check *seagrant.orst.edu/communications/video.html*; the video can be ordered for $30 by calling (800) 375-9360.

Thinking Like a Watershed is Johan Carlisle's 1998 documentary about salmon restoration efforts in the Mattole watershed. A half-hour long, it is available for $39.95 from the Video Project, (800) 475-2638 and described more fully at *www.videoproject.org/ThinkingLikeAWatershed.html*.

For referrals to other resources
Check out the salmon page maintained by Portland's Riverdale School, *www.riverdale.k12.or.us/salmon.htm*. Some outdated links, but provides access to a wide variety of salmon information.

Favoring Wild Fish

Eat the wild ones

Salmon caught in the wild are great food, but unfortunately, only half of the world market in salmon is composed of fish captured from native or hatchery runs. The rest comes from fish farms, with all the related problems described in chapter 3. Atlantic salmon in the marketplace are all the product of fish farms, as are some chinook and coho.

To help buyers and chefs select ecologically responsible salmon for their plates and promote harvest techniques that sustain abundant wild fisheries and the communities in which they are located, efforts are underway to develop a wild salmon marketing campaign. For more information on the current status of that initiative, contact Ecotrust at (503) 227-6225 or Ecotrust Canada at (604) 682-4141, or check out our websites at *www.ecotrust.org* and *www.ecotrustcan.org*.

For information about other kinds of seafood and the health of the fisheries that they are derived from, check out the list published by the Monterey Bay Aquarium in California. They've divided seafoods into three categories: best choices, potential problems, and ones to avoid. Their list can be found through the Seafood Watch section of their website, *www.montereybayaquarium.org*. The Audubon Society offers another good guide, at *magazine.audubon.org/seafood/guide/*.

Farming with fish in mind

Pacific Rivers Council has launched a project to label foods that are grown in ways that are compatible with salmon habitat. Called Salmon Safe, this certification program identifies beef, wine, and other agricultural products that meet certain standards of ecological responsibility. For more information about participating growers and where to find these products, check out their website at *www.pacrivers.org/salmonsafe/index.html* or contact Pacific Rivers at (541) 345-0119.

Wading right in

In the southern parts of Salmon Nation, where damage has been done to fish habitat, there are opportunities to help nature heal that damage. Groups have formed all over the region to undertake this work, and to create a climate in which people act to protect and enhance salmon habitat. For the Sake of the Salmon serves as a networking umbrella for these organizations in California, Oregon, and Washington, and can help you find a group near you from among the more than four hundred they are aware of. For the Sake of the Salmon can be reached at (503) 223-8511 or *www.4sos.org*.

Getting political

Salmon range so widely that they depend on responsible human behavior in arenas from fishing harvests to streamside protection and roadbuilding, from the high seas to the highest peaks of their home watersheds. As a heritage we all hold in common, it is only natural that they have become the subject of political decision-making about everything from dam construction and logging rules to the length of fishing seasons.

Arranged around these issues are a host of groups of many stripes. Sometimes it seems that there are as many different styles of political action on behalf of the salmon as there are runs of coho on the West Coast. If you are moved to become involved in some way in support of the salmon and our relations with them, you would find many groups from which to choose. One gateway to finding those organizations is Save Our Wild Salmon, a coalition of dozens of groups each working in its own way. You can find out about their campaigns and some of their member organizations through the SOWS website at *www.wildsalmon.org*, or by phoning them at (206) 622-2904.

In British Columbia, the David Suzuki Foundation is at the center of many of the political fights being waged over salmon policy. You can contact them at (604) 732-4228 or check their website, *www.davidsuzuki.org*.

About this book

In 1995, Ecotrust published *The Rain Forests of Home: An Atlas of People and Place*, a large-format map atlas designed to raise awareness of the bond between people and forests along the rain forest coast between San Francisco and Anchorage, roughly the territory that some call "Cascadia."

We intended then to create a series of such atlases. We imagined they might become standard references for serious students of the region, each edition a tool for those willing to look beyond arbitrary political boundaries and glimpse the unifying themes of life along this coast.

It was natural that we would turn to salmon, emblematic of the region and at the center of a sustaining economic relationship between people and nature that has endured more than ten thousand years. As salmon hit the front pages with startling population declines, recent Endangered Species Act listings, and U.S.-Canada diplomacy, we realized that few residents had access to the coast-wide "big picture" that could put into context the local salmon story as they lived it.

Salmon Nation is meant to remind all who inhabit or visit the Pacific Northwest that the character, fecundity, and much of the richest history of this place revolve around the abundant presence of these extraordinary fish.

At Ecotrust, we promote an economy built of relationships that restore

such abundance and diversity to our lands and waters. We believe that the marketplace can become one of several arenas where community desires are reconciled with the needs of the salmon and our need to connect with them.

We hope this book helps you to live more knowledgeably and deliberately as a citizen of Salmon Nation, and we invite your comments and reactions.

Salmon Nation emerged like a fingerling from the gravels of a coast-wide study of Pacific salmon distribution and abundance begun in 1995 under the direction of Peter Schoonmaker, Ph.D., using computer-based geographic information systems (GIS) technology and a mapping methodology developed by Edward Backus. The team involved in that analysis between 1996 and 1998 included Jon Bowers, Dorie Brownell, Ted Gresh, Erin Kellogg, Jim Lichatowich, Richard Manning, Hans D. Radtke, and Cleve Steward.

Individuals responsible for GIS mapping for that study and the creation of original maps for this book include David Albert, Dorie Brownell, David Carruthers, and Debra Sohm. We are grateful to Oregon Trout, Kim Hyatt (Department of Fisheries and Oceans), and Alex Wertheimer (Alaska Department of Fish and Game) for sharing data sets we have used in the compilation of these maps and for participating in the analysis. Biologist Willa Nehlsen graciously shared her knowledge, data, and contacts throughout this project, and more than one hundred other fisheries scientists helped to fill our information gaps.

Our colleagues Spencer Beebe, Jennifer Froistad, Ian Gill, and Ed Hunt offered valuable advice and encouragement during the development of the book; Elizabeth Grossman proofread the essays; Ellen Chu (Northwest Environment Watch) shared valuable lessons from her experience of taking manuscripts into print; and John Javna sharpened our thinking about what makes a book appealling.

We owe a special debt to *Chinook Observer* publisher Matt Winters, who shared his personal collection of historic salmon can labels, on which the book's design is based. We are grateful to the Columbia River Maritime Museum for access to their collections of salmon can labels, to Katie Doka for her beautiful cover art and the salmon steak illustration in Chapter 3, to Steve Blackburn for the boat illustrations in Chapter 4, to Shari Erickson and Joe Tomelleri for the salmon illustrations that accompany the map portfolio, and to photographers Gary Braasch and Adrian Dorst for the use of their images. Alex Blendl supplied an historic photograph, and the Oregon Historical Society provided access and permission to reproduce images from its collections.

Bryan and Eldon Potter of Bryan Potter Design in Portland immediately understood our vision for the book and adeptly translated our notions into a graphic treatment. Laura Anderson and her colleagues at the Hatfield Marine Science Center in Newport, Oregon, and Jim Bergeron of the Oregon Sea Grant program in Astoria, offered helpful comments on the illustration of West Coast fishing boats in Chapter 4.

This book and the research and computer mapping that underlie it were made possible by the generosity of Ecotrust's donors and supporters, particularly by project grants from the Compton Foundation, the Giles W. and Elise G. Mead Foundation, the M. J. Murdock Charitable Trust, the Prospect Hill Foundation, and communications support from The Ford Foundation. General support from the Bullitt Foundation, the William and Flora Hewlett Foundation, and the Moore Family Foundation has been invaluable during the course of our work on this book.

We thank our colleagues at Ecotrust and Ecotrust Canada, who have provided support, encouragement, and friendship through many twists and turns along the path to *Salmon Nation*. Finally, we would like to acknowledge and thank the community-builders, conservation entrepreneurs, and Native and non-native fishing families, too numerous to name individually, who believe against all odds that salmon will one day thread the waterways of Salmon Nation in their accustomed abundance and reconstitute our common wealth.

The value in this book is due to all who have shared so generously of their time, resources, and knowledge in its creation. We alone take responsibility for any errors that remain.

— E.C.W. and S.Z.

Contributors

Dorie Brownell holds a masters degree in geography from Portland State University and works as a Geographic Information Systems (GIS) analyst at Ecotrust in Portland, Oregon. Her knowledge of the rivers she maps is often first-hand: she has worked as a Class V guide and trip leader on over forty rivers in the United States, Australia, and Costa Rica. She is currently at work on a project to map the status of salmon stocks throughout their natural range on both sides of the North Pacific.

Freeman House, a former commercial salmon fisherman, is co-founder of the Mattole Salmon Group and of the Mattole Restoration Council. He lives in Petrolia, in northwestern California. *Totem Salmon* (Beacon, 1999), from

which his essay was excerpted, is his first book.

Jim Lichatowich is a biologist who has spent twenty-nine years in salmon management and research. He is co-author of the landmark 1991 *Fisheries* paper "Pacific salmon at the crossroads," which alerted scientists and the general public to the regional extent of salmon decline. His recent book *Salmon Without Rivers* (Island Press, 1999) describes the roots and evolution of the Pacific salmon crisis. He lives in Washington state.

Richard Manning is the author of four books, including *Grassland: The History, Biology, Politics and Promise of the American Prairie* (Viking, 1995) and *Last Stand: Logging, Journalism and the Case for Humility* (Peregrine Smith, 1991), and is at work on a book about biodiversity and economy in the coastal temperate rain forests of North America, to be published by Island Press. He worked for fifteen years as a newspaper editor and reporter in the northern Rockies, and now lives in Montana.

Edward Wolf first encountered salmon at age six, in the form of belly lox served in a delicatessen in Cleveland, Ohio. He is director of communications for Ecotrust in Portland, Oregon and author of *A Tidewater Place: Portrait of the Willapa Ecosystem* (Mountaineers Books, 1993), a monograph about that region of southwestern Washington. His work for conservation organizations has taken him from the headwaters of the Amazon to the mouth of the Yukon River.

Elizabeth Woody (Navajo/Warm Springs/Wasco/Yakama) has published poetry, short fiction, essays, and is a visual artist. Her first collection of poetry, *Hand into Stone* (The Eighth Mountain Press, 1994), received the American Book Award. Ms. Woody received the William Stafford Memorial Award for Poetry from the Pacific Northwest Bookseller's Association in 1995. She works at Ecotrust in Portland, Oregon, and is enrolled in the Hatfield School of Government at Portland State University.

Seth Zuckerman's writings on the relations between humans and the rest of the natural world have appeared in *Newsweek*, *The Christian Science Monitor*, and *Sierra*, among others. Since 1997, he has served as Ecotrust's circuit rider, covering issues of community, economy, and environment along the coast from Anchorage to San Francisco for the on-line news service *Tidepool.org*. He lives on the Mattole River in northwestern California where he is active in watershed restoration.