Oncorhynchus tshawytscha — Chinook Salmon

By Susan McDougall

In the past, a great salmon plied the cold waters of the Strait, swimming ever upstream, answering an ancient call with a fleeting presence to the people who observed its passing. Yet it was they who acknowledge its importance to their lives with a name reserved for the largest of its kind— the "Tyee". In the company of smaller companions, each year the Tyee provided sustenance for those who waited. The return provided sufficient food for a long winter, for this was a temporary passing. With a mixture of relief and thanksgiving, the people took many, while most passed by, forgoing eating in a race against time, bound for the rivers where they had begun their lives only a few years before. There, in the swift freshwater of their birth, the great Tyee would spawn and die, passing on its uniqueness to tiny offspring it would never see.

Today, we know this salmon as the "Chinook," or the "King." For the most part, those great Tyee are consigned to memory, with the occasional photo a reminder of what once was. Most Chinook begin their lives in an environment far removed, in practical if not physical terms, from the cold swift waters that defined their lives.

The largest of all Salmonidae family species, the Chinook Salmon — also called the King, the Blackmouth, the Spring, and the "Tyee" for the heaviest and longest of all, is today amongst the most imperiled of all north Pacific salmon. Delicious and nutritious, its size alone made it a desirable fish in the past for subsistence fisheries and, with the arrival of settlers in the nineteenth century, in the historical record as well. Millions have been taken, so many that the largest fish are nearly consigned to collective memory, while today, rather than swimming up swift rivers that molded its evolution, the Chinook Salmon is more likely to be born in a hatchery.

Born in an environment conducive to size and strength, with a timeframe extending back millions of years — much longer than humanity's existence — this is a fish that at its maximum size tips the scales at 97 pounds and 58 inches (147 cm) in length, although individuals weighing more than 50.7 pounds are rare. The average size is about 36 inches (90 cm) in length and 22 pounds. Fusiform in shape, the adult Chinook has a large conical head, and a forward-directed wide mouth. Sea-run fish are metallic blue to green above, with silvery sides and whitish below. The dorsal fin and both lobes of the caudal fin are marked with small dark spots; the body is spotted above the lateral line. The inside of the mouth is black.

Chinook Salmon – *Oncorhynchus tshawytscha*

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As a mature Chinook enters the Strait and begins its journey towards freshwater, the body color darkens, to an olive brown and reddish or purplish hue. The male develops characteristic hooked jaws (the genus name, *Oncorhynchus*, refers to this form, while *Tsahwytscha* is a Kamchatkan name), with large teeth. Called a "kype," this structure distinguishes the male and is indicative of the aggressive, territorial behavior it demonstrates in its spawning habitat.

The Chinook are divided into two spawning runs — the Spring and the Fall. Spring Chinook ascend their natal rivers and streams in late May and early June, spawning in late autumn: Fall Chinook migrate in August and September, spawn through November, sometimes later. The returning adults tend to move upstream during the day. Some migrations are long: in the Yukon returning Chinook travel nearly 2,000 miles (3,200 km) to their birthplace. Other journeys for this versatile fish terminate close to the intertidal zone.

Large females can produce over 17,000 eggs although the count is most often less. Eggs are deposited in a redd dug by the female in clean gravel beds. After fertilization, hatching occurs in 30-160 days, typically sooner in warm water. Chinook can tolerate waters below freezing but are most often present in temperatures from 46-54° F (8-12° C).

After a residency in their natal river of a few months to more than a year, Chinook smolt begin their seaward journey, swimming downstream while undergoing the physiological transformations that will enable survival in saltwater. The adaptive changes complete, they move seaward, where the rapidly maturing fish will remain for 3-4 years, although sometimes less or occasionally as long as 9 years. At sea, they tend to forage in deep waters during the fall and winter and move closer to the surface during spring and summer. In their oceanic home, Chinook prey primarily on fish and invertebrates: in return, they are eaten by marine mammals, birds, and humans.

Chinook Salmon is considered by many to be the tastiest of all Salish Sea salmon. Rich in fat, it is both buttery and firm, and can be prepared with methods that range from grilling to baking to frying in an open pan. The taste varies depending on the source, and the flesh can be reddish or white — reportedly the flavor is similar, although the red-fleshed fish commands a higher price. Big and delicious, it is understandable why this fish has been eagerly sought for thousands of years.

Introduced from the freshwaters of the Great Lakes to the seas and hatcheries of New Zealand, and South America as well, the Chinook is native to the cold waters of the north Pacific. Emerging as a small fry from the gravels of freshwater rivers and streams, it is an anadromous fish that matures in saltwater, only to return to spawn in the stream where it was born. Its life mission complete, the spent fish dies within days.

From northern Japan to the Russian far east and Kamchatka, across the Pacific to the Bering Sea, and south along the western coast of North America to central California, the Chinook is both widely ranging and adaptable. Prior to dam construction on the Columbia River, spawners returned upriver at least 560 miles (900 km), while in the Salish Sea, the great fish was at home in the shorter but large rivers that descend from the mountains to the sea. Far to the north, to return to its natal stream, the Chinook is known to travel up the Yukon River more than 1,860 miles (3,000 km).

In the Strait of Juan de Fuca, the annual return of the Chinook from the Pacific was a welcomed event in large rivers, such as the Elwha and the Dungeness, and in smaller rivers as well. Often acknowledged with ceremony, people along the coast recognized the importance of the Chinook to their

survival. Thousands of years ago, it seems possible that the fish and the people returned simultaneously to the borders and waters of a deep channel carved by a great ice lobe recently melted. Stabilized by 5,000 years of relatively constant conditions and capable of inhabiting a new home far from the refugia that had sustained them, the Chinook had a long history of adaptability to the waters of the Pacific Northwest. The people as well had a long history of thriving in a cold yet richly endowed land.

Evolution

As the only family of its order, the Salmonidae includes approximately 200 species of Northern Hemisphere, cold water fish. They are migratory, spending much of their lives in both large water bodies, often salty, such as the Salish Sea. The *Oncorhynchu*s genus is perhaps best known, both for its historical significance and its distinctive lifestyle: this is a fish that lives in fresh and salt waters, reaching maturity in the bountiful sea and returning upriver to spawn. Although the origins of such behavior are a subject of debate, the *Oncorhynchus* most likely separated from the *Salmo* — a large genus perhaps best known for the Atlantic Salmon (*Salmo salar*) — into a distinct genus about 5-6 million years ago. Today, *Oncorhynchus* numbers 16 species; six are native to the waters of the Pacific Northwest.

Following the separation of the two genera, one fish that makes the Chinook look like an average-sized trout, plied the waters of North America. Now extinct, this was the Spike-toothed Salmon (*Oncorhynchus rastrosus*), a giant at more than six feet in length weighing nearly 400 pounds. Roaming the waters of the West, fossils of the Spike-toothed have been unearthed from freshwater sites, where it apparently spawned, with males developing the large teeth common to extant species.

More than three million years prior to the onset of the current Ice Age (the Pleistocene), the salmon species familiar to us today were firmly established in the rivers that emptied into the north Pacific. And given their preference for cold waters, the onset of the Pleistocene may have been advantageous for salmon, possibly increasing their range, or at the very least ensuring excellent habitat. The downside of this scenario was that as time passed the encroaching ice sheet, a giant maw sometimes thousands of feet thick, engulfed waters and land alike across much of the continent. With water turned to ice, saltwater shores dropped to lower elevations, obliterating river courses. Plants and animals, including the salmon, were pushed ever southward. And although some fish populations would survive in northern refugia, for the most part the salmon would occupy waters free of the ice.

One such large welcoming flow was the ancient Columbia River. Altered in its northerly course by the encroaching ice, the river flowed across ancient lava beds, cutting downward, creating waterfalls and cold lakes. Subjected to immense watery floods from the blocked waters of ancient Lake Missoula, it consistently ran south and west, emptying as it does today into the Pacific Ocean. Deep channels in the ocean floor reveal the river's path across dry land at a time when ocean waves pounded a shoreline 400 feet lower than it is today.

Although subjected to the changes of ice age dynamics, the constancy of water flow from mountains to the sea in the ancient Columbia River offered a refuge to salmon species forced southward. Research indicates that as the glaciers began their retreat from southern Puget Sound approximately 17,000 years ago, melting ice provided new opportunities for the restless, adaptive Chinook. While Columbia River populations continued to number in the millions, wandering fish moved

north along the coast, straying salt and freshwater bodies recently inaccessible. Northeastward along the Columbia the Chinook reclaimed ancient pathways while nosing into recently carved watery channels previously blocked by ice. The occupation was both a return to an ancient home and an expansion into the new.

Genetic research increases our understanding of what might have transpired as the salmon claimed new territory, traveling up coastal rivers in search of suitable spawning sites, eventually reaching the Strait, a glacially carved channel filled with ice 60 miles west of the current coastline. As the ice retreated, the opening Strait provided a conduit for the Pacific's salty waters into the Salish sea, at that time itself a place of rapid glacial melting.

Although it seems counterintuitive, Chinook Salmon may also have retreated north during the time of ice advance southward across North America. A welcomed refugia in the rivers of Beringia, the dry extension of present-day Alaska, may have provided a home for the Chinook, as well as other salmon species. Such a sanctuary undoubtedly closed at times, as coastal rivers were subjected to cycles of melting and icing over, but if present in the region, salmon could have taken advantage of receding ice. Research indicates that the Bering Sea was such a place, particularly during interglacial periods.

Fishing (Salmon for Food, Fish for Business)

Indigenous fishing of Chinook Salmon goes back thousands of years. In Alaska, fish bones of the related Chum Salmon (*Oncorhynchus keta*) are dated at 11,500 years old, making them amongst the earliest evidence of Paleoindian fishing, in this case far upriver from the coast. The fishing sites are primarily riverine and suggest that salmon were present in the late Pleistocene and perhaps before.

Prior to this finding, it was conjectured that ancient cultures, such as this one, present as the ice began an accelerated retreat, were dependent on hunting large mammal. The fish bones call into question this assumption and contributes as well to knowledge of glacial refugia occupied by salmon.

In the Pacific Northwest, evidence of extensive use of salmon in indigenous diets dates to nearly 10,000 years ago. Located at the Roadcut site located near The Dalles along the Columbia River, a few decades ago thousands of salmon bones were uncovered. Ensuing debate questioned whether humans were engaged in a subsistence fishery at the site. In more recent studies, however, new excavations and a thorough analysis support the evidence for human salmon fishing on the Columbia.

Such ancient sites have not been located along the Strait, and it is most likely that the saltwater was completely iced over, with the lobe reaching westward to the edge of the continental shelf. As a rapid melting began over 13,000 years ago, salmon began to take advantage of the retreat, returning from their southern refugia along the coast, and eventually, perhaps via Puget Sound. When fishing became important to the Indigenous people's diet is unknown, but, as with the fish, humans occupied the land as it rebounded from its icy burden.

As a significant resource for many tribes throughout the Pacific Northwest, it is evident that even with the natural ups-and-downs of yearly runs, the Chinook had a consistent, long-term presence dating to the waning years of the last glacial advance. The fish was deeply appreciated for its part in sustaining human societies near the coast.

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The assuredness of a constant Chinook run would change as the 19th century wound down to the 20th. With the first state hatchery built on the Columbia River in 1891, the effort and investment were motivated by declining wild runs, particularly in the river. Eventually the abundant Chinook would go into freefall throughout its entire range, including the Strait. This survivor of an oscillating climate that had honed its adaptability and expanded its range even as humans thrived on its abundance along the rivers and seas of the Pacific Northwest, would within a few years — a mere fraction of its family's existence — become the object of unprecedented pressures. Subjected to continuing unchecked exploitation as the 20th century advanced, the Chinook and its cousins would be challenged in a way they could not withstand. Radical change throughout the region, brought on by an increased human population, overwhelmed the salmon, sending it into a staggering decline throughout its ancient home.

More than a thousand miles south of Puget Sound, by 1850 Chinook commercial fishing had begun in the Sacramento and San Joaquin rivers of central California. With the first cannery in place by 1864, twenty-two years later the closures began. Canneries were now built in more northly locations, where they processed the bountiful fisheries of the Pacific Northwest. The Columbia River was a hotspot for cannery production; accompanying social and political issues would impact the rapid development, but in time, as the fishing expanded upriver, the resource — salmon — inevitably declined.

To the north, the first cannery in Puget Sound was built at Mukilteo in 1877, and by the beginning of the 20th century, demand was high and increasing. There, in the cold, salty waters of the Sound Chinook numbers are estimated to have been as high as 690,000, most of them natural-origin fish. In 1994, the potential run-size was estimated at 240,000 fish; however, this number includes a higher percentage of hatchery fish, produced in response to declining salmon populations.

The pace picked up, with the heyday of commercial Chinook fishing in the Puget Sound commencing in the early 1980s. It continued for a decade: during that time the harvest exceeded 200,000 fish per year. This high rate persisted until 1994, when it underwent a sharp fall to an annual take of 49,000 fish. What should have served as a blaring signal of a new reality may have been heeded by some, but exploitation rates of the dwindling population remained high.

By the second decade of the 21st century, after listing the Puget Sound Chinook as "threatened," the commercial harvest numbered about 78,000 per year. However, by this time hatchery production had increased further, and thus the natural-origin take was approximately 3,050. The numbers declined proportionately in the recreational fishery. Such sparse numbers, significant as they are to recovery, reveal how deeply exploited the Chinook had become.

The cold reality of over 150 years of salmon fishing, both commercial and recreational, is that the natural-origin Chinook population has declined from at least hundreds of thousands to the hundreds.

Given that there are many impacts on the species, including natural events and increased predator pressure throughout the region, it can be emphasized that the most precipitous drop occurred when fishing pressure intensified. Within a brief time, the various populations declined so dramatically that ultimately it was no surprise that the possibility — the reality — of listing this legally defined Evolutionarily Significant Unit (ESU) was necessary to save the dwindling fish. It is unfortunate that 25 years later the dream of restoration seems to be far in the future, if it is possible to achieve it at all.

Historically, however, fishing was not the only culprit in the Chinook's demise.

Habitat Loss

It was not only fishing that would bring about the decline of all salmon species. On the Columbia River, dam construction brought in its train fish blockage on a grand scale. The construction of two dams on the Elwha River meant the possible demise of many salmon populations, while other rivers underwent less dramatic but nevertheless unprecedented changes. It evolved rapidly, this legacy of human activities. River courses were straightened, banks were riprapped, wood was removed from streambeds, riparian forests were cut, agricultural runoff polluted waterways, while increased building of private and commercial structures on the shores of rivers and saltwater bodies increased, seemingly without limit. It was a time of opportunity, accompanied by a change of magnitude few could imagine. The fish were subjected to a double whammy. Removed in increasing numbers from fresh waters and salt alike, the remaining salmon relentlessly swam to natal homes that were losing their capacity to sustain. Ultimately, natural-origin Chinook Salmon would go into a freefall state, with variation across its range, but the overall impact essentially the same.

Listing the Puget Sound Chinook would force a reality on planners, researchers, and the public alike. It was, in a sense, a check of how close this ESU was to extirpation. To restore it, or at least stop the decline, involved addressing the issues of overfishing, habitat loss, and increased hatchery production. At the same time, the impacts of climate change on ocean productivity, competition from other species, as well as their own, and increased predation, would prove even more difficult to assess.

It seemed that with those factors depressing the populations that could be managed, at least to an extent, the only answer was going backward, if return to a more fish-friendly state could be called that.

Fishing of natural-origin fish would have to be restricted, more than in the past. Assumptions about hatchery production would have to fall under the scrutiny of citizens and scientists alike: it could not be assumed that increasing hatchery fish meant restoration of natural runs.

Perhaps most difficult of all, turning back the clock on destructive shoreline practices would have to be addressed. Structures were in place, impacts on water quality well-known, stream and river alterations a reality. Land acquisition and designation for conservation was a possibility and one that would be pursued; it was a definite positive step. Coupled with removing properties from development altogether was habitat restoration, an approach that considered the entire system, water and land alike.

Fortunately, there was a precedent for restorative actions, one that could provide guidance. In the late 20th century, as the reality of the Puget Sound Chinook Salmon was being addressed at the highest level, restoration was already a process being employed for natural-origin salmon. Such practices included altering river dynamics, a large-scale approach that, once again, was a step “back” to a pre-development state. Streamside practices included enhancing riparian zones with plantings of native shrubs and trees. Short term salmon supplementation projects could restore lost populations, while increased monitoring contributed to evaluating the success of restoration practices.

With listing, restoration projects could be expanded, as more funds became available, and public involvement increased. These efforts consisted of both small scale and large approaches. However, assessing the results posed new challenges — impatience for measurable impacts would have to be acknowledged, while continued commitment was an absolute necessity.

Fishing Until Listing

In 1973, the United States Congress passed the Endangered Species Act (ESA), arguably the most important environmental legislation ever written. Both reactive and visionary, this law offered a hope of halting the decline of animals and plants across the continent with ramifications for the planet itself. Clarified, revised, argued, challenged — just a few of a whole plethora of issues that would accompany the implementation and application of the ESA — since its enactment, this law has been invoked many times for the protection of salmon populations, among many other fish groups as well. Defined and specified as Evolutionarily Significant Units (ESU), in the case of the Chinook Salmon, nine ESUs were eventually listed, two of them as "endangered" and seven as "threatened" throughout the species' range. In the Pacific Northwest, on May 24, 1999, three Chinook ESUs in Washington and Oregon were listed as "threatened," and one as "endangered." The threatened included the Puget Sound ESU, defined as Chinook salmon present in the Sound, north to the Canadian border, and west along the Strait to the Elwha River. The ESU also includes Hood Canal and the rivers that drain into it.

Such a listing set into motion the creation of several documents: amongst these, as required by the ESA, a Recovery Management Plan (RMP) was first published in 2005. It provides a roadmap for the listed group, in this case the Puget Sound Chinook Salmon ESU. The RMP does not have enforcement authority but can serve as a detailed guideline for management and for the research and writing of other documents. Target numbers are specified, as are restoration plans and fishing impact concerns, among others.

Other important documentation includes a Comprehensive Management Plan, a five-year document researched and written by the Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife (WDFW). Among other topics, this plan specifies numbers such as the permitted exploitation rate of the ESU and lists target values for the Puget Sound Chinook populations.

The National Oceanic and Atmospheric Administration (NOAA) also makes reports available to the public; one such is the periodic 5-year review.

All proposed actions and informative reports have a simple goal — the eventual delisting of the ESU. This is the ultimate intent for all ESA-listed species.

But with Chinook Salmon runs numbering in the low hundreds, and target numbers in the thousands, it is difficult to forecast how such ideals could be reached. Thus, for the Puget Sound Chinook, more than 20 years after listing, the goal remains elusive. The directive is in place, plans and reports are written, and restoration is ongoing. Yet recovery is not evident.

With numbers so low, it would seem reasonable that natural-origin Puget Sound Chinook should not be subjected to fishing. However, this is a misconception: listing a salmon ESU as "threatened" does not imply a halt to the take. Although hatchery fish are marked, thus enabling separation, an increase in hatchery fishing invariably accompanies a larger natural-origin take as well. Thus, after listing, as the total catch increased once again, with numbers topping 100,000 by 2002, peaking at nearly 125,000 by 2007, and remaining high, it included wild fish. Except for poor years, such as those following the "blob" in 2012, the natural-origin *take has been higher than before listing*. This reality reflects in part this increase in hatchery-supported fisheries.

With Chinook Salmon runs numbering in the low hundreds and target numbers that reflect a distant past perhaps not repeatable, it is difficult to project how such ideals as delisting could be reached. Unfortunately, not only are recovery sustainability figures high, but little progress has been made since listing over 20 years ago. This, despite reduced fishing of natural-origin Chinook and the increased production of hatchery fish. But, unfortunately, the expansion of the fishery, while providing opportunities for anglers and commercial enterprises alike, does not imply recovery of natural-origin fish. In fact, as recently as the second decade of the 21st century, lawsuits have been filed challenging hatchery practices, particularly the taking of ESA-listed fish as hatchery broodstock. Yet augmentation with pen-hatched fish has been increasingly considered the answer to the question of restoring listed salmon.

Restoration — The Big and the Small

In 2023, the waters of the Dungeness River crept across land historically cut off from the river's ancient flow. The subsequent creation of beneficial estuarine conditions marked the culmination of years of planning and construction work, a process that would involve many players, such as local planning agencies, tribes, and conservation organizations. Begun in 2015, the Clallam County levee setback project began, with land modifications that would ultimately include removal of a dike system built in the 1960s alongside the riverbanks by the Army Corps of Engineers.

While restoration of the Dungeness to its ancient floodplain was the goal of the project, these alterations did not imply a complete reversal. The dikes that constrained the lower river would be removed, but another levee, built farther from the riverbank, was part of an accommodation to current realities. Private land was protected by this approach, but land acquisition for a place to put the new levee was also a necessity. This reality posed a roadblock for the entire project.

When the Jamestown S'Klallam tribe acquired 65 acres for the site of a new levee the restoration dream was rekindled. This structure was completed in 2021. Connected with a new Clallam County levee, with the removal of the old one, the stage was set for the re-entry of the waters of the Dungeness River. The river could now spread across 143 acres of its altered floodplain.

The restoration story was not complete, as revegetation projects began. In 2022, the Tribe announced the intention to plant 35,000 native plants on 56 acres of tribal land. Named the River's Edge Revegetation Project, the hope is to create a riparian forest with benefits that include stabilizing the land, thus slowing riverbank erosion, while providing beneficial faunal habitat.

A visit to the restored Dungeness River floodplain provides the opportunity to observe a mixture of past and present, as the river now spreads unfettered across its old course. Full of hope for permanent residents of this wetland-like habitat, for those that pass through, such as the Chinook, the expanded riverbed can provide a place for the beginning or ending of their lives. Yet much also depends on what transpires away from the estuary, where the spawning fish seek their natal home, and the migrating fry hunt and grow.

Smaller in scale, projects upriver from the Dungeness River mouth are less visible to the public, but important for restoration of salmon habitat. Such efforts involve riparian planting of thousands of native

shrubs and trees. One of the goals of recreating a riverside forest is to provide shading, thus ameliorating rising water temperatures. Erosion control is also enhanced and habitat for a myriad of creatures restored. In time, a mature forest will also contribute woody debris to the river.

As with the floodplain alterations downstream, the creation of a side channel within the new riparian habitat project can reduce the rapid flow within the main river while creating important resting habitat for salmon.

In a sense, such efforts along the Dungeness are a step backward to a more bountiful time, a past that teaches lessons which can be applied to the present, and hopefully, the future.

West of the Dungeness, the Elwha River is designated as the boundary for the Puget Sound Chinook ESU: from this point westward, the Chinook populations are considered part of the Washington Coast Chinook ESU, a region that includes the Strait and the coastal waters as far south as the Columbia River. This ESU is under review for listing, as similar fishing exploitation and habitat alterations have resulted in a sharp declines of natural-origin fish numbers.

Several rivers discharge into the Strait along this stretch, most of them much smaller than the eastern rivers. A hatchery on the Hoko River, the largest of these western flows, supplements a natural Chinook population that numbers in the hundreds. The regulatory goal for the total run is 1,258 fish. The Hoko Chinook is not considered overfished.

Degradation of habitat along the Hoko has provided impetus for restoration projects, some of them large scale. A logging access road near the river is one such site; erosion has historically produced fine sediment, degrading spawning sites. Beginning in 2012, alterations included culvert removal, placement of woody debris in the river, and construction of a bridge to replace a river crossing that was a barrier to salmon access of the upper Hoko. A half-million-dollar project, the non-monetary return for this significant effort is evident in the presence of salmon upstream of the site.

Most of the old growth coniferous forest along the Hoko River is gone, replaced by managed tree farms. Alongside and within the river, the implications of this historical reality are both subtle and profound. Attempts to restore the river to a healthier state — that is, a waterway that benefits from the protection and contribution of the forest — are continuing. In the 21st century, such projects serve to augment restoration efforts that began in the early 1990s along the Little Hoko River, the largest tributary of the Hoko. Proposals such as large-scale plantings near the Hoko estuary are also a continuation of that legacy.

Culvert removal, such as that undertaken in the upper Hoko River, is arguably one of the most important restorative approaches that can be done on rivers that empty into the saltwater of Washington state. These pipes were most often built with little regard for impact on migrating fish populations. The “drop” from such structures was typically measured in feet, implying total blockage to upstream movement of spawning salmon. Other, more directly visible impacts included culvert failure, typically during storms, resulting in washed-out roads and the dumping of tons of sediments into rivers and streams.

The requirement for increased effort in culvert removal was ordered by the Ninth Circuit court in 2016 and affirmed by the Supreme Court in 2018. With millions of dollars proposed to fund removal projects, a drive along Highway 101 reveals the implications of the court-ordered action. Specific project

information is posted on large signs, including the cost. Now seen in the flows above the old culvert sites, the salmon are one of the rewards.

The goal is that replacement of culverts will not only promote the return of salmon but provide mitigation against climate change impacts, such as increasingly heavy rainfall.

Always poised for the opportunity to "stray" into newly opened habitats, salmon offer confirmation that it is not too late to save them. That is most evident in the Elwha River, a much-altered waterway with the largest "culverts" of all. The removal of two dams constructed in the early 20th century has provided an unprecedented opportunity to monitor the hoped-for return of all salmon species to the river.

However, it is not a linear path, nor should it be expected to be. Increased returns of Chinook in the Elwha in the years following dam removal have driven home such realities. Hopeful numbers in the earliest years have been followed by declines and subsequent slow building once again. Fishing the Chinook is still closed as the largest of all salmon continues its tenuous recovery.

The many facets of habitat restoration within and along river boundaries includes a wide variety of activities, a reflection of the complexity of a "natural" system much altered by human impacts. Perhaps it is more instructive that this is our reality. There is not a simple fix, and thus plantings, installation of woody structures, culvert removal, streambed alterations, land conservation, and more, all play their role. In part, because the approach is so multi-faceted, it enforces the idea of long-term commitment to the outcome of mostly short-term projects. It is a world of social and political realities, new ideas and old, and always that desire for something that is in the realm of the magical— quick and spectacular.

Unfortunately, there is no guarantee. Commitment and watchfulness, accountability, and science — all and more must of necessity play their roles.

Today, in the third decade of the 21st century, delisting of the Puget Sound Chinook Salmon remains an elusive goal. Progress is achingly slow, with numbers inching upwards only to undergo fluctuations once again. Nevertheless, it is fortunate for these mighty fish that restoration programs and protection from exploitation are in place. Otherwise, extinction seems inevitable.

Is it possible that listing under the Endangered Species Act is not being correctly applied? It seems that fish populations must be on the brink before petitions are submitted and addressed. Numbers are startingly low: in the case of the Puget Sound Chinook, they had cascaded into the low hundreds. The pattern has been hauntingly repeated. Intensive fishing, unchecked development, a freefall in numbers, and then finally, reality strikes, and listing is granted.

Meanwhile, before the wheels of government grind into their tardy start, citizens implement changes, hoping to create an environment in which the salmon can at the very least stabilize. Lessons from the past serve as one guideline while efforts in the present continue to instruct. And on occasion, inspiration comes from the sight of a mighty salmon, returned from the sea to a more welcoming home.