COLUMBIA RIVER SALMON

Michael S. Spranger
Randall S. Anderson

Washington Sea Grant
Mon[illegible]

INTRODUCTION

The Columbia River was once the greatest salmon-producing area on the entire Pacific Coast. During that era, 10–16 million salmon and steelhead made their home in the Columbia River and its tributaries. In more recent years, however, the annual runs have been only 2.5 million—an 80 percent loss of this valuable renewable resource.

The story of the rise and decline of this legendary fishery is rich and varied. With the decline, it has become a familiar story of competition and conflict over a scarce natural resource, a resource that many Northwest Americans depend on for their livelihood. Today, the region faces new challenges as its citizens attempt to utilize the salmon resource and at the same time to preserve and enhance it.

There is no single reason for the decline of the Columbia River salmon. Rather, it is the culmination of events and activities that have occurred over the past hundred years. This brochure highlights the rich salmon resource that was present for thousands of years; presents reasons for the decline over the past century; and outlines current salmon protection and enhancement efforts that are underway.

Salmon Life History

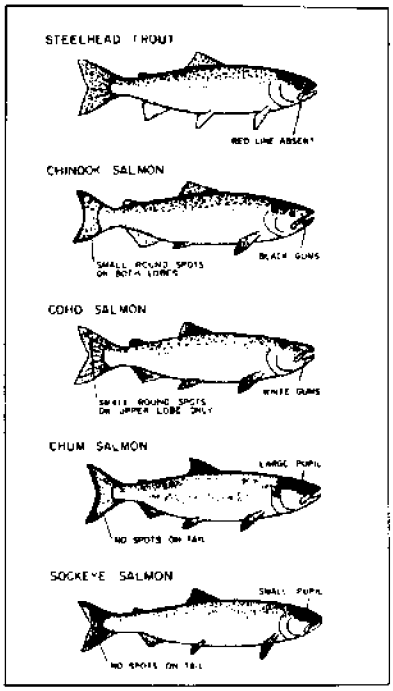
To understand the problems associated with the salmon resource more completely, one must first understand the life cycle of the salmon. All salmon in their natural habitat are anadromous—that is, they spawn in fresh water, and their progeny migrate down river systems to the ocean, where they travel and grow. Several years later, the mature fish return to the same freshwater spawning grounds to spawn and then, invariably, to die.

The Columbia River and its tributaries are home to several species of salmon—the chinook, coho, sockeye, and chum—and to steelhead, an anadromous trout. Each species has developed a unique shape, coloration, behavior pattern, and other characteristics that set it apart from all others. Within the species, various "races" and "stocks" further differentiate one from another. The key to understanding this differentiation is that there are seasonal "races" and tributary "stocks." For example, spring chinook is a race, and in the Yakima River is a stock of spring chinook indigenous to that stream. Seasonal variations and subtle characteristics of different streams, and even different areas within specific streams, probably led to the evolution of these differing species, races, and stocks.

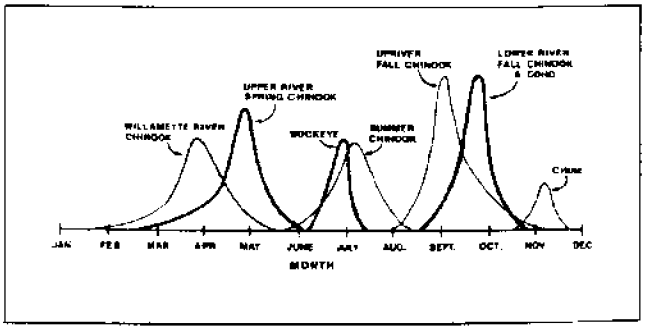
Salmon have adapted to the unique features of their spawning area. As a result, the various salmon species and races migrate through the lower Columbia River on their way to spawning areas during different times of the year.

The timing of each fish run has evolved over the years so that it places the fish in desirable spawning areas at a time when water flow and temperature will be optimum for spawning and, in turn, for egg incubation, fry emergence, and rearing.

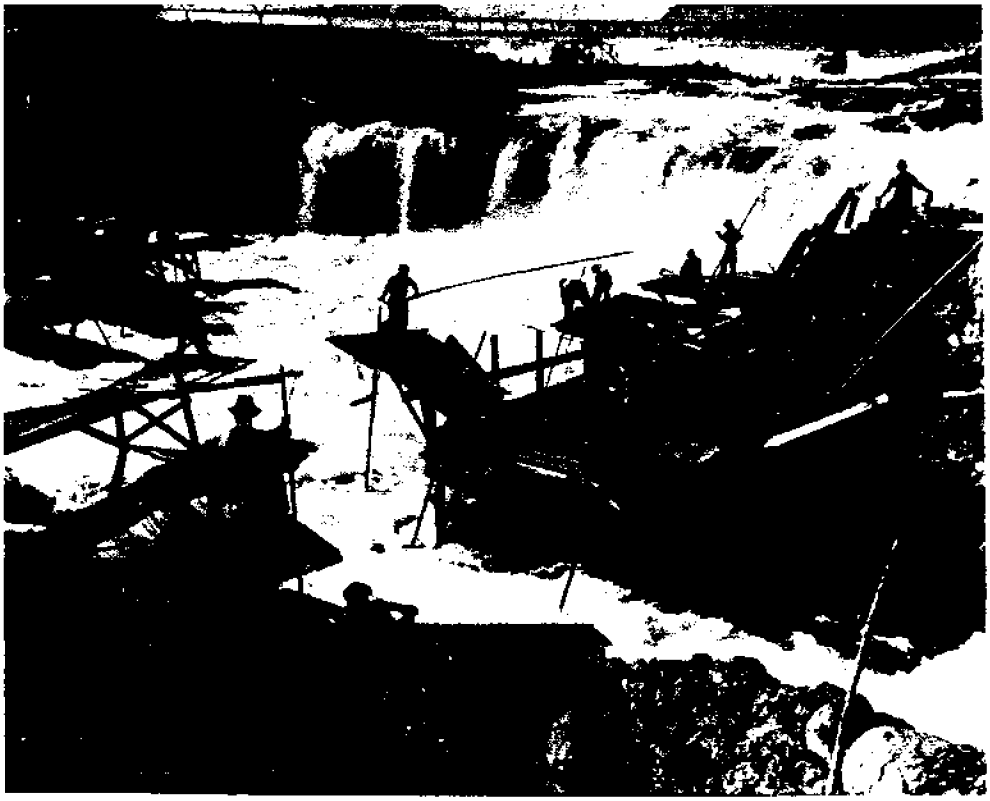
This timing also reflects the distance the particular stock must travel to reach its spawning ground. Salmon in the Columbia Basin originally spawned in areas from tidewater all the way into Canada and southern Idaho—over a thousand miles from the ocean. Since salmon cease feeding when they begin their spawning migration, fish going long distances need more energy reserves than those going short distances. Energy reserves come from accumulated fatty tissue; and upriver runs, such as the spring chinook, are famous for their high oil content. Fish travelling a shorter distance, such as the chum salmon, need fewer reserves and are typically low in oil content.



The Steelhead Trout and Four Species of Pacific Salmon Native to the Columbia River



Time of Run Passage through the Lower Columbia River for Different Salmon Species and Races



Oregon Historical Society ORHI 39376

Netting Salmon at Celilo Falls

HISTORIC SALMON FISHERIES

The Indian Fishery

It is not known exactly how long Indians have lived in the Columbia Basin, but most experts agree that it has probably been at least ten to fifteen thousand years. Salmon was their lifeblood—essential to their subsistence, their culture, and their religion.

A focal point of this great salmon fishery for many centuries was Wy-am, one of the longest continuously occupied sites on the North American continent. Located near Celilo Falls (upstream from the present site of The Dalles, Oregon), the Wy-am area was a flourishing metropolis during the fishing season. In 1957, this area was lost, inundated by waters backed up from The Dalles Dam.

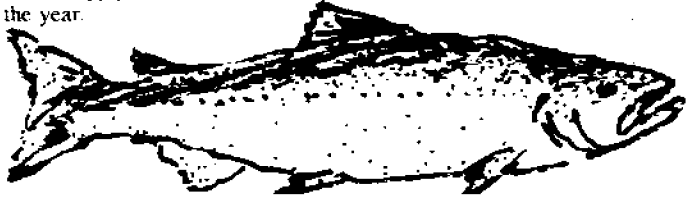
A 1981 article in the CRITFC News, published by the Columbia River Inter-Tribal Fish Commission, describes life at Wy-am and Celilo Falls in the following excerpt:

For its thousands of years of human civilization, Wy-am was one of history's great marketplaces. A half dozen tribes had permanent villages between the falls and where the dam now stands. And in the autumns of bygone years, as many as 5,000 people would gather to trade, feast, and participate in games and religious ceremonies. Here at salmon time were Indian goods from half the continent: Columbia River fishing tribes could offer their prized dried salmon and pemmican to coastal tribes, who couldn't preserve salmon in this way because their climate was too humid. On hand were traders, and trade goods such as abalone shells and wampum beads from California tribes; horses from the Nez Perce and Cayuse, who ranged from the river to lands east of the Cascades; highly valued dentalium shells from the Pacific tribes near Vancouver Island; slaves and dried clam meat from the Chinook, shrewd traders who lived near the mouth of the Columbia; buffalo robes and native tobaccos from the plains tribes east of the Rockies. Local tribes traded huckleberries from the wooded slopes of Mt. Adams, root foods dug with sharp-pointed sticks from hillsides and riverbanks, graceful baskets fashioned of coiled cedar splints, tule mats for home construction and furnishings made from cattail rushes and ornamented with colored grasses. Here also, goods were won at gambling, as in the beaver tooth dice-throwing game that women played.

But before the feasting and trading and gambling, Nusux the salmon had to be caught. During the spring run...the river at Celilo Falls proper was too high, and most fishing took place from platforms downstream near Long Narrows (close to the present-day town of The Dalles, Oregon, and Spearfish, Washington). As the river lowered throughout the summer, fishing stations at Wy-am again appeared. By fall, after the first heavy rains...fishing began in earnest. For centuries, tribes netted and speared salmon from the top of vertical walls around which the water swirled and snarled. Later, they cut narrow ledges into the walls of the chute-like channels. Each year the fishermen built wooden scaffolds over the water, and from them would stretch out and drop their dipnets into the turmoil below, where legions of salmon thrashed their way upstream to spawn.

Elders and chiefs regulated the fishing, permitting none until after the first salmon ceremony. Each day, fishing started and ended at the sound of a whistle. There was no night fishing. And when a fisherman was pulled into the water during his pursuit—most who fell did not survive—all fishing ceased for the day. In later years, each fisherman was required to tie a rope around his waist with the other end fastened to shore. Old people and others without family members able to fish could take what they needed from the catches. Visiting tribes were given what they could transport to their homes. The rest belonged to the fishermen and their families.

While the men pulled salmon from the treacherous waters, the women sliced and dried salmon meat for an abundant supply of winter food. Some of the salmon was pulverized and stored in large circular baskets lined with dried steelhead skins. Baskets were staked together and wrapped in mats, so that the food would keep for months, even years. When Lewis and Clark traveled through Columbia River country in 1805, they counted in one locale 107 stacks of dried salmon containing 10,000 pounds of fish. And this enormous supply was seen after all but the resident tribes had left for the year.



The White Settlers

Before the arrival of white settlers, Indians harvested an estimated 18–24 million pounds of salmon and steelhead from the river each year. The abundance of fish caught by the Indians clearly astonished Lewis and Clark when they first explored the region in 1805–1806, and many of the earliest accounts of the fishery were detailed in the diaries of these early explorers.

Following the successful journey of Lewis and Clark, more white explorers and settlers came to the Northwest. These explorers were most interested in obtaining furs for the commercial trade. However, by 1823, the Hudson's Bay Company was packing salmon at Fort George near Astoria. Although insignificant in its impact, this first commercial harvesting by white settlers marked the start of a new and disastrous era for the Columbia River salmon resource.

A small amount of commercial harvesting occurred between 1820–1850; however, it was not until the 1850s that the white traders were able to make any progress exploiting the salmon resource. Early treaties between the Indians and the government of the United States—most of them signed in 1855—allowed Indians and whites to fish in common for salmon, and for many decades the resource was adequate for both groups. The salmon fishery was perceived as inexhaustible. However, technological advances would soon alter this situation.

The Canneries

In the 1860s, the process of canning salmon was perfected, permitting the fish to be transported over long distances, stored for extended periods, and kept palatable for consumers. The first cannery on the Columbia River appeared in 1866 and produced 272,000 pounds of canned salmon its first year. As Eastern markets developed an insatiable demand for canned salmon, the fishing and canning industry expanded rapidly. Canneries arose on both banks of the river and less than 20 years later, 55 canneries were operating on or near the Columbia.

Cannery work was a seasonal activity, employing cheap immigrant labor—mainly Chinese—who were both fast and reliable. Some could clean a 30-pound salmon in 45 seconds. A man skilled with a knife could clean 10 tons of salmon in a 10-hour day. Francis Seufert, a leading fishwheel operator and cannery owner, had high regard for the Chinese laborer stating that he had "hands as nimble as a woman's...and the power in his fingers and wrists of a man."

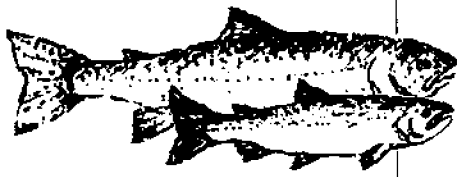
The Chinese cleaned, packed, cooked, and labeled the salmon; and their employment in Columbia River canneries continued as late as 1953. However, by the turn of the century, increasing competition in the marketplace and ongoing demand for the salmon forced the canneries to improve their capacity with new technology. Manual labor was eventually replaced by machines. One such machine, labelled the "Iron Chink," could clean salmon at the rate of fifteen per minute, doing the work of ten Chinese laborers.

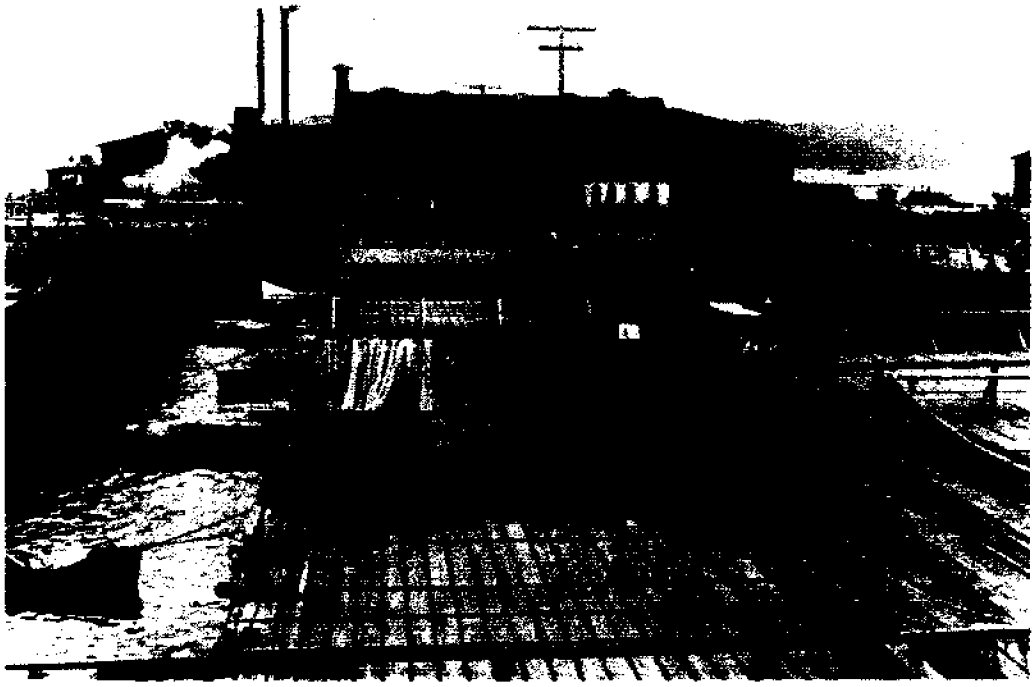
Changes in Fishing Techniques

As the number of canneries increased, so did the number of fishermen. With them came advances in efficiency and technology. Wind-powered scows were used to purse-seine and gillnet the fish. In 1866, four men in two gillnet boats caught more than a quarter of a million pounds of salmon. By 1883, there were more than 1,700 boats, and the catch reached a record high of 43 million pounds. At this time, only the valuable chinook salmon was canned. The other species—coho, sockeye, and chum, as well as steelhead—were not used. By 1915, there were more than 3,000 fishing boats and all species were used commercially.

Early Columbia River Cannery

Oregon Historical Society ORHS 11230





Oregon Historical Society ORHI 28424

Union Co-op Packing Company in Astoria, Oregon

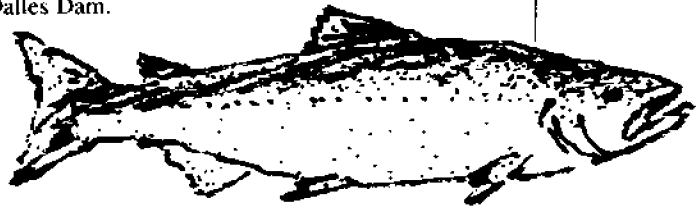
Most fish were caught with gillnets, which entangle the fish, but other methods were also employed. On the lower Columbia, trap nets as well as purse seines were also used to catch salmon. The fish entered the trap nets through a narrow opening, and unable to find their way out, would be stranded at low tide and taken out by dipnet.

By the 1890s, seines pulled by horses were used to harvest salmon. These nets could bring in thousands of pounds of fish. One net in 1921 caught 60,000 pounds in one haul.

Fishwheels were yet another way to catch salmon. Strategically located in the pathways of migrating salmon, the fishwheels used the swift river current to catch and deposit the fish in boxes with a minimum of effort.

The first fishwheel was erected at The Cascades (upstream from the present site of Bonneville Dam) in 1879, and only 20 years later, 76 fishwheels were in operation. A good fishwheel could average 100,000 pounds of salmon per year. In 1913, one fishwheel caught 70,000 pounds in one day. Almost all of the fishwheels were in the Columbia River Gorge near either The Cascades or Celilo Falls.

Many blame the fishwheels and their giant revolving scoops for destroying the fishery. The Seufert No. 5 wheel, near The Dalles, did lift out great numbers of salmon. But the wheel next to it, No. 6, constructed soon after the 1894 flood at a cost of $10,000 or more, never turned on its axle until the flood of 1948 and never harvested a single fish before being burned to make way for the rising waters above The Dalles Dam.



Fishwheels had to be located at very rare spots in swift water to be highly productive and many did not even pay for their licenses. According to Ivan Donaldson, co-author of *Fishwheels on the Columbia*, fishwheels historically took only 5 percent of the commercial catch. It was the 2,500 nets on the river that garnered the great majority of salmon.

During the late 1800s and early 1900s, the commercial catch was approximately 40 million pounds per year. It was during this peak of commercial fishing activity that the first declines in the salmon runs were observed. By 1890, declines in the chinook runs forced the canners to utilize some of the other salmon species. By the 1920s, the average catch had declined to 34 million pounds.

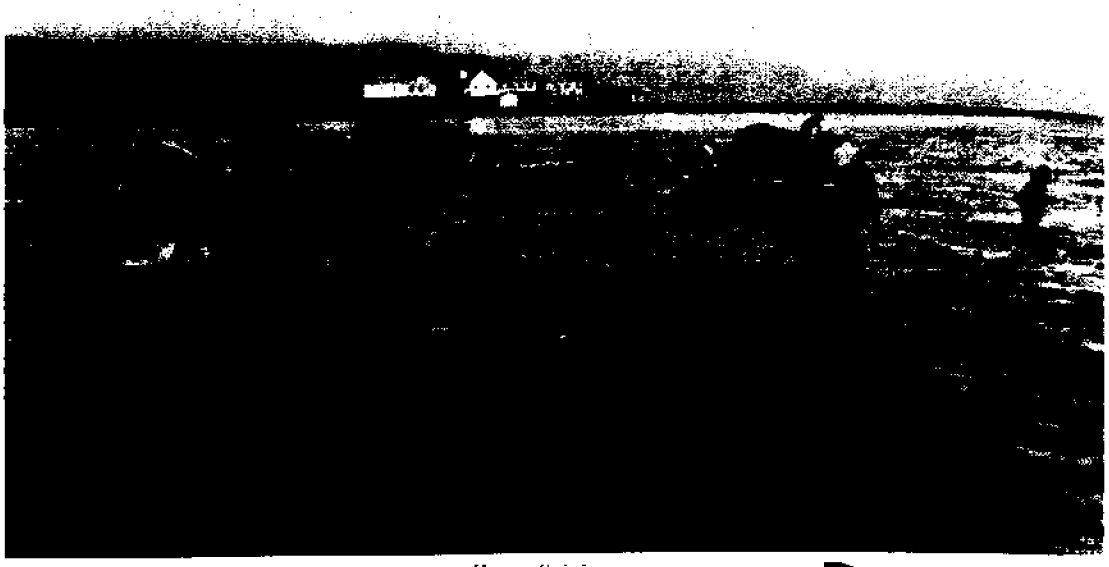
Oregon Historical Society Cr 7185

Salmon Seining

This was also a period marked by conflicts among users of different types of fishing gear. As the salmon runs began to decline, each group claimed that its method of fishing was less harmful to the salmon runs than those of its

competitors. Those gear owners with the greatest political backing usually succeeded in eliminating competitors with less political influence.

As the salmon numbers dropped, state legislatures began to restrict or eliminate different types of gear. Fishwheels, for example, were outlawed in Oregon in 1926 and in Washington in 1934. Seines were finally outlawed on the river in 1950. Today, only gillnetting, Indian dipnetting, and sport fishing are allowed in the Columbia River.

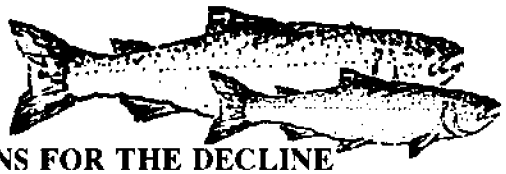


Oregon Historical Society ORHI 49091

Horse Seining

CHRONOLOGY OF COLUMBIA RIVER EVENTS

pre 1800s	Indians harvest 18–24 million lbs. of salmon and steelhead annually
1805	Lewis and Clark explore the Columbia
1823	First commercial harvesting by white settlers
1866	First salmon cannery on the Columbia
1871	First regulations to restrict fishing
1879	First fishwheels appeared
1883	Fifty-five chinook canneries on or near the Columbia Chinook catch peaks at 43 million pounds
1889	2,600 rowboats and sailboats pursuing salmon in the river
1890	Chinook runs continue to decline and canneries turn to smaller species
1899	At least 76 fishwheels in use
1915	Commercial fishing fleet almost fully motorized Over 3,000 fishing vessels
1920s	Annual harvest is approximately 34 million pounds
1926	Fishwheels outlawed by Oregon legislature
1933	Rock Island Dam
1934	Fishwheels outlawed by Washington legislature
1938	Bonneville Dam
1930s	Annual harvest declines to 24 million pounds
1941	Grand Coulee Dam
1940s	Annual harvest drops to 20 million pounds
1950s	Annual harvest declines to 9 million pounds
1960–70	Fourteen high dams completed on the Columbia
1970s	Series of court cases clarifies tribal fishing rights
1970-80	Commercial catch declines from 12 million pounds in 1970 to 1.2 million pounds in 1983
1980	Northwest Power Act signals a new era to preserve and restore the region's anadromous runs
1985	U.S.-Canada Pacific Salmon Treaty



REASONS FOR THE DECLINE

The Dams

Shortly after the commercial fishery peaked, a new threat to the salmon resource emerged. Under the Reclamation Act of 1902, federal dams were constructed to store water for flood control and irrigation. These dams decreased the flow of water needed for successful migration of the salmon and steelhead; they also blocked access to miles of upriver spawning habitat.

Oregon Historical Society ORHI 4997

Stationary Fishwheel

Further development of the Columbia River—this time for hydropower production—quickly followed. The Columbia River begins as a small stream, high in the

mountains of British Columbia. In its 1,200-mile course to the Pacific Ocean, it drains almost 260,000 square miles and drops over 2,600 feet in elevation. The combination of tremendous flow and elevation gives the Columbia River more hydroelectric potential than any other river system in the United States.

This great hydropower potential was tapped in the 1930s with the first hydroelectric dams on the Columbia—Rock Island Dam in 1933 and Bonneville Dam in 1938. Soon other dams and developments followed and the Columbia River became the cornerstone for economic development in the rapidly growing Pacific Northwest.

Construction of dams on the Columbia River system had a major impact on the salmon resource. Currently, the Columbia and its tributaries have more than 190 dams. Salmon originating above Bonneville Dam must contend with one or more of these in their upstream and downstream migrations.

One of the major impacts on the fishery came with the 1941 completion of Grand Coulee Dam on the mainstem Columbia and the 1967 completion of Hells Canyon Dam on the Snake River. These "high dams" were built without fish ladders; therefore, they became total barriers to upstream salmon migration. Because of these dams, fish access to more than one-third of the spawning habitat in the Columbia River watershed—some 90,000 square miles—was eliminated.

Grand Coulee, Hells Canyon, and all the other dams have also slowed the river system's flows, transforming the Columbia from a natural, free-flowing river into a series of reservoirs behind the dams. Most young salmon (called smolts) migrate to the ocean between April and June. Historically, they were helped downstream by the spring freshets. But now the rivers' reduced flows increase the downstream migration time for the young fish and lessen their survival chances. Smolts are on a limited schedule to reach the ocean and cannot physically sustain this increased time lag. Held back by the slack water of the reservoirs, they may not make it to the ocean, or if they do, they may be unable to survive the adjustment to salt water.

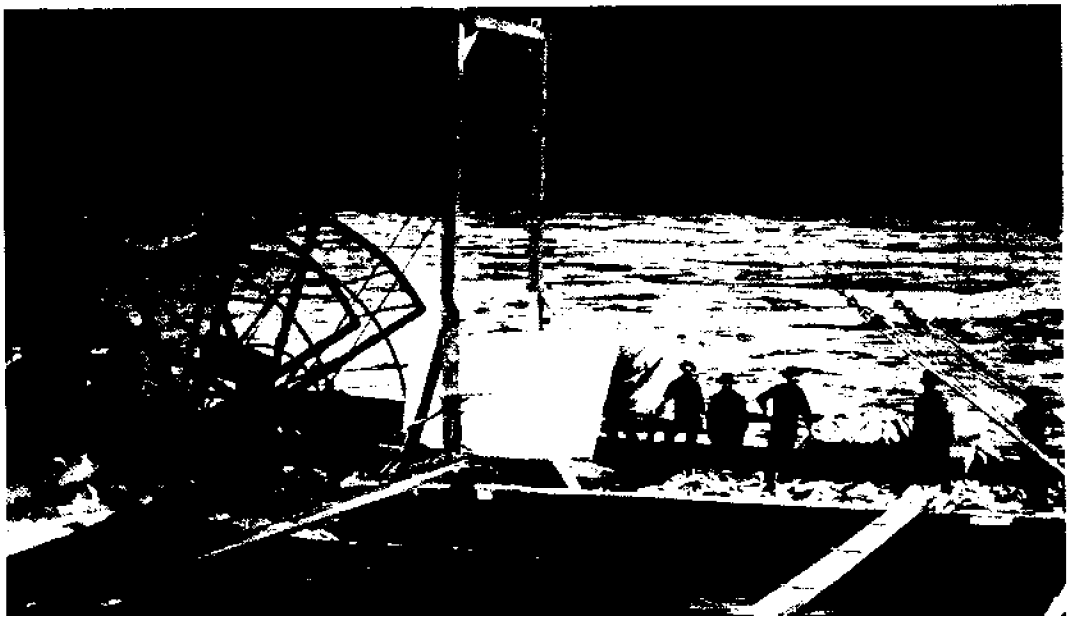
Passage through the dams has been another serious problem. An estimated 5 to 15 percent of the smolts migrating downstream are killed when passing through the turbines at each dam. This is most severe in years when low rainfall and poor snowpack cause low water flows. With up to eight mainstem dams to contend with, upper Snake and Columbia River smolts face a more than 90-percent risk of being killed before they reach the ocean.

Adults returning to spawn also battle great obstacles. If dams lack fish ladders or the ladders are operating inefficiently, the salmon may be injured or killed as they leap against the concrete. In addition, fish delayed by the dams and fish ladders during upriver migration may not reach the spawning area in time for successful reproduction.

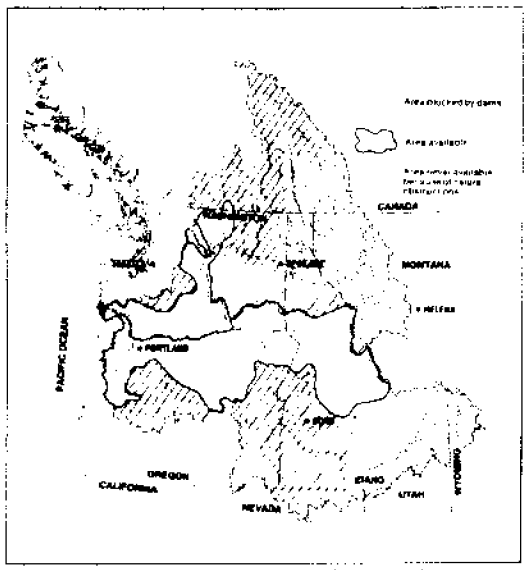
Poor Land Management Practices

Overharvesting by the early commercial fishing fleet and construction of the dams were major factors contributing to the decline of the anadromous fish runs. Throughout the years, however, land management activities associated with development in the Northwest have also contributed to the decline. Poor logging, mining, and farming practices cause the land to erode, depositing sand and silt into Columbia River tributaries. This sediment gradually covers the gravelled stream bottom, filling the spaces between the stones that are so important for protection of eggs and young fish. The gravel substrate is also important for production of the aquatic insects that salmon eat.

Fish Scow on the Columbia



Oregon Historical Society ORHI 4172



Columbia Basin Anadromous Salmon and Steelhead Habitat

Excessive livestock grazing along streambanks has also destroyed salmon habitat. Removal of streamside vegetation and erosion of streambanks by foraging livestock can create a wide and shallow, sediment-filled channel, often resulting in a river devoid of adequate spawning and rearing areas for the salmon.

Water quality has also been affected. Water run-off carries not only eroded soil particles, but also herbicides, pesticides, and fertilizers used in agriculture and forest management. In various areas, the cumulative effect of these chemical compounds in the rivers and streams has been a reduction in water quality.

CONFLICTS AMONG FISHING GROUPS

As already indicated, the past has been marked by conflicts among the various Columbia River commercial fisheries. As the salmon runs declined, political pressure was exerted to eliminate various fishing methods. By 1950, the drift gillnet became the only nontreaty commercial fishing gear allowed to harvest salmon in the Columbia River.

In recent years, the rise of strong commercial and recreational ocean fisheries has again intensified the conflict over the limited number of Columbia River salmon. Salmon are harvested by a variety of methods. Hook and line, purse seines, and gillnets are used by different fishermen, in different geographical areas, at different times of year. As the stocks have declined, controversy has increased over which group will get the remaining fish.

Management of Pacific Northwest salmon and steelhead stocks is complicated by several factors. The migration routes of many stocks span several thousand miles. As a result, the fish move through fishing areas controlled by a multitude of management entities. Fish of a given run originating in Oregon or Washington, for example, while maturing in the ocean may pass through fishing areas controlled by any of the following: the states of California, Oregon, Washington, and Alaska (for fisheries up to 3 miles offshore); the Pacific and North Pacific Fishery Management Councils through the U.S. Department of Commerce (for fisheries 3–200 miles offshore); and the Canadian Department of Fisheries (for fisheries off the coast of British Columbia).

Upon return to the rivers of their origin, the fish are subject to management not only by the states (acting both independently and, in the case of Columbia Basin runs, jointly through the Columbia River Compact), but are also subject to fisheries controlled exclusively by individual treaty Indian tribes. Most of these management entities are, in turn, subject to the jurisdiction of the federal district courts for Oregon and western Washington. The federal courts maintain continuing jurisdiction over controversies arising from actions of the states, the tribes, and the Pacific Fishery Management Council.

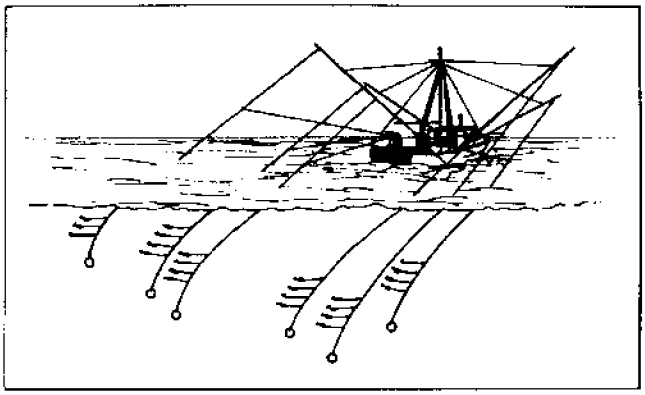
This fragmented management structure is only part of the problem. While in the ocean, salmon and steelhead do not swim in discrete groups according to whether they originate from a given stream or are wild or hatchery stocks. As a result, it is difficult to prevent the various commercial and sport fisheries from taking excessive numbers of fish from weak stocks, while at the same time permitting full harvest of comparatively strong stocks. The controversy intensifies when these various fisheries—Puget Sound, ocean commercial, ocean sport, in-river commercial, in-river sport, and treaty tribe—all wish to protect their share of the salmon.

Determining who catches Columbia River fish is a major task in itself. In the ocean, Columbia River salmon range from California to Alaska. For years, many Columbia River salmon were caught by Canadian fishermen, and some Canadian salmon, such as those from the Fraser River, were caught by U.S. fishermen. Because of this interception problem, both countries were reluctant to invest large sums in restoring fish runs when a considerable part of the increased runs would be harvested by the other country's fishermen.

In 1985, the U.S. and Canadian governments signed the Pacific Salmon Treaty that begins to address this particular harvest issue. The Treaty puts harvest controls on the intercepting fisheries and offers both countries the opportunity to receive the benefits from any fishery enhancement work. This treaty further illustrates the international—as well as federal, state, and tribal—cooperation that is needed for proper management of Columbia River fisheries.

TREATY FISHING RIGHTS

Tribal fishing rights constitute another important aspect of the Columbia River Fisheries. The right to fish at "usual and accustomed places" was reserved by the tribes when they signed treaties with the U.S. Government in 1855. In the 1970s, a series of federal court cases clarified the meaning of the 1855 treaty rights in today's world and reaffirmed the right of Indians to fish at usual and accustomed places. The court cases decided in the 1970s by Judges James Boldt and Robert Belloni stated that Indian fishermen are entitled to up to 50 percent of the salmon and steelhead destined to pass those usual and accustomed places.



A Troller

Other aspects of treaty fishing rights have been litigated since 1980 in a second phase of the original case brought before Judge Boldt. These "Boldt Phase II" decisions further clarify treaty fishing rights in two respects: first, hatchery-produced fish are to be allocated in the same manner as wild fish, since they are actually replacements for fish lost to dams and other development. Second, the right to protection of fish habitat is a part of tribal fishing rights, since in the words of Judge William Orrick, "exercising the right to fish requires the existence of fish to be taken." As a result of these court rulings, and unless they are reversed on appeal, activities that "impair the environmental conditions necessary for the survival of the treaty fish" would violate treaty fishing rights.

THE NORTHWEST POWER ACT

After years of declining salmon runs and increasing conflict among user groups, it was becoming obvious that dramatic measures were needed in order to save the salmon resource. In 1980, the 96th Congress passed several key legislative measures aimed at protecting the salmon resource. The most far-reaching effort was the Northwest Electric Power Planning and Conservation Act (Power Act).

Through the Power Act, Congress created a Northwest Power Planning Council (the Council) composed of representatives appointed by the governors of Idaho, Montana, Oregon, and Washington. Congress then gave the new Council two major charges. The first was to develop an electrical power plan designed to meet the energy needs of the region over the next 20 years. The second co-equal charge was to develop a program to "protect, mitigate and enhance" the fish and wildlife that have been damaged by hydroelectric development in the Columbia River Basin.

Passage of the Power Act marked the start of a new era for the Columbia River. In the past, federal agencies managed the basin's rivers primarily for power, flood control, navigation, and irrigation without regard for adverse impacts to the fishery. Because of the Power Act, however, the fish and wildlife were now to be given co-equal status in management decisions affecting the Columbia River system.

Another important aspect of the Power Act was that it ushered in a new era of public involvement. As the Council developed its Fish and Wildlife Program, it received a great deal of participation from the fish and wildlife agencies, other government agencies involved in Columbia River management, Indian tribes, public and private utilities, and concerned citizens. These diverse groups all recognized the problems facing Columbia River salmon and steelhead, and made specific recommendations on actions needed to restore the fishery resources.

The Fish and Wildlife Program

The Fish and Wildlife Program (the Program) developed by the Council brought a new focus to the plight of Columbia River salmon. An interesting aspect of the Program is that Northwest ratepayers, through the Bonneville Power Administration, are the primary funding source for fish and wildlife restoration efforts. Congress felt that since ratepayers have benefited from the cheap power produced at the dams, they should help pay for the impact those dams have had on the fishery resource.

The Fish and Wildlife Program was first adopted in 1982 and has been amended several times since. The current Program has set an interim goal of trying to double the current run—from 2.5 million to 5 million adult fish. To accomplish this goal, the Council is looking towards a coordinated effort that focuses on three major elements of the fishery: 1) additional fish production in natural and artificial environments; 2) safe fish passage past mainstem dams; and 3) managed harvests that support rebuilding.

Balancing the production, passage, and harvest is no easy task because of the number and variety of management entities involved. Fish production is controlled by the state and federal agencies and the Indian tribes that maintain habitat and operate hatcheries. Fish passage past the mainstem dams is largely the responsibility of the Bonneville Power Administration, the Corps of Engineers, the Bureau of Reclamation, and the Federal Energy Regulatory Commission. Harvest is managed by the Pacific and North Pacific Fishery Management Councils, the Columbia River Compact, the states, the Indian tribes, and the Pacific Salmon Commission.

As outlined above, an important part of the program is focused on improving the survival of juvenile fish attempting to migrate past dams on their downstream journey to the ocean. The current program emphasizes four means to accomplish this goal:

(1) Mechanical bypass systems are being installed to divert young fish from the dam's turbines. Screens placed in front of the turbine intakes divert the juvenile fish into special conduits, which then carry the fish around the dam. The Council's Program calls for bypass facilities and screens to be operational at all Army Corps of Engineer dams by 1994.

(2) Another solution to keep migrating fish from the turbines is to spill water and fish over the dam. Although this method does reduce fish mortality, water that is spilled cannot be used to generate electricity. Because this can be a costly alternative, spills are being used only as a temporary measure until mechanical bypass systems are installed.

(3) Certain stocks of salmon and steelhead are collected and transported around the dams in barges and trucks.

(4) A "water budget" has been established to help speed the young migrating fish through the system. The water budget represents an innovative approach to managing Columbia River Basin flows to increase the survival rate of young salmon and steelhead migrating to the ocean. It is a designated amount of water held in storage that can be used to increase the river flow during the spring migration. The increased flow helps "flush" the young fish down the river, decreasing their travel time to the ocean and thus increasing their survival chances.

Some Current Issues

Although the Northwest Power Act provides the authority and funding source needed for enhancing Columbia Basin fish runs, a number of problems and issues still exist.

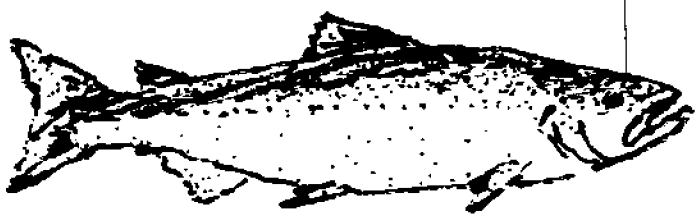
Restoration Costs

One critical issue is how much the region's ratepayers are willing to pay to restore fish runs. The Program has been described as one of the largest efforts at biological restoration in the world; some estimate that it could cost as much as $1 billion over the next 20 years. Specific measures in the Program are often under close scrutiny. The water budget, for example, reduces the amount of water available to generate power at other times of the year. In dry years, the Bonneville Power Administration estimates that it could lose as much as $60 million just to meet the needs of fish.

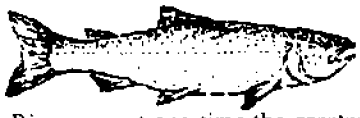
Wild *vs.* Hatchery Fish

Another item of frequent debate is the future of wild fish in the system. The issue focuses on whether policies should encourage increases in natural fish populations or whether the increase in fish populations should come through increased hatchery production. Approximately 80 percent of the salmon and steelhead runs in the Columbia River now originate from hatcheries. But there are many concerned that the hatchery fish may have irreversible effects on the wild strains.

Wild fish have evolved through natural selection, a process by which the fish continuously adapt to changing conditions of their natal stream. Over time, only the fittest of the stock have been able to adapt to their local conditions and thus survive. Conversely, hatchery fish have not undergone this same natural selection process and are often viewed as being less productive than wild fish in the natural stream environment. Therefore, it is thought that interbreeding with wild fish lowers production. Many are also concerned that interbreeding will reduce disease resistance in wild fish.



SUMMARY



The Columbia River was at one time the greatest salmon producer on the Pacific Coast. However, hydroelectric developments, poor watershed management and commercial overharvest all contributed to a severe decline in the anadromous fish runs. Most of these activities have had long–term and, in many cases, irreversible impacts on the resource.

After declining to levels of near extinction, the fish runs are now making a remarkable comeback. Recent record fish runs indicate that cooperative efforts, such as the Northwest Power Council's Fish and Wildlife Program, are working. If these trends continue, it appears that the Columbia River salmon, and hence Northwest residents, will have a brighter future.

About the Authors:

Michael S. Spranger is program leader for Washington Sea Grant Marine Advisory Services, headquartered at the University of Washington in Seattle. Before assuming his present position, he coordinated and conducted educational programs on public policy issues affecting the Columbia River.

Randall S. Anderson is a marine resources specialist with Washington Sea Grant Marine Advisory Services. He works out of the Columbia/Snake River office in Vancouver, WA, conducting educational programs that deal with Columbia River resource and policy issues.

A consortium consisting of the University of Washington, Washington State University, Oregon State University, and the University of Idaho cooperatively administer the Columbia/ Snake River System component of Washington Sea Grant.

For additional copies of this brochure, contact:

Washington Sea Grant
3716 Brooklyn Ave. N.E.
Seattle, WA 98105
(206) 543–6600

or Washington Sea Grant
1919 N.E. 78th St.
Vancouver, WA 98665
(206) 696–6018