

One estuary: a link to the sea

At Cape Disappointment in the extreme northwest corner of Oregon, where one of the great rivers of the world slows down, sprawls out, and spills into the sea, lies the Columbia River estuary, 150 square miles of tidal marshes, mud flats, and shallow brackish water.



Cape Disappointment. The mouth of the Columbia River is world-famous for its storms and rough seas.

Photographs courtesy of Oregon Sea Grant College Program.

Valuable and vulnerable, these precious few acres are important in two often conflicting ways: biologically and economically.

Biologically, this estuary is essential to the survival of much of the fish and wildlife that inhabit the North Pacific. Duck hunters, commercial and sport fishermen, and the industries which have built up around them depend upon a health, productive estuary. These industries contribute millions of dollars and thousands of jobs to society.

Economically, the Columbia River estuary is a busy portal to the sea. Most of the world's commerce passes through estuaries; industries, cities, and port facilities are clustered there, competing for access to the water. The pursuit of some of these economic interests often ignores an estuary's biological needs, and in so doing, dramatically affects other economic interests, for example, those of the fishing and tourist industries.

The Columbia River estuary is being changed by human activity. As in other estuaries, there's a lot to lose here: the world-famous salmon resource hangs in the balance. What is done to this river and its estuary has dramatic effects on the salmon resource and, ultimately, on the people who depend upon salmon.

During much of the past year, I have traveled throughout the Columbia River drainage basin making a documentary film about the complex problems and conflicting interests which, together, will decide the fate of the estuary and the salmon of the Columbia. Representing Oregon State University's Sea Grant Program, I began by trying to capture on film what it is that makes this estuary unique.

James R. Larison
Oregon Sea Grant College Program

Excerpts from the film narration

Amidst a maze of islands, sloughs and channels, salt and fresh water meet and mix. On the rising tide, the Pacific Ocean floods in, raising the water level by as much as 12 feet, driving a salt water wedge 26 miles up the Columbia River. When the tide ebbs, the river's fresh water washes much of the salt back to sea.



The vast interconnected reservoirs created by the dams have become a highway to the sea. From as far away as Lewiston, Idaho, commerce flows uninterrupted for 500 miles.

Fresh water predominates in the Columbia. For centuries its volume has pulsed rhythmically with the passing seasons. In spring, as much as a million cubic feet of water pours into the estuary every second. This constant mix of salt and freshwater is responsible for much of the physical character of the estuary and is essential to the biological life found there. Salmon are known to home in on the flush of freshwater which often extends hundreds of miles out into the Pacific.

Many plants and animals have adapted to the rhythms of this ever-fluctuating environment. They thrive in great abundance and form the base of an elaborate food chain. Specifically, this base comprises microscopic plants, called phytoplankton, and the remains of larger plants, such as sedges and rushes. Tiny animal plankton, insect larvae, and small crustaceans feed on this plant material and, in turn, are eaten by a variety of fish and shellfish.

Salmon and steelhead pass through the estuary as juveniles migrating to the sea and again years later as adults returning to their freshwater birthplace to reproduce. As juveniles they rely upon the estuary's abundant food, sheltered bays, and unique mix of salt and fresh water to help them make the adjustment between the ocean and the river.

Seals and sea lions also frequent the lower river where they feed on a variety of fish and other life.

Most of the islands in the estuary are set aside as wildlife refuges. The endangered Columbian white-tail deer thrives here. So does the Roosevelt elk. More than 175 kinds of birds, including nesting colonies of great blue herons, the threatened bald eagle, and a major concentration of wintering waterfowl, live or migrate through here.

Hunting and fishing life styles thrived on the abundance in the estuary for more than 10,000 years. Throughout most of that time, the estuary changed little.

Its physical character began to change dramatically during the late 1800's. Farmers were attracted to the river's broad flood plain by the rich black soil. The problem was that much of the flood plain was part of the estuary and, at least during high tide, was submerged. By the 1930's farmers had "solved" that problem, or so it seemed. Two-thirds of the estuary was diked and drained. At first the land was productive. Dairy herds sprang up throughout what was once fish and wildlife habitat. But the good times did not last. Within a few short decades, the land began to subside. While farming contributed substantially to the culture and economy of the region for a short time, the land was not suited to agriculture and it began to fail. Land which once supported a herd of dairy cows soon supported only a few animals. The first tragedy of the estuary was becoming apparent: the drained acreage was no longer useful as wildlife habitat and was rapidly losing its value as farmland too. Much of it now lies fallow.



Dams on the Columbia River have provided cheap hydroelectric power and attracted industry. However, they have also created problems for the salmon industry.

A second serious blow to the estuary and to salmon occurred in the early days of logging. Clear cutting practices caused soil and debris to flood into the estuary and the streams that fed it. The debris buried once-productive shallow water areas. The richness of the land began to wash out to sea where it settled to the bottom and was lost. Log dams were built to temporarily store and float logs. These were disastrous to the salmon runs of the Columbia.

Logging practices today are more responsive to the needs of the river and the estuary. The logging industry depends upon the river for log storage, efficient waterways for moving the logs to awaiting ships, and its direct link with the sea and with foreign markets.

The economy of this entire region depends upon logging. In a good year, logs comprise ninety-nine percent of the tonnage exported from the Port of Astoria. The timber industry employs more people than any other in the area. Revenues often exceed a half billion dollars.

But, while the logging industry today seems at least partially dependent upon the river and the estuary, it should be remembered that its dependence is not related to the estuary's health. While logging is essential to the region's economy, it is also potentially dangerous to salmon, to the estuary, and to the other portions of the economy which depend upon a healthy estuary. Care must be used to insure that the two co-exist. They can co-exist if adequate planning is done to insure that logging practices do not, once again, damage the estuary and, thus, its ability to support salmon.



The future of salmon runs on the Columbia/Snake River system is uncertain. Experts believe that we may be facing the last opportunity to save the salmon runs as we know them today.

The estuary is becoming more and more important for ocean ships shuttling global trade routes. A few of these ships stop to load logs at the Port of Astoria, but most simply cut paths through the estuary, headed 100 miles inland to Portland, Oregon.

The estuary has been changed by all the ship traffic. Jetties were built on either side of the river's mouth in the late 1800's in an effort to tame the infamous Columbia River bar.

Constant dredging must be done to maintain the forty-foot ship channel. For many years the dredged materials were simply piped from one location to another within the estuary. Dredge spoils were dumped on some productive shallow water areas. Other areas were completely filled with dredge spoils. In recent years, care has been used in finding more appropriate disposal sites.

The Columbia, like all great rivers, is often used as a waste disposal system. Agricultural chemicals, pesticides, oil spills, storm sewer drainage, and sewage regularly spill into the river and flow downstream to the estuary. No one really knows how much of these wastes spill into the river, nor what exactly their effect is on biological life.

Perhaps the most important present impacts on the estuary occur as many as one thousand miles from the river's mouth. The estuary is a critical and vulnerable link in the large Columbia/Snake River system. It is the neck of a funnel that drains a quarter million square miles of seven states and British Columbia.

From the time it cascades out of the high Rocky Mountains until it reaches the Pacific, the Columbia's water will be used and reused; coveted, diverted and contaminated; heated, treated, and mistreated. And yet, its use has influenced all of our lives.



The Great Blue Heron is one of the many hundreds of thousands of birds which depend upon the lower Columbia River estuary for survival.

Without the dams the Northwest could not have developed as it has. Much of the industry and many of the jobs in the region are tied to the abundance of cheap hydropower. In the early days the river's power and water supply seemed unlimited and inexhaustible. Industry was attracted to the river by the cheap power, and with industry came people. Demand for electricity and water quickly rose to meet supply, and today, competing demands often exceed the capacity of even this great river.

While the dams have served the Northwest well, considerable costs were associated with their construction.

Many wild rivers were drowned by the dams. The nutrients and soil in the spring rush of water settled out at the bottoms of the reservoirs. The seasonal rhythms of water were interrupted, and some of the salmon runs disappeared .

Many of the dams were built without fish ladders, and as a result, half of all the spawning streams of the Columbia River system were cut off to salmon. Wherever fish ladders were built, the spawning adult salmon had a fighting chance to reach their spawning streams, but providing for the young salmon on their way back to sea has proven to be far more difficult. Biologists estimate that 15 percent of all of the juvenile salmon passing through a single reservoir and dam are killed. Many of the juveniles must negotiate several dams on their way to sea.

There is no doubt that the Columbia River salmon resource and the fishery have been damaged by changes in the river's flow. The dams, their reservoirs, water diversion, and contamination all have affected the river, the estuary and the salmon in ways that were never fully predicted. Gone are most of the river fishermen. Gone are the huge salmon canneries and many of the jobs. In their place are a large international offshore fishery and a sport fishing industry.

These environmental changes have caused economic and cultural hardships for some people, while others seem to have prospered, or at least survived. An entire era of human use of the lower river ended last month when the last of the great Columbia River salmon canneries closed in Astoria.



An employee of the Little White Salmon Hatchery removes a dead salmon from a raceway. The dams, water diversion, and contamination have adversely affected the salmon fishery.

The sharp decline of the fishing industry has forced the communities in the Astoria area to look elsewhere for income. New port facilities proposed here would mean more jobs and an economic boost. But as these demands grow, the effects on the biological health of the estuary and on salmon are destined to grow too.

Much of Astoria's vitality has emanated from the natural resources of the Columbia River and her estuary. A serious question facing the residents of the lower Columbia is how can these towns undertake the development projects they need to prosper and still preserve the biological health of the estuary.

Research teams from local, state, and federal agencies and universities have begun gathering the essential environmental information needed to make decisions far into the future. Jim Good, Extension oceanographer at Oregon State University, says, "The research is designed to answer some tough questions. For example: How will future water withdrawals affect the estuary? What areas must be preserved to protect dwindling salmon resources? Is further channel deepening feasible? Where should new facilities be located, and how should they be built?"

With government assistance, local leaders wrote a comprehensive management plan which provides for all of the projected port and industrial growth and still preserves more than 95 percent of what's left of the estuary's most productive shallow water areas. But many of these programs are faced with extinction as the federal budget axe cuts its way through the Northwest.



The estuary is used by the logging industry as a convenient storage area. Tugboat crews strap these logs together into giant floating forests and tow them to awaiting ships.

In the next few years very important decisions will be made regarding future dam construction, building in the estuary, and water diversion. How we make them will help decide the fate of the Columbia River estuary.

"Estuary: Columbia's Link With the Sea" is a film suitable for junior high school through adult audiences. This 28 minute documentary may be rented for \$20 or purchased for \$250 from Sea Grant Communications, AdS 418, Oregon State University, Corvallis, OR 97331.