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Amid climate change, fish struggle to adapt

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CLARKSTON – As professional fishing guides, Pat and Judy Long have been up and down the Clearwater and Snake rivers in southeast Washington the past ten years, spending day after day on the river. Today, they notice the little things – weeks without fish biting. Fish runs dispersed over longer intervals. Later runs.

“We’ve seen problems with water flow, changes in patterns, and things that just aren’t stable,” Judy Long said.

In recent years, a new variable has been added to the tricky formula of salmon survival: climate change.

Water temperatures — estimated to increase nearly 2 degrees by 2040 — and decreased snowpacks could pose an emerging threat to Pacific salmon, according to federal scientists. More frequent and powerful spring floods may sweep through spawning grounds. Heat-stressed fish may be more vulnerable to parasites and pathogens, scientists warn.

And while debates rage on about what constitutes the biggest impact to fish migration, higher water temperatures have been affecting salmon and steelhead as they migrate up and down rivers of the Pacific Northwest.

“The rate of climate change is faster than the evolution of the migrating fish,” said Matt Keefer, a research support scientist at the University of Idaho.

How climate affects salmon

Each summer, salmon and steelhead trout begin the treacherous migration from the Pacific Ocean to spawning grounds in Washington, Oregon and Idaho.

During that trip, the migrating fish eat very little, meaning a high loss in calories if they are forced to stay cool, said Keefer, who has spent the past 11 years studying salmon and steelhead migration in the Columbia, Snake, and Clearwater rivers.

Data dating back to 1960 – before the Lower Granite Dam was built on the Snake River – show freezing water temperatures used to come much earlier and lasted longer than

they do now.

From the 1960s to the 1980s, freezing water temperatures were seen as early as October, sometimes lasting until late February. Today, those low temperatures aren't seen until December, and last a month until January, according to National Oceanic and Atmospheric Administration (NOAA) and Army Corp of Engineers data.

Living in Clarkston in the 1970s and early 1980s, Judy Long remembers being able to walk across the frozen Snake River during the winter.

"We used to have really cold weather for several weeks," Long said. "It was not unusual for the river to freeze."

But in the past two decades, Judy Long and her husband Pat have not seen prolonged cold that led to the thick ice.

With the installation of dams along the Snake and Columbia rivers came large tributaries that moderated the fluctuations of the annual river temperature.

In the 1960s, the river would see extreme heat and extreme cold in a short window of time. Nowadays the cycle does not fluctuate as far, a phenomenon that leaves fish struggling to adapt.

Tracking fish with implanted chips, Keefer and other researchers at UI have found that some species have the ability to adapt to high temperatures by waiting in cooler waters until temperatures recede, while others have become increasingly scarce in recent years.

Later migrations not as successful

In a corner of the Lower Granite Dam visitor center, a portion of the green-tinted Snake River flows past a viewing window. The light seeps in revealing fish as they swim through the narrow channel of the dam's fish ladder.

As they shoot past the window, Mona Hacker, a fish counter employed by the Washington State Department of Fish and Wildlife, can tell with just a glance the difference between a chinook, sockeye, or steelhead, whether they were hatchery bred or wild, and how old they are.

When the fish ladder is in operation, it is monitored 24 hours a day, either by human eye or video camera, in an effort to document the number of fish that pass through this ladder.

The job plays an important role in the research of salmonid species.

The data is used by scientists, researchers, engineers and lawmakers to make decisions regarding the survival of the fish that are an economic and cultural icon of the Pacific

Northwest.

In a 2006 study of endangered sockeye in the Snake River, Keefer found that the fish that returned earlier than July 13 made it to breeding grounds successfully. However, after July 13, every tagged fish died before reaching breeding grounds.

In the study Keefer concluded that water temperature was a major factor in the deaths.

“Perhaps the most important finding in our study was the clear pattern of lower survival for later migrants,” the study said.

Water temperatures may be one of the significant factors that will dictate which species thrive, while others perish, Keefer said.

The two other most populous salmon species in the Columbia and Snake are chinook salmon and steelhead trout, and their different migration patterns and survival rates give insight into what is needed to adapt to increasing water temperatures.

Steelhead numbers decreased from about 48,000 fish in 2001 to 33,000 fish in 2007. Adult Chinook went from around 195,000 fish in 2001 to just over 40,000 swimming through the fish ladder at the Lower Granite Dam.

Steelhead – a migratory trout that live in the ocean for a portion of their life before traveling back to breeding grounds – have had the fewest problems adapting to water temperatures, Keefer said.

“Chinook salmon have had more trouble with increased temperatures,” he said. “Chinook have a smaller window of time to migrate to their spawning grounds, whereas steelhead have the ability to wait the warmer temperatures out.”

Stressed in the river, stressed in the ocean

Making it to spawning grounds does not mean successful reproduction. After migrating upriver to spawn, adults return to the ocean or die, leaving their eggs in the streams and tributaries of the Inland Northwest.

Increases in water temperature accelerate the rate of egg development for Chinook salmon. The resulting smaller-than-average fry are likely to have lower survival rates due to increased predation, according to an independent scientific advisory board that looked at climate change and its impact to Columbia River Basin fish.

On the way to the ocean, juvenile fish are forced to travel through the same conditions that their parents struggled to navigate.

“Stress is cumulative,” said Thomas Wainwright, a research fishery biologist with NOAA. “Fish that are stressed in freshwater are stressed in the ocean.”

He said that stressed fish entering the ocean bring with them higher disease and parasite loads, and are also less resistant to disease.

The ocean is not forgiving to the young fish.

“As juvenile salmon leave rivers, they need food and the right temperatures,” Wainwright said. And the favorable ocean conditions needed by salmon fluctuate more often than in the past.

Wainwright said conditions were favorable to salmon in the 1960s, but really bad in the '90s.

More recently, Wainwright said he has seen good phases and bad phases, with 2005 and 2006 being very bad for fish, while 2007 was very favorable.

Fish numbers and policy

Decisions regarding spillway use, energy consumption, dam design and functionality all require that fish numbers along with various research studies be taken into consideration.

NOAA's fisheries division is in charge of synthesizing research to make informed decisions about river and dam protocol in the Pacific Northwest. The agency works extensively with the Army Corp of Engineers to monitor salmon and implement procedure.

“We meet every week, sometimes multiple times a week,” said Nola Leyde, a public affairs specialist at the Army Corp of Engineers in Seattle.

Leyde has worked with NOAA fisheries for more than 20 years to manage the rivers of the Pacific Northwest, along with several government and nonprofit environmental groups.

“In the 1980s there was concern that as separate agencies we were all doing something to benefit salmon, but we were not working together,” she said. “Now we manage the river systems using several opinions from various areas.”

Leyde said that while some action may take years to complete, others are adapted quickly and efficiently.

Policies are geared towards fish survival, something that does not always make river recreation seekers happy, Leyde said.

“If push came to shove, the fish would win,” said Gina Baltrusch, public affairs specialist for the Walla Walla district of the Army Corp of Engineers.