Spring Chinook are running for their lives

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Statesman Journal

January 10, 2010

Cold, clear water gurgles past banks thick with vine maples, hemlocks and firs in the North Santiam River east of Detroit Lake.

Here, a spring Chinook salmon soon will emerge from an egg nestled in the underwater gravel beds and begin her fight for survival and reproduction.

Like many before her, the journey won't be easy.

Her species has dealt with ice ages, volcanic eruptions and massive floods. Salmon have survived droughts that reduced streams to a trickle, fires that charred entire watersheds and changes in the ocean that transformed a salmon's rich buffet to a bread line.

But now the journey proves more harrowing for salmon, especially on the North Santiam River.

Two dams block 70 percent of the fish's native spawning ground, the flow and temperature of water from the dams threaten every stage of their life cycle, and land uses have destroyed key habitat downstream.

The toll is clear: In the span of three human generations, wild chinook have gone from 56,000 fish in the 1920s to at most a few hundred today. Scientists think that, without significant changes, spring Chinook could be extinct not only from the North Santiam River but from the entire Willamette Basin in 40 years.

Federal and state agencies are beginning recovery efforts in the Willamette Basin — 10 years after spring Chinook were placed on the Endangered Species List.

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Christopher Boyd, assistant manager of Marion Forks Fish Hatchery, handles a spring Chinook salmon at the Minto Salmon Facility, about 14 miles east of Detroit.

Chinook series

The Statesman Journal's two-day series explores the obstacles and opportunities facing the recovery of spring Chinook in the North Santiam River, one of four critical recovery areas for the state fish.

Today: Follow a just-hatched salmon down the North Santiam River and the many temperature and habitat problems she'll encounter.

Monday: Follow the physical obstacles, water flow issues and future hatchery facility changes likely to be encountered by an adult female heading upriver to spawn and then die.

Willamette Basin Biological Opinion

Under the Endangered Species Act, the federal government is required to release a biological opinion on how to reduce its impact on protected species, including spring Chinook in the North Santiam.

In 2008, nearly 10 years after Chinook were listed, the government released its opinion. The changes outlined could cost hundreds of millions of dollars on the North Santiam alone.

A few of the major requirements on the North Santiam:

Fish passage: Reconnect wild fish with spawning ground above Detroit Dam by 2023. There are no price estimates yet, but similar projects have ranged from $50 to $108 million.

Temperature: Change water temperatures released from the dams so they follow

historic seasonal trends by 2009 with a permanent solution by 2018. The Army Corps of Engineers already has adjusted spill methods to correct temperatures, which costs about$3.25 million in lost power generation. The Corps is considering installing a water tower for a more permanent solution. The improvement cost $52 million on nearby Cougar Dam.

Flow requirements: The Army Corps is required to release a certain amount of water from Detroit Reservoir each season to ensure adequate flows for fish — for example, 1,000 cubic feet per second in the summer and 1,500 cubic feet per second starting Sept. 1 for spawning spring Chinook.

Water usage: No new contracts for stored water can be issued on the North Santiam River. There are 30 contracts to farmers.

Habitat improvements: Large woody debris collected in the reservoir is required to be made available for downstream habitat restoration projects, which have to be completed every year from 2011 to 2023.

Go to https://pcts.nmfs.noaa.gov/pls/pcts-pub/pcts_upload.summary_list_biop?p_id=26588 to read more.

Spurred by a lawsuit, the federal government released a plan in 2008 explaining how it would reduce the impact of the 13 Willamette basin dams on endangered fish, including Chinook.

Improvements outlined in the document could cost hundreds of millions of dollars on the North Santiam River alone.

Oregon also will release a recovery plan in the summer for spring Chinook in the Willamette Basin that targets the North Santiam as one of four critical areas. The goal for the North Santiam River is more than 5,000 wild fish returning every year for about 50 years.

Ultimately, residents will pay for these efforts through tax dollars, lottery proceeds and their electric bills. About15 percent of all electric bills go toward salmon recovery on hydroelectric dams that block the fish.

Some of the money will be diverted from the $1 billion spent each year on the Columbia River to restore salmon.

But in the end, advocates say, salmon survival points to larger issues such as water quality and the long-term health of watersheds.

"If salmon are the first species to start dying out, what is that showing us about our watershed?" said Liz Redon, coordinator of the North Santiam Watershed Council. "Does that mean that our watershed is sustainable for our needs, like drinking water, growing food and raising families?"

Detroit Dam

Built: 1953

Height: 463 feet

Purpose: Built primarily for flood control, saving an estimated $650 million in flood damage since construction, according to the U.S. Army Corps of Engineers.

Power generation: $20 million per year

Irrigation storage: Stores about 321,000 acre-feet of water that can be used for irrigation downstream. There are 30 water contracts for farmers along the North Santiam River.

Recreation: The most popular recreation lake in Oregon, according to the Oregon Department of Fish and Wildlife.

Fish passage: The dam blocks about 70 percent of spring Chinook's spawning habitat, and juvenile fish have — at best — a 75 percent chance of surviving a trip through the dam.

Operation: The U.S. Army Corps of Engineers operates the dam.

Harrowing journey

In late winter when the ground is still covered in snow, a female spring Chinook salmon hatches in waters above Detroit Lake.

Her parents were hatchery fish trucked above the dam in a flatbed with a tank attached so they could spawn in these waters. Hatchery fish are the only ones allowed to reach the historic beds above Detroit — their offspring's journey through the dam's spillway and turbines is too dangerous to risk losing rare wild fish.

Within a month or two, the young salmon grows large enough to hunt for insects in the crevices of rocks or in small pools created by fallen trees.

She swims through the best habitat in the watershed. Snowmelt from Mount Jefferson feeds the creeks and rivers as they wend through federal forests on their way to the lake. As a result, the water is cold, pristine and so well-suited for salmon that the nearby hatchery produces fish for rivers throughout Oregon.

Despite her pristine surroundings, she also will face the single largest threat to salmon on the river: Detroit Dam.

The dam, built in 1953, plugs the river canyon with concrete that reaches 463 feet high, mostly for flood control. The U.S. Army Corps of Engineers, which controls the dam, estimates that the structure has prevented $650 million in flood damage since construction.

Detroit Dam also produces $20 million per year in power in addition to storing water for irrigation and creating a lake for recreation.

But the dam also blocks some of the best habitat in the watershed and effects temperature and water flow downstream.

With her tail pointed downriver, the young fish starts her journey to Detroit Lake from several weeks to a almost a year after hatching. Juvenile fish swim tail-first, like a toddler crawling downstairs backwards.

As she approaches the lake, the current all but disappears into a body of water 9 miles long with no safe way out.

If she's lucky, she'll enter the lake in time to catch faint flow cues from water spilling through the dam's spillway. As she swims close to the concrete dam, she gets sucked through the spillway, where she'll likely experience multiple collisions or falls with an impact 130 times the force of gravity, according to preliminary test results from an U.S. Army Corps of Engineers' study. Humans are unlikely to survive car crashes in which they sustain a G-force of more than 100.

About one in four fish die within 48 hours after going through the spillway.

When lake levels are lower, the outcome is more grim. About half the fish sucked through the power turbines below the spillway die within 48 hours.

Fish navigating the regulating outlets near the bottom of the dam aren't expected to fare much better, although tests are still under way.

This particular female fish is lucky — she goes through the spillway, survives the plunge into the water and swims through the regulating pool below where she approaches her second

concrete hurdle: Big Cliff Dam.

At less than half the size of Detroit Dam, Big Cliff is unlikely to stop her now, although tests have not been conducted on its safety for fish passage or compound effects of passing through both dams.

One of the major keys to salmon recovery on the North Santiam, according to the federal government's biological opinion, is to figure out a safer way to get fish around the dams.

Projects at similar dams have ranged from $50 million to $108 million each, but no one is sure what the solution might be for Detroit Dam.

One favored technique is a fish "gulper," which uses hundreds of feet of net to stop fish and simulated currents to direct them into a trap. A similar setup cost $50 million on Baker Lake in Washington and helped bring sockeye salmon from the brink of extinction to juvenile runs of more than 200,000.

After surviving both dams, the female on her journey to the ocean swims four miles down river and over a velocity barrier at Minto collection facility.

The barrier stops salmon from coming up to spawn and instead directs them into holding tanks. This is where she'll likely return if she survives.

Temperature threats

When she reaches the gravel beds just below the Minto facility, she will find juveniles of wild parents who never made it to the Minto collection facility and spawned naturally below the dam.

The juveniles who hatched in these lower reaches may struggle more than the female who started above the dam — they've had to deal with unseasonable water temperatures that threaten their survival.

A deep reservoir, such as Detroit Lake, separates cold and warm water into distinct layers. In the summertime, the cold layer is trapped at the bottom of the lake, where it's released through power turbines into the North Santiam River.

The lower temperatures can stunt juvenile growth and delay returning adult salmon, which can increase pre-spawning mortality, according to studies cited in a U.S. Army Corps of Engineers report about temperature.

In autumn, it's the reverse problem. The water surface cools, and the reservoir layers mix, allowing water that's too warm to release through the turbines.

This warm water in late fall tricks fish into thinking it's springtime. They hatch, sometimes as early as late November instead of February or March, only to find a lack of food and stormy conditions.

"We are stacking the deck against little fish," said Kirk Schroeder, a lead biologist and researcher of spring Chinook on the North Santiam River.

In 2008 and 2009, the Army Corps corrected the temperature problems downstream by "mixing" water going through the turbines with water spilled from the top of the reservoir.

It created more suitable temperatures for fish, but at a cost — the anticipated loss in potential

hydropower generation is $3.25 million per year, according to the Bonneville Power Administration, which sells power from Detroit and Big Cliff dams.

The federal government's biological opinion requires a permanent temperature solution on the North Santiam by 2018. The Corps is looking into a temperature control tower that mixes the water behind the dam before releasing it through the turbines.

It would eliminate the strain of opening and closing spillway gates. A similar tower cost $52 million on the McKenzie River in 2005.

Habitat obstacles

Aside from the temperature, the habitat here, next to Packsaddle Park, is ideal for fry, which are just-hatched salmon. Tree branches reach over the river's edges — providing shade, places to hide from predators and areas that support insects for fish food. The river moves in and out here, offering pockets of slack water, and boulders create eddies where fish can hang out.

Although this section of habitat on the North Santiam River is safe for juveniles, the lower sections can prove difficult.

Downstream, fish find areas where banks are reinforced with rocks, called riprap. Riprap straightens a river and causes water to flow faster.

"Fish hitting riprap get blasted out of there," Schroeder said.

In efforts to funnel water the way people wanted, banks were stabilized with rocks, and wood and logs were removed from rivers and vegetation was cleared along banks. Meandering side channels, places for fish to spend months growing, have dried up.

The result: no place for fish to rest, hide from predators, grow or find insects. These places are particularly important for spring Chinook, which generally spend a year in fresh water before heading to the ocean.

Riprap isn't the only type of bad habitat for fish.

The female fish on her journey to the ocean encounters areas of river where lawns are manicured up to the water's edge — eliminating trees and other plants that provide shade, which cools the water, and letting soil and fertilizer flush into the river, which reduces oxygen levels.

Costs of habitat improvements — opening up side channels, placing wood and debris in the streams and planting trees and shrubs for shade and protection — are unknown but likely to be millions of dollars. Most of the habitat work will be funded through lottery funds administered through the Oregon Watershed Enhancement Board.

When she reaches Upper Bennett Dam, the fish could run into problems if the Santiam Water Control District has put boards up on the dam — called flash boards — to divert more flow into the north channel, where the district withdraws its water.

Because of a buildup of gravel, the north channel also tends to have more water — potentially giving an easier ride to spring Chinook.

Fish that head down the south channel have to go over Bennett Dam, where they could scrape their bodies against a concrete pad and which could lead to infection later, said Bill Sanderson,

a fishing guide and longtime river advocate on the North Santiam River.

But state biologists say that the dangers of going over Bennett Dam are minor compared with the rest of the journey.

Safely past the dam, Geren Island offers a sanctuary unlike what the female that hatched above Detroit Dam has seen so far on the river: meandering side channels, extensive wetlands and trees and shrubs that shade the water and provide homes for insects.

"There's a lot of protection around the grasses and willows and trees," Schroeder said. "Plus, they could eat like crazy here."

On her way to the next sanctuary — Wiseman Island — the fish is funneled quickly past places such as Green's Bridge, a fairly straight section of river that moves quickly and offers no rest.

But once at Wiseman Island, she can again regain her energy, find food and hide from predators among the logjams and multiple meandering turns that the river takes.

Once she leaves here, she'll reach one other place of respite — the confluence of the North and South Santiam Rivers.

From here, she will travel hundreds of miles down the Willamette and Columbia rivers and out into the ocean, where she'll spend from two to four years before she returns home to the North Santiam.

The journey back sometimes proves even more difficult because of the loss of habitat, human handling and water temperatures and flows that threaten spawning and survival of the next generation.

The series continues Monday.

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