by Kimberlee Craig

Going round and round to help fish

Water-saving technology raises healthier steelhead

A new approach to raising northwest steelhead using circular tanks and water that is filtered and reused is being tested at Chelan County PUD's Chiwawa Hatchery near Lake Wenatchee, northwest of Leavenworth, Wash. This new system applies technology from the aquaculture industry to salmon and steelhead reared for conservation and supplementation.

A study of the 25,000 juvenile steelhead raised in the new facility in 2009-2010 showed that they survived the trip down the Columbia River on their way to the ocean at greater rates than a group of comparable fish reared in traditional linear raceways. In addition, the fish reared in circular tanks arrived downstream at McNary Dam nearly four days faster on average than the raceway fish.

"We are really at the early stages here and recognize that hatchery innovations may require many years to prove their effectiveness, but in this case, we are extremely optimistic that water conservation and hatchery supplementation efforts can complement one another," said Joe Miller, Chelan PUD hatchery program manager. "This could be a win-win for hatchery managers and the public as we face increasing demands on our water resources."

Another 25,000 juvenile steelhead are being raised at the hatchery for release this spring as part of continuing studies of the new approach being done in cooperation with the Washington State Department of Fish and Wildlife, Miller said.

Hatchery production is part of the PUD's three-prong approach to fish protection as called for in its Habitat Conservation Plans (HCPs). These plans are now part of the federal operating licenses for Rock Island and Rocky Reach dams. Along with at least 93 percent survival rates for salmon and steelhead passing the dams and habitat restoration in tributaries, the PUD is close to reaching its commitment to operate its Columbia River dams with no net impact on the fish listed as endangered species.

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- Joe Miller, Chelan PUD hatchery program manager

A fish and engineering challenge

Chelan County PUD owns nine hatcheries in the Columbia River Basin, most of which are operated by the Washington State Department of Fish and Wildlife (WDFW). As some of those facilities needed updates, PUD biologists and engineers were looking for better ways to operate them.

"Hatcheries use a lot of water and we have a lot of hatcheries," Miller said. "We needed a risk management strategy to meet our HCP hatchery production responsibilities and account for predicted changes in water supplies."

In addition, steelhead destined for the upper Wenatchee River have historically been raised at a hatchery on the Columbia River and then moved to acclimation ponds in the Wenatchee River Basin. But research showed a high proportion of the returning adults strayed. Biologists believe this is due to not having enough time for the young fish to "imprint" on their native waters.

The PUD has been working with the HCP Hatchery Committee to find a solution to the straying by moving the program to the Wenatchee River Basin. The Chiwawa River acclimation facility, near Lake Wenatchee, provided a suitable location within the Wenatchee Basin, but limited space and water proved to be significant challenges for moving the steelhead program there, explained Sam Dilly, PUD project manager and engineer.

An innovative approach

Beginning in 2006, PUD Natural Resources staff investigated options to increase capacity at the Chiwawa Hatchery to accommodate the steelhead program.

PUD engineers and biologists identified techniques used in commercial aquaculture that had potential application at the Chiwawa Hatchery. Three circular fiberglass rearing tanks with partial water reuse were proposed for the steelhead, which would fit the geographic and environmental footprint of the site. This technology differs considerably from traditional concrete flow-through raceway designs used at salmon hatcheries throughout the Northwest.

The 20-foot-diameter circular tanks are much smaller than the long, straight concrete raceways and use a new filtering system which cuts down on water use. About 10,600 gallons of water are used in each tank.

Dilly said that fiberglass circular tanks are widely accepted around the world as standard technology, but are not common in the Pacific Northwest.

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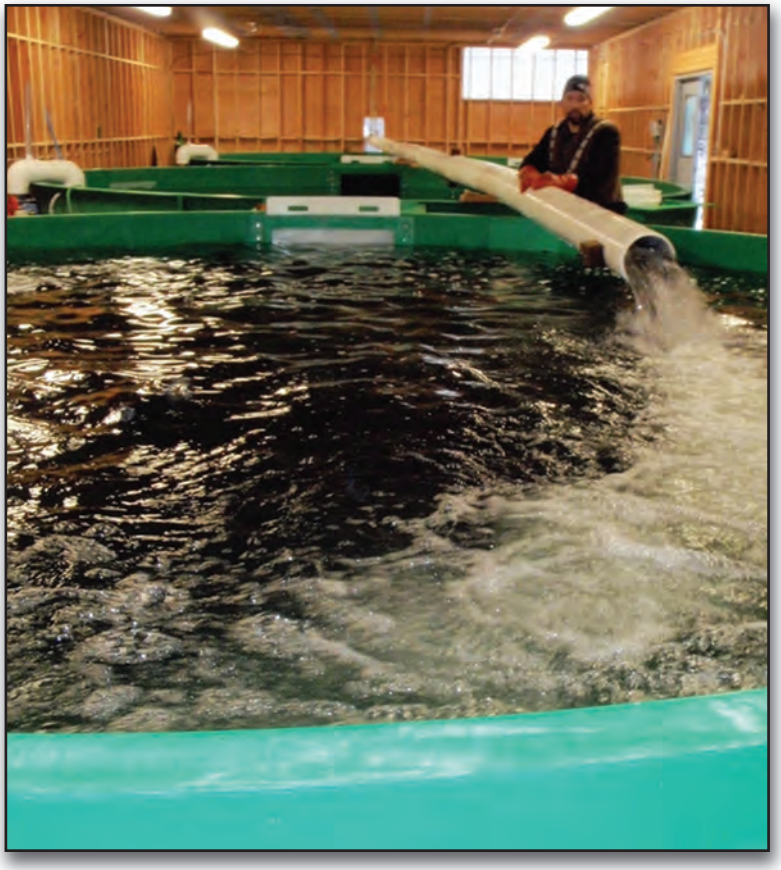

Initial study results show the circular current in the round tanks at the Chiwawa Hatchery is raising healthier steelhead. Photos courtesy of Chelan County PUD.

Overall the new tanks use 85 percent less water, compared to a standard raceway, and offer distinctive water-quality advantages. The circular flow and central drain promote capture of waste, including fish feces and uneaten food. This has the potential to reduce waste discharge by 30 percent, compared to traditional raceway systems.

Water intended for reuse is captured through outlets on the side of the tank. Approximately 75 percent of the water is captured through these outlets and enters a system that filters and adds oxygen to the water, then returns it to the pool. This reduces overall water use and pump costs, while maintaining uniform water quality.

Three questions were posed to evaluate the new technology at Chiwawa Hatchery:

- Will the circular tanks create healthy juvenile steelhead?
- Will the juvenile fish mature and display a high degree of seaward migration?
- Will the fish perform adequately in terms of in-river survival and rate of migration?

The initial answers appear to be yes, yes, and yes.

The PUD hired the Fresh Water Institute of Shepardstown, W. Va., as an independent party to analyze the health and performance of the circular-tank-raised fish and comparable raceway fish, examining everything from blood chemistry to fin shape.

The PUD's Natural Resource and Engineering departments also provided staff to examine the rate of smolts that willingly left the circular tanks prior to the big release into the Wenatchee River.

Lastly, 10,000 of the young fish outfitted with passive integrated transponder (PIT) tags were monitored at dams and in-river locations all the way downstream through Bonneville Dam and into the Columbia River Estuary.

All results were examined in comparison to a control group reared in raceways on Turtle Rock Island in the Columbia River near Rocky Reach dam. The fish all came from the same parents.

Initial results look good

After release, the differences in the test and control fish were readily observed. The steelhead raised in the circular tanks migrated faster and in greater numbers. They cleared the checkpoint four days sooner and survived in greater numbers than the raceway-raised fish — 79 percent compared to 55 percent.

"Water reuse in circular tanks provides a range of swimming velocities that appears to be beneficial to the fish, and it does so with a far more efficient use of water," said Dr. Brian Vinci, director of engineering services at the Freshwater Institute.

Added Dilly, "(The circular current) is a giant treadmill that continually prepares them to be more like a wild fish and prepares them for their migration to the ocean."

Chelan PUD and the Freshwater Institute collaborated on a presentation of the 2009-2010 study results at the Northwest Fish Culture Conference in Portland, Ore., last December.

In addition to benefits for the fish and the smaller environmental footprint of the circular tanks, the ability to use new technologies could save millions of dollars over the cost of building a traditional hatchery, Dilly said. NWPPA

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