December 2008

www.emsl.pnl.gov

EMSL Spotlight

Little Fish, Big River

Instrument Development Lab helps follow young salmon's route through dam

Thanks to the Instrument Development Laboratory in the Department of Energy's EMSL, scientists triangulated the position of juvenile salmon as the tiny fish prepare to navigate the dark, noisy passages of the North Bonneville Dam, the last dam on the Columbia River before the Pacific Ocean. To improve their odds through this and other dams, a team at Pacific Northwest National Laboratory is studying the behavior of the fish as they arrive at the dam and the choices they make passing through. The data will aid in helping those agencies that must balance the multiple uses of the Northwest's water resources.

Experts at EMSL's Instrument Development Laboratory provided new receivers and solved data filtering issues for scientists tracking endangered juvenile salmon through a major Northwest dam.

The IDL team, led by Thomas Seim, gathered technical data and requirements for the acoustic tags the team wanted. These tags were easier on the fish and transmitted signals further. The data and requirements became the basis for a competitive bid, which resulted in new tags that cost about $50 less than the previous tags, a significant savings when tens of thousands of tags are used.

The tags' signals were detected by submerged hydrophones and recorded by digital receivers designed by IDL. The previous receivers, which cost about $20,000 a piece, only recorded that a tag was nearby. The new receivers recorded the signal from the tag (a serial number that identified the fish) and the time the fish passed, down to the microsecond, which is required for three-dimensional triangulation. Also, the receivers were about a third the cost, so the scientists could obtain enough receivers to triangulate the position of the fish through the entire forebay, the reservoir just upstream of the dam.

In addition to the time a fish passed by, the hydrophones also picked up background noise from the dams and the river, such as the sound of rattling sluice gates. At IDL, Eric Choi, Brian LaMarche, and Seim designed custom algorithms that decoded the signals from the hydrophones. Also, they designed algorithms that discriminated between real signals from the tags and background noise. This activity was made more challenging because the acoustic frequency of the tag signal varied by as much as 0.5%, which has an effect similar to increasing the noise. The ability to decode signals corrupted by noise determines the range at which the tag can be detected.

After filtering out the background noise using desktop computers in a trailer near the dam, the team stored approximately a terabyte of signal data every day. "We worked hard on storing more real data and less noise," said Seim. Today, the scientists are using the data to study fish behavior in the dam's forebay and as close to the spillway as possible. In addition, the new receivers are being used on other studies in the Northwest.

For more information, contact EMSL Communications Manager Mary Ann Showalter (509-371-6017).