

Sonar studied for fish survival

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By Annette Cary

A camera that's been used to survey harbors for invading frogmen is showing potential on another front: the battle to guide salmon safely past Northwest dams.

The University of Washington developed the technology in the mid-1990s to allow the Navy to use sound waves to see through murky water.

Traditional sonar techniques can pick up movement in the water. But it may not show whether the movement is from a school of fish, a dolphin or a frogman preparing to magnetically attach a small bomb to the hull of a ship.

But by using up to 96 different sonar beams -- high-frequency sound waves sent through water to register vibrations reflected from an object -- the Navy's acoustic camera collects enough information to show more than a blip on a screen.

It also shows the size, shape and movement of an object, said Ed Belcher, principal engineer at the university's Applied Physics Lab.

That has applications not just for the Navy, but also for biologists who'd like to study fish behavior but have limited options in dark or turbulent water.

"The idea is to let us get a picture of what fish are doing in the water to get the fish by the dams safely," said Russ Moursund, research scientist at Pacific Northwest National Laboratory in Richland.

Since 1999, researchers in Richland have been testing the camera for underwater surveillance of fish.

Initially tested in the laboratory, it's now installed at The Dalles Dam on the Columbia River on an underwater rotator that can be used to pan and tilt the camera.

The Army Corps of Engineers and the Richland lab are testing the technology's effectiveness and watching how fish react to a new structure in the fish bypass system there.

"We've exceeded expectations with what we see," Moursund said.

At The Dalles, the Corps is testing a prototype structure that uses J-shaped plates to guide fish away from seven turbines into a sluiceway to take them safely through the dam. Without the J-plates' guidance, about 40 percent of fish go through the sluiceway.

With the new acoustic camera, biologists are trying to determine whether many young salmon are slipping through gaps between the plates rather than being guided to the sluiceway, said Corps biologist Mike Langeslay.

Based on initial observations, the fish "do not just go shooting into the surface bypass," Moursund said. "They slow down as they approach, and they may come back. They take it cautiously."

The camera shoots a video of six to 10 frames per minute showing the white shapes of wiggling fish, the heads and tails visible, swimming through dark water.

"We can actually see places we couldn't see before," Langeslay said. The camera peers through muddy water or water at night, and images aren't ruined if

the fish are in confined spaces or near bubbles that would deflect traditional sonar technology.

Not only does the acoustic camera use many sonar beams, but it also uses a higher frequency -- up to 1.8 megahertz -- than traditional sonar, to get greater detail. However, at high frequencies, more of the sound waves are absorbed by the water, which shortens the distance in which it can pick up images.

Traditional sonar might detect objects and show them as a dot on a screen 1,000 yards away, but the acoustic camera takes good video up to 30 feet.

Video cameras, in comparison, can seldom provide clear pictures of fish more than 3 feet away and are hampered by turbid water.

Biologists also can use electronic tracking tags to study fish behavior, but using the acoustic camera allows them to observe "run of the river" fish without catching them first, which could potentially change their behavior.

The acoustic camera may next be used at Bonneville Dam down-river from The Dalles to watch fish at screens set up to divert them at turbine intakes. The screens guide the fish upward, but biologists want to make sure that once they reach the top they enter the fish bypass system rather than swimming downward again toward the turbine intakes.

Additional tests also will show how well the acoustic camera can be used to estimate fish size and shape.

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