BUSINESS NEWS

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Lab effort targets fish habitats, hydropower

Thousands of miles from the Pacific Northwest, researchers at the Department of Energy's Oak Ridge National Laboratory work to preserve the salmon habitat and balance power generation needs.

Hydroelectric power accounts for about 10 percent of the electricity generated in the United States, but it plays a far bigger role along the Pacific coast.

There, according to an ORNL press release, it accounts for more than 60 percent of the electricity generated.

"The trick is to generate electricity without harming salmon, sturgeon and steelhead as they pass through turbines and also to minimize effects of dams on their habitat," the release quotes Michael Sale of ORNL's Environmental Sciences Division as saying.

A team of ORNL researchers is working on a variety of projects ranging from dam licensing issues to white sturgeon growth to nighttime migration of young salmon.

One project, the Virtual Fish, represents some of the latest work aimed at determining the effects on fish of the turbulence created by dams and also the direct effects of turbines, according to the press release.

The joint project with Georgia Tech and Voith Siemens Hydro Power Generation, a turbine manufacturer in York, Pa., uses ORNL's teraflop (1 trillion calculations per second) IBM/Compaq supercomputers to perform simulation and analysis, according to the press release.

"Through projects like the Virtual Fish, we're working on ways to reduce the number of fish that get killed or injured in turbines," Sale said.

"Because the hydraulic environment inside a hydropower turbine is extremely complex and difficult to observe directly, we use computational fluid dynamics models to simulate what's happening to the fish."

Using ORNL's supercomputer and complex mathematical formulas, researchers hope to quantify those forces.

That information can then lead to safer turbines for new dams and for retrofitting existing dams.

"Turbine designers need numbers that define a safety zone for fish within which water pressures, shear forces, turbulence and chances of mechanical strike are all at acceptable levels for survival," the release quotes Glenn Cada of ORNL's Environmental Sciences Division as saying.

The work of Sale and Cada falls under DOE's Advanced Hydropower Turbine Systems Program, which strives to reduce mortality for fish passing through turbines to 2 percent compared to current levels ranging from about 5 percent to 30 percent.

Another goal of the program, begun in 1994, is to develop aerating turbines to increase the level of dissolved oxygen in tail waters.

Cada and others are providing technical direction and oversight of shear and water pressure experiments

being performed at Pacific Northwest National Laboratory.

Idaho National Engineering and Environmental Laboratory is also part of DOE's hydropower program.

In another project, Yetta Jager and Mark Bevelhimer are studying the white sturgeon and its viability in the Snake River.

The white sturgeon, which matures at 15 to 30 years and can live more than 100 years, is also the largest freshwater fish in North America, according to the press release.

"A main concern is that fragmentation of large rivers by dams has adverse effects on fish populations because small populations can easily go extinct if, for example, not enough adult spawners of the opposite sex happen to be available," Jager said in the press release.

"Also, fragmentation by dams converts free-flowing river habitats to reservoir habitat that is less suitable for spawning."

ORNL's white sturgeon model quantifies the effects of fragmentation on the population of the fish. Jager developed a similar model to track individual Chinook salmon as adults migrate upstream into California to spawn.

"Fish survival, growth and development is linked to local river flow and temperature conditions," said Jager, who discovered that optimal flow differed for dry and wet years.

In wet years, it was better to provide very high flows in spring during out-migration.

In addition to its work in these areas, ORNL researchers make other contributions that preserve the salmon habitat, according to the press release.

For instance, Chuck Coutant serves on the Northwest Power Planning Council's Independent Scientific Advisory Board and the Independent Scientific Review Panel.

In those capacities, Coutant's scientific expertise helps set policies and goals for the salmon recovery efforts and ensures that the council takes on worthwhile projects, Coutant said.

"One of our main tasks is to press for accountability for plans and accomplishments, something that is still very incomplete, although we're making progress," the release quotes Coutant as saying.

These ORNL researchers also work with the Federal Energy Regulatory Commission on relicensing issues involving dams along, for example, the Madison River, which flows north from Yellowstone to eventually form the Missouri with two other rivers.

Balancing the opinions of competing interests of how the rivers should be used is a delicate one, the press release stated, but sound science can provide the information needed to make wise decisions, and that's where Bevelhimer's work is making a difference.

"Environmental impact statements provide mitigative measures that the dam owners and operators must fulfill to minimize impact to the fisheries and other resources," Bevelhimer states in the press release.

"Our analyses allow hydropower dams to continue to generate electricity in an environmentally responsible manner."

ORNL is a DOE multiprogram facility managed by UT-Battelle for the Department of Energy.