RESOURCE & ECOSYSTEMS MANAGEMENT

A Technical Resource for Government and Private Industry

Aquatics Research Laboratory

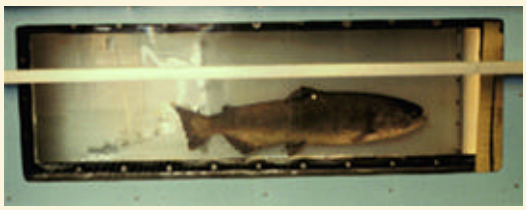
The Pacific Northwest National Laboratory (PNNL) operates an aquatic facility that supports a variety of research on fish and other aquatic life, covering topics as diverse as toxicology, bioengineering, and biosensor development. Housed in PNNL's Life Sciences Laboratory 1 in Richland, Washington, the laboratory is operated for the U.S. Department of Energy. Waters from the Columbia River and a groundwater well are delivered to the lab and conditioned to meet specific research needs. Inside the lab, temperature and lighting control are used to simulate seasonal and diurnal cycles. The lab is used for prototype aquatic tool development and to conduct tests to answer questions that are difficult to resolve in the field. These include toxicity testing, fish behavior studies, fish physiology, and modeling of biological systems. The outdoor facility is used for holding and acclimating test fish and supports specialized research equipment that can be installed and operated to meet specific research needs.

A rainbow trout brood stock is maintained at the laboratory year around. Many species of cold- and warm-water fishes and invertebrates have been successfully reared and cultured for research projects.

Research conducted at the Aquatics Laboratory supports a variety of projects related to aquatic resource management challenges in the Pacific Northwest and elsewhere. These include:

- Effects of radiation on the Columbia River ecosystem
- Biological uptake, effects, and transport of contaminants
- Fish physiology and energetics in relation to water flow fields and shear/ turbulence
- Fish behavior in response to physical structure and flow
- Radio- and acoustic tag development and testing
- Flow quantification and modeling
- New generation hydroturbine design
- DNA microarray development for environmental monitoring
- Genetic fingerprinting using DNA microarrays

RESEARCH EQUIPMENT



Fish Respirometer/Swim Chambers. The lab is equipped with two swim chambers. Each can produce water velocities up to 1.75 m/sec. The working sections of the systems are large enough to exercise most fish, including adult salmon.

Controlled Environment Chamber. A self-contained room with independent light, temperature, and humidity controls is used to grow aquatic plants and rear aquatic insects for testing purposes. Toxicological studies, bioassays, and pharmacokinetic studies are also conducted in this room.

For more information, contact:
Dr. Joseph L. Devary, Manager
(509) 376-8345
joe.devary@pnl.gov

or

Dr. Charles A. Brandt
(509) 375-5345
charles.brandt@pnl.gov

Resource & Ecosystems Management
Environmental Technology Division
PO Box 999
Richland, WA 99352
www.pnl.gov

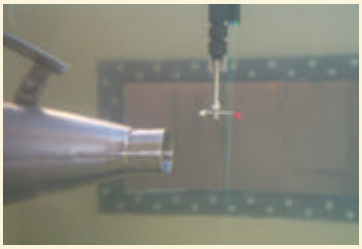
Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

RESOURCE & ECOSYSTEMS MANAGEMENT

RESEARCH EQUIPMENT – Cont'd

Turbine Simulation Hyperbaric Chamber. The system consists of two parallel chambers that can hold fish. A computer controls pressure within the chambers to simulate fish passing through a turbine at a hydroelectric dam. The pressure/time profile can be altered to simulate a range of fish passage conditions.

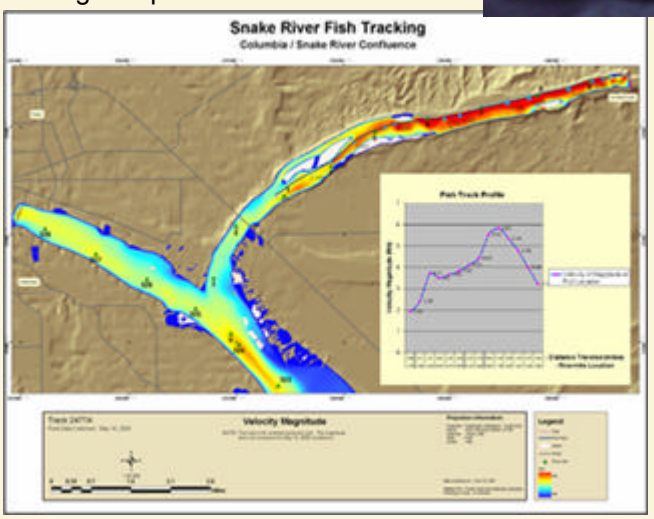
Gas Supersaturation System. This system can produce up to 38 L/min of water at 100% to 165% saturation.



Shear/Turbulence Flume. The shear flume is 1.2 x 1.2 x 12 m, with a 75 HP recirculation pump with variable speed control. The sensor platform is driven by three ZETA4TM step-motor drives. This system is capable of positioning instruments (LDV, ADV, and pitot tube) in three dimensions with sub-millimeter accuracy.

Proportional Dilutor. The proportional diluter (1 x 2 x 2 m) can perform serial dilutions in batch mode to provide controlled dosages for long-term exposure experiments to evaluate pharmacokinetics and effects of contaminants on aquatic biota.

Fish Behavior Tank. This large (3 x 7 x 2 m) tank is used to conduct fish behavior tests, such as responses to strobe flashes and underwater sound and calibrate research equipment.

Miscellaneous Equipment

- Flow/Velocity measuring equipment
- Underwater video
- Hi-speed video
- Hydroacoustic equipment
- GPS
- Computational/LAN/GIS
- Sensor fish
- Physiological sensor systems
- Radiotelemetry equipment
- PIT tagging equipment
- High-output strobe