

Available Technologies

# Biological Performance Assessment (BioPA) Toolset

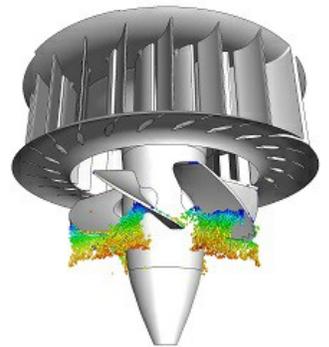
**Battelle Number(s):** IPID 30289-E

Copyrighted

Available for licensing in all fields

## SUMMARY

Fish passage through hydro turbines is a major concern wherever fish must navigate through hydropower facilities. The capability of predicting the risks to passing fish can inform the design of new and upgraded turbines leading to superior fish-passage performance and survival. The Biological Performance Assessment (BioPA) toolset, developed by researchers at Pacific Northwest National Laboratory, offers such predictive capability. The tool assimilates hydraulic field data, computational fluid dynamics (CFD) results, and laboratory fish-injury studies to estimate the probabilities that fish will encounter hazardous conditions during passage through specific regions of the turbines.



The BioPA method features a proportional sampling scheme that uses streamtraces in a numerical flow simulation to model potential pathways through the turbine environment. It uses CFD simulations of the turbine design to quantify the exposure of passing fish to a set of known injury mechanisms. The exposure probabilities are combined with dose-response data from laboratory stress studies of fish to produce a set of objective scores. These metrics can be used to compare competing turbine designs, refine a new design, or evaluate the performance of an existing turbine. The BioPA process can be performed during the turbine design phase and is considerably less expensive than prototype-scale field testing.

## ADVANTAGES

- Increase the number of fish successfully passing through hydro turbines
- Inform the design of new and upgraded turbines for superior fish-passage performance
- Cost savings with early detection of potential pathways risks due to biological performance testing being performed during the turbine design phase

## RELATED LINKS

- **"Quantifying barotrauma risk to juvenile fish during hydro-turbine passage "**

Fisheries Research: Volume 154, June 2014, Pages 152

<http://www.sciencedirect.com/science/article/pii/S0165783614000095>

## PORTENTIAL INDUSTRY APPLICATION(S)

- Energy & Utilities
- Public Administration & Government

## CONTACT

**Sara M. Hunt**

Pacific Northwest National Laboratory

(509) 375-6555

[sara.hunt@pnnl.gov](mailto:sara.hunt@pnnl.gov)

<http://availabletechnologies.pnnl.gov>