

## Barochambers for Understanding Fish Trauma

**Client:** NSW Department of Primary Industries - Fisheries

**Year:** 2012

**Project Reference:** 2011050

The Water Research Laboratory has recently completed the design, build, testing and delivery of specialist barochambers for NSW DPI Fisheries. Small-scale hydropower projects have been identified as a potential way to meet future renewable energy targets. However, one constraint to future developments of such projects is the pressure fluctuations that Australian fish species can withstand. The NSW Department of Primary Industries (DPI) fish biologist, Dr Craig Boys, is leading investigations to understand the ranges of pressure changes and turbulence acceptable on Australian fish species.



To undertake their barotrauma experiments, DPI required specialised barochambers that could allow fish of various species and ages to be acclimated before being subjected to rapid pressure changes. Some of the challenges for the design that WRL were able to overcome included:

- Acclimation pressures to 200 kPa
- Pressure changes to as low as 20kPa
- Pressure changes in less than 0.5 of a second
- Large open windows allowing for video and photography
- Installation possible within a portable trailer laboratory

The barochambers rely on water being highly, but not completely, incompressible. A chamber full of water can have the pressure varied by moving a piston in or out of the tank. The chambers were 700 mm x 400 mm x 400 mm built from 16 mm stainless steel with a large 20 mm thick laminated glass window.

The associated instrumentation was controlled from bespoke Labview software and a National Instruments A/D cards including:

- An electromagnetic linear motion actuator to drive a piston
- Pressure transducers to monitor pressures and provide active feedback
- Temperature thermistors
- Actuated control valves to adjust the acclimation pressures
- Isolation valves
- Pumps to circulate flow and provide the acclimation pressure

The chambers, electronics and software were all developed at WRL and installed into DPI's mobile laboratory. The software was automated with active feedback loops, allowing the DPI researchers to upload particular configuration files of desired pressure time-series.

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A 17 day old Murray Cod showing evidence of injury (bubble in gut) resulting from rapid pressure changes.

WRL project leader, Brett Miller also attended workshops targeting international collaboration on this research topic and contributed through his knowledge of fundamental hydraulics. At a three day workshop at the Port Stephens Fisheries Institute (PSFI), Dr Boys of DPI stated:

*"Only a small number of these facilities exist throughout the world. Of these, the one at Port Stephens is the most sophisticated. PSFI now has the research and development capacity to be a world leader in 'fish friendly' hydropower research and development."*

*Over the next twelve months, researchers at PSFI will be studying the tolerances of native freshwater fish such as silver perch, golden perch and Murray cod to simulated passage through a turbine, during larval and juvenile stages."*

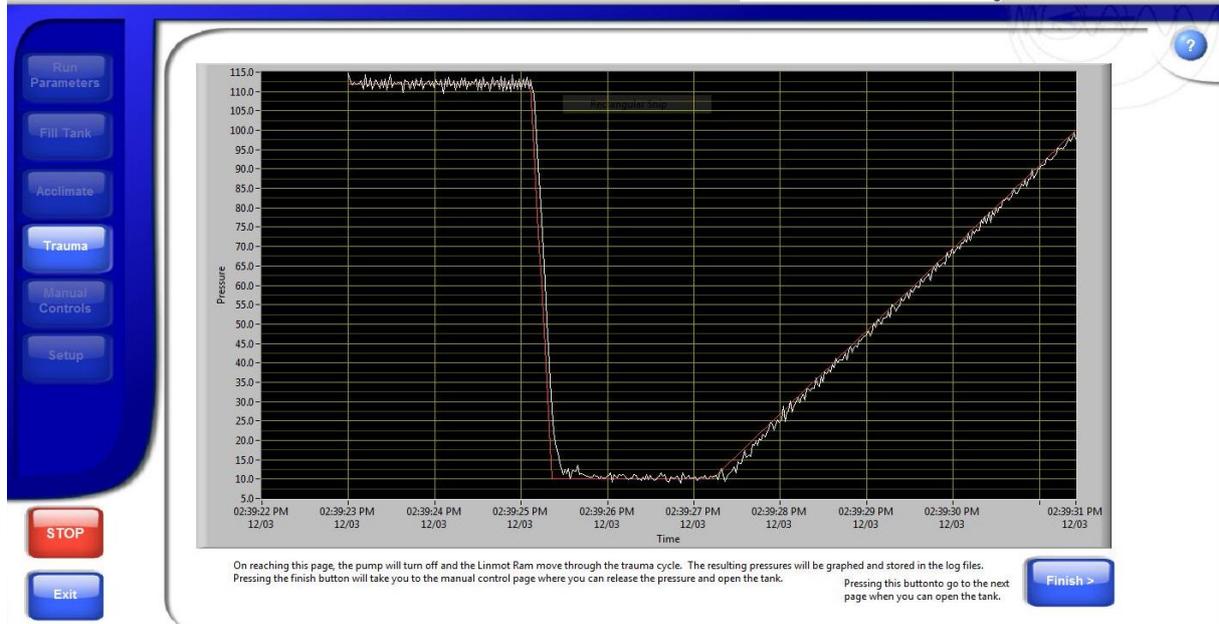
Barotrauma Chamber v 1.3.0



Fisheries Barotrauma Laboratory



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