UNIVERSITÉ DE SHERBROOKE

Université de Sherbrooke is seeking two PhD candidates in eco-hydraulics

Use of velocity, turbulence, and attachment-inhibiting substrate to provide selective fish passage at sea lamprey barriers

Context: Invasive sea lamprey are a persistent predator of teleost fishes and have had detrimental effects on native fish populations in the Great Lakes. Low-head dams have been installed at many Great Lakes tributaries to impede lamprey access to spawning habitats. While barriers are effective, they as well block access for native fish species. High velocity barriers have shown promise when combined with attachment-inhibiting substrate.

Research Objectives: The purpose of this study is to explore how turbulence and turbulence-inducing structures might further inhibit lamprey passage, while promoting passage of native fishes (i.e., selective passage). More specifically, the study will compare locomotion behaviour and performance of invasive sea lamprey and native ray-finned fishes over weir and spoiler baffles at different spacings. Flow structure will be quantified and related to the quantified fish locomotor behaviour and performance.

Methodology:
Laboratory experiments will be performed at the USGS, S.O. Conte Anadromous Fish Research Center (CAFRC), Massachusetts, USA and the Civil Engineering Department, Université de Sherbrooke (UdeS), Québec, Canada. Fish experiments will be conducted at both facilities where the fish will be allowed to volitionally enter and ascend a large flume lined with an attachment-inhibiting substrate and with several baffle configurations (i.e, weir and spoiler). Ascent behaviors, kinematics, and passage performance with and without baffles will be quantified using radio frequency identification (RFID) and high-speed video. Flow structure of specific geometries will be measured in detail using a stereoscopic high-frequency particle image velocimetry (sPIV) system. Open-source computation fluid dynamics (CFD) software (OpenFOAM) will be used to model flow over substrate / baffle geometries, providing additional knowledge on passage-limiting flow and turbulence characteristics.

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Selection Criteria:

- Bachelor's degree in engineering and a master's degree in a relevant subject: hydrotechnical engineering, fluid mechanics, fish biology or related fields.
- Experience in laboratory experimentation, quantitative analysis methods, CFD and advanced measurement techniques such as ADV and/or PIV.
- Experience in coding, image processing and/or fish handling are assets.
- Peer-reviewed scientific publications.
- English fluency is necessary. French fluency (or a desire to learn) is an asset for working and living in a francophone environment.
- Priority will be given to American and Canadian citizens or permanent residents. International applicants can also apply, but they must be able to secure a visa to permit travel between the USA and Canada on a regular basis.

Institution: The workplace is at the Faculty of Engineering at the University of Sherbrooke, with occasional travel to the USGS's CAFRC in Massachusetts. The PhD students will work with other students and a multidisciplinary team of researchers working on the project: Prof. J. Lacey (UdeS), Dr. T. Castro-Santos (USGS), Dr. E. Goerig (Harvard University). The team brings together expertise in eco-hydraulics, experimental fluid mechanics, fish biology and biomechanics. A stipend of **$21,000 CAD/year** and excellent working conditions are offered (health care benefits, opportunities to attend conferences, professional development, etc). Starting date: **January 10th 2022**. Interested candidates are encouraged to contact by email: Prof Jay Lacey (Jay.Lacey@USherbrooke.ca). Please send a **cover letter**, **detailed CV, 3 recommendation letters (see Faculty format*) and copies of any relevant peer-reviewed publications**.

*https://www.usherbrooke.ca/genie/futurs-etudiants/2e-et-3e-cycles/deposer-une-demande-dadmission/pieces-exigees-par-la-faculte-de-genie/#c71763