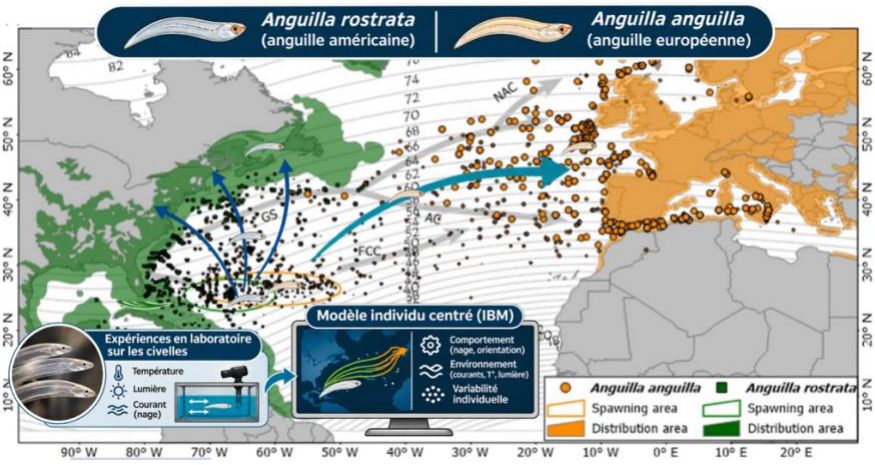
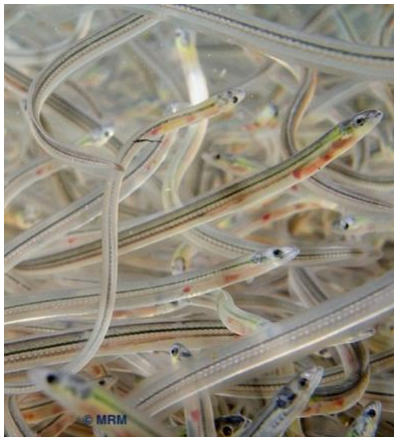
PhD Position in Biological Oceanography and Modelling

Title: From the Sargasso Sea to the Atlantic Coasts: Understanding Larval Dispersal, Recruitment, and Connectivity of European and American Eels





Institutions and Research Environment

Located in Rimouski, Québec, the Institut des sciences de la mer at the Université du Québec à Rimouski (ISMER-UQAR) is Canada's leading French-speaking marine research institute (https://www.uqar.ca/institut-des-sciences-de-la-mer-ismer/). Recognized for its interdisciplinary excellence, ISMER offers advanced analytical facilities and state-of-the-art marine research infrastructure.

The project will also be conducted in collaboration with the Institute of Marine Research (IMR) in Norway, one of Europe's largest marine research institutes. Based in Bergen, IMR has extensive research infrastructure, including specialized laboratories, research vessels, and the Austevoll Research Station, renowned for its expertise in fish biology and ecology.

The PhD candidate will be based at ISMER-UQAR and will benefit from joint supervision with IMR. Research stays in Norway will provide opportunities to draw on IMR's expertise in eel ecology as part of an international and interdisciplinary research training experience.

Background and Project Description

European (*Anguilla anguilla*) and American (*A. rostrata*) eels are catadromous migratory species that grow in continental freshwater or brackish habitats before migrating to partially overlapping spawning areas in the Sargasso Sea. After hatching, their larvae, known as leptocephali, are transported by ocean currents towards distinct recruitment regions: from Morocco to northern Norway for European eels, and from Venezuela to southwestern Greenland for American eels. Despite more than a century of research, the precise locations and timing of spawning, as well as the mechanisms determining larval trajectories and their destinations, remain poorly understood.

These knowledge gaps are particularly concerning given the substantial declines experienced by both species. The European eel is classified as Critically Endangered and the American eel as Endangered on the IUCN Red List. In Québec, the marked decline of American eel populations in the St. Lawrence River basin has led to the implementation of a recovery action plan, including fisheries management, habitat restoration, improvements to migratory connectivity, and glass eel stocking. Although fishing pressure, degradation of continental habitats, and barriers to migration contribute to these declines, the role of changing ocean conditions, particularly temperature and circulation, remains poorly understood. In this context, improving our understanding of larval dispersal and the mechanisms controlling recruitment is essential for the conservation and management of these species, particularly in the St. Lawrence River basin.

The **main objective of this PhD project** is to better understand the physical and biological mechanisms controlling larval dispersal in European and American eels, in order to explain and predict spatial and temporal variations in recruitment and, ultimately, contribute to improved management of both species.

The project will primarily focus on the development of a generic Individual-Based Model (IBM), parameterized for both eel species, incorporating larval biological and behavioural characteristics. This model will be coupled to a

Lagrangian particle-tracking model, potentially LADiM, driven by three-dimensional ocean circulation fields. This biophysical modelling approach will allow the simulation of transatlantic larval dispersal and connectivity for both species. Experiments using drift chambers, conducted in Québec and Norway, will help characterize larval behaviour and provide biological parameters for the simulations. Finally, sensitivity analyses will assess the relative influence of physical and biological processes on larval trajectories and recruitment regions.
Several scientific questions may be explored throughout the PhD, including the influence of ocean variability on larval trajectories and the probabilities of reaching different coastal regions, the relationships between larval connectivity and recruitment variability, and the mechanisms potentially contributing to the geographical separation of the two species and the distribution of hybrid individuals. Model simulations will be evaluated against available observations, including larval distributions, genetic data, and recruitment time series (ICES/WGEEL), to assess their relevance for understanding and monitoring eel populations.

Supervision
The PhD candidate will be supervised by Prof. Déborah Benkort (ISMER-UQAR) and co-supervised by Dr. Caroline Durif (IMR) and Dr. Lucie Vanalderweireldt (IMR). This international collaboration will bring together complementary expertise in oceanographic and biophysical modelling, eel ecology, and experimental biology of early fish life stages.

Required Qualifications
Applicants must hold a Master's degree in oceanography, ecology, biology, applied mathematics, or a related discipline, and meet the admission requirements for the PhD program in Oceanography at UQAR.
We are primarily looking for a curious and motivated candidate with a strong interest in scientific research and critical thinking skills, who is able to analyse, question, and discuss their results.
An interest in marine ecology, particularly migratory fish, as well as biophysical oceanography and numerical modelling, is desirable. Previous programming experience (Python, R, or Fortran) would be an asset, but a strong motivation to develop these skills is equally valued.
The project will require independence, initiative, and adaptability to an international and interdisciplinary research environment involving travel between Canada and Norway.

Funding
CAD 25,000 per year for three years, with the possibility of a one-year extension. International candidates may be eligible for an exemption from differential tuition fees, allowing them, subject to approval, to pay the same tuition fees as Québec students.

Application Procedure
Applicants must submit a complete CV, a motivation letter outlining their academic background and interest in the project, university transcripts, a letter of support from their research supervisor, and three letters of recommendation, at least one of which must come from a previous research supervisor.
Applications should be sent to all three supervisors:

- **Déborah Benkort:** deborah_benkort@uqar.ca
- **Caroline Durif:** caroline.durif@hi.no
- **Lucie Vanalderweireldt:** lucie.vanalderweireldt@hi.no

Application deadline: January 20, 2027

Expected start date: Fall 2027

Equity, Diversity, and Inclusion
We encourage applications from individuals with diverse backgrounds and are committed to providing an inclusive and respectful research environment. Selection will be based on applicants' qualifications, research potential, and motivation.