ISMER Oceanography PhD Excellence Scholarships

Kelp Forest Trajectories in the North-West Atlantic





Context : Kelp forests, formed by large brown macroalgae of the order *Laminariales*, are foundational components of Arctic, subarctic, and temperate coastal ecosystems worldwide. In the Northwest Atlantic (NWA), forests dominated by *Laminaria digitata, Alaria esculenta, Saccharina latissima, Hedophyllum nigripes*, and *Agarum clathratum* extend from Long Island Sound to the Canadian Arctic. These ecosystems provide critical ecological functions and generate an estimated USD 157 billion annually in ecosystem services. Kelp forests support marine biodiversity, provide nursery habitat for numerous species, contribute to carbon and nutrient cycling, and sustain economically important fisheries.

Despite their ecological and socioeconomic significance, our understanding of kelp forest dynamics across the NWA remains fragmented and largely based on localized, short-term studies. While early syntheses suggested heterogeneous trends among regions, recent analyses looking at the region as a whole reveal widespread declines across several southern subregions, including the Virginian Province, Gulf of Maine, Scotian Shelf, and Gulf of St. Lawrence. These concurrent declines suggest the influence of common large-scale drivers operating across the region, such as warming, grazing pressure and hydrodynamics. At the same time, declines are moderated by local drivers in a way that suggests a need to understand the larger dynamics of kelp forests in the NWA to make accurate predictions about the future. Treating individual subregions as isolated systems, as we currently do, limits our capacity to understand and predict ecosystem responses to climate change and other anthropogenic pressures. We wish to build a broader, comparative perspective to inform conservation and management strategies for NWA kelp forests.

Project description: This PhD project aims to advance our understanding of the consistency and variability of drivers shaping kelp forest dynamics in the Northwest Atlantic under a changing climate. The research will compare kelp forest trajectories and the effects of drivers across different contrasting regions: the Gulf of Maine, located near the southern distribution limits of several kelp species, and the Gulf of St. Lawrence, representing a more northern system experiencing rapid environmental change.

A particular focus will be placed on the role of hydrodynamic processes in structuring kelp communities and mediating ecosystem responses to climate stressors. The project will combine large-scale comparative analyses, causal statistical modelling, and field-based ecological experiments conducted by scientific scuba diving across sites spanning contrasting hydrodynamic conditions.
The project will be structured around the following objectives that would be discussed with the candidate selected:

- Develop and adapt a standardized kelp monitoring framework, building upon recent international initiatives (e.g., the Kelp Ecosystem Ecology Network, PISCO, RLS), while ensuring its applicability to Northwest Atlantic species and compatibility with global observing networks such as MarineGEO.
- Implement long-term monitoring at reference sites across Québec, to quantify species turnover, recovery trajectories following canopy disturbances, and shifts in community composition.
- Assess long-term ecosystem change across hydrodynamic regimes by integrating contemporary monitoring data with historical datasets to evaluate rates of ecological change and identify the influence of climate-driven stressors.
- Investigate kelp-urchin interactions under contrasting hydrodynamic conditions, providing new insights into the mechanisms governing grazing pressure, kelp persistence, and the potential for ecosystem regime shifts

The project will combine the analysis of extensive historical and contemporary datasets collected by members of the Northwest Atlantic Kelp Working Group with field-based experimental approaches. The selected candidate will conduct ecological surveys and manipulative experiments using scientific scuba diving, including kelp canopy clearings, sea urchin exclusion and removal experiments, and assessments of kelp recruitment and recovery dynamics. The candidate will be provided with experience and training in marine ecology, climate-change biology, ecological monitoring, underwater field techniques, advanced statistical analyses, and collaborative research within an international network of kelp scientists.

Candidate profile

- Hold a Master's degree (M.Sc.) in oceanography, natural sciences, biology, ecology, or a related discipline.
- Strong interest in fieldwork, particularly scuba diving;
- Interest and skills in the analysis of environmental time series data;
- Ability to work independently, scientific rigor, curiosity, and a strong interest in climate change issues.

The successful candidate will join **ISMER** under the supervision of **Fanny Noisette** and the co-supervision of **Jarrett Byrnes** (UMass Boston, USA). The candidate will also benefit from collaborations established through the *North West Atlantic Kelp* working group, which brings together scientists from across the Atlantic coast of North America working on kelp forest ecosystems.

For further information, please contact **fanny_noisette@uqar.ca** before the formal selection process conducted by ISMER.

The final application package must include:

- A complete CV (including scientific presentations and publications, scholarships, awards, field experience, etc.). Note that narrative CVs are accepted on the same basis as traditional CVs.
- A cover letter describing the candidate's academic and professional background and explaining how their experience aligns with the proposed project and the ISMER PhD program in Oceanography;
- All university transcripts;
- Three (3) letters of recommendation submitted electronically, including at least one from the applicant's research supervisor.

We are committed to employment equity and foster a work environment grounded in the values of equity, diversity, and inclusion. Accommodation measures are available throughout the recruitment process as needed. We strongly encourage applications from women, persons with disabilities, members of visible and ethnic minority groups, Indigenous Peoples, and individuals from LGBTQ2E+ communities. UQAR recognizes that career interruptions may have an impact on the assessment of a candidate's research achievements. Applicants are therefore invited to describe any relevant circumstances in their application, where applicable.