How do seaweeds shape local environmental conditions: application to aquaculture diversification in Québec

© Tamigneaux et al. (2013) Rapport Merinov

As engineering species, brown seaweeds influence the physical and chemical parameters in their direct surroundings, shaping chemical micro-habitats with environmental conditions completely different from those of the water column. These micro-habitats constitute potential refuge zones in the context of global changes, both at the micro-scale of the algal surface and at the canopy level. Indeed, under the control of the light intensity, the photosynthetic metabolism of seaweed increases oxygen concentration and pH while it decreases carbon concentrations directly above the algal blade. This local increase in pH would likely help calcareous species (e.g., shellfish) cope with the corrosive effects caused by the global phenomenon of ocean acidification.

This concept of a refuge to mitigate global ocean change has only been mentioned very recently in the context of aquaculture. By improving local environmental conditions, the multi-trophic integrated culture of seaweeds and shellfish may help maintain good aquaculture production rates under the unfavourable context of climate change. However, the beneficial effect of seaweeds would be very dependent on shellfish species (e.g., mussels, oysters) and local hydrodynamics, thus creating strong specific site-related conditions.

In eastern Canada, seaweed aquaculture is a rare activity, despite growing appeal in the local market. The diversification of aquaculture activities in eastern Canada, including seaweed production, could be an attractive source of new income. In addition, seaweed culture combined with that of commercial shellfish could improve aquaculture productivity.

In this context, this Ph.D. project aims to study the role of seaweeds in influencing the local environment and any potential consequent improvement of aquaculture productivity in a situation of integrated multitrophic aquaculture. To meet this main goal, the project will address different objectives:

1. Characterize the effect of seaweed growing lines on local physico-chemical conditions, in terms of hydrodynamics, oxygen concentration, nutrients, and pH;
2. Determine the best recruitment and growth areas for early life stages of shellfish close to the seaweed lines; and
3. Compare shellfish productivity (quality and quantity) with and without the presence of seaweeds.

The study will be carried out in partnership with Salaweg, a company focused on sugar kelp aquaculture. This company, founded and managed by the Mi'gmaq and Malecite First Nations of Quebec, is an example of economic development for these communities, who are committed to the sustainable management of their resources in a context of climate change.

Additional information and thesis supervision: Fanny Noisette, Supervisor, and Réjean Tremblay, Priscilla de Cottignies (Université de Nantes), Co-supervisors.