Lake **Dy**namics and the **Ne**arshore (LDyNE)

We are investigating the role that nearshore processes may play in lake dynamics. Wind-induced water circulation can manifest as seiches that move large volumes of water towards the windward shore and set up large-scale oscillations. Such circulation can also create standing waves in the mixed layer. Nearshore areas, both lee and windward, are affected by these circulation patterns as a) warm water moves shoreward and inundates bottom sediments, b) cold water wells up, and c) waves break with an intensity that is related to current speed and nearshore slope. Resultant sediment and nutrient resuspension could influence bacterial and algal productivity, especially in less productive northern lakes. Such "hotspots" of productivity could move up the food web if there is adequate spatial overlap of predators and prey in this sometimes high-energy environment.

This project involves a number of collaborators including a physicist interested in wind-induced current patterns, a modeller developing circulation models, an ecologist with expertise in nutrients, algae and the benthos, a microbial ecologist interested in the role of phytoviruses in lakes, and fisheries biologists using acoustic technologies to determine fish abundance and spatial distributions.

In addition, our lab is contributing information on the spatial patterning of zooplankton and its impacts on predator-prey interactions. We use a combination of field observations obtained with continuously recording electronic sensors (optical plankton counter, fluorometer, conductivity-depth-temeprature probe) and laboratory experiments. Three projects are available for graduate opportunities leading to MSc or PhD degrees:

A. Spatial patterns of zooplankton

   In this project, the digital sensors are used in the field under a wide variety of wind conditions to document spatial patterning of zooplankton along linear sampling transects oriented parallel or perpendicular to windward and lee shores and proximate to both steep and shallow slopes. Analyses of these data provides an opportunity to learn statistical methods of spatial analyses, and to study spatial coherence among algae, zooplankton and fish.

B. Simulation modelling of spatially explicit trophic interactions

   Some published evidence suggests that aquatic organisms cannot survive in uniform or random distributions of their prey. The existence of prey patches where predators can experience large energy gains for modest energy expenditures appear to be essential for survival. We have develop some simple simulation models using our spatial data to explore this conjecture, but the models require refinement in light of the new data we are collecting.

C. Lab experiments on zooplankton bioenergetics

   Do zooplankton grazing on algal patches have higher net energy gain than those grazing on uniform or random distributions of algae? The challenge is to devise laboratory experiments in which respiration costs of zooplankton feeding on algae or artificial microspheres are measured under these different feeding modes.

Field Site: Harkness Fisheries Research laboratory (http://www.harkness.ca/home.htm)
Lab Site: University of Toronto, Mississauga (http://www.utm.utoronto.ca)
Publications on spatial patterns: Kaevats et al 2005; Milne et al. 2005; Blukacz et al. 2009

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