GRADUATE AND POSTDOCTORAL STUDIES

McGILL UNIVERSITY

FINAL ORAL EXAMINATION
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

OF

AMÉLIE GRÉGOIRE TAILLEFER
DEPARTMENT OF NATURAL RESOURCE SCIENCES

PHYLOGENETIC, TAXONOMIC, AND FUNCTIONAL DIVERSITY OF WETLAND DIPTERA COMMUNITIES

11 November 2016
10:30 a.m.

MACDONALD-STEWART BUILDING, ROOM MS2-022
McGill University, Macdonald Campus

COMMITTEE:
Dr. Roger Prichard (Pro-Dean) (Institute of Parasitology)
Dr. Benoit Côté (Chair) (Department of Natural Resource Sciences)
Dr. Brian Driscoll for Dr. Terry Wheeler (Supervisor) (Department of Natural Resource Sciences)
Dr. Andrew Gonzalez (Internal Examiner) (Department of Biology)
Dr. Stéphanie Pellerin (Other Member) (Département des Sciences Biologiques)
Dr. Jacquie Bede (External Member) (Department of Plant Science)

Dr. Josephine Nalbantoglu, Dean of Graduate and Postdoctoral Studies
Members of the Faculty and Graduate Students
are invited to attend

ABSTRACT
The goal of this thesis was to describe biodiversity and community composition of Diptera in wetlands across Quebec. Three approaches to community analysis were used to describe patterns: taxonomic identity, functional traits, and phylogenetic relationships. Diptera were sampled using standardized methods (pan traps, sweeping) across three types of wetlands (marsh, swamp, bog) in the Montreal region, and in 15 bogs distributed in three Quebec ecoregions.

When comparing three types of wetlands, abundance and species richness did not differ even with wetland areas ranging from 6 to 161 ha. Bogs supported phylogenetically closely related Diptera species filtered by harsher environmental conditions compared to the other two wetland types. Clustering of closely related species was found in bogs, which is probably due to environmental filtering at the initial stage of community assembly postglacially. The slow peat accumulation process and characteristic plant composition adapted to acidic and low nutrient conditions potentially play a role in the structure of the Diptera community. Neutral processes were more important in marshes and swamps, as dispersal limitation explained species abundance dynamics of small and common Diptera species within each wetland type. The assembly of marsh communities is a balance between neutral processes and environmental filtering, while the assembly of swamp habitats is neutral. Clustering, thus environmental filtering, increased with environmental extremes. Rare species tended to be distantly related to common species, based on phylogenetic signal. They have unique habitat requirements and their diversity is maintained by temporal turnover during the active season of species with similar traits filtered by the environment.

When the spatial extent of the research was expanded to bogs in three Quebec ecoregions, a selective filtering role of anthropogenic disturbance was found. Recent drastic human modification of the landscape in Eastern Great Lakes Lowland Forest ecoregion, less suitable peatland patches and more barriers to dispersal are adjacent to those bogs, so agriculture and urban development act as filters for the small proportion of species in the regional pool that can disperse in these conditions. In Eastern Canadian Forest and Central Canadian Shield ecoregions, stochastic processes such as dispersal limitation of abundant, small, multivoltine species seem to be the dominant influence. High diversity of Diptera species and different historical disturbances are at the origin of the functional and phylogenetic structure observed for peatland Diptera.

Phylogenetic community structure and functional analyses revealed high value and complementarity to standard biodiversity measures. This suggests that the three levels of diversity studied should be used in environmental assessments to have a complete picture of macroecological patterns in wetlands. Conservation of mobile organisms in wetlands will depend on conservation plans focusing on both patch quality and surrounding landscape. Different conservation strategies need to be applied in the different ecoregions.

CURRICULUM VITAE

UNIVERSITY EDUCATION

Ph.D. Entomology 2012-Current
McGill University, Ste-Anne-de-Bellevue, QC

M.Sc. Entomology 2005-2007
McGill University, Ste-Anne-de-Bellevue, QC

B.Sc. Biology 2002-2005
Laval University, Quebec City, QC

EMPLOYMENT

Biologist for General Status of Species in Canada 2016-Current
Canadian Wildlife Service, Environment Canada

Teaching Assistant -Insect Biology Laboratory 2015
Population and Community Ecology 2015
McGill University, Ste-Anne-de-Bellevue, QC

Contractor- Report General Status of Species in Canada 2012 and 2013
Canadian Wildlife Service, Environment Canada

Database Coordinator of Lyman Entomological Museum 2007-2011
McGill University, Ste-Anne-de-Bellevue, QC

Research Intern in Entomology 2005
McGill University, Ste-Anne-de-Bellevue, QC

Research Intern in Animal Science 2004
Laval University, Quebec City, QC

Conservation and Biodiversity Field Course in Borneo 2004
Laval University, Quebec City, QC

Research Intern in Molecular Biology 2003
St-François-D'assise Hospital, Quebec City, QC

OTHER WORK EXPERIENCE- EXTRACURRICULAR

Secretary and Coordinator of common names committee 2015-Current
Entomofaune du Québec Inc.

Book Revision 2015
Chapter 7 –Batzer et al. Peatland invertebrates - Invertebrates in Freshwater Wetlands: An international perspective on their ecology. Batzer D. and Boix D. (Eds.). Springer 2016

Abstract Committee Member 2014
Quebec Center for Biodiversity Science symposium

Technical Director and Night Surveillance 2006-2013
Quebec and Montreal Motorcycle show

Present insects to the public within a kiosk 2010 and 2016
City of Vaudreuil-Dorion, Canada Wide Science Fair

AWARDS

Alexander Graham Bell Canada Graduate Scholarship – NSERC (2012-2015)
QCBS Excellence Award (2016)
2 Canada Summer Jobs grants (2014-2015)
Doctoral Research Scholarship - FQRNT (Declined)
Graduate Excellence Award - McGill (2012-2014)
Masters research scholarship - FQRNT (2006-2007)
Honorable Mention, President's Prize (poster) - Entomological Society of America (2007)
Nature Discovery Fund - Canadian Museum of Nature (2006)
Walter M. Stewart Scholarship - McGill University (2006)
E. Melville Duporte Award - McGill University (2006)
Margaret Duporte Fellowship - McGill University (2005-2006)
Undergraduate Student Research Award- NSERC (2004-2005)

PUBLICATIONS

1. **Grégoire Taillefer A**. 2016. Défis et opportunités des bases de données des collections d'insectes. Bulletin de l'Entomofaune no.49
2. **Grégoire Taillefer A**., Wheeler T.A. 2013. Animal colonization of restored peatlands: Inoculation of plant material as a source of insects. *Restoration Ecology* 21: 140-144
3. **Grégoire Taillefer A**., Wheeler T.A. 2012. Community assembly of Diptera following restoration of mined boreal bogs: taxonomic and functional diversity. *Journal of Insect Conservation* 16: 165-176
4. Savage J., Wheeler T.A., Moores A.M.A, **Grégoire Taillefer A.** 2011. Effects of habitat size, vegetation cover, and surrounding land use on Diptera diversity in temperate Nearctic bogs. *Wetlands* 31: 125-134
5. **Grégoire Taillefer A.,** Wheeler T.A. 2011. The genus *Calamoncosis* in the Nearctic region (Diptera: Chloropidae). *The Canadian Entomologist* 143: 652-661
6. **Grégoire Taillefer A**., Wheeler T.A. 2010. Effect of drainage ditches on Brachycera (Diptera) diversity in a southern Quebec peatland. *The Canadian Entomologist* 142:160-172