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Meeting report

Ecology and evolution join forces to good effect

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The 3rd regular meeting of the Canadian Society of Ecology and Evolution was held at the University of British Columbia, Vancouver, Canada from 11 to 14 May 2008.

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1. INTRODUCTION

The disciplines of ecology and evolution are inherently connected, with advances in one field often having significant implications for the other. Yet, there are very few societies that explicitly put both fields under the same umbrella to profit from a synthesis of knowledge. The third regular meeting of the Canadian Society of Ecology and Evolution (CSEE) was a good example of how diverse scientific themes, from reproductive biology to climate change, can bring together researchers in an effort to gain an understanding of the prevailing issues in ecology and evolution (table 1). The recent creation of this Society reflects recognition by Canadian researchers that although the two fields have often been treated separately, they share a number of intersecting trends and questions. For one, unprecedented advances in molecular biology and computing power have enabled researchers to tackle fundamental problems at previously intractable scales, from entire ecosystems down to single genes. Second, while not abandoning pure science, many researchers are seeking ways to use the concepts of ecological and evolutionary theory to address questions of medical, economic and conservation relevance. These trends provided recurring themes that helped to unify the diverse membership of a young and rapidly growing society.

2. THE SOCIETY AT A GLANCE

The CSEE was formed only three years ago with the mandate to (i) promote the study of ecology and evolution in Canada, (ii) raise public awareness of the importance of ecology and evolution to Canadian society, (iii) facilitate communication between members of the Society and decision-makers in the public, private and non-governmental sectors and (iv) act as a liaison with Federal and Provincial funding agencies to support and promote ecological and evolutionary research in Canada. Regular meetings to achieve its mandate have steadily increased in attendance. This year's meeting had 450 attendees, with very strong student participation. A general business meeting by the CSEE council updated members of recent progress as well as new initiatives being pursued by the Society. Douglas Morris (Lakehead University; CSEE President 2008–2010) addressed members to inform them of pressing issues, such as promoting the role of ecology and evolution to politicians and funding agencies (http://www.ecoevo.ca/en/announcements.htm). This need has never been more important considering the Federal Government's recent dismissal of its National Science Advisor, a decision that has been criticized both nationally and internationally (see Science in Retreat, Nature 451: 866). The council further announced results of its invitation to host a Canadian Institute of Ecology and Evolution, endorsing the bid by the University of Toronto. This exciting initiative to establish a national institute will undoubtedly have a major impact on the study of ecology and evolution in Canada.

3. WORKSHOPS THAT WERE INSTRUCTIONAL YET 'SWEEET'

Two workshops preceded the meeting. One was the Symposium for Women Entering Ecology and Evolution Today (SWEEET), which aimed to address issues that influence the advancement of women from postgraduate degrees into academic, government and industry positions in ecology and evolution. The transition into permanent jobs remains a step fraught with challenges for women, and the excellent attendance at this symposium highlighted the strong demand for a forum to discuss these issues. The second workshop was a popular instructional workshop on how to use the phylogenetic freeware of 'MESQUITE' led by its creators, David and Wayne Maddison. MESQUITE represents a flexible program that enables the user to do a number of different analyses within a single programming environment. There is a great diversity of 'modules' specializing in questions from various branches of evolutionary biology (e.g. phylogenetics, molecular evolution, population genetics, geometric morphometrics), and it is possible for users to write their own modules as well. Thus, the aim of MESQUITE is not only to provide analytical tools for answering present questions, but also to enable new questions to be addressed.

4. ECOLOGY AND EVOLUTION AT MULTIPLE SCALES

Methodological and conceptual advances often progress in tandem in the life sciences, and the influence of new molecular and statistical approaches was clear in many presentations. Until recently, the genetic architecture underlying ecologically important phenotypes represented a black box for researchers. The large number of talks describing work on candidate adaptive genes demonstrates that we now have the molecular tools to open this box. Quantitative trait locus analysis and genome scans for selection have enabled new research focused on making the functional connections between genotype, phenotype and fitness. We heard

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Table 1. Topics presented at the 2008 meeting of the Canadian Society for Ecology and Evolution.

topic	talks	posters	total
community ecology	67	17	83
conservation and invasive species	45	2	47
evolution	38	17	55
evolutionary applications	13	6	19
genetics	34	11	45
reproductive biology	17	5	23
population ecology	26	21	47
totals	240	79	319

several examples of specific genes responsible for traits with clear adaptive significance, such as pathogen resistance in salmon, cold hardiness in spruce, armour plates in stickleback, sperm competition in apes and photoperiod sensitivity in *Arabidopsis*. These talks herald a new era of ecological genetics, where we can determine both the ecological causes and evolutionary consequences of genetic variation in adaptive traits. Along these lines, a number of important genetic and ecological questions were addressed, with speakers providing evidence that ecologically similar environments often favour the same genes, but also that it is possible to achieve the same phenotype with different genetic mechanisms. Many adaptive phenotypes discussed involved relatively few genes rather than, as predicted from traditional population genetics theory, many genes of small effect. Furthermore, evidence for non-neutral sequence evolution was provided for a number of candidate adaptive loci.

Operating at a completely different scale, researchers studying the complex interactions occurring among and between biological communities have also benefited from recent methodological advances. Massive improvements in computing power have made it possible to model extremely intricate ecological systems across multiple scales of spatio-temporal organization. Many talks demonstrated the usefulness of this kind of modelling for investigating the recent conceptual advances made in ecosystem functioning, metacommunity and food web research. As analytical and numerical models generate new predictions about the ecological mechanisms and dynamics that influence community and food web structure, they have in turn motivated innovative empirical work. The complex dynamics occurring in a wide variety of natural systems were carefully explored, with studies on communities ranging from coral reefs to boreal forests. More focused analyses tackled the specific interactions between taxa such as mycorhizae and pollinators, seagrass and macroalgae, sea lice and salmonids, and epiphytes and their hosts. In addition, the use of artificial mesocosms proved a popular way to conduct controlled empirical tests of pure ecological theory. Interestingly, distributions of species and interactions were often found to be more stable in nature than in randomly constructed systems with the same number of species and interactions. This stability was attributed to the hierarchical organization of natural systems along the spatial and temporal niche axes of species and their food resources.

5. OLD IDEAS, NEW APPLICATIONS

As the impacts of human exploitation become increasingly obvious, there have been recent efforts in ecology and evolution research to make a contribution towards solving real world problems. There is a new appreciation that many of the tools, approaches and concepts used in pure science can be applied to issues of social, economic and environmental importance. This trend was clear at the meeting, particularly in the evolutionary applications symposium. This symposium demonstrated that many researchers share interests in applying our fundamental understanding of evolutionary processes towards addressing questions of practical relevance. A diversity of important issues were discussed in this context, including but not limited to ensuring the long-term genetic health of endangered species and crops, reducing drug resistance of pathogens and parasites, improving our understanding of the dynamics of medical diseases, combating invasive species and predicting the response of populations to climate change and exploitation. A symposium in honour of the late Ransom Myers also provided an excellent example of how the integration of population dynamics, evolutionary theory and conservation biology can lead to important insights into the long-term dynamics of fish stocks.

Climate change in particular represented a hot topic for the meeting, with several symposium talks raising the issue, both from ecological and evolutionary perspectives. Indeed, the meeting began with a well-attended public seminar by Ian Stirling on the effects of climate change on the Canadian emblematic species, seals and polar bears. Plenary speaker Isabelle Côté continued along this vein, exploring the impacts of climate change on coral reefs worldwide and calling for greater efforts to protect marine habitats, at home as well as abroad. Another plenary address by CSEE past-president Graham Bell also made the connection between adaptation towards rapidly changing climatic conditions and the probability of extinction in natural populations. On a hopeful note, Bell suggested that experimental evolution studies can help provide the knowledge that researchers need to predict how the biological world may change in response to altered climate. Armed with this understanding, we have a greater chance of making the policy decisions required to ameliorate the impacts of climate change. The emphasis on practical research displayed at this meeting reflects a realization that we need to do more to communicate the strong relevance of ecology and evolution research to a wide audience.

6. A BRIGHT AND CONVERGING FUTURE FOR ECOLOGY AND EVOLUTION IN CANADA

The emerging trends discussed above represent just some of the remarkable advances presented by members of the society, and this meeting was marked by a sense of excitement at the potential of future research and collaboration. Without doubt, the integration of ecology and evolution, the study of biological processes at scales ranging from molecules to

ecosystems, and the application of fundamental theory to practical socio-economic issues all represent positive advances in these merging fields. The meeting was enjoyable in its diversity, and much credit should go to the local organizing committee and the council of the CSEE. The talks presented at the meeting will provide a benchmark of Canadian progress in ecology and evolution and a valuable foundation for future studies. The next meeting will take place from 13 to 17 May 2009 in Halifax, Nova Scotia. People interested in learning more about the CSEE or becoming a member should visit the Society's website at www.ecoevo.ca.