Meeting report

Ecology, evolution and genetics join together on Canada's east coast

Brian M. Starzomski^{1,*†} and Carissa D. Brown²

¹School for Resource and Environmental Studies, Dalhousie University, 6100 University Avenue, Halifax, Nova Scotia B3H 3J5, Canada

²Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, Saskatchewan S7N 5E2, Canada

*Author for correspondence (brian.starzomski@dal.ca).

†Present address: School of Environmental Studies, University of Victoria, 3800 Finnerty Road (Ring Road), Victoria, British Columbia V8P 5C2, Canada.

The 4th regular meeting of the Canadian Society of Ecology and Evolution was held in conjunction with the 52nd Annual Conference of the Genetics Society of Canada at Dalhousie University, Halifax, from 14 to 17 May 2009.

Keywords: ecology; evolution; genetics; Canadian Society of Ecology and Evolution; Genetics Society of Canada

1. INTRODUCTION

Charles Darwin was both an excellent natural historian and famously the father of the theory of evolution by natural selection. Early on, he recognized the connections between the ecology and evolution of species. The modern synthesis of evolutionary biology, building on Darwin's original observations and suggestions, incorporated genetic architecture into our understanding of evolution. The latter half of the twentieth century has brought increasing environmental damage, and ecologists have been asked to assess and alleviate the consequences of biodiversity loss and ecosystem change. Now, 150 years after the publication of *The origin of species* and 200 years after the birth of Darwin, ecologists and evolutionary biologists are working together on all of these fronts. The 4th Annual Meeting of the Canadian Society for Ecology and Evolution (CSEE) brought together many of these researchers at a conference held in conjunction with the 52nd Annual Meeting of the Genetics Society of Canada (GSC) at Dalhousie University in Halifax, Nova Scotia, Canada.

Held from 14 to 17 May 2009, the joint meeting included more than 450 attendees from around the world, with more than 100 posters and over 250 talks. Although the CSEE is a young society with its first annual meeting held in 2006, its membership is now over 800, a growth rate of more than 30 per cent in the last year alone. Ecologists and evolutionary biologists repeatedly demonstrated the strength of collaborative research across disciplines, with many talks and posters incorporating molecular and ecological techniques. Combining CSEE with the Annual

Conference of the GSC further strengthened the increasing integration of these disciplines.

2. A BIG YEAR FOR ECOLOGY, EVOLUTION, AND GENETICS

As appropriate for the Year of Darwin, the CSEE and GSC meeting included many talks and sessions with a distinctly Darwinian theme. Darwin came to the fore in Brian Hall's (Dalhousie University) plenary lecture discussing developmental and evolutionary biology in the context of the 150th anniversary of *On the origin of species*. By demonstrating what science would be like had the theory of evolution by natural selection not been proposed, Hall emphasized just how much Darwin's theory revolutionized our understanding of life on Earth.

Symposium topics that continued to build upon the Darwinian theme included the ecology and evolution of conservation programmes, plant reproduction and mating systems, phylogenomics and climate change in Arctic terrestrial ecosystems. The latter amalgamated a number of International Polar Year (IPY) researchers, highlighting climate change as another prominent theme of the conference.

3. THE CONTINUED SUCCESS OF SWEET AND STUDENT WORKSHOPS, AND A SPECIES DISCUSSION

Several workshops were held in conjunction with the meeting, including the second annual Symposium for Women Entering Ecology and Evolution Today (SWEET). Topics discussed by the more than 50 participants focused on achieving a successful career and included advice on writing grants, balancing research and family and the importance of mentorship. Also discussed was the lack of dedicated student training on skills required in a research career, including teaching, finance and laboratory management. A common theme of SWEET was the challenge of securing permanent employment, whether within academia or outside it.

To provide guidance on this issue, a student workshop was held on non-academic career opportunities, with a panel of five researchers from government, industry and non-governmental organizations sharing their experiences. Students challenged the panel with questions regarding freedom of research, funding options and censorship in non-academic jobs.

A third workshop centred on the SPECIES Project (Stability of Populations Evolving in Changing Integrated Ecological Systems). CSEE President Douglas Morris (Lakehead University) introduced the workshop by highlighting the growing mismatch between the need for research in ecology and evolution and the funds allocated for this research. This introduction was followed by a discussion (chaired by Sina Adl of Dalhousie University) of national and global research priorities and shortfalls. An extended workshop to develop appropriate national research and funding priorities will take place in the coming months at the Canadian Institute for Ecology and Evolution.

4. PURE AND APPLIED SCIENCE

(a) *Bringing ecology, evolution and conservation programmes together*

Participants in the Ecology and Evolution of Conservation Programmes symposium sought to challenge the classic view that evolutionary and ecological changes do not occur on the same time scale. Many talks framed conservation genetics in the context of applied evolution, showing ways that evolutionary processes can be manipulated to either enhance the conservation of threatened species or to decrease the spread and impact of invasive species. Several researchers called attention to the importance of genetic diversity in altering the dynamics of populations and communities, while others illustrated how genetic diversity within a species can have effects that are surprisingly large relative to the impact of species diversity in the functioning of communities. Modelling and empirical studies showed the importance of genotypic and phenotypic diversity in the performance of populations, notably in response to species invasions and climate change. An interesting conclusion of a study by Russell Lande (Imperial College) was that for invasive species, the fitness of the invading organism can change rapidly (over the course of a generation) owing to phenotypic plasticity, so that accurate predictions of the spread of invasive species require sampling over the appropriate time frame.

(b) *Fisheries and marine conservation*

Dalhousie University has a tradition of great strength in marine ecology and conservation, and the influence of one of Dalhousie's famous marine researchers, the late Ransom (Ram) Myers, was apparent in several excellent talks. Results were presented from studies conducted at local to global scales, each with a similar and ominous thread: species continue to decline in many marine systems. This includes both shifts in the distributions of important commercial species, and indeed, the decline of entire communities that have undergone commercial exploitation. For example, in the North Sea, impacts of climate change are dramatic, with research showing that northern biogeographic boundaries of fish communities are moving in both latitude and depth below sea level by $4 \text{ m } ^\circ\text{C}^{-1}$ of warming. Further, large-bodied fishes are being replaced by small-bodied species (caused mostly by fishing pressure, though some of the change is explained by warming waters). Other studies showed declines in species that have traditionally proven difficult to monitor (such as sharks and rays in the tropics) but can now be tracked with new volunteer-based techniques. Modelling exercises linking global fisheries and climate change demonstrated the susceptibility of national economies to changes in fish landings, especially in countries such as Colombia, Peru, Pakistan and much of the African continent.

(c) *Quantitative evolution*

The combined CSEE/GSC meeting provided an opportunity to see the outcomes of recent evolution research, from genes to communities, highlighted by Rees Kassen (University of Ottawa), the recipient of

the 2009 GSC 'Robert H. Hanes Young Scientist Award'. In his plenary lecture, Kassen outlined experimental evidence of the adaptive steps taken by evolving microbes, and the consequences for our understanding of the evolutionary process.

In the Plant Reproduction and Mating Systems symposium, leading plant scientists presented new insights into evolutionary concepts such as bet-hedging traits and adaptive divergence. Testing mechanisms of adaptive diversification is challenging; nevertheless, many presentations showed important advances in this field. Experimental manipulations of, for example, *Pseudomonas* bacteria and vascular plant populations demonstrated scientists' increasing knowledge of the links between competition, natural selection and diversity. Researchers also presented novel theoretical results, such as using computer simulations to investigate the evolution of habitat selection strategies. Other studies used known data on species ranges and phylogenies to build models for use in predicting species or community responses to climate change.

(d) *An emphasis on northern research and climate change*

This CSEE meeting came at the end of the IPY, a worldwide research drive to explore polar regions. The IPY involved thousands of researchers, and this research was highlighted in several talks and posters as well as in a symposium. Given the rapid changes in polar climates and ecosystems, international collaboration on this research is essential. Research presentations covered, for example, global analyses of treeline movement and ITEX (International Tundra Experiment), experimental warming work showing dramatic responses in tundra ecosystems worldwide, in terms of both biogeochemical changes in carbon dioxide and methane production, as well as in rapid changes to community structure and species dominance. Several talks showed changes to ecosystem functioning at the landscape scale, and how this is having dramatic impacts on northern communities that depend on these resources. Much of this research was conducted in conjunction with northerners, as the IPY was explicitly designed to be in the service of northern communities.

5. SYNTHESIS OF A LIFETIME OF RESEARCH, AND THE FUTURE

Charley Krebs (University of British Columbia), the recipient of the inaugural CSEE President's Award for Outstanding Contributions to Ecology and Evolutionary Biology, summarized an amazing lifetime of research on keystone taxa in the dominant northern ecosystems: lemmings drive the ecosystem dynamics in tundra and hares do the same in boreal forest. Krebs also highlighted the fact that Canada places low priority on ecology and evolution funding relative to other industrialized countries. This is very troubling to the many conference attendees who rely on Natural Science and Engineering Research Council grants for much of their research operating funds and is especially problematic for the new cohort of young researchers trained during the IPY. With most

northern research funds now gone, both nationally and internationally, this training may be for nought. The penchant for cutting research funds during hard economic times (e.g. Brumfiel & Gilbert 2009; Hoag 2008, 2009) represents a waste of intellectual capital, especially expertise on climate change and the Arctic.

Despite these concerns, the large number and quality of presentations at the joint CSEE/GSC meeting heralds a bright future for ecology and evolution. The annual CSEE meeting has become a showcase of excellent research and, with increased attendance by scientists from around the world, is providing an opportunity for new collaborations and new ideas. To learn more about the CSEE and GSC, visit

<http://www.ecoevo.ca/> and <http://evol.mcmaster.ca/GSC/index.html>.

Comments by Karen Harper, Andrew Hendry, Douglas Morris, Sally Otto and one anonymous reviewer greatly improved this meeting report.

Brumfiel, G. & Gilbert, N. 2009 Basic researchers protest UK budget. *Nature* **458**, 1084–1085. (doi:10.1038/4581084b)

Hoag, H. 2008 Canada abolishes its national science advisor. *Nature* **451**, 505. (doi:10.1038/451505a)

Hoag, H. 2009 Cash concerns for Canadian scientists. *Nature* **457**, 646. (doi:10.1038/457646a)