

# MAMMALS OF NOVA SCOTIA

2013  
FIELD  
REPORT

# Mammals of Nova Scotia

## 2013 FIELD REPORT

### Background Information

**LEAD PI:** Christina D. Buesching

**REPORT COMPLETED BY:** Chris Newman

**PERIOD COVERED BY THIS REPORT:** 2013-14

**DATE REPORT COMPLETED:** 2014-06-30 16:56:22

#### **CHANGES TO:**

**PROJECT SCIENTISTS:** No

**RESEARCH SITE:** No—although we increasingly operate under the banner of Cook's Lake Farming Forestry and Wildlife Inc.

**RESEARCH SITE LATITUDE / LONGITUDE:** No—although we increasingly operate under the banner of Cook's Lake Farming Forestry and Wildlife Inc.

**PROTECTED AREA STATUS:** No



Dear Volunteers,

Huge thanks for your support and camaraderie with our 2013-14 field season. Your contribution to our project allowed us to continue collecting data on how unseasonable conditions impacts on small mammal populations, and how trophic cascades affect the success of mouse and vole predators. We now have sufficient data to start analysing these results (a function of how many 'odd' springs we have observed), however first in the pipeline is to finish papers in preparation reporting on how the age and experience of these rodents influences their behaviour - as evidenced by the way they navigate our maze experiment. For those of you who were interested in how your help with deer dropping counting allows us to estimate deer population densities, our paper on this is now out in Oryx (link: <http://journals.cambridge.org/action/displayAbstract;jsessionid=A407276380D9605746194CA1212F4038.journals?fromPage=online&aid=9168166>) and for those of you wanting to know more about our findings on the Citizen Science front, you might be interested in the Chapter I co-authored in the new edition of Key Topics in Conservation (link:<http://books.google.co.uk/books?hl=en&lr=&id=oAfLrDUC200C&oi=fnd&pg=PA127&dq=buesching+deer+oryx&ots=SBllblA02X&sig=xVhQv9aUhc-pDwa9hM7hR3z4qQg#v=onepage&q=buesching%20deer%20oryx&f=false>) More broadly, our involvement in climate change and mammal monitoring lead Chris to be asked to produce the UK governments coping document on implications for British fauna - downloadable at: <http://www.lwec.org.uk/publications/terrestrial-biodiversity-climate-change-impacts-report-card/2-mammals>.

Climate change, and the emerging pressures on ecosystems, are obviously international issues. Crucially, the work you have helped to enable us to undertake continues to fit into a range of international collaborative projects, involving Norway, Bulgaria, China and Japan, as well as fitting into our mixed UK-Canada portfolio. Emergent from this work is that the issues involved are complex, and that the solutions are not simple ones, however, the ability of species and ecosystems to respond and adapt to changing weather patterns and extremes seems ever-more hampered by the suite of pressures we place on them, with habitat loss, fragmentation, disease and over-exploitation. Thanks again for your contribution and please continue to support the pressing need for both local and global conservation.

Best Wishes,



Dr. Christina Buesching Mammals of Nova Scotia

## SECTION ONE: Scientific research achievements

### TOP HIGHLIGHT FROM THE PAST SEASON

Climate changes, that's what it does - and throughout evolution, species have had to adapt to changing environmental conditions, sometimes even to rapid rates of change. Redressing human impacts on climate, due to greenhouse gas emissions is an enormous issue - so much so that we risk exempting ourselves from responsibility. It's all too easy to examine a degraded ecosystem, subject to reduced species abundance and functionality and to over-look those proximate causes that we could redress (habitat loss, fragmentation, drainage, pollution etc), and instead focus on the intractability of instantly resolving those added pressures attributable to climate change. Unimpeded, nature is very resilient, and life has survived many palaeontological climate extremes and rapid changes in conditions from hypsithermals to glaciations. So the answer might not lie in worrying about climate change per se, so much as the other impediments we impose, freeing processes of adaptive selection.

### REPORTING AGAINST RESEARCH OBJECTIVES

**Objectives:** 1) In terms of fulfilling our over-arching project-objective, to research aspects of mammalian ecology and behaviour in relation to environmental and climatic change and habitat management strategies with the help of amateur-volunteers, we have advanced several datasets in this last year, published a series of papers and reports (below), and engaged not only those volunteers participating directly, but in particular also those school pupils following teachers on the LFF programme. 2) With the addition of data from our single 2014 team, we have established a database from which we can now begin exploring how inter-annual and seasonal weather variability impacts population dynamics, following methods we have established in complementary work on Beavers and Badgers. We are also currently exploring Network Analysis with a colleague with the Chinese Academy of Sciences to look at ecosystem cascades resulting from extreme weather events. We hope that in the future we might attempt a reciprocal analysis, if our multi-species monitoring data can support this modelling. Our work on deer dropping counts to estimate deer numbers, and evaluating the efficacy of using volunteers in these surveys is now complete, and published in *Oryx*. Products on rodent movement patterns and ability to solve maze puzzles with experience are well-advanced, and we have a number of CS products published recently and in press. 3) We have continued to collaborate very extensively with colleagues around the world, sharing data and expertise, and have produced a very significant number of scientific papers over the last 18-months, ranging from studies of climate change, applied conservation and theoretical ecology. Importantly, our work with EW over the last 15 years, monitoring a variety of species in the UK and Canada, contributed very significantly to our ability to produce the UK Government's scoping report on the impacts of climate change on terrestrial mammals last autumn (something EW Europe might be interested in promulgating). 4) In addition to a Chapter in the latest volume of 'Key Topics in Conservation Biology' (2013) we have another book chapter on CS in press with OUP (which went to press today) and have contributed to the GEOBON chapter with Mark Chandler Please see Publications listed later in this report for full paper details, tables, figures etc.

### CHANGES TO RESEARCH PLAN OR OBJECTIVES

We have actually concluded our current Earthwatch Project, after 15 years of involvement in the UK and Canada. This has been necessitated by our need to invest more time in the summer months in our new Haskap berry farming enterprise, with an emphasis on sustainability, biodiversity and multi-functional landscapes. Once these berry bushes are past their critical stage of maturation, however, there may be scope to involve Earthwatch volunteers in biodiversity monitoring in the future, to exemplify how farming and wildlife can be complimentary, and not mutually exclusive.

## SECTION TWO: Impacts

### **PARTNERSHIPS**

As described earlier in this report, our Earthwatch Project has increasingly become amalgamated into our new 'Cook's lake Farming Forestry and Wildlife' Enterprise, in which there lie many synergies. In this mixed capacity our research site continues to be FSC certified, and we collaborate with the local FSC group 'Picea' on appropriate Acadian forest management. The farming side of this enterprise is supported by the Nova Scotian Dept Agriculture's 'FarmNEXT' programme, and we are a registered farm working with 'ACORN' (Atlantic Canada Organic Network). Our Academic collaborations stem principally from our affiliation with Oxford University and include: Tokyo University / Prof. Yayoi Kaneko (with whom we have just secured a large international research grant) Beijing University (Chinese Academy of Sciences) / Prof. Youbing Zhou. Telemark University / Prof. Frank Rosell Trakia University / Prof. Evgeny Raichev Michigan Sate University / Prof. Bob Montgomery & Prof. Kevin Theis

### **CONTRIBUTIONS TO CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS**

- **International**

UK Government: Newman, C. & Macdonald, D.W. (2013). The Implications of climate change for terrestrial UK Mammals. Terrestrial biodiversity Climate change impacts report card Technical paper. Living with environmental change partnership. <http://www.lwec.org.uk/sites/default/files/Mammals.pdf>

- **National or regional**

GEOBON - Book chapter (with Mark Chandler) on CS

- **Local**

There has been considerable local interest in our ability to estimate local deer densities (from our Oryx paper) and in our lead on 'wildlife-friendly' farming.

### **DEVELOPING ENVIRONMENTAL LEADERS**

Those students we support and supervise embodied in the academic partnerships, detailed above.

### **ACTIONS OR ACTIVITIES THAT ENHANCE NATURAL AND/OR SOCIAL CAPITAL**

Promotion of sustainable, wildlife-friendly forestry and Farming, as embodied in our new company Cook's Lake Farming Forestry and Wildlife Inc. Conceptually, this almost exemplifies a biotech derivative of our former Earthwatch project.

### **CONSERVATION OF TAXA**

We are conserving, and promoting the restoration of the Acadian Forest ecosystem, as part of the regional Southwest Nova Scotia Biosphere Reserve designation. Taxonomically, we work on common (less imperilled) species, specifically; this enables us to generate the sample size necessary for population dynamic studies and to model climate change effects.

### **CONSERVATION OF HABITATS**

We are conserving, and promoting the restoration of the Acadian Forest ecosystem, as part of the regional Southwest Nova Scotia Biosphere Reserve designation. Taxonomically, we work on common (less imperilled) species, specifically; this enables us to generate the sample size necessary for population dynamic studies and to model climate change effects.

### **ECOSYSTEM SERVICES**

Again - the Acadian Forest ecosystem, and sustainable farming and forestry therein. Alternative crops (berries) to obviate the need to raise finance through clear cuts. Sustainable biodynamic farming and selective, responsible forestry practices, to minimise impacts on wildlife.

### **CONSERVATION OF CULTURAL HERITAGE**

N/A

## IMPACTING LOCAL LIVELIHOODS

We hope that as the Cook's Lake Farming Forestry and Wildlife initiative flourishes out of our EW project that our commitment to FSC silviculture and wildlife-friendly farming in a multi-functional landscape will enhance the local environment and provide an exemplar for woodlot / farm management. In time we will need to employ locals to help with harvesting and we are all-ready working with a local bee-keeper on pollination services. More broadly, our contribution to promote Haskap berry production in the Province is part of a broader growing associations' effort to promote employment and prosperity in local farming.

## LOCAL COMMUNITY ACTIVITIES

Due to health and safety restrictions, we have not mixed Earthwatch and local volunteers together. As our emphasis shift more toward sustainable land-management we are part of a Haskap growers association that seeks to advocate responsible agriculture, with hopes that this new crop will enhance the local economy in the future. Our particular interest in this is to demonstrate that farm productivity and ecosystem services are compatible, without the need to manage land in ways detrimental to wildlife.

## DISSEMINATION OF RESEARCH RESULTS

### Scientific peer-reviewed publications

Publications 2013-2014, to date: Directly involving EW data, past or present and acknowledging EW:

- Silvertown, J., Buesching, C.D., Jacobson, S.K. & Rebelo, T. (2013). Citizen science and nature conservation. In: Macdonald, D. W., & Willis, K. J. (Eds.). Key topics in conservation biology 2. Wiley-Blackwell.
- Buesching, C. D., Newman, C., & Macdonald, D. W. (2014). How dear are deer volunteers: the efficiency of monitoring deer using teams of volunteers to conduct pellet group counts. *Oryx*, 1-9.
- Buesching, C.D., Slade, E.M., Newman, C., Riutta, T., Riordan, P. & Macdonald, D.W. (in press) "Many Hands Make Light Work" - But do they? A Critical Evaluation of Citizen Science in Wytham Woods. In: *Farming and Wildlife: Conflict in the Countryside (Vol 2) OUP*.

### In prep.

- Buesching, C.D., Leaf, A. Newman, C. Zhou, Y & Macdonald, D.W. (in prep). Effects of different path types on small mammal movement patterns. (for Conservation Biology)
- Brouard, M.J., Buesching, C.D., Newman, C., Coulson, T. & Macdonald, D.W. (in prep). Previous captures affect subsequent capture success of small rodents (for Agriculture, Ecosystems and the Environment)
- Related to involvement in EW Project:
- Newman, C. & Macdonald, D.W. (2013). The Implications of climate change for terrestrial UK Mammals. Terrestrial biodiversity Climate change impacts report card Technical paper. Living with environmental change partnership.
- Macdonald, D.W., Feber, R., Newman, C. & Raebel, E. (in press). War or Peace: farming and wildlife. In: *Farming and Wildlife: Conflict in the Countryside (Vol 2) OUP*.
- Buesching, C., Slade, E., Merckx, T. & Macdonald, D.W. (in press). Local and landscape-scale impacts of wooded habitats and their management on wildlife. In: *Farming and Wildlife: Conflict in the Countryside (Vol 2) OUP*. Other papers by PIs 2013-14, independent of EW data:
- Campbell, R. D., Newman, C., Macdonald, D. W. and Rosell, F. (2013). Proximate weather patterns and spring green-up phenology effect Eurasian beaver (*Castor fiber*) body mass and reproductive success: the implications of climate change and topography. *Global Change Biology*, 19: 1311-1324.
- Bilham, K., Sin, Y. W., Newman, C., Buesching, C. D., & Macdonald, D. W. (2013). An example of life history antecedence in the European badger (*Meles meles*): rapid development of juvenile antioxidant capacity, from plasma vitamin E analogue. *Ethology Ecology & Evolution*, 25(4), 330-350.
- Zhou, Y-B., Newman, C., Chen, J., Xie, Z-Q. & Macdonald, D.W. (2013). An anomalous and extreme weather event disrupts an obligate seed dispersal mutualism: Snow in a sub-tropical forest ecosystem. *Global Change Biology*, 19(9), 2867-2877.
- Zhou, Y., Newman, C., Xie, Z., & Macdonald, D. W. (2013). Peduncles elicit large-mammal endozoochory in a dry-fruited plant. *Annals of botany*, 112(1), 85-93.
- Raichev, E. G., Tsunoda, H., Newman, C., Masuda, R., Georgiev, D. M., & Kaneko, Y. (2013). The reliance of the golden jackal (*Canis aureus*) on anthropogenic foods in winter in central Bulgaria. *Mammal Study*, 38(1), 19-27.

- Zhou, Z.-M., Zhou, Y., Newman, C. & Macdonald, D.W. (2014). Scaling up pangolin protection in China. *Frontiers in Ecology and the Environment*, 12: 97-98.
- Noonan M.J., Markham, A., Newman, C. Buesching, C.D., Ellwood, S.A. & Macdonald, D.W. (2014) Climate and the Individual: Inter-Annual Variation in the Autumnal Activity of the European Badger (*Meles meles*). *PloS one*, 9(1), e83156.
- Zhou, Z.-M., Zhou, Y., Newman, C. & Macdonald, D.W. (2014). Synthetic ivory fails to stop illegal trade. *Nature*, 507: 40.
- Kaneko, Y., Kanda, E., Tashima, S., Masuda, R., Newman, C. & Macdonald, D.W. (in press) Japanese badger (*Meles anakuma*) socio-spatial dynamics *Journal of Mammalogy* 95: 290-300.
- Zhou, Y.B., Newman, C., Palomares, F. Xe, ZQ., Zhang, S. & Macdonald, D.W. (in press). Spatial organization and activity patterns of the masked palm civet *Paguma larvata* in subtropical forest in China. *Journal of Mammalogy*.
- Annavi, G., Newman, C., Buesching, C.D., Burke, T., Macdonald, D.W. & Dugdale, H.L. D.W (in press) Heterozygosity-fitness correlations in a wild mammal population: single locus, paternal and environmental effects. *Ecology and Evolution*.
- Annavi, G., Newman, C., Dugdale, H.L. Buesching, C.D., Sin, Y.W. Burke, T & Macdonald, D.W (in press) Neighbouring-group composition and relatedness drive extra-group paternity rate in the European badger (*Meles meles*). *Journal of Evolutionary Biology*.
- Macdonald, D.W., Newman, C. & Buesching, C.D. (in press) Badgers in the rural landscape - Conservation paragon or farming pariah: Lessons from the Wytham Badger Project. Book Chapter: In: *Farming and Wildlife: Conflict in the Countryside (Vol 2)* OUP.
- Buesching, C. D. & Jordan, N.R. (in press). "Small carnivore latrines in space and time (with special emphasis on badgers and mongooses)". In :*Small Carnivores in Space and Time: Part II*.

#### Submitted

- Sin, W.A., Dugdale, H.L., Newman, C., Burke, T. & Macdonald, D.W. (invited re-subm) Pathogen burden, co-infection and major histocompatibility complex variability in the European badger (*Meles meles*). *Molecular Ecology*.
- Sin, Y.W., Annavi, G., Dugdale, H.L., Newman, C., Buesching, C.D., Burke, T. & Macdonald, D.W. (Invited re-subm) MHC-associated mate choice in a carnivore population: preference for genetic compatibility in extra-group mating but not within-group mating. *Molecular Ecology*.
- Noonan M.J., Markham, A., Newman, C. Trigoni, N., Buesching, C.D., Ellwood, S.A. & Macdonald, D.W. (Subm) Den use by a fossorial carnivore: uncovering European badger subterranean activity patterns *Methods in Ecology and Evolution*.
- Tinnesand, H.V., Buesching, C.D., Zedrosser, A., Rosell, F. & Macdonald, D.W. (subm). The role of anal gland secretion in mediating socio-spatial contact networks in European badgers (*Meles meles*): behavioural consequences of perturbation. *Ecology*.
- Zhou, Y.B., Chen, W., Kaneko, Y., Newman, C., Liao, Z., Zhu, X. Buesching, C., Xie, Z. & Macdonald, D.W. (Subm). Seasonal variation in diet and food resource exploitation by the Hog badger (*Arctonyx collaris*) in a subtropical forest of China. *European Journal of Wildlife Research*.
- Zhou, Y.B., Chen, W., Buesching, C.D., Newman, C., Kaneko, Y., Xiang, M. Nie, C., Macdonald, D.W. and Xie, Z. (Subm) Hog badger (*Arctonyx collaris*) latrine use in relation to environmental food abundance: Evidence of the scarce factor paradox. *Ecosphere*.
- Hisano, M., Raichev, E.G., Peeva, S., Tusunoda, H., Newman, C., Masuda, R., Georgiev, D.M. & Kaneko, Y. (subm). Comparing the summer diet of stone martens (*Martes foina*) in urban and natural habitats in Central Bulgaria. *Ethology, Ecology & Evolution*.
- Chen, W., Newman, C., Liu, Z., Kaneko, Y., Omote, K., Masuda, R., Buesching, C.D., Macdonald, D.W., Xie, Z. & Zhou, Y. (Subm) The illegal exploitation of hog badgers (*Arctonyx collaris*) in China: Genetic evidence exposes impacts on regional populations. *Conservation Genetic Resources*.
- Campbell, R. D., Newman, C., Macdonald, D. W. and Rosell, F. (Subm) Senescence and reproductive trade-offs in the monogamous Eurasian beaver: resource history influences senescence rates. *Proceedings of the Royal Society B*.
- Sun, Q., Stevens, C., Newman, C., Buesching, C.D. & Macdonald, D.W. (in prep). Cumulative experience, age-class, sex and season affect the responses of European badgers (*Meles meles*) to handling and sedation. *Animal Welfare*.

#### Grey literature and other dissemination

Note: our LFF Teacher team in 2013 blogged extensively, posted video on Youtube, and were variously evolved with the media in their home towns.

## SECTION THREE: Anything else

### **IS THERE ANYTHING ELSE YOU WOULD LIKE TO TELL US?**

We have enjoyed our 100 teams and 1000 volunteers over the last 15 years of working with EW immensely - it has been a big part of our lives. We hope to continue to work with EW in some capacity in the future and may yet find ways to integrate volunteer participation into our new wildlife-friendly farming initiative.



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