Natural resources and
bioeconomy
studies 21/2016

The XVI Nordic Congress of Wildlife Research

Transdisciplinary Wildlife Management

Arctic Centre, Rovaniemi, Finland, May 31-June 3, 2016

Abstracts

Vesa Ruusila and Jani Pellikka (eds.)

Luke
NATURAL RESOURCES
INSTITUTE FINLAND

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The XVI Nordic Congress of Wildlife Research

Preliminary programme

MONDAY 30 MAY	
19:00–21:00	Registration (Pilke, Ounasjoentie 6, map)
20:00–22:00	Ice-breaker (Pilke)
TUESDAY 31 MAY	
08:00–17:00	Registration and Info desk open
09:00–09:15	Opening Ceremony Welcoming words by Chair of the Congress Vesa Ruusila Other speakers will be named later
09:15–10:00	Keynote 1: Camilla Sandström
10:00–10:20	Coffee
10:20–11:20	Session A1: Hunters as citizen scientists
10:20–11:40	Session B1: Understanding population dynamics and human benefits
11:20–12:20	Session A2: How to manage large birds?
12:20–13:20	Lunch
13:20–14:40	Session A3: From new ideas and concepts to concrete actions
13:20–14:40	Session B2: Making arguments for and against lethal management
14:40–15:00	Coffee
15:00–17:00	Session A4: Large carnivore governance and conflicts
19:00–20:00	City Reception, Rovaniemi City Hall (Hallituskatu 7)
WEDNESDAY 1 JUNE	
09:00–10:00	Introduction of the excursion themes and organizers
10:00–19:00	In-Congress Excursion, Theme: Reconsiling wildlife habitat requirements and natural resource use, Organizers: Ari Nikula & Ilpo Kojola
THURSDAY 2 JUNE	
08:00–17:00	Registration and Info desk open
09:00–09:50	Keynote 2: Jean-Michel Gaillard
09:50–10:10	Coffee
10:10–11:30	Session A5: The ecosystem effects of predation
10:10–12:10	Session B3: Estimating population sizes of large mammals
11:30–12:30	Session A6: New strategic avenues in managing wildlife-human interactions
12:10–13:10	Lunch
13:10–14:10	Session A7: Human impact on wildlife habitats and resources
14:10–14:30	Poster session and serving
14:45–17:00	WORKSHOP: Practicing transdisciplinary wildlife research, Chair: Juha Hiedanpää
19:00–23:00	Congress Dinner

FRIDAY 3 JUNE	
08:00–14:00	Registration and Info desk open
09:00–09:50	Keynote 3: Ilpo Kojola
09:50–10:10	Coffee
10:10–11:45	Panel discussion: Challenges of the Nordic wolf management Moderator and panelists: Will be named later
11:45–12:15	Summary and Closing Ceremony
12:15–13:50	Lunch (OR Bus to the airport, snack)

Welcome to the exhibitions in the Arktikum and Pilke

NKV 2016 congress guests can visit the Arktikum and Pilke Exhibitions freely during the conference.

The changing exhibitions:

Northern Impressions photo exhibition

A new way to see Nordic nature, Irma Varrio & Ari-Matti Nikula

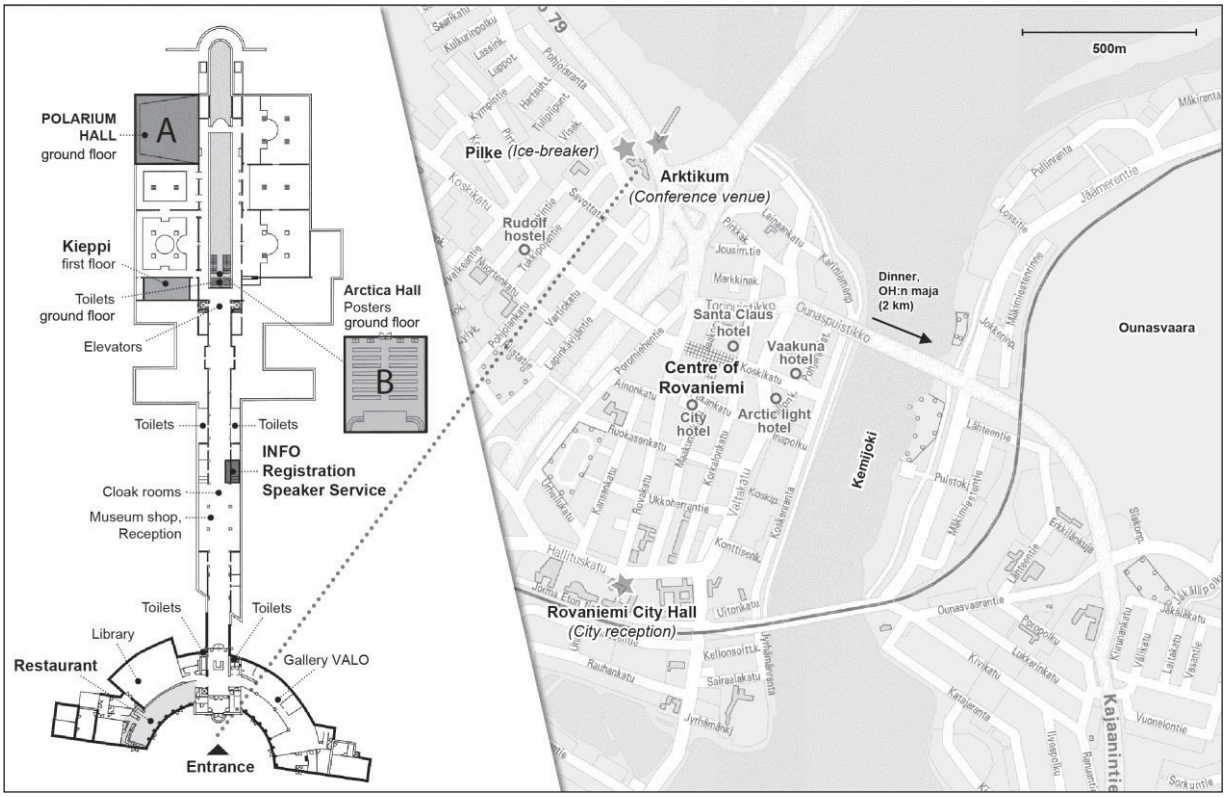
NAM NAM – Arctic food, snacks and grub

What does Arctic taste like? In exhibition you can see, smell and maybe even taste a bite of Northern nature. Opening Thursday 2 June 2016 at 16 p.m.

See the forest for the trees

At the Science Centre Pilke exhibition you will have the opportunity to explore the forest with all your senses and from many different angles.

Venue map



Welcome to the XVI NKV Congress ‘Transdisciplinary Wildlife Management’!

Dear Friends and Colleagues,

On behalf of the Nordic Board for Wildlife Research (NKV) and the co-organizers, we are pleased to welcome You to the XVI NKV Congress!

NKV was founded in the early 1970’s to promote Nordic wildlife research and foster co-operation, not only among researchers but also between researchers and wildlife managers. Corresponding Nordic organizations were founded and still running in many research fields, such as forestry and agriculture. Increasing networking and exchanging of knowledge between the variety of disciplines and in the science-management interface were acknowledged as essential parts of doing science and sustainable management.

Wildlife issues are increasingly present in every day media from various points of view. Species emerge too abundant and causing damage, too rare and subject to severe population decline, the potential vectors of zoonosis, too cute or too frightening, to mention some of the views. Encounters between wildlife and people with increasing different backgrounds may have complex consequences, and, unfortunately, also conflicts may arise. The complex societal problems increasingly call for research that helps to tackle the problems and make the difference.

Although at the dawn of NKV ecological research was the main source of finding solutions for human-wildlife problems, last decades have raised and proved the importance of approaches that take advantage of the variety of research approaches, data sources and tools. Interactions between animal behavior and human attitudes create complex interactions and wicked problems. Reliable knowledge, and most importantly, proper action are required in solving these cases in practice. A need for transdisciplinary approach and interaction with management is obvious – that is why we are here in Rovaniemi.

Running a congress is also a joined effort of many actors. We wish to thank Natural Resources Institute Finland, University of Lapland and the Arctic Center, Metsähallitus, ONCFS and our sponsors for their effort and contribution. We also want to thank the members of the scientific and the organizing committees for their valuable work. There is no congress without people willing to learn and share their knowledge, ideas and thoughts. We express our warmest thanks to participants presenting their work and actively participating in the discussions. You all make this XVI NKV Congress possible. We hope that you will enjoy the congress!

Vesa Ruusila
Chair of the Nordic Board for Wildlife Research

Jani Pellikka
Secretary of the Nordic Board for Wildlife Research

Contents

KEYNOTE ABSTRACTS

Collaborative governance and the wolf: Attitudinal patterns in a rural and urban context

Camilla Sandström
Umeå University, Umeå, Sweden

Participation has become an important part of new processes of governance, acknowledging actors to play a role in shaping the rules and objectives of governing, and management of large carnivores. These processes are often motivated by the idea that participation improves public input into, and support for, policy making and implementation, or, that they support democratic values by adopting a more inclusive and deliberative form of decision making. Despite the strong motives in favor of collaborative governance it has proved to be difficult to implement various forms of governance arrangements. Studies based on interviews and surveys with members of large carnivore committees confirms deficiency both in terms of policy output and democratic quality, which tend to reduce the support for collaborative arrangements. Despite the lack of success, our studies show a strong and increasing support for collaborative governance among the public. However, attitudes to collaborative governance of large carnivores, challenge traditional attitudinal patterns and suggest a strong role for social identity in why people support or oppose large carnivore policy.

Current prospects of large carnivore management in Northern Europe

Ilpo Kojola
Natural Resources Institute Finland (Luke)

To facilitate protection of species that are valued at a global scale, but have negative value at a local scale, due to public fears and damage to livestock, is a major challenge to management of large carnivore (LC) populations. Due to low human densities northern LC species have been doing better than southern species. The recent expansion into human-dominated landscapes in Europe set new challenges to large-carnivore human co-existence. Damages to livestock and other human property caused by LCs, are most comprehensively compensated in countries with high per capita gross domestic product (GDP), but brown bear (*Ursus arctos*) and wolf (*Canis lupus*) densities in Europe are negatively related to GDP. This relationship is very strong for the wolf and do not exist for the Eurasian lynx (*Lynx lynx*). These patterns are likely explained by the public image of different carnivore species and political history in Europe. Although the existence of compensation system or the compensation paid for the damages are not keys to higher large carnivore densities they might be a necessity for the presence of large carnivores in countries with high GDP. Innovative compensation systems may enhance conservation of large carnivores, e.g. paying for their presence that is maybe the primary reason for the recovery of wolverine (*Gulo gulo*) population in the reindeer husbandry area of Sweden. Fear of bears and wolves is relatively common in Nordic Countries where bears have attacked humans in recent years. Although these attacks are still rare they have been becoming more common due to increased number of bears and peoples' outdoor activities. Wolves made nightly visitations close to human residences in territories with high residence density and although e.g. sub-adults may gradually begin to decrease such visitations, social pressure to remove such wolves is sometimes very strong. Large carnivore-human conflict compasses a high diversity of case-by-case reasons where predation on harvestable ungulate prey, loss of reindeer to LCs and wolf attacks on domestic dogs is common to all Nordic Countries. Management of brown bear and lynx is relatively successful in Northern Europe in terms population numbers and the intensity of conflicts but wolf management is really disputed although compromises are a necessity for sustainable solutions.

SESSION ABSTRACTS

A1.1 Hunters and Trappers as Citizen-Scientists

James Anderson, Christopher Rota, Stephanie Landry, Saahirah Cua, Hannah Clipp
West Virginia University, Morgantown, WV, USA

Citizen science relies on nonprofessional volunteers collecting or processing data as part of scientific investigation. Over the past decade the number of citizen science projects that contribute to scientific knowledge has increased. Technological advances (game cameras and smart phone applications) have increased the potential for the general public to contribute. While the phrase "citizen scientist" is relatively new, hunters have been critical sources of data for decades. For example, the United States and Canada solicit ducks wings and goose tails from hunters to obtain data on species, sex, and age demographics, which is critical in monitoring population trajectories and setting harvest limits. West Virginia solicited donations of bobcat carcasses from hunters and trappers to obtain reproductive, age, diet, and parasite information, which is being used to update population demographic models. Numerous agencies request that hunters and trappers voluntarily provide harvest information. Some agencies rely on hunters to report numbers of predators or winter kills observed while spring turkey hunting. Benefits of involving hunters or trappers as citizen scientists include stronger connections between the management agency and their constituency groups, increased efficiency of limited research and monitoring funds, the ability to tap into a work force that vastly exceeds an agency's capacity to cover large areas, the development of more robust databases, and more rapid advance of scientific knowledge. This study provides an overview of the historic and contemporary role of hunters and trappers in citizen science and begins to examine ways of more effectively incorporating hunters as citizen scientists.

A1.2 Wildlife monitoring: The rise of citizen science

Nirmala Séon-Massin[1], Philippe Aubry[1], Clément Calenge[1], Murielle Guinot-Ghestem[2], Eric Marboutin[2], François Reitz[1], Sandrine Ruette[3]
[1]French National Hunting and Wildlife Agency (ONCFS), Saint Benoist, France, [2]French National Hunting and Wildlife Agency (ONCFS), Gières, France, [3]French National Hunting and Wildlife Agency (ONCFS), Birieux, France

Compared to other Earth observation fields, wildlife monitoring is usually poorly funded. Moreover, many observation techniques still rely on human observation rather than sophisticated technologies. In this context, citizen sciences appear as a promising way to collect large amounts of wildlife data while based on a low budget and decreasing academic manpower. Drawing on the 30 year experience of wildlife monitoring gathered at the French National Hunting and Wildlife Agency (ONCFS), several research and management questions can be addressed:

(i) How to optimize the use of opportunistic data? Both lynx and mustelid species display elusive behaviour and assessing population densities can be challenging. Recent research led to new statistical methodologies to handle opportunistic data.

(ii) Estimating hunting bags: so-called census of hunters' declaration or true probabilistic survey? A recent national hunting bag survey allows to discuss of both approaches regarding the non-response bias.

(iii) Enabling managers to conduct their own monitoring: how to develop monitoring schemes and protocols that are both scientifically sound and adapted to the manager's capacity? How to estimate regional trends from a selection of territories conducting local monitoring of small game?

In conclusion, this wide array of examples shows interesting promises from the mobilization of citizens and non-scientific professionals to monitor wildlife, as well as some pitfalls to avoid.

A1.3 Co-producing knowledge: The making of wolf monitoring data in Finland

Annaleena Hytönen[1], Jani Pellikka[2]
[1]University of Helsinki, Helsinki, Uusimaa, Finland, [2]Natural Resources Institute Finland, Helsinki, Uusimaa, Finland

Volunteer participation in wildlife monitoring and research is increasingly justified not only because it offers possibilities to reduce the cost of field work, but because it is believed to enlarge the range of opportunities for public participation in wildlife governance. It has been assumed to provide legitimate and socially more robust knowledge, to increase public awareness of environmental problems, to empower citizens to participate in political debate, and to increase their scientific literacy and "intellectual capital".

As a case of collaborative monitoring, the population monitoring of wolves is probably the most controversial one. Many hunters have negative attitudes toward wolves and wish to decrease the population size. Yet, hunters are active volunteers in Finnish wildlife monitoring programs, including that of year-around monitoring program of wolves. In our presentation we explore what kind of participation profiles there are among Finnish volunteers in wolf monitoring in 2001–2002, 2005–2006 and 2010–2013. Our aim is to preliminary characterize the factors affecting the participants' activity as volunteers. We analyze the temporal trend in the number of participants, the rate of volunteer retention, and the number of personal records (sightings) made. We also analyze the profiles of the contents in participants' written comments given as supplementary information in the meta-data of the sightings.

Our analysis identifies tensions between expected and actual forms of volunteering, and discuss the roles that new technology assisting in collecting, maintaining and visualizing large carnivore records have played in volunteer participation in the knowledge production.

A2.1 Large grazing birds and agriculture-predicting field use of common cranes and implications for crop damage prevention

Lovisa Nilsson[1], Nils Bunnefeld[2], Jens Persson[1], Johan Månsson[1]
[1]Swedish University of Agricultural Sciences, Riddarhyttan, Sweden, [2]Stirling University, Stirling, UK

Increasing numbers of previously threatened large grazing birds are causing crop damage along their flyways worldwide. The number of reported crop damage incidents caused by common cranes is escalating which raises the need for evidence-informed preventative strategies. We surveyed fields for autumn staging common cranes in an area surrounding a wetland reserve in Sweden. We assessed the following factors in relation to the probability of crane presence on fields: crop stage/type, distance to roost, time of day, field size and time since harvest. Stubble fields had the highest probability of cranes, progressively decreasing through grassland, bare soil to growing crop. A stubble field at 5 km from a roost had a predicted mean probability of cranes of 0.25. The probability of cranes visiting a field was linearly and negatively related to distance to the roost, e.g. the probability increased from 0.05 to 0.09 when distance decreased from 5 to 1 km. At stubble fields, the probability of cranes decreased with time since harvest and was highest for barley. Scenario predictions developed from the models demonstrated that the mean probability of cranes could be high, 0.60, if all favorable factors were combined (barley stubble, 1 day after harvest, 1 km from roost). Based on our results, crop preventative strategies should focus on providing stubbles as diversionary fields close to roosts. Stubble field availability can be achieved by careful crop rotation planning. We suggest that crop rotation and time of harvest should be added to flyway management plans recently developed for some species to facilitate co-existence between conservation and agriculture.

A2.2 Changes in numbers and distribution of staging and wintering goose populations in Sweden 1977/78–2015/16

Leif Nilsson
Lund University, Biology Department, Lund, Sweden

Regular monitoring of the staging and wintering goose populations in Sweden started with a NKV-project on Bean Geese in the late seventies and is still ongoing. Counts are organized in September, October, November and January (parallel with the International Waterfowl Counts) each year since the start in 1977/78, being coordinated internationally through the Goose Working Group of Wetlands International.

Over the years marked changes in numbers of staging and wintering geese have been noted in Sweden. The Taiga Bean Goose has shown a decrease since a peak in the early eighties but in later years a staging and wintering habit has been established for the Tundra subspecies. During the same period there was a change in the autumn staging distribution of the species in the country. When the counts started few Greylags were staying in Sweden during the autumn, but over the years the staging population increased (in parallel with the breeding population) and reached a peak of more than 200,000. At the same time the migration habits changed and a wintering traditional was established in south Sweden. During the last fifteen years there was a marked change in the migration pattern of European Barnacle Geese and an autumn staging tradition started in Sweden, the autumn total for the species going from a few hundred to more than 300000 recently, the species also establishing a wintering tradition in the country.

A2.3 Genetic methods for determining subspecies composition of bean goose harvests

Johanna Honka[1], Laura Kvist[1], Marja E. Heikkinen[1], Pekka Helle[2], Jeremy Searle[3], Jouni Aspi[1]
[1]University of Oulu, Oulu, Finland, [2]Natural Resources Institute Finland, Oulu, Finland, [3]Cornell University, Ithaca, NY, USA

Management of harvested species is of great importance in order to maintain a sustainable level of harvest. Genetics is however largely neglected in management plans, which is also the case in goose management. Here, we have studied genetics of the bean goose (*Anser fabalis*), in order to plan management actions for the declining subspecies, the taiga bean goose (*A. f. fabalis*), hunted throughout most of its range. We used mitochondrial DNA and microsatellites to determine the subspecies composition of the Finnish bean geese harvests, as the hunting bag consists of the declining taiga bean geese and of stable tundra bean geese (*A. f. rossicus*). We also determined the existence of the eastern subspecies (*A. f. serrirostris*, *A. f. middendorffii*) in the Finnish hunting bag and searched for possible interspecific hybrids. We estimated also the genetic diversity, genetic structure and sex-biased gene flow of the subspecies. Most of the harvested bean geese belonged to the taiga bean goose, whereas most of the tundra bean goose harvest was found to be geographically restricted to southeastern Finland. We also detected eastern *A. f. serrirostris* mtDNA haplotypes and evidence of interspecific hybridization with other *Anser* species. The mtDNA data supported strong genetic structure, while microsatellites showed much weaker structuring. This is probably due to the extreme female philopatry of the species. The taiga bean goose had lowered genetic diversity compared to other subspecies, warranting for management actions.

A3.1 Urban wildlife management in Germany – Governance concepts beyond hunting

Geva Peerenboom[1], Ilse Storch[1], Ulrich Schraml[2]
[1]Wildlife Ecology & Management, Faculty of Environment and Natural Ressources, Univerity of Freiburg, Freiburg im Breisgau, Germany, [2]Forest Research Agency of Baden-Wuerttemberg, Freiburg im Breisgau, Germany

Wildlife species adapting successfully to urban areas cause a variety of human-wildlife conflicts ranging from economic damages to threats to health and security. In urban areas wildlife management faces particular challenges: human densities are high, and control of wildlife population is delicate. In Germany, the management of game species is assigned to hunting authorities and traditionally focuses on population numbers. We argue that these governance structures do not support rationality and adaptability, which are key elements to wildlife management models. To challenge this assumption, we analyzed urban wildlife management systems in seven cities in four German federal states. We conducted semi-structured interviews with wildlife management representatives and analyzed complementary documents. We found that all cities used lethal wildlife control methods, although expensive and of little success. The majority of cities made little use of alternative intervention techniques, which we link to the fact that human-wildlife conflict management is no official task of hunting authorities. Only in few cases management interventions were monitored and evaluated systematically, which is an indicator for missing adaptability. Cases with high rationality and adaptability showed a high level of stakeholder involvement in the planning and implementation process. According to our results we suggest urban, district and state authorities to address urban wildlife management deliberately. Concepts for more holistic approaches beyond hunting are needed. Governance structures should support rationality and adaptability of the management systems to increase success.

A3.2 Evaluating a management indicator from an biological, ecological, and social perspective

Wiebke Neumann[1], Camilla Sandström[2], Lars Östlund[1], Göran Ericsson[1]
[1]Swedish University of Agricultural Sciences, Umeå, Sweden, [2]Umeå University, Ume, Sweden

The implementation of environmental management milestone targets require measurable goals as well as a specification of their monitoring and evaluation. An actual example is the implementation of the National Environmental Quality Objectives (EQO) such as A Magnificent Mountain Landscape. We evaluated whether the milestone target a landscape characterized by grazing can be applied from a biological, ecological, and humanistic perspective merging results from analyses on (1) historical landscape use, (2) current wildlife landscape utilization, and (3) stakeholder document and interview analyses using a structured decision-making process. Our results indicate that in order to maintain a landscape with a grazed character and thereby contributing to biodiversity and cultural values requires the combined information from all three data sources. As such, knowledge about the historical use of the mountain landscape as well as knowledge about how the reindeer and moose currently utilize this mountain landscape, and a consensus among key stakeholders is crucial to define what the term a landscape characterized by grazing means, i.e., defining a measurable goal, and thereby setting the scene what to measure and what to follow up. A structured decision-making process coupled with adaptive management is a key tool to map discrepancy among definitions by stakeholders and to help to agree on common goals, as well as to evaluate management alternatives.

A3.3 Grouse-friendly forest and peatland management in state-owned commercial forests managed by Metsähallitus in Finland

Ahti Putaala[1], Maarit Kaukonen[2], Antti Otsamo[3], Mikko Rautiainen[1]
[1]Metsähallitus, Parks & Wildlife Finland, Oulu, Finland, [2]Metsähallitus, Forestry, Oulu, Finland,
[3]Metsähallitus, Forestry, Vantaa, Finland

Metsähallitus manages state-owned lands which cover about one third of the land area of Finland. State-owned lands being managed by one organization enables the management of wildlife habitats in unified methodologies.

Forest management impacts to game species' populations on many levels from a nesting site of a single bird to a landscape level. Metsähallitus uses Region-Ecological planning as a tool to secure connectivity of game habitats. On a site level the focus is in preserving certain features of favourable habitats for game. The common nominator is a mixed forest type with sufficient understory (shelter) and a rich layer of shrubs (food).

Management of capercaillie lek sites is more demanding in terms of forestry practices. Typically a capercaillie lek area covers a couple of hundred hectares and a lek site is roughly 20 hectares. Currently there are more than 2,500 lek sites in the GIS-system which can be treated only with small scale, maximum one hectare clear cuttings. The lek center should be left untouched.

Metsähallitus has developed a cost-effective method to restore peatland grouse habitats. Forestry planners recognize suitable sites and prepare a site-specific work plan. Sites for implementation are selected together with wildlife specialists. By the end of 2015 nearly 4000 hectares of habitats were restored.

Methods of grouse-friendly forest management are under constant development in Metsähallitus. The latest step in the progress is so called "doughnut thinning", which aims at diversifying often monotonous young forest habitats in connection to thinning procedures.

Keywords: Grouse, forest management, restoration, adaptive management

A3.4 Augmenting our armoury in the war against invasive alien species: Adaptive management and the evolution of techniques used to find, attract, catch and remove invasive mammalian predators

P-A Åhlén[1], Fredrik Dahl[1,2]
[1]Swedish Association for Hunting and Wildlife Management, Nyköping, Sweden, [2]Dep. of Ecology, Swedish University of Agricultural Sciences, Grimsö, Sweden

The management of invasive species has advanced hugely over the last few decades. This is particularly true of eradications where species such as brown and black rats, feral cats and rabbits have been removed from islands of ever increasing size. Managing invasive species however is still expensive. Invasive species, particularly mammals, are often illusive and hard to detect or monitor at low density. The areas from which they need to be removed are often vast or topographically challenging, making the costs of removal prohibitively expensive. They are difficult to then remove from the environment, either lethally or through live-capture trapping, due to many reasons such as lack of management knowledge and species specificity in the techniques available. This presentation looks at how some of these challenges have been overcome at each stage of the management process. We explore novel methods that are being developed to detect species. We look at how live capture techniques can be made more effective through the use of scent glands, lures and attractants. Efforts to improve the effectiveness of lethal and non-lethal management techniques are discussed by exploring ways in which they are being made more affordable, species specific or less resource hungry. Strategies discussed include the use of self-setting or self-reporting traps. These advances in technology are described using case examples, and highlight how they have enabled managers to cover larger areas for less cost.

A4.1 The evolution of reasonableness in Finnish wolf policy

Juha Hiedanpää
Natural Resources Institute Finland, Turku, Finland

Since Finland joined the EU in 1995, the European Commission has showed a continuous concern over Finland's wolf policy. After the Infringement Procedure (2001-2005), the European Court of Justice (ECJ) found Finland guilty of the unselective hunting of the wolf in 2007. Since then Finland has revised the hunting legislation and related administrative practices several times. The wolf population size first decreased from 250 (2005) to 125 (2013) and then increased again to some 230 wolves (in 2015). By the means of updating the wolf management plan (2014-2015) and its hunting-oriented measures (2015-2016), the wildlife administration, it seems, has seemingly managed to turn the trend. My research question is: how has the reasonableness of Finnish wolf policy changed during the past ten years? I will answer the question by applying the habit-based conception of reasonableness by philosopher Charles S. Peirce (1839-1914) and the theory of reasonable valuation by institutional economist John R. Commons (1864-1952). As empirical data, I will use the legal and policy documents and ten semi-structured interviews from the spring of 2016. As I write this abstract, half of the interviews with the key actors in Finnish wolf politics and policy are completed. In my presentation, I will give a critical assessment of Finnish wolf policy and indicate some points of weakness and strength from the view point of concrete reasonableness. I conclude the presentation with a rather simple insight that reasonableness – as a logical and ethical policy principle – is a key feature of good governance.

A4.2 Exploring instrumental and symbolic constitutive conditions for environmental communication: The case of the Swedish Wildlife Management Delegations

Annelie Sjölander Lindqvist[1,2], Madeleine Prutzer[1,2]
[1]School of Business, Economics and Law, GRI, Gothenburg, Sweden, [2]School of Global Studies, Gothenburg, Sweden

To resolve human-wildlife conflicts and advance decision-making on the management of large carnivores in Sweden, stakeholders and politicians have been enrolled to participate in regional Wildlife Management Delegations. By involving a diverse set of interests, including forestry, fishery, tourism, land use, outdoor life and nature conservation, as well as politicians at the local and regional level, the idea is that the legitimacy of both the management system and its outcomes will be strengthened. Research on the ability of collaborative measures in natural resource management to consolidate diverse voices, interests and knowledge frames, emphasizes a range of problems which can affect the process; including the dimensions of equality, the degree of knowledge on the topics to be discussed and decided upon, fragmented ideas and lack of capacity to focus, variation in process between different institutions, sense of inclusivity and accountability among the participants, and organizational culture favoring certain themes and directions in advice and decisions. This study explores, through personal interviews, the work of two delegations, and highlights the instrumental and symbolically constitutive conditions for advising and decision-making.

A4.3 Quota-regulated hunt for wolves in Sweden: Analysis of media frames 2010 and 2015

Annelie Sjölander Lindqvist, Jenni Sandström Lindberg
University of Gothenburg, Göteborg, Sweden

In October 2009 the Swedish Government passed a resolution on management reforms to facilitate mutual agreement on the disputed presence of wolves in rural areas. One of the reforms was the introduction of quota-regulated licensed hunt for wolves, argued to help the establishment of collaborative governance, the building of consensus on national predator policy and supporting recovery of the Scandinavian wolf population. The present study investigates how printed media reports on the implementation of this measure by means of inductive framing analysis. Focus was directed towards this reporting, motivated by the understanding that media in its communication role has the power to control the themes reported, and consequently assumes an important role in shaping public opinions, perceptions and attitudes in wildlife management. By emphasizing certain aspects of an issue and taking this as lead in the organization of the text, media can through the providing of meaning, a frame for understanding, amplify positive or negative depictions associated with the phenomenon covered. Articles, editorials and columns from newspapers with regional and national coverage were analyzed. We analyze media material from 2010, as it was the first quota-regulated wolf hunt in fifty years, and include 2015 to provide a frame for comparison. The study offers insight into the ways Swedish media conveyed and evaluated information on the hunting of wolves, which actors that are heard in the debate, and how certain aspects of a particular situation or phenomenon were highlighted while downplaying others in order to make a news story.

A5.1 Egg predation by raccoon dog Nyctereutes procyonoides in the archipelago of northern Sweden

Fredrik Dahl[1,2], P-A Åhlén[2]
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The raccoon dog *Nyctereutes procyonoides* is a medium-size canid native to East-Asia and introduced to Eastern Europe 1929–1955. Since then it has spread and established viable populations over large parts of the rest of Europe. Currently it is invading Scandinavia, both from the south into Denmark and from the east, into northern Sweden. Raccoon dogs are suspected to have negative impact on populations of ground nesting birds, especially in insular habitats. Nevertheless, their role as active predators is debated and firm scientific evidence of their negative effects on bird fauna is currently largely lacking.

In an ongoing study we are investigating; 1. How and when raccoon dog move in the archipelago of northern Sweden, 2. If raccoon dogs arriving to an island will find hidden nests and eat the eggs, 3. If egg predation by raccoon dog is additive or compensatory to predation from natural predators.

In summer of 2015, 20 artificial nests were constructed on two islands. One GPS collared raccoon dog was released on each island. A game camera was directed towards each nest during the study to be able to determine their faith.

After 9 days all but one nest were predated when raccoon dogs were present on the islands. In 16 cases raccoon dog was the predator. When the study was repeated without raccoon dogs present only 1 nest was predated after 20 days, all other nests were intact. In summer of 2016 the experiment will be repeated, both with artificial and natural nests.

A5.2 Moose movement pattern and grouping behaviour in relation to wolf predation risk

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In a predator-prey system, prey species may adapt to the presence of predators with behavioural changes such as alterations in their movement pattern or grouping behaviour. In North America, moose (*Alces alces*) have shown behavioural adaptations to presence of predators, but such anti-predator behavioural responses have not yet been found in Scandinavian moose in response to the re-colonization of wolves (*Canis lupus*). We used GPS-collared female moose to study travel speed and direction of movement, and aerial observations of moose to study grouping behaviour, in relation to wolf predation risk as well as to prey population and environmentally-related variables. Both travel speed and the direction of movement was affected by time of year and reproductive status. Wolf predation risk was not an important factor affecting movement pattern of moose. Likely causal factors to the lack of effect of wolf predation risk include high moose to wolf ratio and intensive hunting harvest of the moose population during the past century. Moose mostly stayed solitary or in small groups independent of whether they were observed inside or outside wolf territories. Other variables such as moose density, snow depth and adult sex ratio were overall more influential on grouping behaviour than wolf predation risk. However, the results showed a sex specific difference in social grouping in relation to wolf presence where males formed larger groups in areas with wolves. Our results suggest that caution should be taken as to generalize about the effects of returning predators on the behaviour of their prey.

A5.3 The effect of common apex predator to the activity and habitat use of red fox in Finland

Katja Holmala
Natural Resources Institute Finland, Vantaa, Finland

The circadian activity and habitat use of red foxes (*Vulpes vulpes*) and Eurasian lynx (*Lynx lynx*) were studied in southern Finland from 2009 to 2014. The aim was to find out how red fox activity and habitat use is affected by both landscape (available habitat types) and the presence of a larger predator. Foxes showed large individual variation in their habitat use but seemed to select fields in landscape level and sparse tree cover habitats in the home range level. There were significant differences in the composition of day and night time habitats used by foxes. Analysis of the circadian activity further demonstrated the avoidance of apex predator showing that fox activity continued during those hours when lynx was less active.

A5.4 Carnivore top-down effects in a heavy anthropogenic influenced landscape: Potential for trophic cascades?

Håkan Sand, Camilla Wikenros, Johan Månsson
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A large number of studies have recently casted new light on the importance of top predators for terrestrial ecosystem processes and biodiversity. The vast majority of these studies has been performed in North America and Africa and has been restricted to a few well known protected areas. Several studies have presented results suggesting that large carnivores may have a disproportionally large effect on several trophic levels, and thereby have the potential to significantly affect ecosystem processes and causing trophic cascades. Re-colonization of large carnivores now occurs in many areas in Europe but the conditions are different to many previously studied systems. Most areas in Europe are exposed to heavy anthropogenic influence and with the size of national parks small relative to areas used by large carnivores. In Scandinavia, wolf recolonization recently resulted in a strong population growth with a population currently numbering >460 wolves and with local densities in some areas close to biological saturation. We use data from research on Scandinavian wolves and apply three different approaches to calculate the biological carrying capacity for wolves in an area of Sweden which have high potential for future colonization. For the same area we then estimate the impact by four species of ungulates on the vegetation community with another important key species in this system; humans. With this perspective, we discuss the potential for trophic cascades to occur in Scandinavia as a result of future wolf population growth and important functional differences as compared to other wolf-ungulate systems of the world.

A6.1 Improving Transboundary Protection of Marine Wildlife in an Ice-Free Arctic Ocean

Stefan Kirchner
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The Arctic Ocean will be ice free by 2040. This will mean (near-)extinction for many iconic species like polar bears, but the impact of climate change will be will far more dramatic. Many of these changes are at risk of being overlooked by policy makers. Climate change also leads to an increase in shipping, oil exploration and other uses of the Arctic Ocean. This leads to increasing stresses for the wildlife currently still found in the Arctic Ocean, e.g. through pollution or submarine noise. Already today, poleward migrations of several fish species as a result of climate change dramatically change the ecosystem of the Arctic Ocean and e.g. the North Atlantic. The international law of the sea already contains rules concerning the transboundary protection of marine wildlife. In this research project it will be shown how existing norms can be used to improve the transboundary protection of marine wildlife in an Arctic Ocean affected by climate change and increased usage claims.

A6.2 New national strategy for Swedish wildlife management

Maria Hörnell-Willebrand
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The Swedish Environmental Protection Agency introduces a new long-term strategy for national wildlife management. The strategy envisions a wildlife management in balance that allows everyone to experience the values of wildlife. It focuses on wildlife values in a broad sense – outdoor tourism, hunting and conservation of biodiversity. Everyone should have the possibility to take part in these values, regardless of background, gender, functional barriers or other circumstances. However, for that to be possible we need to develop sustainable use of wildlife and find new ways to manage, mitigate and prevent damages and other problems that wildlife causes.

The strategy describes a roadmap for the development and strengthening of Sweden's wildlife management until 2020. It is relevant for all authorities and stakeholders with interest in wildlife management and should be seen as a guide as a basis for their own strategies, goals and activities.

Nature and society both change constantly. The landscape, climate and game populations vary over time, as well as society's priorities and the way it uses the land where the wildlife lives. Sweden currently has historically large wildlife populations which are a resource used for the benefit and joy of many people but also may cause damage to livelihoods. Future wildlife management needs to be able to handle constant change, varying populations, invasive species, and new ways to manage wildlife during unexpected events due to climate-change.

A6.3 How to promote the understanding regarding sustainable use, incl. hunting, among children and young people

Madeleine Nyman
Parks and Wildlife Finland, Ekenäs, Finland

Our relation to nature is changing rapidly with the exponential development of technology and changes in lifestyle. Studies show that especially children and young people in urban areas have very little experience of fishing, hunting or other recreation in natural environments. Parks & Wildlife Finland has set a goal to challenge this change in the society through building a network of wildlife tutors in Finland. These tutors will work on a voluntary basis with children and young people in their local communities, guiding them in topics concerning wildlife and sustainable use. The aim is to inspire and promote children of all ages and all backgrounds to build up a personal relation to nature and wildlife. The 10 -year programme was launched in 2014, and is a cooperation between national administrative units and NGO´s within this field.

A network of tutors will be built up covering the whole country, based on a collaboration between local hunting, fishing and other recreational societies. In areas with existing wildlife activities for children and young people, the local actors will be asked to join the network of tutors, and will be offered tuition material and best practices. The material covers themes like species identification, wildlife management, hunting and fishing methods, ethical hunting and fishing, everyman´s right and finding your way in the wilderness. The tutors will visit school classes of different ages to teach, discuss and do things together outdoors. Children and young people will be invited to join clubs and summer camps.

A7.1 Wolverine response to timber harvest in the lowland boreal forest of northern Alberta

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Timber harvest within wolverine habitats has the potential for both positive and negative effects on wolverine populations. During timber harvest, human activity associated with harvest might displace wolverines from nearby habitats. After timber harvest, wolverines likely avoid recently created cut blocks because of a loss of cover and deep snow. In the decades after timber harvest, wolverines might return to these harvested areas to hunt small prey that take advantage of horizontal cover in regenerated cut blocks. The aim of our paper is to relate the ecological effects of timber harvest on wolverine movement and habitat selection. Our research took place in the lowland boreal forest of north-western Alberta, near the town of Rainbow Lake. Here, we live-trapped and radio-collared wolverines over three winter field seasons. Wolverine GPS data, collected at two hour intervals over these three years, forms the basis for our analyses. We use a before, during, and after (BACI) study design to document the immediate effects of local timber harvest on wolverine movements and habitat selection during both summer and winter. We then investigated wolverine distribution relative to cut blocks in the study area that vary from new to relatively old (>30 years). Initial results indicate uplands, and associated cut blocks, are selected strongly by wolverines before timber harvest. Wolverines continue selection for uplands during and after timber harvest but avoid the clear cuts. We discuss strategies that management could use to maintain habitats suitable for wolverines in areas with active and historic timber extraction.

A7.3 Puberty in Swedish wild boar subjected to supplementary feeding

Anna Malmsten, Anne-Marie Dalin
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The Swedish wild boar population has increased remarkably and today it comprises 2-300 000 animals. The reproductive potential, supplemental feeding and no natural regulating factor, such as disease or predation, are most likely reasons for the high increase. The supplemental feeding and its effects are highly debated, e.g. hunters claim that wild boar gilts reach puberty at a very early age and that females reproduce throughout the year which is not natural for a short-day-breeder such as the wild boar.

The aim of this study was to investigate when female wild boars, subjected to extensive supplemental feeding, reach puberty according to age, weight and season. Reproductive organs, ovaries and uteri, from about 620 females, was collected during ordinary hunting between Jan. 2013 – Dec. 2015 and macroscopically examined. Teeth were examined for age. In this part about puberty, only animals within age 5–15 months were included (n= 186). An animal was defined as 'had passed puberty' if ovarian corpora lutea were present and 28/186 (15.1%) had passed puberty. The proportion of post-pubertal animals increased with weight (4 weight classes) and age (3 classes). Also, seasonal differences were found. Supplemental feeding may affect the puberty of wild boar gilts.

Keywords: Wild boar, gilt, puberty

B1.1 Temporal and spatial dynamics of Finnish grouse populations during the past half-century

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The Finnish grouse populations have experienced considerable changes during the past half-century, from which period there are quantitative, nation-wide density data available. Capercaillie densities decreased markedly in southern and central Finland during the 1960-80s, but since then the trend has been rather the opposite. Black grouse densities similarly decreased first, but tended to increase later in the north. Hazel grouse shows broadly the same as black grouse. Willow grouse has dramatically decreased in numbers outside central and northern Lapland. Cyclicity was clear in southern and central Finland during the period 1964-80, and the cycle length was 6-7 years revealed by autocorrelation analyses. There were clear cycles at that time in the north, too. In southern and central part of the country, the regular cycles vaned in the 1980s. During the most recent period the regular cycling pattern seems to be recovering in south, and some signs for the same can be seen in central Finland, too. The within-species spatial synchrony is basically similar among species and there have been major changes in the average level of synchrony. It first increased, then decreased considerably from the 1970s to 1990s, and since then there has been again a steady increase. There are connections between average synchrony and mean density of species: for capercaillie and black grouse the correlation is significantly positive and in hazel grouse also significant but negative. The results are difficult to explain, and the underlying causal mechanisms recall deeper research.

Keywords: grouse, population dynamics, Finland

B1.2 Are parasites driving the population dynamics of grouse?

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Populations of Finnish capercaillie *Tetrao urogallus*, black grouse *Lyrurus tetrix* and hazel grouse *Tetrastes bonasia* have long been fluctuating in synchronous cycles. In recent decades, they have also experienced remarkable decline and simultaneous loss of regularity in fluctuations. Mechanisms behind the fluctuations of forest grouse populations are not well known. Since grouse harbour commonly intestinal parasites, the influence of parasites on the fluctuation has raised interest. Parasites have the potential to regulate their host population if there is parasite-induced mortality or parasite-induced reduction of fecundity in the host population and the reproduction rate of the parasite is sufficiently high. We studied basic prerequisites for parasitic regulation in Finnish forest grouse using intestinal samples from hunted grouse collected from four regions in Finland in 1995-2000. We found that annual abundance and prevalence of the nematode *Ascaridia compar* affected negatively the annual grouse density growth rate (all three species combined) and annual survival of grouse. In years of grouse density decline, the prevalence and abundance of *A. compar* was considerably higher than in other years. Cestode prevalence was highest in years of grouse density increase but there was no connection between cestode prevalence and the grouse population growth, survival or juvenile proportion. Our results suggest that the Finnish forest grouse community is regulated by intestinal parasites and that the key parasite is the nematode *A. compar*.

B1.3 The interplay between ticks, tick-borne diseases and wildlife

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Sharp increases in human cases of tick-borne diseases have been evident over the past 20 years all over Europe. At the same time it seems as tick distribution and abundance also has increased. Climate change may be responsible for parts of these co-occurrences, but also the number of animals and species that ticks feed on might have changed. The mechanisms behind the coinciding events of increasing tick abundance and increasing human cases of diseases is less well known. Some suggests wild mammals, particularly ungulates, act as amplifiers of tick numbers and pathogens. However, as ticks can feed on many different animals and every host species has a unique reservoir competence or ability to carry and transmit pathogens, the presence of different blood hosts might affect disease incidences. The core of this presentation thus aims to present empirical data and alternative explanations of tick disease dynamics from an ongoing study of the interplay between tick numbers in different life stages, disease transmission and dynamics in several wild mammal species with particular emphasis on roe deer and small mammals. This is accomplished by using two contrasting study areas with low and high roe deer at Grimsö and Bogesund, respectively. Through a multidisciplinary collaboration, interpreted results would make it possible to project future incidence scenarios of tick borne diseases in Sweden in relation to the abundance of different wildlife species and thus to support knowledge based action plans.

B1.4 The ecosystem services provided by beavers

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Beavers (Castor spp.) are ecosystem engineers, raising floodwaters into surrounding forests, killing trees, and releasing organic material into riparian systems and lakes. Through the biogeochemical and hydrological changes they exact on wetlands, beavers also provide a multitude of ecosystem services to humans in the form of necessary benefits and economic gain. Ecosystem services can be used to appraise both the economic and ecological value of ecosystems. Beavers mitigate flood peaks by retaining rainwater and drought conditions by slowly releasing water and raising groundwater levels. The economic gain provided by beaver-created wetlands in terms of flood mitigation is extensive, and will probably increase in the future due to climate change. Carbon storage is significant in beaver meadows, although the landscape-level effect beavers exact on carbon dynamics is not well known. Water quality and wastewater management are improved by the beaver's filtration service, as impurities (e.g. pollutants, disease-causing agents) are removed from waterways through sedimentation and increased evapotranspiration in the buffer zones created through damming. These same processes potentially improve soil quality upstream of beaver dams. They generate habitats suitable for recreation and relaxation, providing e.g. hunting, fishing, hiking, and canoeing possibilities. Beaver wetlands are also important hot spots for species diversity, upholding biodiversity and ecosystem functionality, and also benefiting societies implementing wetland restoration schemes. Lastly, beavers provide several types of raw materials, e.g. pelts and castoreum, which are directly utilizable by humans.

B2.1 Community power over conservation regimes – Techniques for neutralizing illegal killing of large carnivores in Finland

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The lack of place-based conservation policies has led to a form of political dissent and resistance against dominant conservation regimes, and has manifested most intensely in the drastic decrease in wolf population from about 250 wolves in 2006 to 140 wolves in 2014. The illegal hunting of large carnivores has been committed as part of a social group with the support of community members, and hunting violators have been considered 'good poachers' by many of their fellow citizens. To show how rural communities sustain alternative ways of regulating their worlds under pressure from conservation regimes and to understand how hunting violators and community members negate the shame from the stigma, neutralisation techniques introduced in sociological literature by Sykes and Matza serve as an effective tool. In collecting data, we used non-active role playing with empathy-based fictitious stories. We obtained altogether 231 narratives from a core group of hunting violators from which we identified the use of the nine different techniques. These discourses express cultural protest, that is, how rural identity and way of life is defended and how rural protests toward conservation policies are expressed in the pressure of Europeanisation that has occurred in recent decades. Results address the importance of implementing responsive and deliberative governance, and indicate how to formulate effective deterrents to illegal killing and increase compliance with conservation regimes.

B2.2 Poaching risk model of the Finnish wolf

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Poaching can have a crucial effect on animal populations. Due to its cryptic nature, its volume and impact is difficult to quantify. We examined poaching of wolves, mostly motivated by human-wolf conflict, by analyzing the volume of human-caused mortalities and corresponding risk factors in competing risks framework. We created scenarios by modelling the significant risk factors to detect the effect of the covariates on population level. The goal of the study was to analytically investigate a hidden phenomenon and to offer applicable knowledge for conservation and management. Data consisted positioning and mortality data on 147 tagged wolves from the period 1998-2015. Methods used were incidence functions and hazard models. Illegal and legal hunting were by far the most common causes of mortality, respectively. Covariates included at individual level were social status and sex; at seasonal level snow cover, snow depth, and ecological year; and human dimensions covariates were preceding legal hunt of wolf and moose in the area, damages to livestock and proportion of inhabited area in the range close to the kill site. The differences in the effects on territorial and dispersal wolves were analyzed. We mapped the significant factors and scenarios to visualize the terrain risk factor experienced by the wolf. The study is a part of the PhD thesis of Johanna Suutarinen from University of Oulu and is done in cooperation with the Natural Resources Institute Finland.

Keywords: Canis lupus, carnivore conflict, wildlife crime, cause-specific mortality, hazard model

B2.3 Demographic estimates of an exploited bobcat (*Lynx rufus*) population in West Virginia, USA

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Bobcats are highly regulated for international trade due to pelt similarities with the endangered Iberian Lynx (*Lynx pardinus*). Appendix II of the Convention on International Trade in Endangered Species requires management agencies to affirm stability of their bobcat populations before granting exportation authority to international markets. In West Virginia, USA, the bobcat population has been regulated since 1977. West Virginia Division of Natural Resources (WVDNR) is currently using biological data collected in 1978 to guide management decisions for the population. However, with harvest rates at a peak, it is critical to update population abundance and demographic estimates. Our research objectives are to estimate age distribution and recruitment of West Virginia bobcats. Results will be used by WVDNR to modify the current change in population model used to determine harvest limits. Hunters and trappers across West Virginia donated 296 bobcat carcasses during the 2014–2015 harvest season. Canines (n=296) and female reproductive organs (n=147) were used to estimate age at mortality and reproductive success. Age was estimated by counting cementum annuli of canines, and implantation rates were estimated by placental scar counts. Results indicate that juvenile (<1 year) and yearling bobcats each represent 20% of the harvest subsample, with adults (2+ years) representing 60% of the population. Implantation rates for adults (n=88) and yearlings (n=30) were estimated at 2.18 and 0.63 kittens per female, respectively. Accurate demographic data, along with density estimates, will provide WVDNR with the necessary data to ensure sustainable harvest of bobcats in West Virginia.

B3.1 State-space modeling to support adaptive management of hunting small populations of carnivores

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Many large carnivores population are often small relative to many other wildlife species and decisions on hunting need to be made particularly carefully to prevent unexpected decreases in carnivore abundance. It is also vital to monitor carnivore populations closely and adjust hunting if the population fails below or exceeds acceptable limits for abundance. Adaptive management is particularly well suited to managing hunting of small populations. Sensible management goals for abundance are set, a hunting prescription is made, the population is monitored, and hunting levels are change if the population becomes too large or too small. Forecasting models that assimilate monitoring data with studies of vital rates of populations can be a particularly useful for informing decision makers about the effects of alternative hunting levels. Preventing excessive optimism in these decisions requires models that are honest about uncertainty. Here, we illustrate the use of Bayesian state-space models to support decisions on hunting small populations of carnivores using European lynx in Sweden and Norway as an illustrative model system. This study is part of Scandlynx that coordinates research on lynx in Sweden and Norway.

B3.2 Estimation of Finnish moose population

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Moose (Alces alces) is indisputably the most important game animal in Finland providing a notable majority of annual game bag. On the other hand, forestry may suffer considerable damage on the areas with high moose density. Further, the abundant moose implies a higher collision risk in traffic.

Successful management of moose requires precise knowledge of the regional populations. The key factors determined in the harvest quotas are the animal abundance and the age-sex-structure of the population. Fortunately, we have an established data collection paradigm, moose observation card, which allows for development of sophisticated methods for estimating the population size and structure.

With our Bayesian state-space model (SSM) framework, we aim for reliable estimates of population sizes and population structure as well. In the discrete-time SSM, we combine moose population dynamics model with sequential change-in-ratio module for daily moose observations, aerial surveys conducted in distance sampling and line transect surveys, ground censuses, hunters' approximations of stock sizes, moose-vehicle collisions, and the predation of large carnivores (wolf and brown bear).

The result is a multidimensional synthesis of all available data, i.e. a posterior distribution of population estimates and other model parameters. Our model results give a straightforward tool for decision making for the game managers.

Keywords: moose, population abundance, Bayesian state-space model, multiple data sources

B3.3 Back-calculation of large carnivore populations in Finland in 1865–1915

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We estimated population abundances of the bear, lynx, wolf and wolverine in Finland in 1865–1915 by combining official bounty statistics with verified knowledge on annual intrinsic growth and mortality rates of these species. We used an annual backwards iteration method for all of these species, starting from a systematically-adjusted population size in 1915. According to our results, there had been approximately 1000 bears and an equal number of wolves in Finland until their decline started around 1875. As for lynx, it appears that its population increased markedly in the first quarter of our study period, but seemed not to have exceeded 3500 in the 19th century. Concurrently with the assumed strong growth of the lynx population, a marked increase took place in sheep and goats killed by large carnivores. The number of wolverines prior to 1885 appears to have been varying between 300 and 600. When it comes to comparing today's large carnivore abundances to those of the 1860s, current number of bears is 1.5 times higher, whereas the wolf population is still only one fourth of that in the past. Today's lynx numbers are roughly the same as in the 1880s when the population peaked. As for wolverines, their number prior to 1885 appears to have varied between 300 and 600. That is just about twice the population of the 2010s.

Keywords: back-calculation, historical population abundance, large carnivores, bear, lynx, wolf, wolverine

B3.4 The effects of climate and humans on the genetic and phenotypic variation of the moose (*Alces alces*)

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In this study, we investigated the genetic and phenotypic variation as well as the different processes affecting them in the moose (*Alces alces*). Altogether 809 DNA samples of moose, gathered throughout Finland and the Republic of Karelia in Russia, were analysed with a variety of population genetic methods. Furthermore, the shape of the moose mandible was investigated with the help of geometric morphometrics using a subset of samples gathered from 179 moose. The results showed that the Finnish and especially the Karelian moose population harboured relatively high genetic diversity, albeit with clear regional differences in its spatial distribution. In the northern half of Finland, a secondary contact of two diverged mitochondrial lineages was revealed, which was interpreted to reflect the existence of allopatric refugia of moose during the Last Glacial Maximum and the subsequent bi-directional recolonisation of Fennoscandia. Furthermore, a spatially explicit Bayesian clustering analysis suggested existence of three genetic clusters, which were estimated to have split after the recolonisation. The results also showed that past declines in the moose numbers during the 18th and 19th centuries led to population bottlenecks, leaving a genetic imprint. Finally, a significant latitudinal shift was revealed in the shape of the moose mandible. The pattern was independent of the genetic clustering of the population. The main changes included an enlargement of the attachment surfaces of the muscles controlling biting and mastication, implying more effective mastication in the north compared with the south, possibly an adaptive response to a longer period of hard wintertime diet.

B3.5 Wildlife population recovery and what genetics can tell us – Temporal analyses during recovery and range expansion in the Finnish brown bear population

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The northern European brown bear has been hunted down until almost extinction. Nowadays, the populations are structured into several genetic clusters and clear genetic changes during the process of recovery and recolonization have been documented and published recently. Immigration of bears from Russia has been substantial and important for the recovery in Finland and was be one of the drivers for the rapid recovery and range expansion of brown bears in the region. Here, we present results of our genetic assessment, using autosomal STRs, Y-STRs and Y-SNPs, of the Finnish brown bear population. In this study we use brown bear genotype data from Finland sampled from legally harvested bears 1996 to 2010. Individuals were aged estimated resulting in coverage of bears born 1977 to 2010. As suggested by simulation studies on population recovery, we detected genetic patterns and changes, which were to be expected. However, the velocity of these genetic changes was unexpected. Our results give insights into the large scale recovery and comeback of bears in northern Europe as well as feasibility of current methods of wildlife genetics.

POSTER ABSTRACTS

P1 The effect of human-modified landscape structure on forest grouse broods in two landscape types

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The presence of a grouse hen with a brood in a landscape was used to indicate habitat-related breeding success. We combined the locations of 938 black grouse, 388 capercaillie, and 917 hazel grouse broods after the breeding season with landscape data by employing GIS and grouse data derived from the wildlife triangle censuses conducted during 1997-2004. Two large study areas with different landscape structures; northern forest-mire area and southern cultivated area, were selected for the investigation. The presence of grouse broods was strongly related to the amount of old coniferous mixed forest. Grouse broods may prefer this forest habitat because of a rich bilberry field layer offering a diversity of insects as food. There was no general response to forest fragmentation. The effect of forest fragmentation on the broods' distribution did not increase even with decreasing forest cover. We suggest that there are several ecological causes for the observed spatial correlations. Predation on nests and broods by generalist predators is presumably high in human modified open and semi-open landscapes. Against our expectations, the effect of landscape composition on grouse broods was more marked in the northern than in the southern study area, most likely because predator populations are more food-regulated in the north. This finding supports the alternative-prey hypothesis. Further, large drained and reforested peatland mire areas had a negative impact on grouse broods in the north. In the drainage areas, decreased availability of insect food, increased predation risk, and drowning of chicks in ditches may increase brood mortality.

P2 Elements of sociality in the solitary living Lynx

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The social system of solitary felids such as the Lynx is determined by the factors behind female space use, with males adopting strategies to gain and defend access to females. The Lynx lineage includes four species: Eurasian lynx (*Lynx lynx*), Iberian lynx (*Lynx pardinus*), Canada lynx (*Lynx Canadensis*) and the bobcat (*Lynx rufus*). In this poster, we try to visualize, with the help of thematic mapping, the different factors and their relative importance to sociality. We will present the current understanding of the elements behind sociality of Lynx species, focusing on space and home range use, dispersal and relatedness. Also the need for further research will be discussed.

P3 Wildlife triangle scheme in internet: On-line information for game administration, hunters and the wider public

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Wildlife triangle scheme has collected data on small game populations in Finland since 1989. The system is based on a large number of transect lines covering the entire country. The permanent wildlife triangles are comprised of 12 km transects in forested areas. The program involves an astonishing amount of fieldwork: around 10,000 km of transect line is studied during every summer and winter count. Most of the heavy fieldwork is performed by trained volunteers, mainly hunters. Riistakolmiot.fi internet service was launched in 2014. Via the internet, trained hunters can record their observations in a database and follow the progress of the count during the fieldwork period. In the public section of the website, anyone can view the results of ongoing counts. The internet service is a significant innovation speeding up the collection of observations, simplifying the storing of data and assisting in the summary reports and sending of them. Data provided by the wildlife triangle scheme are utilised by the EU, the Ministry of Agriculture and Forestry and other game administrative organisations, as well as hunting clubs and the general public. Annual results of the late-summer monitoring procedure are used immediately when deciding on the restrictions to the forthcoming grouse hunting season, due to begin just a few weeks later. It is important to react rapidly to temporal changes in bird populations since the yearly offspring survival is highly variable and has a great effect on the autumn densities and sustainable hunting possibilities.

Keywords: Forest game, monitoring, website, Finland

P4 Riemerella anatipestifer: A new pathogen in wild birds in Finland

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Riemerella anatipestifer is a bacterial pathogen of birds. It is mainly regarded as a pathogen of domestic birds as ducks, geese and turkeys, but it has also been isolated from various species of wild birds. In domestic birds R. anatipestifer causes sudden mortality due to septicemia, or in less acute form respiratory and neurological signs including sneezing, coughing, head tremors, torticollis and ataxia. The mortality rates vary from 5 to 75%.

In the year 2015 we isolated R. anatipestifer for the first time from wild birds in Finland. The bacterium was isolated from 6 whooper swans (*Cygnus cygnus*) and one barnacle goose (*Branta leucopsis*) from different parts of the country. All disease cases were identified during October and November 2015. Some of the birds had shown neurological disorders and difficulties in swimming and flying. The most common post mortem finding was purulent meningitis, but severe pericarditis and peritonitis was observed in one juvenile swan. R. anatipestifer grows well on standard blood agar at 37°C. Microaerophilic atmosphere enhances the growth in the primary cultivation. The identification of the bacterium as R. anatipestifer was confirmed by biochemical tests and Maldi-Tof analysis.

P5 Guardian or threat: Cascading effects of golden eagle predation risk on forest grouse

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Previous studies on intraguild predation have mainly focused on within-class assemblages, even though avian top predators may also influence mammalian mesopredator prey. By using nation-wide long-term data from Finland, northern Europe, we examined the impacts of golden eagles (*Aquila chrysaetos*) together with red foxes (*Vulpes vulpes*) and pine martens (*Martes martes*) on forest-dwelling herbivores, black grouse (*Tetrao tetrix*) and hazel grouse (*Tetrastes bonasia*). We hypothesized that eagles may indirectly benefit grouse if the intraguild predation risk imposed on mesopredators alleviates the overall predation pressure on grouse. The predation impact of eagles was modelled using density estimates and distance to eagle nest. Wildlife triangle counts were used as predation impact proxies of mammalian mesopredators and as measures of response in grouse. Our results show that eagle density correlated negatively with black grouse abundance while being positively associated with the proportion of juveniles in both grouse species, irrespective of the abundance of mesopredators. Yet, foxes and martens alone had a negative effect on both the abundance and the proportion of young in the two grouse species. This suggests that the possible cascading effects of eagles are not mediated by decreased numbers of fox and marten but instead through intimidation, which may change mesopredator hunting behaviour and microhabitat use. In conclusion, we found support for the hypothesis that eagles provide protection for juvenile black and hazel grouse, whereas they are a threat for adult grouse. This kind of information helps us to better understand the role of avian top predators in terrestrial ecosystems.

P6 Hunting and fishing provides benefits for regional economies and well-being to people – Example from Finnish state owned areas

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Metsähallitus administers 12 million hectares of state-owned areas in Finland. One of its legislative duties is to provide opportunities for recreational outdoor activities. App. 150.000 hunting and fishing permits are sold annually. While travelling, hunters and fishers use money for supplies, food, accommodation and other services, and experience social, physical and psychological well-being.

In 2014 Metsähallitus and its research partners carried out two studies in which the main aims were to 1) evaluate the impacts of hunters and fishers expenditure to regional economies, and to 2) study the well-being experienced by hunters and fishers. The data used, comprising of more than 8.000 responses from hunting or fishing permit holders, was collected using a Webropol online survey.

The results indicate that hunters and fishers' expenditures do have a positive impact to regional economies with total impacts being 28.2 million EUR and 238 person-years.

Results indicate that hunting and fishing trips are beneficial in terms of social, psychological and physical well-being of people. Hunters experienced somewhat higher increase in well-being than fishers. Women experienced the most positive impacts on their psychological well-being. The results support earlier studies regarding the revitalizing and activating impacts of nature.

The studies are examples how to measure ecosystem services. They confirm that regional economies benefit when state provides facilities for outdoor activities, and also show the value of to the human well-being and health.

P7 Bacterial contamination of hunted white-tailed deer in Finland

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Moose and white-tailed deer are the most popular hunted big game species in Finland. There is very little study done on the quality and safety of game meat. We have studied and reported the bacterial contamination of moose carcasses before and now we did the same on white-tailed deer.

Hundred carcasses were sampled with swabbing method during hunting seasons 2013/2014 and 2014/2015, 50 carcasses each. To study the hunting hygiene, the number of mesophilic aerobic bacteria (MAB), Enterobacteriaceae (EB) and Escherichia coli (EC) were examined. Meat safety was assessed by PCR detecting Salmonella, Campylobacter, Yersinia and stx-positive E. coli (STEC) and by isolation of Listeria monocytogenes. Statistical analyses were performed using SPSS 23.

The mean counts of MAB, EB and EC were 4.4, 1.5 and 0.7 log/cm^2, respectively. No statistical difference was found between the samples obtained during the two hunting periods. There was a positive correlation between MAB/EB counts and EB/EC counts. The carcasses contaminated with E. coli were significantly more often contaminated with pathogens. In total, 25 carcasses were contaminated with pathogens: STEC (12), Y. enterocolitica (9), L. monocytogenes (5) and Campylobacter (2).

This study shows, that mean counts of MAB, EB and EC on deer carcasses were moderate and significantly lower compared to moose. The occurrence of deer carcasses contaminated with pathogens (25%) was high, however, lower compared to moose (38%). Good hunting hygiene is important to ensure the safety of game meat.

P8 Turkey pathogens in wild birds submitted for necropsy in Finland

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The most important disease hazards posed by wild birds on pastured turkeys were identified in the 2014 Evira report "Animal disease hazards and biosecurity of organic and pastured turkeys". These were *Histomonas meleagridis* (histomonosis), avian influenza virus (AI) and Paramyxovirus-1 (Newcastle disease). The Evira laboratory information system was searched for cases where these pathogens were diagnosed in wild birds to see how common these diagnoses are in the material sent in to Evira.

1,270 wild birds were submitted for necropsy between 2011 and 2015. Of these, approximately 100 birds per year were tested for avian influenza as part of the European Union AI surveillance program. Low-pathogenic AI virus was isolated from 9 *Anatidae* and 2 *Laridae* members. High-pathogenic AI has never been diagnosed in Finland. Paramyxovirus-1 was diagnosed in 13 wild domestic pigeons (*Columba livia*). There were no identified cases of histomonosis.

The primarily soil-born pathogen *Erysipelothrix rhusiopathiae* (erysipelas) is likely to be one of the biggest threats to the health of pastured turkeys. Between 2011 and 2015 it was isolated as the primary cause of death from four wild birds. However, wild birds are unlikely to add to the overall disease pressure for erysipelas. *Salmonella spp.* and *Campylobacter spp.*, although potentially spread by wild birds, were not included in this study as their importance lies primarily in consumer food safety rather than turkey health.

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