7th World Lagomorph Conference

Belfast, 22nd-26th July 2024

Program and Abstracts

WLS
World Lagomorph Society

lagomorph specialist group

IUCN
International Union for Conservation of Nature

Organised by

QUEEN'S UNIVERSITY BELFAST

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The WLC7 logo

The 7th World Lagomorph Conference (WLC7) logo reflects Ireland as the host country and the range of the endemic Irish hare (*Lepus timidus hibernicus*) incorporating the ancient Irish symbol of the triskelion or triskeles; three interlocking spirals often found carved at Neolithic archeological sites, for example, the 5,200 year old burial tomb at New Grange. The Irish hare is one of Ireland's very few paleoendemics with fossil remains up to *ca*. 28K year old.

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FOREWORD

The 7th World Lagomorph Conference (WLC7), the major regular conference of the World Lagomorph Society (WLS), is hosted by Queen's University Belfast (QUB) in July 2024.

The World Lagomorph Conference brings together researchers and experts on rabbits, hares, and pikas from all over the world.

Ordinarily every four years, the WLS Board moved to every two years to make up for a lost meeting due to the COVID19 pandemic and maintain international momentum in the study of lagomorphs.

This meeting is a great opportunity to share and exchange information on the evolution, genetics, morphology, physiology, behaviour, ecology, diseases, management and conservation of wild lagomorphs.

The WLC prides itself on being a forum for research postgraduate students and postdoctoral researchers to present their findings to promote their future research careers. As such, the WLS has sponsored three Travel Bursaries awarded to students delegates from the Global South.

The WLC7 is a truly international world conference with **delegates from 27 countries (34 including co-authors)**, with talks on **41 lagomorph species** whose range taken together with author countries cover **84% of the Earth's terrestrial surface** (Fig. 1)!

Welcome to Belfast.

#WLC7

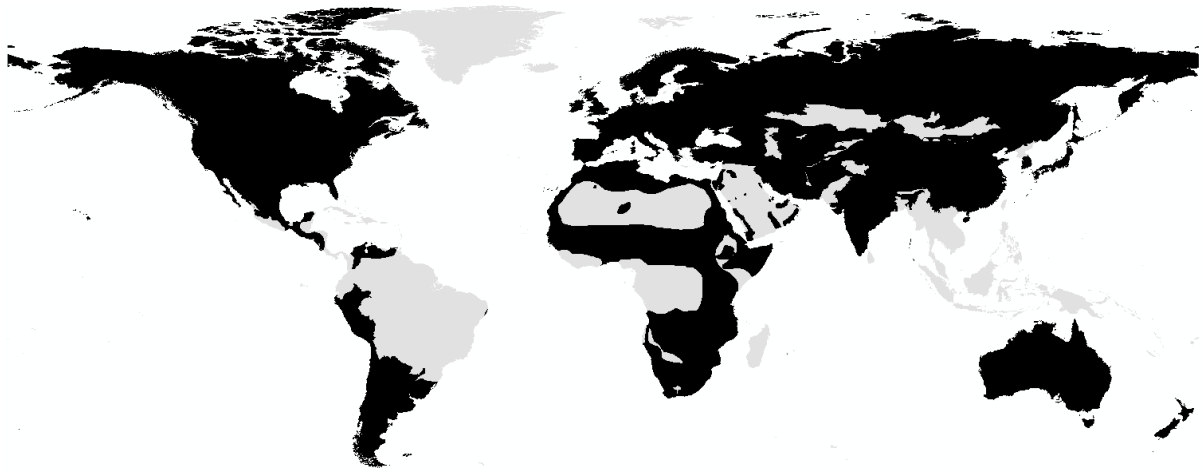

Fig. 1 The global distribution of WLC7 delegates, their co-authors and the ranges of lagomorph study species named in submitted abstracts covering 84% of the Earth's terrestrial land area (excluding Antarctica).

Organisers

Scientific Committee

Paulo C. Alves, WLS President, University of Porto, Portugal

Janet Rachlow, WLS Vice-President, University of Idaho, USA

Neil Reid, WLS Vice-President, Queen's University Belfast, UK

Brian Kraatz, WLS Secretary, Western University of Health Sciences, California, USA

Klaus Hackländer, WLS Vice-Secretary, BOKU University Vienna, Austria

Stéphanie Schai-Braun, WLS Treasurer, BOKU University Vienna, Austria

Irina Ruf, WLS Vice-Treasurer, Senckenberg Research Institute & Natural History Museum, Germany

Heiko Rödel, WLS Auditor, University Sorbonne Paris Nord, LEEC, France

Carlos Rouco, WLS Vice-Auditor, University of Seville, Spain

Local Organising team

Neil Reid, Chair, Queen's University Belfast, UK (Chair)

Michael Hills, Event Coordinator, Queen's University Belfast

Mary Devlin, Finance, Queen's University Belfast

PhD students, Queen's University Belfast

Countries and species represented at WLC7

Delegate countries	
1	Argentina
2	Australia
3	Austria
4	Canada
5	Czechia
6	Denmark
7	France
8	Germany
9	India
10	Ireland
11	Israel
12	Italy
13	Japan
14	Netherlands
15	New Zealand
16	Norway
17	Peru
18	Poland
19	Portugal
20	Russia
21	Spain
22	Sweden
23	Switzerland
24	UK - England
25	UK - Northern Ireland
26	UK - Scotland
27	USA

Additional co-author countries	
28	China
29	Chile
30	Finland
31	Iran
32	Nepal
33	South Korea
34	UK - Wales

	Common name	Species
1	Pygmy Rabbit	*Brachylagus idahoensis*
2	Riverine Rabbit	*Bunolagus monticularis*
3	Hispid Hare	*Caprolagus hispidus*
4	Antelope Jackrabbit	*Lepus alleni*
5	Snowshoe Hare	*Lepus americanus*
6	Japanese Hare	*Lepus brachyurus*
7	Black-tailed Jackrabbit	*Lepus californicus*
8	Cape hare	*Lepus capensis*
9	Broom Hare	*Lepus castroviejoi*
10	Corsican Hare	*Lepus corsicanus*
11	European brown hare	*Lepus europaeus*
12	Ethiopian Hare	*Lepus fagani*
13	Granada Hare	*Lepus granatensis*
14	Abyssinian Hare	*Lepus habessinicus*
15	Cape Scrub Hare	*Lepus saxatilis*
16	Ethiopian Highland Hare	*Lepus starcki*
17	Desert Hare	*Lepus tibetanus*
18	Mountain hare	*Lepus timidus*
19	African Savanna Hare	*Lepus victoriae*
20	Alpine Pika	*Ochotona alpina*
21	Collared Pika	*Ochotona collaris*
22	Northern Pika	*Ochotona hyperborea*
23	Ili Pika	*Ochotona iliensis*
24	Large-eared Pika	*Ochotona macrotis*
25	American Pika	*Ochotona princeps*
26	Afghan Pika	*Ochotona rufescens*
27	Turuchan Pika	*Ochotona turuchanensis*
28	European Rabbit	*Oryctolagus cuniculus*
29	Natal Red Rock Hare	*Pronolagus crassicaudatus*
30	Bunyoro Rabbit	*Poelagus marjorita*
31	Jameson's Red Rock Hare	*Pronolagus randensis*
32	Smith's Red Rock Hare	*Pronolagus rupestris*
33	Hewitt's Red Rock Hare	*Pronolagus saundersiae*
34	Desert Cottontail	*Sylvilagus audubonii*
35	Brush Rabbit	*Sylvilagus bachmani*
36	Tapeti	*Sylvilagus brasiliensis*
37	Eastern Cottontail	*Sylvilagus floridanus*
38	Honduran Cottontail	*Sylvilagus hondurensis*
39	Appalachian Cottontail	*Sylvilagus obscurus*
40	New England Cottontail	*Sylvilagus transitionalis*
41	Yucatan Cottontail	*Sylvilagus yucatanicus*

Kindly supported by:

WLS

IUCN lagomorph specialist group

NPWS An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra National Parks and Wildlife Service

Department of Agriculture, Environment and Rural Affairs

NIEA Northern Ireland Environment Agency www.daera-ni.gov.uk

THE Mammal SOCIETY

diversity an Open Access Journal by MDPI

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Lotek advancing wildlife science

e-obs Wildlife Telemetry

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Thank you!

Supporting Organisations

The WLC7 has been kindly and generously sponsored by a range of organizations (Page 3) including:

The **World Lagomorph Society** (WLS) is the global professional society for scientists and conservationists working on the mammalian Order Lagomorpha (wild rabbits, hares and pikas). The society supports communication between those interested in the research, management and conservation of lagomorphs. The main purpose of the society is to promote the cooperation and collaboration between lagomorph researchers and to spread information, in order to improve the knowledge in this key taxa.

The WLS supports the study on lagomorph species, in particular little studied taxa usually in the Global South and those IUCN Red-Listed as threatened, by helping fund specific projects and by providing scientific support. As some lagomorphs have an important economic value, either as game or as pest species, a special attention is drawn to these species, namely by promoting the exchange of technical reports.

WLS promotes the World Lagomorph Conference, hitherto each 4 years but now every 2 years until 2030, and supports complementary regional symposia in specific subjects. The WLS Travel Bursary supports students from the Global South in attending the conferences. The Board of Directors organizes each WLC together with local organizing teams.

The International Union for Conservation of Nature (IUCN) Species Survival Commission (SSC) Lagomorph Specialist Group (LSG) supports the red listing exercise for all lagomorphs and engages in lagomorph conservation and management through science, education, and advocacy. The current LSG Co-Chairs are Dr Hayley Lanier and Prof Andrew Smith who is also the Red List Authority Coordinator.

The National Parks and Wildlife Service, in Irish: *An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra*, manages the Republic of Ireland's nature conservation responsibilities. As well as managing the national parks and designated sites, the activities of the NPWS include commissioning research into Irish hare (*Lepus timidus hibernicus*) to assess the species' conservation status, national population surveys of abundance, as well as a diverse range of topics relevant to conservation including hare genetics and the monitoring and surveillance of hare coursing.

Department of Agriculture, Environment and Rural Affairs

NIEA Northern Ireland Environment Agency
www.daera-ni.gov.uk

The Northern Ireland Environment Agency (NIEA) is part of the Department of Agriculture, Environment and Rural Affairs (DAERA) and manages Northern Ireland's nature conservation responsibilities. As well as managing designated sites and agri-environment schemes, the activities of the NIEA include commissioning monitoring and surveillance of Irish hare density and abundance, funding PhDs into Irish hare ecology and the impacts of introduced non-native European brown hare (*L. europaeus*) as well as hare taxonomy and systematics.

THE Mammal SOCIETY

The Mammal Society is the UK's professional body for mammalogists striving for a future in which sustainable mammal populations thrive as part of healthy and diverse ecosystems benefiting people and nature across the British Isles and Ireland. The Mammal Society is committed to data-driven, robust scientific evidence to inform conservation strategy and practice underpinning collective effort to work collaboratively with a diverse range of partners, stakeholders, and communities to achieve positive outcomes for nature and people.

The UK has three lagomorphs: the native mountain hare which includes the Scottish hare (*L. timidus scoticus*) in the Highland's and introduced to the Peak District, England and the Irish hare (*L. t. hibernicus*) endemic to Ireland; the European brown hare (*L. europaeus*) naturalized in Great Britain and invasive in Ireland; and the European rabbit (*Oryctolagus cuniculus*) naturalized throughout Britain and Ireland.

Ecotone is an association of professional ornithologists and ecologists. We produce various kinds of mist nets for catching birds and bats. The quality and efficiency of our nets are the result of more than 30 years of experience in the field work. Besides mist nets we offer a wide range of equipment for ornithological and bat researches. We also produce GPS-GSM loggers for wildlife tracking. Nowadays our telemetry equipment is worldwide used and let researchers to obtain the unique and precise data about animal behaviour and migrations. Our loggers are also custom designed to meet the researchers needs.

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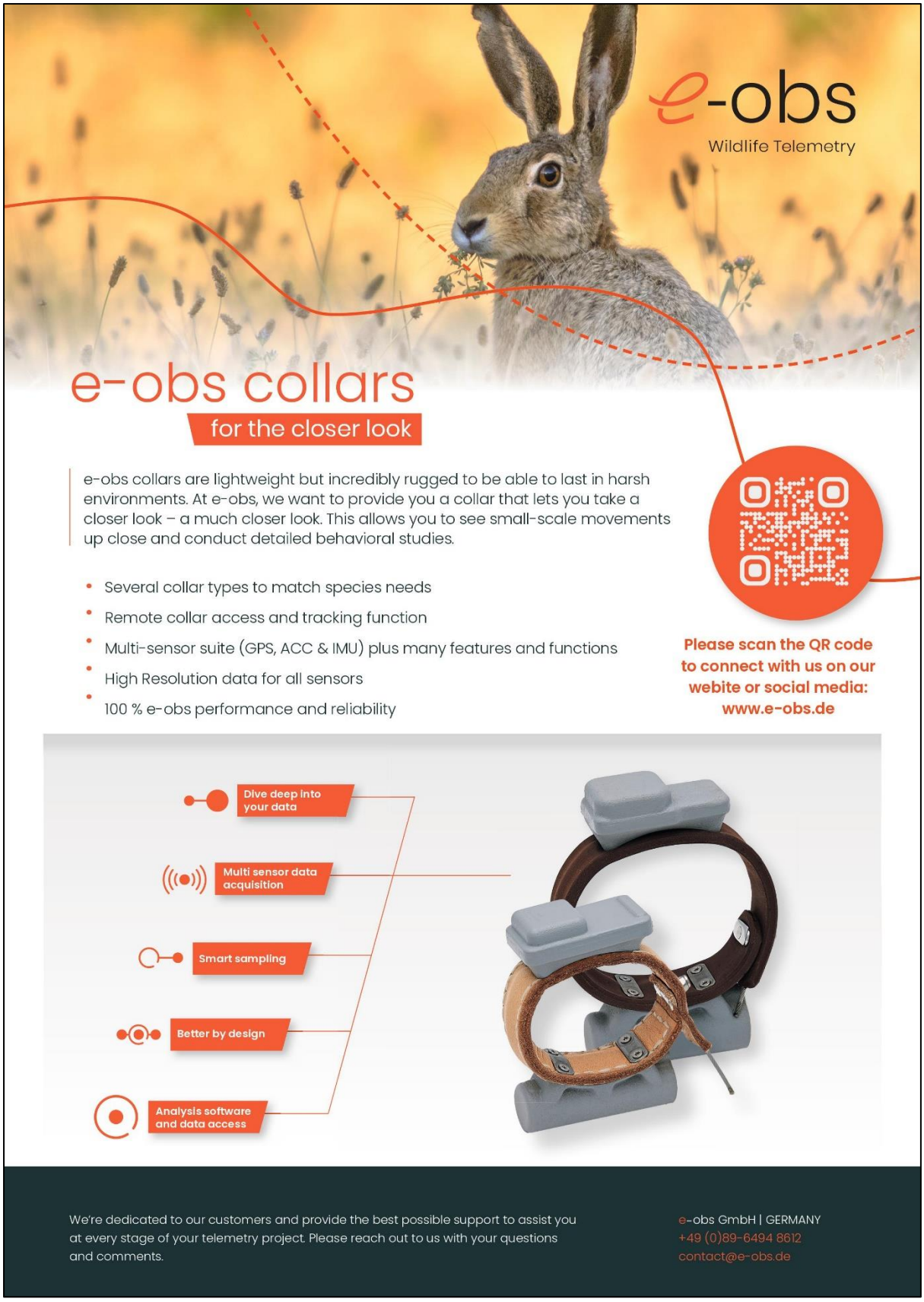

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PROGRAMME OVERVIEW

All talks in Peter Froggatt Centre, 02.026 (2nd Floor, Room Number 26)
… except **Workshop 2 in Peter Froggatt Centre, 02.018** (2nd Floor, Room Number 18)

Monday 22nd July	
17:00 – 19:00	Reception Opens, Peter Froggatt Centre Foyer
19:00 – 21:30	Welcome Reception
Tuesday 23rd July	
08:00 – 09:00	Reception Opens, Peter Froggatt Centre Foyer
09:00 – 09:15	Welcome Address
09:15 – 10:10	Plenary 1
10:10 – 10:30	Tea/Coffee
10:30 – 12:15	**Open session**
12:15 – 13:45	Lunch Break
13:45 – 14:40	Plenary 2
14:40 – 15:00	Tea/Coffee - WLC7 Photo
15:00 – 16:30	**Cold adaptation**
Wednesday 24th	
10:00 – 10:55	Plenary 3
10:55 – 11:15	Tea/Coffee
11:15 – 12:15	**Anatomy & morphology**
12:15	Lunch
13:45 – 14:45	**Workshop 1 - Lagomorph taxonomy and conservation**
14:45 – 15:00	Tea/Coffee
15:00 – 15:45	Workshop 1 continued
13:45 – 14:45	**Workshop 2 - Lagomorph diseases: Advances in virology, genomics & parasitology**
14:45 – 15:00	Tea/Coffee
15:00 - 16:30	Workshop 2 continued
16:30 – 16:45	World Lagomorph Society (WLS) Session
17:00 – 17:30	Wine Reception / Posters
17:30 – 18:00	The Armagh Rhymers
18:00 - 21:00	Conference Dinner (The Great Hall)
Thursday 25th July	
10:00 – 10:55	Plenary
10:55 – 11:15	Tea/Coffee
11:15 – 12:15	**Open Session**
12:15 – 12:20	Poetry recital: '*Incantation for the hare*' by Nidhi Zak
12:20 – 13:45	Lunch
13:45 - 14:45	**Open Session**
14:45 – 15:00	Tea/Coffee
15:00 – 16:00	**Open Session**
16:00 – 16:15	Neil Reid Closing remarks and Prizes
Friday 26th July	**Post Conference Excursions**
09:00 – 17:00	Rathlin Island
09:00 – 17:00	Giant's Causeway
09:00 – 17:00	Navan Fort
10:00 – 15:00	Mount Stewart

DETAILED PROGRAMME

Monday 22nd July 2024

17:00 – 19:00	**Registration Opens** Peter Froggatt Centre Foyer
19:00 – 21:30	**Welcome Reception**

Tuesday 23rd July 2024

Tues **08:00 – 09:00**	**Registration** Peter Froggatt Centre Foyer

Peter Froggatt Centre, 02.26

Tues **09:00 – 09:15**	**Welcome Address**
Tues **09:15 – 10:00**	**1 PLENARY – David Hik** The resilience of pikas to the impacts of climate variability and change
Tues **10:10 – 10:30**	**Tea/Coffee**

Open Session

Peter Froggatt Centre, 02.26

Tues **10:30 – 10:45**	**2 Ian Montgomery** What's the point of subspecies? Status of the Irish hare *Lepus timidus hibernicus*
Tues **10:45 – 11:00**	**3 Samantha Ball** Dublin Hareport: The movement ecology and active area interactions of five airside hares, at an international airport
Tues **11:00 – 11:15**	**4 Nina Fülep** The relationship between landscape characteristics, the density of European hares (*Lepus europaeus*) and predator community characteristics
Tues **11:15 – 11:30**	**5 Jonas Roth** An experimental assessment of acceleration dependent energy expenditure and behaviour-specific metabolic rates in European brown hares
Tues **11:30 – 11:45**	**6 Neil Reid** Survival, movements, home range size and dispersal of hares after coursing and/or translocation
Tues **11:45 – 12:00**	**7 Mark Jones** Hares in England and Wales – the case for a close season
Tues **12:00 – 12:15**	**8 Jana Stefanova** Wild animal rescue centres and the scientific opportunities to study wild lagomorphs
Tues **12:15 – 13:45**	**Lunch**

Tues **13:45 – 14:40**	**9 PLENARY Mafalda Ferreira** Evolution according to Lepus: camouflage, introgression and adaptation to future climates
Tues **14:40 – 15:00**	**Tea/Coffee - WLC7 Photo**

Cold adaptation

Peter Froggatt Centre, 02.26

Tues **15:00 – 15:15**	**10 Rebecca Chandross** Cyclic dynamics in a changing climate: snowshoe hare populations across the Great Lakes
Tues **15:15 – 15:30**	**11 Melia Romine** Identifying genetic signatures of local adaptations to high-altitude environments in large-eared pikas (*Ochotona macrotis*) across their broad distribution range in the Himalayas
Tues **15:30 – 15:45**	**12 Simen Pedersen** Mountain hare coat colour mismatch – are they able to keep up with the changing climate?
Tues **15:45 – 16:00**	**13 Gohta Kinoshita** The genetic basis and evolutionary history of winter coat colour polymorphism in the Japanese hare
Tues **16:00 – 16:15**	**14 Stéphanie Schai-Braun** Coexistence of European hares and Alpine mountain hares in the Alps: what drives the occurrence and frequency of their hybrids?
Tues **16:15 – 16:30**	**15 Pedro Sousa** Exploring hybridization dynamics in Alpine Hare Species under climate-driven range shifts

Wednesday 24th July 2024

Peter Froggatt Centre, 02.026

Wed **10:00 – 10:55**	**16 PLENARY Irina Ruf** Hopping through space and time: New insights into lagomorph evolution and morphology
Wed **10:55 – 11:15**	**Tea/Coffee**

Anatomy & morphology

Peter Froggatt Centre, 02.026

Wed **11:15 – 11:30**	**17 Lucie Helfmann** Comparative anatomy of the maxillary fenestration in Lagomorpha
Wed **11:30 – 11:45**	**18 Brian Kraatz** Cranial shape changes in leporids as an indicator of visual performance
Wed **11:45 – 12:00**	**19 Alexander Kuznetsov** The intracranial fissure serves hares to suppress masticatory noise, not to save the eyes as suggested by Bramble in 1989
Wed **12:00 – 12:15**	**20 Christine Böhmer** Craniomandibular anatomy in domestic rabbits and its relation to dental disease
Wed **12:15 – 13:45**	**Lunch**

WORKSHOP 1 - Lagomorph taxonomy and conservation (Chair - Paulo Celio Alves)

Peter Froggatt Centre, 02.026

Wed **13:45 – 14:00**	**21 Paulo Alves** Conservation Genetics of a forgotten hare species, *Lepus castroviejoi*
Wed **14:00 – 14:15**	**22 José Costa** Using sister taxa to unravel the role of demography and adaptation promoting divergence and admixture
Wed **14:15 – 14:30**	**23 Lara Marinangeli** Genomic identification of two hare species (*Lepus timidus, L. europaeus*) and their hybrids using a novel panel of genomic loci: MIPs (Multi-locus Intron Polymorphisms)
Wed CANCELLED **14:30 – 14:45**	**24 Andrey Lissovsky** Phylogeny and impact of hybridisation in the evolution of pikas Ochotona from the subgenus Pika
Wed **14:45 – 15:00**	**Tea/Coffee**
Wed **15:00 - 15:15**	**25 Silvia Diaz** An introduction to the systematics of the cottontail rabbits *Sylvilagus* (Lagomorpha: Leporidae) from Peru
Wed **15:15 – 15:30**	**26 Luis Ruedas** *Sylvilagus floridanus* is not
Wed **15:30 – 15:45**	**27 Lucja Fostowicz-Frelik** Filling the gap: an exclusive mitogenome target-enrichment probe set for the superorder Euarchontoglires

WORKSHOP 2 - Lagomorph diseases: Advances in virology, genomics & parasitology (Chair – Ana Lopes)

Peter Froggatt Centre, 02.018

Wed **13:45 – 14:00**	**28 Ana Lopes** Novel gammaherpesviruses in lagomorph species (*Oryctolagus cuniculus, Lepus* spp and *Ochotona alpina*)
Wed **14:00 – 14:15**	**29 Joana Abrantes** RNA virome of wild European rabbits (*Oryctolagus cuniculus algirus*): insights into a novel betacoronavirus and zoonotic potential
Wed **14:15 – 14:30**	**30 João P. Marques** MyxoHares: Unravelling the genomic landscape of myxomatosis susceptibility in Iberian hares
Wed **14:30 – 14:45**	**31 Maria Carolina Matos** Evolution and expression of a newfound FCRL gene, FCRL7, in the European rabbit
Wed **14:45 – 15:00**	**Tea/Coffee**
Wed **15:00 - 15:15**	**32 Jay Prebble** Investigating the potential role of lagomorphs in the transmission of parasites of agricultural significance
Wed **15:15 – 15:30**	**33 Leonardo Brustenga** Parasitological survey of European brown hare (*Lepus europaeus* Pallas, 1778) breeding facilities from southern Italy
Wed **15:30 – 15:45**	**34 Josep Estruch** Molecular monitoring of rabbit hemorrhagic disease virus 2 (RHDV2, GI.2) in European brown hares and European rabbits from Catalonia (NE Spain)
Wed **15:45 – 16:00**	**35 Tereza Almeida** Dynamics of rabbit hemorrhagic disease virus 2 (RHDV2) and rabbit populations in geographically Isolated regions: a case study of Terceira and Santa Maria Islands, Azores

Wed **16:00 – 16:15**	**36 David Peacock** Surveillance for rabbit haemorrhagic disease virus in South Australia: the value of active monitoring
Wed **16:30 – 16:45**	**World Lagomorph Society (WLS) Session** Peter Froggatt Centre, 2nd Floor, Room 150
Wed **17:00 – 17:30**	**Wine Reception / Posters** Peter Froggatt Centre Foyer
Wed **17:30 – 18:00**	**The Armagh Rhymers** Peter Froggatt Centre Foyer
Wed **18:00 – 21:00**	**Conference Dinner** The Great Hall

Thursday 25th July 2024

Peter Froggatt Centre, 02.026

Thurs **10:00 – 10:55**	**37 PLENARY Janet Rachlow** Ecology and conservation of pygmy rabbits (*Brachylagus idahoensis*): habitat specialists in a changing environment
Thurs **10:55 – 11:15**	**Tea/Coffee**

Open session

Peter Froggatt Centre, 02.26

Thurs **11:15 – 11:30**	**38 Hanne Lyngholm Larsen** Preliminary Diet Analysis of European Hares (*Lepus europaeus*) in Denmark: A Comparative Study Using Traditional Methods and DNA Analysis
Thurs **11:30 – 11:45**	**39 Heiko Rödel** Age-specific effects of density and rainfall on reproduction in an Australian population of European rabbits
Thurs **11:45 – 12:00**	**40 Tami Bočková** Lagomorpha of the Appalachians: Biotic influences on the presence of *Sylvilagus obscurus*
Thurs **12:00 – 12:15**	**41 Arjun Thapa** Ecological habitat correlates of the endangered Hispid hare (*Caprolagus hispidu*) in Nepal
Thurs **12:15 – 12:20**	**Nidhi Zak** Poetry recital *Incantation for the hare*
Thurs **12:20 – 13:45**	**Lunch**

Thurs **13:45 – 14:00**	**42 Anukul Nath** Habitat selection of endangered Hispid hare: A landscape scale approach: implications for conservation and habitat management
Thurs **14:00 – 14:15**	**43 Anna Schertler** Distribution Range and Ecological Niches of the Genus Lepus in Africa and Near East.
Thurs **14:15 – 14:30**	**44 Natasha McGowan** Upscaling camera trap Distance Sampling to National population estimates using hares in Ireland.
Thurs **14:30 – 14:45**	**45 Alexandra Malinowska** Camera trap monitoring of rabbits (*Oryctolagus cuniculus*) and Irish hares (*Lepus timidus hibernicus*) on Rathlin Island prior to eradication of introduced predators
14:45 – 15:00	Tea/Coffee Break
Thurs **15:00 – 15:15**	**46 Ramón Pérez de Ayala** LIFE IBERCONEJO: governance for the European wild rabbit monitoring
Thurs **15:15 – 15:30**	**47 Ana E. Santamaría** The Iberian monitoring system of the European wild rabbit
Thurs **15:30 – 15:45**	**48 Tamara Burgos** Abundance and trend estimates using different data sources: the case of the European wild rabbit
Thurs **15:45 – 16:00**	**49 Thomas McGreevy** Establishing and monitoring island breeding colonies to conserve an imperiled lagomorph
Thurs **16:00 – 16:15**	**Paulo Alves & Neil Reid** Closing remarks and Prizes
Thurs **16:15**	**END**

Friday 26th July 2024 – Post-conference Excursions

*All times are provisional only. A revised timetable will be confirm during the conference on Thursday.
Please note that lunch is not provided. Attendees will have an opportunity to purchase lunch.

Fri **08:00 – 19:30**	**Rathlin Island, Area of Special Scientific Interest** 08:00 Coach departs Lanyon Building, main QUB site 10:00 Spirit of Rathlin Ferry departs Ballycastle Harbour 10:40 Arrive Church Bay, Rathlin Island Church Bay, Hire bikes, Manor House, Puffin Bus, RSPB Kebble, walking/hiking 17:00 Spirit of Rathlin Ferry departs Church Bay 17:40 Arrive Ballycastle Harbour 17:55 Coach departs Ballycastle Harbour 19:10 Arrive Lanyon Building, main QUB site
Fri **08:00 – 18:00**	**Giant's Causeway & Causeway Coast UNESCO World Heritage Site** 08:25 Twenty minute walk from Lanyon Building, main site 08:45 Arrive at Glengall Street 09:00 Coach departs Antrim coast road tour, Giant's Causeway, Visitors Centre 18:00 Arrive Glengall Street
Fri **10:30 – 18:00**	**The Navan Centre & Fort, Newgrange** 10:30 Departs front of Lanyon Building, main QUB site 12:15 Arrive Newgrange 12:30 Tours, walk, shop, lunch 15:30 Depart Newgrange 17:00 Arrive Lanyon Building, main QUB site
Fri **10:00 – 18:00**	**Mount Stewart, The National Trust** 10:00 Departs Lanyon Building, main QUB site 11:00 Arrive Mount Stewart House tours, walks, café, gift centre 15:00 Depart Mount Stewart 16:00 Arrive Lanyon Building, main QUB site

POSTERS

Opportunities throughout the week

Peter Froggatt Centre, Foyer

Tuesday 23rd July	
10:10 – 10:30	Tea/Coffee
12:15 – 13:45	Lunch Break
14:40 – 15:00	Tea/Coffee
Wednesday 24th July	
10:55 – 11:15	Tea/Coffee
12:15	Lunch
14:45 – 15:00	Tea/Coffee
17:00 – 17:30	Wine Reception / Posters
Thursday 25th July	
10:55 – 11:15	Tea/Coffee
12:15 – 13:45	Lunch
14:45 – 15:00	Tea/Coffee

P1	**50 Anna Schertler** Distribution Range and Ecological Niches of Leporids in Africa and Near East.
P2	**51 Carlos Bedson** Highest densities of mountain hares (*Lepus timidus*) associated with ecologically restored bog but not grouse moorland management.
P3	**52 Carlos Bedson** Estimating density of mountain hares using distance sampling: a comparison of daylight visual surveys, night-time thermal imaging and camera traps.
P4	**53 Michelle Henley** Habitat adaptation strategies of a protected species: diet assessment of the mountain hare in Scotland.
P5	**54 Hayley Lanier** The North American Lagomorph Working Group (NALWG): Monitoring and conservation across the continent
P6	**55 Neil Reid** Bidirectional hybridisation and introgression between introduced European brown and endemic Irish hares.
P7	**56 José Costa** MitoCatch: Mitogenome extraction from whole genome sequencing.

P8	**57 João Marques** Dynamics and evolution of immune multigene families in Lagomorphs: a comparative genomics approach .
P9	**58 Andrew W. Byrne** Rabbit haemorrhagic disease virus 2 (RHDV2; GI.2) in Ireland focusing on wild Irish hares (*Lepus timidus hibernicus*): an overview of the first outbreaks and contextual review.
P10	**59 Christine Böhmer** Skull shape diversity in pet rabbits and the applicability of reference lines for objective interpretation of dental disease.
P11	**60 Víctor Pacheco** New morphological data on the cottontail rabbits *Sylvilagus capsalis* and *S. inca* (Lagomorpha: Leporidae) from Peru.
P12	**61 Lucie Helfmann** Comparative anatomy of the maxillary fenestration in Lagomorpha.
P13	**62 Stéphanie Schai-Braun** Reproductive performance in the European hare (*Lepus europaeus*): are maternal body conditions decisive?
P14	**63 DJ Histon** The Irish Coursing Club.
P15	**64 Isabel Pacios Palma** The European hare (*Lepus europaeus*) in the province of La Pampa, Argentina: a pilot study disentangling its role as potential reservoir species of infectious diseases on humans, domestic animals and native wildlife.
P16	**65 Darius Weber** Cereals in wide rows as an instrument for the propagation of brown hares: a success story from Switzerland

Tues 23rd July 09:15 – 10:00

1 INVITED PLENARY

The resilience of pikas to the impacts of climate variability and change.

David S. Hik[1]*

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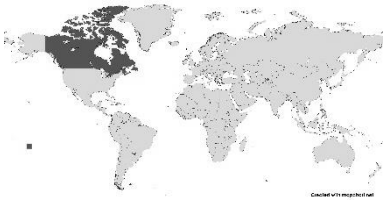

PLENARY SPEAKER BIOSKETCH

Professor of Terrestrial Ecology, Simon Fraser University, Canada.

His research focuses the structure and dynamics of plant and animal populations and their interactions. Mostly in mountain, northern and arid environments, where landscape heterogeneity, climate change, and seasonal variability have a strong influence on ecological processes. Collared and American pika (*Ochotona collaris* and *O. princeps*) behaviour, genetics and ecology.

SFU SIMON FRASER UNIVERSITY

In 2004, a short note published in Species (Smith, Weidong & Hik) noted some concerning observations about recent declines in several populations of pikas (*Ochotona princeps, O. collaris, O. iliensis*). What was going on? The potential for anthropogenic effects to wreak havoc on pika populations was not something that had received much attention, and yet that was exactly what appeared to be happening in these three isolated cases. The dramatic decline or loss of pika populations was undoubtedly complex, but one cause consistently jumped out – the impacts of increased temperatures resulting from global climate change in the high elevation environments where pikas live. Over the past 20 years we have learned much more about this relationship, and I will discuss the potential for population declines due to impacts of global climate change. In more detail, I will review some factors that may influence the resilience and persistence of collared pikas (*O. collaris*) to environmental variability at the edges of their range compared with the core. I will also discuss some of the strategies and conservation recommendations in the 2023 Species at Risk Management Plan for the Collared Pika in Canada, relevant to the maintenance of sufficient suitable habitat to allow collared pika to persist and be resilient to environmental change. More broadly, the absence of long-term monitoring of both biological and physical parameters constrains our ability to assess the implications of the changes being observed in pika populations as the world rapidly approaches future 'no-analog' climate scenarios.

Keywords: Climate change; conservation; mountains; *Ochotona collaris*; pika; population monitoring.

Tues 23rd July 10:30 – 10:45

2 ORAL

What's the point of subspecies? Status of the Irish hare *Lepus timidus hibernicus.*

Ian Montgomery[1*], Paulo Prodöhl[1], Neil Reid[1]

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We outline the molecular systematics and phylogeography, and morphological and ecological variation in mountain hares focusing on the Irish hare. Early descriptions and nomenclature of the Irish hare are reviewed. Current distribution of sub-species in European mammals is reviewed and compared with its historical use. Recent, theoretical reviews of the value of sub-species as a taxonomic category are summarized. Finally, we address whether there is any legitimate taxonomic reason to retain sub-species status in Irish hares, whether it should be absorbed into *L. timidus*, or return to its original status as *L. hibernicus*.

Keywords: Nomenclature; species concepts; species description; subspecies; taxonomy.

Tues 23rd July 10:45 – 11:00

3 ORAL

Dublin Hareport: The movement ecology and active area interactions of five airside hares, at an international airport.

Samantha Ball*[1,2,3], Anthony Caravaggi[4], Gerry Keogh[2], Fidelma Butler[1]

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[2] daa, Airport Fire & Rescue Service, Dublin, Ireland;
[3] Marine and Freshwater Research Centre, Department of Natural Sciences, Atlantic Technological University, Galway, Ireland;
[4] School of Applied Sciences, University of South Wales, Pontypridd, Wales.
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Within airfield environments, animal movement can present a substantial risk to aircraft, resulting in wildlife-aircraft collisions ('strikes') if animals enter into manoeuvring, 'active' areas of the airfield (i.e., runways, taxiways). Despite this, little is known about animal movements within airfield environments and the collection of reliable ecological data to inform management decisions can be difficult to obtain, due to access restrictions. Here, we explore the use of GPS devices within an airfield environment and present the first GPS data describing the movement ecology and spatial use of mammals on an airfield. This was achieved through the deployment of GPS collars onto five individuals from the Irish hare (*Lepus timidus hibernicus*) population residing on the airfield at Dublin International Airport. Over the course of the study period (December 2021- August 2022), a total of 4,571 active area interactions were recorded, with a mean of 4.3 (range: 0-65) active area interactions, per hare, per day. We identified that the average home range size of collared hares was 2.8 km^2 (±SD 0.1 km^2), based on 95% Kernal Utilisation Distribution and identified when hares most frequently engaged with active areas. Furthermore, we demonstrate that the hares incorporate active area (i.e., runway/ taxiway) habitat types into their home ranges with up to 13% of one individual's movements incorporating these areas. Our study demonstrates the suitability of GPS tracking devices for gaining valuable insights into the movement ecology of mammal species at airfields, which in turn may help to inform airside management practices.

Keywords: Airfield ecology; GPS telemetry; human-wildlife conflict; movement ecology.

Tues 23rd July 11:00 – 11:15

4 ORAL

The relationship between landscape characteristics, the density of European hares (*Lepus europaeus*) and predator community characteristics.

Nina Fülep*, Peter Venekamp, Martijn Weterings*, Henry Kuipers

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Insight into the factors that affect community composition is needed to fully comprehend and map the reasons for species decline and community assemblage. Many studies focus on single trophic levels foregoing the complexity of relationships between multiple trophic levels. This paper examines the relationships between predator communities and landscape characteristics both directly and indirectly through prey density using a multitrophic model approach. Hunters provided estimations of the numbers of hares and the number of individuals of predator species present in their hunting leases during 2021. We used fragmentation, heterogeneity, land use types and primary productivity as landscape characteristics. Canonical Correspondence Analysis (CCA) and Structural Equation Modelling (SEM) were used to model the relationships between landscape characteristics, prey density and predator community characteristics. Predator species assemblage was significantly affected by agricultural grass in hunting leases. There was no relationship between the predator community characteristics and prey density. Fragmentation had a positive relationship with predator community characteristics. Primary productivity was positively related with the energetic requirements of the predator community. No indirect relationships were found. Our results do not support the bottom-up control theory between prey and predator species as well as between primary producers and primary consumers but does between landscape characteristics and predators. The complexity of studying whole ecosystem processes and relevant factors of influence may play a role in conflicting results in the literature. Future research must continue to expand on the body of knowledge pertaining community ecology using a multitrophic approach.

Keywords: Bottom-up control; community ecology; multitrophic approach; pathway analysis; predator-prey dynamics

Thurs 25th July 11:15 – 11:30

5 ORAL

An experimental assessment of acceleration dependent energy expenditure and behaviour-specific metabolic rates in European brown hares

Jonas Roth[1]*, Claudia Bieber[2], Melanie Dammhahn[5], Diana Estrada[1], Kira Homeyer[1], Stephanie Kramer-Schadt[3,4], Sylvia Ortmann[3], Myriam Schröder[3], Jonas Stiegler[1], Niels Blaum[1]

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[2] University of Veterinary Medicine, Vienna, Austria;
[3] Leibniz Institute for Zoo and Wildlife Research, Berlin, Germany;
[4] Technische Universität Berlin, Berlin, Germany;
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European hares (*Lepus europaeus*) are significant agents of ecological connectivity, especially in anthropogenically altered landscapes. Understanding the energetic costs associated with mammalian movement is fundamental for explaining activity patterns, movement paths and therefore the species' contribution to landscape connectivity. However, quantifying their energy expenditure in free-living conditions, especially during various activities, presents challenges necessitating innovative experimental approaches. This study aims to quantify activity costs and behaviour-specific energy expenditure of European hares and establishes a calibration for Overall Dynamic Body Acceleration (ODBA) as a proxy for energy expenditure. ODBA is easily derived from the signal of triaxial acceleration sensors by summing up the three orthogonal vectors and is therefore often used as a proxy for energy expenditure. However, it needs calibration to be applied reliably. Combining ODBA with daily energy expenditure values measured via the Doubly Labeled Water (DLW) technique, we conducted a comprehensive investigation on 26 captive hares. We incorporated differently sized semi-natural enclosures, to ensure a range of daily activity intensities. The DLW technique provided data on total daily energy expenditure, ODBA served as a proxy for activity-specific costs, while continuous camera observation allowed for a gapless behaviour classification of four non-locomotive and four locomotive behaviours. Our findings unveil the energetic demands of hare activity across various behaviours and also provide a calibration for translating the proxy of ODBA to the exact energy expenditure of European hares. Since ODBA is easily calculated in studies utilizing GPS- and acceleration collars, this study provides the basis for energy-focused research in wild European hares without impeding their natural movement.

Keywords: Behaviour-specific metabolic rate; doubly labeled water; energy expenditure; European hare; overall dynamic body acceleration.

Tues 23rd July 11:30 – 11:45

6 ORAL

Survival, movements, home range size and dispersal of hares after coursing and/or translocation.

Neil Reid[1]*

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Hare coursing is the pursuit of a hare by dogs for sport. In recent years in Ireland, between 2,900 to 3,700 hares have been caught from the wild (under Government license) and held in captivity for up to 8 weeks. Hares are given a head start and coursed in an enclosed arena by two muzzled greyhounds where the object is not to kill the hare, but judge the dogs on their ability to turn the hare which escapes under a partition through which the dogs cannot follow. Recent licence returns suggest over 99% of hares survive and are released back into the wild. This study aimed to assess survival and behaviour of coursed hares after their release sometimes into unfamiliar territory. Forty hares were tracked using GPS-radio collars for six months after release in a factorial experimental design to test the impact of coursing and translocation on survival, movements, home range size and dispersal. Coursed and uncoursed hares did not differ in observed mortality rates, movements, home range sizes or dispersal distances after release back into the wild though fewer coursed than uncoursed hares were relocated six months after release, due to a combination of collar strap failures and radio silence. Spatial behaviour was similar between the cohorts once translocated hares, which moved further and had larger home range sizes during the first four days after release, had settled. Two hares released shortly before sunset were killed in road traffic collisions during their first night. Releasing hares during daylight, preferably as early as possible, may provide time for animals to settle before darkness. Suggestions are made for potential methodological improvements such as the use of cellular (mobile phone) or satellite communication technology mounted on stouter straps to reduce failures and improve relocation rates.

Keywords: GPS tag; hunting; Irish hare; post-release mortality; telemetry; tracking.

Tues 23rd July 11:45 – 12:00

7 ORAL

Hares in England and Wales - the case for a close season.

Mark Jones[1]*

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Across most of Europe, hares are protected against shooting and deliberate killing during their breeding season, which typically runs from February to September. Scotland introduced a close season in 2012 under the Wildlife and Natural Environment Act 2011 which makes it an offence to intentionally or recklessly kill, injure or take brown hares from 1 February to 30 September, and mountain hares from 1 March to 31 July. However, in England and Wales hares enjoy no such legal protection. The Hares Preservation Act of 1892, which is still in force, only prohibits the sale of hares from 1st March-31st July, but does nothing to prevent them being shot. The UK government classified both species as 'Priority Species' under the UK Biodiversity Action Plan in 1994, and a Species Action Plan was created for the brown hare in 1995 which set a target of doubling spring numbers in Britain by 2010 and increasing leveret survival. Hares remain priority species under the UK Post-2010 Biodiversity Framework. However, associated targets have not been delivered. In spite of this, hare shoots in England continue to take place in February when females are already pregnant or nursing dependent young, resulting in the loss of breeding females and the death of dependent young through starvation. This talk will consider the evidence for the serious conservation and animal welfare implications of shooting hares during their breeding season and will make the case for the establishment of a mandatory close season in England and Wales.

Keywords: Brown hare; mountain hare; shooting; close season; welfare.

Tues 23rd July 12:00 – 12:15

8 ORAL

Wildlife rescue centres and the scientific opportunities to study wild lagomorphs

Jana Stefanova[1]*

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This presentation will explore the potential of utilizing data collected by wildlife rescue centres focusing on the scientific opportunities to study wild lagomorphs using Kildare Wildlife Rescue (KWR) as a case study example. By delving into the data on wild European rabbit (*Oryctolagus cuniculus*) and Irish hare (*Lepus timidus hibernicus*) admissions and rehabilitation, the aim to uncover potentially valuable opportunities for scientific research.

Keywords: Animal rescue; hand rearing, veterinary; recovery; rehabilitation, release back into the wild.

Tues 23rd July 13:45 – 14:40

9 INVITED PLENARY

Evolution according to *Lepus*: camouflage, introgression and adaptation to future climates.

Mafalda Sousa Ferreira[1,2]*

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[2] Department of Medical Biochemistry and Microbiology, Uppsala University, Uppsala, Sweden.
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PLENARY SPEAKER BIOSKETCH

Postdoctoral researcher in evolutionary genomics interested in how species adapt to their local environments. In particular, what regions in the genome are involved in adaptation, what is the origin of adaptive genetic variants, and how are these variants maintained in populations over time. Adaptation of winter whitening in snowshoe hare (*Lepus americanus*) and white-tailed jackrabbit (*L. townsendii*).

Stockholm University

Hares (*Lepus* spp.) are one of the most cosmopolitan genera among Lagomorphs. With at least 32 described species, hares are adapted to contrasting environments throughout the globe, from hot deserts to the arctic, from open plains to alpine zones. In the last few years, *Lepus* has emerged as a model to study adaptation to environmental change both at the genus and the species level. Phylogenomic studies have shown that hares have spread across the world in the last 5 million years colonizing diverse environments aided by the exchange of adaptive genetic variation through pervasive hybridization among ancestral and extant lineages. In particular, the study of the shared evolution of seasonal camouflage among hares has contributed to a better understanding of how organisms adapt to changing seasonal climates through ancestral and introgressed genetic variation. To illustrate these findings, I will present recent work focusing on seasonal coat colour changing species, including mountain hares, snowshoe hares and white-tailed jackrabbits. This work has used population genomics and transcriptomics to dissect the genetic basis of white to brown/gray variation in winter coloration. With comparative genomics, this work uncovered the origin of the winter-brown/gray genetic variation that allow these majorly winter-white species to adapt to changes in snow cover in their habitat. Finally, I will present work on white-tailed jackrabbits to illustrate how we have incorporated the genetic basis of adaptation into predictions of population resilience to future snow cover declines.

Keywords: Adaptation; environmental change; genomics; hares; hybridization; seasonal camouflage.

Tues 23rd July 15:00 – 15:15

10 ORAL - WLS Travel Bursary Award

Cyclic dynamics in a changing climate: snowshoe hare populations across the Great Lakes.

Rebecca S. Chandross[1*], Jonathan N. Pauli[1]

[1]Department of Forest & Wildlife Ecology, University of Wisconsin-Madison, Madison, WI, USA.
*Email: Rchandross@wisc.edu

Climate change is altering various aspects of mammalian population dynamics globally. Snowshoe hares (*Lepus americanus)* are an emblematic species for climate change with many populations at their southern range boundary exhibiting dampening cyclic dynamics and facing local extirpation due to worsening winter conditions. To better understand the response of these hares to changing climatic conditions, we investigated snowshoe hare cyclic dynamics across a latitudinal cline in the Great Lakes region; an area exhibiting rapid environmental change and eroding snow conditions. Utilizing indices for snowshoe hare abundance, we examined periodicity and amplitude of population cycling from 44ºN to 49ºN. Preliminary results suggest that while cyclicity has been lost at the southernmost populations, cycles nonetheless persist across higher latitudes. Notably, an island population of snowshoe hares on Isle Royale National Park appear to cycle in synchrony with mainland populations despite both lacking a specialized predator (i.e., lynx, *Lynx canadensis)* and being spatially and genetically isolated. These results reveal that while the role and ecological function of snowshoe hares along their southern range boundary appear to be weakening due climate change, the population of hares on Isle Royale appears to maintain defining features of this species' population dynamics. Furthermore, our results suggest that Isle Royale could act as a climate change refugia for snowshoe hares if winter conditions continue to deteriorate.

Keywords: Climate change, cyclic dynamics, latitudinal cline, population dynamics, population genetics, refugia.

Tues 23rd July 15:15 – 15:30

11 ORAL

Identifying genetic signatures of local adaptations to high-altitude environments in large-eared pikas (*Ochotona macrotis*) across their broad distribution range in the Himalayas.

Melia Romine[1]*, Nishma Dahal[2], Sangeet Lamichanney[1]

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[2] CSIR-Institute of Himalayan Bioresource Technology, Palampur, Himachal Pradesh, India.
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Ochotona macrotis, commonly known as the large-eared pika, has an extensive distribution range. Their habitat extends across several countries in South and Central Asia, such as Afghanistan, Tibet, Bhutan, India, Kazakhstan, Kyrgyzstan, Nepal, Pakistan, and Tajikistan. Within the Himalayas, the large-ear pikas are known to occupy habitats of diverse topography and elevations in this region. Their habitat encompasses up to four distinct zones (alpine, sub-alpine, cool temperate, and warm temperate), each characterized by unique environmental conditions. Hence, they are suitable models to study genomic adaptations to alpine environments. 17 samples of *O. macrotis* have been collected and whole genome sequenced across four habitat zones in the Himalayas. Population genomic approaches are being implemented to understand how different populations are genetically related. This study is expected to identify specific genomic regions and candidate genes associated with local adaptation to varying habitats, potentially encompassing genes linked to cold tolerance, oxygen utilization, and other ecological factors. This research will contribute to a more comprehensive understanding of how a species with a large distribution range can adapt and thrive in different environmental contexts.

Keywords: High-altitude adaptation*; Ochotona macrotis*; population genomics.

Tues 23rd July 15:30 – 15:45

12 ORAL

Mountain hare coat colour mismatch - are they able to keep up with the changing climate?

Simen Pedersen[1]*, Allan Stokes[1], Tim R Hofmeester[2], Neri H Thorsen[3], John Odden[3], John D. C. Linnell[1,4], Caroline Pierquin[1], Stian Kalleberg[1], Scott Mills[5], Marketa Zimova[6]

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[2] Swedish University of Agricultural Sciences, Umeå, Sweden;
[3] Norwegian Institute for Nature Research, Oslo, Norway;
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[5] University of Montana, Missoula, USA;
[6] Ohio University, Athens Campus, USA.
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In many areas, current climate change causes reduced seasonal snow cover duration, leading to seasonal coat colour changing species to be mismatched against their environment for an increasingly longer time. This mismatch leads to increased predation, and may have population level effects for these species. Here we investigate how mountain hare coat colour mismatch is influenced by climate change induced reductions in snow cover over a 60-year period. We quantified degree of mismatch using multiannual (2011-2019) camera trap data from 678 camera traps spread across a large environmental gradient in Norway spanning from 58° N to 69° N. We coupled this with spatially extrapolated snow cover time series from 1959 and onwards on a country wide scale, creating two 30-year averages of snow cover duration (1959-1988) and (1989-2018) for each camera trap location. When comparing snow cover duration over the two 30-year averages, areas that experienced the largest reduction in snow cover duration were also areas where hares experienced the highest number of days of mismatch. Thus, hares seem not able to adjust the timing of the moult fast enough to keep track with the pace of winter shortening. However, behavioural plasticity may be a faster way for species to adjust to climate change, and we end by discussing preliminary results from ongoing work with GPS marked hares where we ask the question whether hares may do behavioural adjustments to reduce the negative impact of coat colour mismatch.

Keywords: Behavioural plasticity; climate change; mismatch; seasonal coat colour change; *Lepus timidus*; snowcover.

Tues 23rd July 15:45 – 16:00

13 ORAL

The genetic basis and evolutionary history of winter coat colour polymorphism in the Japanese hare.

Gohta Kinoshita[1]*, Mitsuo Nunome[2], Yasuhiro Go[3, 4], Takashi Makino[5], Shoji Tatsumoto[3], Alexey Kryukov[6], Sang-Hoon Han[7], Irina Kartavtseva[6], Atsushi Nagano[8], Fumio Yamada[9], Yuji Isagi[10], Hitoshi Suzuki[11], Jun Kitano[12]

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[3] Exploratory Research Centre on Life and Living Systems, Okazaki, Japan;
[4] University of Hyogo, Kobe, Japan;
[5] Tohoku University, Sendai, Japan;
[6] Centre of the East Asia Terrestrial Biodiversity, Russian Academy of Sciences, Vladivostok, Russia;
[7] Inter-Korea Wildlife Institute, Inje, South Korea;
[8] Ryukoku University, Otsu, Japan;
[9] Okinawa University, Naha, Japan;
[10] Kyoto University, Kyoto, Japan;
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[12] National Institute of Genetics, Mishima, Japan.
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As islands are geographically isolated, it is challenging for populations to persist in the face of rapid environmental changes during the Quaternary period. Genetic variation introduced from mainland ancestors, along with first colonization and subsequent gene flow, should have played a crucial role in adaptation. How such variations can be maintained during environmental changes? As the Japanese archipelago has diverse landscapes spanning from north to south, we hypothesized that such spatial variations in the environments have maintained genetic diversity during climatic fluctuations. To test this hypothesis, we focused on a bimodal winter coat coloration observed in the Japanese hare (*Lepus brachyurus*). These coat colours likely reflect adaptations to snow-covered and snow-free regions across the archipelago. Through a Genome-Wide Association Study (GWAS), we identified the genomic region responsible for this colour dimorphism. Furthermore, we demonstrated that alleles at a candidate gene were inherited in concordance with winter colour types in captive-bred animals from zoos. Additionally, during autumn moulting, gene expression levels differed between the divergent alleles. Phylogenetic analysis, incorporating other Lepus species, indicated that the alleles associated with the colour dimorphism in the Japanese hare diverged before its speciation, likely due to either ancestral polymorphism or introgression. Niche modelling analysis suggested that despite significant distributional changes over past glacial-interglacial cycles, both winter colour types have persisted within the archipelago. These results collectively imply that the colour dimorphism has been maintained since long before the Last Glacial, contributing to environmental adaptation and species persistence throughout the Quaternary climatic fluctuations within the island ecosystem.

Keywords: Genomics; Japanese Archipelago; Quaternary climate change; standing genetic variation; snow camouflage.

Tues 23rd July 16:00 – 16:15

14 ORAL

Coexistence of European hares and Alpine mountain hares in the Alps: what drives the occurrence and frequency of their hybrids?

Stéphanie C. Schai-Braun[1]*, Simon Schwienbacher[1,2,3], Steve Smith[4], and Klaus Hackländer[1, 5]

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[3] Forststation Kaltern, Kaltern an der Weinstrasse, I Italy;
[4] University of Veterinary Medicine, Vienna, Austria;
[5] Deutsche Wildtier Stiftung, Hamburg, Germany.
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Mountain hares are adapted to cold and snowy conditions. Conversely, European hares originate from the grasslands of the Middle East and spread from there throughout agricultural areas of Europe. Mountain hares and European hares generally occur allopatrically, but sympatry occurs in some areas. In sympatric areas introgressive hybridisation poses a threat to the Alpine mountain hare. Introgressed individuals are found in both species but are far more frequent in European hares. The ecology of hybrids is poorly known in these species. To examine the Alpine mountain hare and European hare populations in the Alps with a particular focus on the occurrence and ecology of their hybrids, we performed molecular genetic analysis of hare faecal samples collected in the Alps in South Tyrol and compared habitat associations of the genotyped samples. We recorded 150 individuals (i.e., 14 hybrids, 25 European hares, 111 Alpine mountain hares). Four introgressed individuals were at levels consistent with F2 hybrids, whereas the others showed an older interspecific gene flow. We found that hybrid faeces tended to be at lower elevations compared to those of Alpine mountain hare but at higher elevations than those of the European hare. The frequency of Alpine mountain hares decreased as the proportion of Alpine grassland increased but was positively correlated with the proportion of dwarf shrub heaths. Our results support the widely raised concerns that the European hare, as a generalist, is a competitor with the Alpine mountain hare in the Alpine ecosystem in the time of global climate change.

Keywords: Backcrossed individuals; Leporidae; *Lepus timidus; Lepus europaeus*; population estimates; specialist.

Tues 23rd July 16:15 – 16:30

15 ORAL

Exploring hybridization dynamics in Alpine hare species under climate-driven range shifts.

Pedro Sousa[1,2,3]*, José Costa[1,2,3,4], Liliana Farelo[1,3], Jérôme Letty[5], Cécile Kaerle[6], Guillaume Queney[6], Paulo Célio Alves[1,2,3,7], João Pimenta[1,3], José Melo-Ferreira[1,2,3], João Pedro Marques[1,3]

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Anthropogenic-driven environmental changes pose significant threats to biodiversity, impacting both species dynamics and ecosystems. Mountain ecosystems are particularly vulnerable to the effects of climate change, with marked increases in temperature and decreases in winter snow cover in recent years. These environmental changes result in the invasion of temperate species into mountain habitats, which has a significant impact on the distribution and survival of species adapted to high mountain environments. When closely related species are involved in the retraction-invasion dynamics and can still hybridize, this potentially alters interspecific gene flow dynamics, which may impact the gene pool of the interacting species. Hybridization introduces novel variants in the species genomes upon which selection can act on, on the one hand incrementing the genetic variation that is what ultimately determines the adaptive capacity of species but on the other hand introducing potential maladaptive variation. This work aims to quantify hybridization levels and characterize genetic diversity between the populations of the mountain hare (*Lepus timidus*), a retracting arctic-boreal species, and the European brown hare (*L. europaeus*), an invading temperate species, in the French Alps. Using RADseq (Restriction-site Associated DNA sequencing), our analysis aims to unravel the genetic exchanges occurring between these hare species with opposing demographic trends and understand their genetic structure and gene flow dynamics. Additionally, we aim to identify introgression outlier alleles, that may be indicative of rapid adaptation driven by hybridization, shedding light into the mechanisms driving species interactions and adaptation in the threatened Alpine ecosystem.

Keywords: Biodiversity conservation; climate change; genomics; hybridization; range-shifts.

Wed 24th July 10:00 – 10:55

16 INVITED PLENARY

Hopping through space and time: New insights into lagomorph evolution and morphology.

Irina Ruf[1,2,3]*

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[2] Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, Frankfurt am Main, Germany;
[3] Jilin University, Changchun, Jilin, China.
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PLENARY SPEAKER BIOSKETCH

Head of the Section Mammalogy at the Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, Germany.

Since 2014, teaching vertebrate paleontology at the Goethe-Universität Frankfurt am Main and since 2023 guest professorship at the Research Center of Paleontology and Stratigraphy, Jilin University in Changchun, China. Her research is based on µCT, histology and comprises the evolution, comparative anatomy, ontogeny and functional morphology of the cranium in extant and extinct mammals and their ancestors, with a special focus on the nasal and auditory regions in Lagomorpha, Rodentia and Mesozoic mammals.

The order Lagomorpha has a long evolutionary history since the Eocene resulting in their present-day diversity and almost global distribution as specialized small herbivores. Therefore, they represent the perfect model morphological system for elucidating evolutionary transformations, phylogenetic hypotheses and functional morphological adaptations. Recent studies based on high-resolution computed tomography (µCT) of extant as well as extinct lagomorph taxa significantly increased our knowledge on their specific anatomy. The major focus of these studies is on cranial and dental structures that are often preserved in the fossil record and therefore can contribute to a deeper understanding of lagomorph evolution, systematics and functional morphology. For instance, intracranial structures of the nasal and ear regions of selected Leporidae, Ochotonidae and stem-lagomorphs revealed new patterns of systematic and functional relevance, i.e., the turbinal skeleton inside the nasal cavity, the anterior anchoring of the auditory ossicle chain or the course of the internal carotid artery. The presentation will provide insight into recent lagomorph research and will address specific evolutionary, anatomical and functional morphological aspects of this enigmatic order: What if anything is a lagomorph? Which further cranial characters separate Leporidae from Ochotonidae? Which are the major sensory, dietary and locomotory adaptations and how/why did they evolve? And why are lagomorphs so small compared to other herbivores?

Keywords: Adaptation; cranium; functional morphology; herbivory; µCT; Leporidae; Ochotonidae; stem-lagomorph.

Wed 24th July 11:15 – 11:30

17 ORAL

Comparative anatomy of the maxillary fenestration in Lagomorpha.

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Lagomorpha are unique in having an extensive fenestration of the maxillary bone, which shows a cribriform pattern in Leporidae (facies cribrosa maxillae). Previous studies showed some differences in the extent of fenestration between the different lagomorph genera. However, systematic relevance and functional meaning of the maxillary fenestration are still discussed as comprehensive morphological studies are still pending. Here we provide the first results of a detailed anatomical comparative study of the maxillary fenestration based on µCT scans of 27 species covering all 12 extant lagomorph genera and two fossil species (*Litolagus molidens, Palaeolagus haydeni*). *Ochotona* shows a big fenestra in the posterodorsal part of the maxillary corpus. Among leporids different patterns are evident on the generic level. *Nesolagus, Poelagus* and *Pentalagus* show a dense bony meshwork with tiny foramina, similarly to the stem-lagomorph *Palaeolagus*; this may resemble a plesiomorphic lagomorph pattern. *Caprolagus* is unique in having parallel organized bony rods perpendicular to the nasolacrimal canal. All other studied genera have a larger anterodorsal foramen, ventrally bordered by a distinct bony rod as well as an extensive bony meshwork on the maxillary corpus. However, single species deviate from this pattern. *Litolagus* shows a specific meshwork dominated by larger openings and rods. Our results clearly show that the maxillary fenestration pattern can be a useful character for lagomorph taxonomy and systematics. Both living families can be clearly distinguished; within Leporidae the observed patterns are restricted to specific genera although some of which may have evolved several times independently.

Keywords: Facies cribrosa maxillae; Leporidae; Ochotonidae; stem-lagomorphs; µCT.

Wed 24th July 11:30 – 11:45

18 ORAL

Cranial shape changes in leporids as an indicator of visual performance

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Strong correlations between cranial shape and locomotor behaviour is rare among mammals. Cranial disparity within leporids (rabbits and hares) has been shown to be driven by pronounced changes in cranial flexion (facial tilt). Within leporids, facial tilt angle is strongly correlated to locomotor mode and significantly predicts cranial shape variation on the major axis of cranial shape space. In short: the more leporids tilt their face downwards, the more likely they are to exhibit high-speed, cursorial locomotion. We previously hypothesized that leporid cranial transformations related to adaptive aspects of the visual field. Here we measure orbital convergence/divergence angle in 184 leporid crania, representing 20 extant species, to test the relationships among cranial shape, locomotor behaviour, and visual acuity. Our analyses show significant negative correlation ($p < 0.01$) between orbital convergence and facial tilt; as leporids tilt their face downwards, they also increase orbital divergence and, therefore, they both reduce the size their binocular field and increase the size (i.e., widen) of their overall visual field. We also show that there is a strong correlation ($p=1e-05$) to the size of the posterior wing of the supraorbital process and orbital divergence angle; the more divergent the orbital fields, the larger the posterior wing. Given previous work establishing the links between facial tilt and locomotor behaviour, these relationships provide a more direct functional link between cranial shape variation and locomotor behaviour within leporids. Though a relationship between orbital convergence and behaviour has been shown for anthropoid primates, there are important differences between what we report here and that observed in primates.

Keywords: Cranial shape; Leporidae; locomotion; morphometrics; visual field.

Wed 24th July 11:45 – 12:00

19 ORAL

The intracranial fissure serves hares to suppress masticatory noise, not to save the eyes as suggested by Bramble in 1989.

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Leporids differ from all other mammals by the presence of an intracranial fissure. It traverses the skull from the interparietal-supraoccipital suture at the top, between squamosal and petrotympanic laterally, and between basisphenoid and basioccipital at the bottom. It cuts the skull into ethmoid-orbit-mandibular and otic-occipital moieties, separating the jaw joint from the inner ear. We propose that it disrupts the bone conduction of the owner's masticatory noise to cochlea, thus enhancing the ability to discriminate the sound of an approaching predator during chewing. To check this hypothesis we used a fresh head of an adult *Lepus europaeus*. The skin was cut along the top of the skull, and flat areas were made on bones with a file for metal, to which a pair of piezoelectric transducers was glued with cyanoacrylate. One was constantly glued to parietal, and the second was glued to frontal, supraoccipital or mastoid. The masticatory sound was produced by hand-driven side-to-side movement of mandibular against maxillar teeth. RMS amplitudes of wavelets were compared on the two channels of oscilloscope. The mean parietal-to-frontal RMS amplitude decrease, characterizing the masticatory noise attenuation within the orbit-mandibular moiety, was about 2.2-fold. The attenuation across the fissure was considerably larger. The mean parietal-to-supraoccipital attenuation was about 2.9-fold, and the parietal-to-mastoid one was about 6.7-fold. Thus, the mastoid, representing the nearest place to the cochlea, was proved to be the most silent area in the head in respect of the masticatory noise. Further experiments are required to prove the suggested hypothesis.

Keywords: cochlea, inner ear; jaw joint; *Lepus europaeus*; piezoelectric transducer; sound conduction.

Wed 24th July 12:00 – 12:15

20 ORAL

Craniomandibular anatomy in rabbits and its relation to dental disease.

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Through artificial selection, domestication has led to considerable and often extreme changes in the behavior, physiology and morphology of mammals. This involves traits such as increased sociability, reduction in brain size and brachycephalism. The latter certainly has various negative effects on the animal's health since short-faced mammals suffer from respiratory diseases amongst others and generally have a shorter lifespan due to their health issues. However, it is not only the phenotype that causes problems, but also how the animals are kept. Diet, in particular, is implicated in plastic changes of the musculoskeletal system and plays a role in the development of acquired dental disease. Here, we quantified the intraspecific variation in masticatory musculature and craniomandibular bone morphology of a population of domestic rabbits (ZIKA) held under the identical laboratory conditions and fed one type of rationed commercial pellet feed. This revealed the diversity in muscle cross-sectional area (proportional to the maximum force-producing capacity) and the diversity in 3D shape of the cranium and the mandibula based on geometric morphometrics. Next, we included wild rabbits in our analyses to reveal their relation to the domestic rabbit population. We expect the wild rabbits to display stronger masticatory muscles because they feed primarily on grass. The muscle-bone covariation analysis will reveal if differences in musculature are associated with the differences in craniomandibular morphology or not. A better understanding of the link between anatomy, diet and hypselodont teeth will help to prevent husbandry-related dental problems, which represents a serious welfare concern in rabbit keeping.

Keywords: Dentition; landmark-based geometric morphometrics; masticatory musculature; pathologies; teeth; veterinary medicine.

Wed 24th July 13:45 – 14:00

21 ORAL

Conservation Genetics of a forgotten hare species, *Lepus castroviejoi.*

Paulo C. Alves [1,2,3,4]*, José Costa[1,2,3,5], José Melo-Ferreira[1,2,3], João Queirós[1,2,3,4], Fernando Ballesteros[6#]

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[#] In memory of Fernando Ballesteros

The broom hare (*Lepus castroviejoi*) is a threatened European endemism that is restricted to the Iberian-Cantabrian Mountains. Despite its status, it is one of the least known lagomorph species in the world. To improve knowledge of its geographical distribution, population structure and genetic variability, we used a genetic non-invasive sampling (gNIS) approach and collected 185 hare pellets between 2019-2021, together with opportunistic tissue sampling (22) between 2003-2021 across the Cantabrian mountains. Nuclear and mitochondrial DNA markers were used for species and individual identification. Populations of the other European hare species, *L. granatensis*, *L. europaeus, L. corsicanus* and *L. timidus*, were also analyzed to compare levels of genetic diversity and to infer possible hybridization. Species identification was successful in 87 pellets (47%), all belonging to *L. castroviejoi*. In total 54 individuals were identified, some outside of the known range. The genetic variability of *L. castroviejoi* (Ho=0.168; He=0.186, Na=2.53) is the lowest reported for any hare species, comparable only to its sister species *L. corsicanus*. A slight east-west population structure was also observed, with the eastern group showing higher diversity. There was no evidence of recent hybridization. In summary, this study emphasizes the highly reduced genetic diversity of *L. castroviejoi* showcasing the vulnerability of this species to extinction. Furthermore, highlight the potential use of gNIS to study lagomorph species, namely to assess the demography, spatial distribution, population structure, and to implement genetic monitoring plans, especially in endemic, rare, and threatened species.

Keywords: Endemic species, genetic variability; conservation biology, genetic non-invasive sampling.

Wed 24th July 14:00 – 14:15

22 ORAL

Using sister taxa to unravel the role of demography and adaptation promoting divergence and admixture.

José Costa [1,2,3,4 *], João P. Marques [1,2,3], Liliana farelo [1,2,3], Pierre Boursot [4], José Melo-Ferreira [1,2,3]

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The Italian hare (*Lepus corsicanus*, endemic to the Italian Peninsula) and the broom hare (*L. castroviejoi,* endemic to the Cantabrian Mountains in the Iberian Peninsula), exhibit significant genetic similarity and reduced diversity relative to other European hare species. The mountain hare (*L. timidus*), inhabiting northern and high-altitude European regions, shares genetic material with both species, with a remarkable complete mitochondrial introgression in both. Recent research have unveiled nuclear introgression from the Iberian hare (*L. granatensis*), which is present across the Iberian Peninsula, into the broom hare, further complicating their genetic landscape. In order to properly reconstruct the history of divergence and introgression in the two species, we enlarged available sampling by including whole genome sequencing from mainland Italy specimens, in addition to the previously available from Corsica with uncertain origins due to their human-mediated introductions. As well as extra samples from Cantabria. This enlarged dataset allows us to comprehensively explore divergence between the Italian and broom hares. As well as their past genetic interactions with other hare species from Europe. Our study aims to reconstruct the divergence history of these two hare species and elucidate their admixture events with other hare species present in Europe, integrating past ecological niche modelling to incorporate temporal and geographical dimensions. Our findings reveal evidence of balancing selection in both hare species and detected instances of introgression from the mountain hare throughout their genomes. Additionally, introgression from the Iberian hare was identified in the broom hare, shedding further light on their complex genetic dynamics.

Keywords: Evolution; genomics; hares; hybridization; introgression; *Lepus*.

Wed 24th July 14:15 – 14:30

23 ORAL

Genomic identification of two hare species (*Lepus timidus*, *L. europaeus*) and their hybrids using a novel panel of genomic loci: MIPs (Multi-locus Intron Polymorphisms)

Lara Marinangeli[1,2]*, Elisa Boscari[3], Annalisa Scapolatiello[3], Barbara Crestanello[1], Giulio Galla[1], Francesco Nonnis-Marzano[2], Maria Ferloni[4], Leonardo Congiu[3,5,6] & Heidi C. Hauffe[1,6]

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The mountain hare (*Lepus timidus*) is an arctic-alpine species, with relictual populations in the Alps threatened by climate and anthropic changes that result in snow cover reduction and habitat loss, as well as resource competition and hybridization with the European brown hare (*L. europaeus*). The latter is a typical species of open habitats in agricultural landscapes, often restocked for hunting and with an Alpine distribution currently shifting into areas once dominated by the mountain hare, due to an increase in mean winter temperatures. For conservation and management purposes, we developed a new panel of Multi-locus Intron Polymorphisms ('MIPs') for mammalian genomic surveys, species and individual identification, and monitoring of interspecific hybridization, with a specific subset for *L. timidus*, *L. europaeus* and their hybrids. To generate the mammalian panel, a total of 121 genomes were aligned to identify the most conserved intronic regions and 192 introns randomly distributed across the genomes were then selected. Primer pairs suitable for multiplex PCR amplifications followed by Illumina amplicon sequencing were designed on conserved exonic flanking regions. The MIPs panel was tested on tissue samples from 260 mountain and 70 brown hares bagged in the Province of Sondrio (Italy), from three hunting areas with different intensities of *L. europaeus* restocking; in addition, two altitudinal ranges (below and above 2000m a.s.l.) and two collection periods (2001-2008 and 2016-2023) were considered as proxies for climate change scenarios. Amplicon sequencing data were analysed with dedicated bioinformatic pipelines to assess inter- and intraspecific genetic diversity and level of hybridization of the populations under study. Our work highlights the impact of *L. europaeus* restocking and climate on *L. timidus* genomic diversity, and we discuss the usefulness of MIPs for guiding conservation strategies.

Keywords: Climate change; mountain hare; genomic markers; intron amplicon sequencing; SNP genotyping; taxonomic classification.

Wed 24th July ~~14:30~~ 14:45

CANCELLED

24 ORAL

Phylogeny and impact of hybridisation in the evolution of pikas *Ochotona* from the subgenus *Pika.*

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Subgenus *Pika* includes 11 species of rock dwelling pikas. The all supposed speciation events within the subgenus were related to allopatric processes that took place during Pleistocene distribution dynamics. Six of the 11 species inhabit mountains of the northern Asia and are very similar in morphology. During the XX century, these 6 species were recognised as either one species *O. alpina*, or two — *O. alpina* and *O. hyperborea*. One of the 6 species, *O. turuchanensis*, is a relative to *O. alpina* but extremely similar to *O. hyperborea* in morphology. Turuchan pika is largely sympatric with the latter species; besides it is the only representative of the group that has different ecological niche. Given the mosaic of traits, it was tempting to test the hypothesis that interspecific hybridization was involved in *O. turuchanensis* speciation. New genomic data has given us such opportunity. General phylogenetic pattern of the subgenus, inferred from genomic data, was very similar to the previous oligolocus reconstructions. Resolution on the lower taxonomic level was slightly dependent on the loci sampling. Our tests did not support hybridogenous origin of *O. turuchanensis*. Nevertheless, we found the gene flow between some populations of different species, including Turuchan pika. Interestingly, we did not confirm the gene flow between most modern sympatric populations. Our genomic data allows us to discuss influence of hybridisation and selection on speciation processes in the subgenus *Pika*. Analysis was supported by RSCF 24-24-00310.

Keywords: phylogeny; genomics; hybridisation; *Ochotona*; *Pika*.

Wed 24th July 15:00 - 15:15

25 ORAL - WLS Travel Bursary Award

An introduction to the systematics of the cottontail rabbits *Sylvilagus* (Lagomorpha: Leporidae) from Peru

Silvia Diaz[1]*, Luis A. Ruedas[2], Elizabeth Escobar[1], Danilo Bustamante[3], Martha Calderón[3], Richard Cadenillas[1,4], Monica Arakaki[1], Dennisse Ruelas[1], Víctor Pacheco[1]

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Recent studies showed that the tapeti *Sylvilagus brasiliensis*, formerly considered polytypic, was a species complex which resulted in the recognition of some subspecies to species level. However, in Peru the formal subspecies *capsalis*, *inca*, and *peruanus*, only described by coloration patterns and scarce cranial characters, have not yet been systematically revised. Based on the direct examination of 140 specimens from Peruvian and international museums, including the examination of 1 neotype, 2 holotypes, and 10 topotypes, we scored more than 70 external, cranial, and dental discrete characters, and took measurements for 22 variables to perform multivariate analyses. Additionally, we sequenced the cytochrome-b gene to infer phylogenetic relationships and the use of delimitation species tools. We concluded that: 1) *capsalis* and *inca* can both be differentiated from congenerics and merit species level; and 2) at least three other morphotypes from the Peruvian Amazonian region can prove to be valid species, which need to be confirmed by genetic data. Morphological characterization, morphological and molecular phylogenies, multivariate analyses, and distribution of these lineages are presented. Our data suggests that the Huancabamba depression and the Marañón River constitute important dispersal barriers for some of these lineages and support the hypothesis that tapetis are more diverse than previously thought.

Keywords: *capalis*; Huancabamba depression; *inca*; Marañon River; *peruanus*.

Wed 24th July 15:15 – 15:30

26 ORAL

Sylvilagus floridanus is not.

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Lagomorphs (rabbits, hares, and pikas), with 112 species currently recognized, constitute only the ninth most speciose order of mammals, although its true species diversity currently remains unknown. One of those species is the Eastern Cottontail, *Sylvilagus floridanus*, with a geographic range of 19,065,866 km^2. Distributed from Canada to Venezuela, it has one of the broadest distributions among mammals. As such, the conservation status of the species is listed as "Least Concern" in the most recent version of the IUCN Red List. We examined character variation and mitogenomes of specimens associated with *S. floridanus*. Our findings demonstrate that, far from constituting a single species, the *floridanus* group of *Sylvilagus* in fact is constituted by a number of species–level taxa generally congruent with biogeographic regions. Here, we describe the morphological attributes and molecular data, and their joint bearing on speciation and biogeography of *Sylvilagus* in general, and taxa associated with the *S. floridanus* species group in particular. We previously had extracted *S. yucatanicus* and *S. hondurensis* from *S. floridanus*, hypothesizing that the latter is limited to regions north of the Isthmus of Tehuantepec. Here, we bring additional data to bear data from molecular clock analyses and demonstrate that the invasion of the Neotropics by *Sylvilagus* only took place once and was temporally congruent with the Great American Biotic Interchange.

Keywords: Biogeography, evolution, Lagomorpha, Leporidae, mitogenome, systematics.

Wed 24th July 15:30 – 15:45

27 ORAL

Filling the gap: an exclusive mitogenome target-enrichment probe set for the superorder Euarchontoglires

Anwesha Saha[1,2]*, Mateusz Baca[2], Danijela Popovic[2], Zeinolabedin Mohammadi[3], Urban Olsson[4,5], Emily Roycroft[6], Lucja Fostowicz-Frelik[1,7]

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Filling the gap in genomic information for any species is crucial to explain taxonomic uncertainties and evolutionary relationships. In Museomics, preserved old specimens are used for target enrichment followed by high-throughput sequencing to generate good quality complete reference genomes (nuclear or organelle). Despite limitations, mitogenome remains a useful phylogenomic marker due to its smaller size, compact organization, and higher copy number. The superorder Euarchontoglires has five constituent orders i.e. Primate, Rodentia, Lagomorpha, Scandentia, and Dermoptera. The inter-order relationship is still debated as novel reference genomes are lacking for the species from the three latter groups. Here, we present an mRNA probe set (3× tilling), designed from 71 Euarchontoglire mitogenomes representing all five orders to develop mitogenomes for the remaining taxa. A total of 43 (10 to 100-year-old) ethanol-preserved muscle (28 samples) and dry skin tissue (15 samples) from two extant lagomorph families were used to test the probe's efficiency. Among 40 successful samples, 31 mitogenomes have a mean coverage >100x and the remaining 9 have a coverage value between 20x-99x. Tissue type or age did not affect the enrichment success. The length of these complete mitogenomes varies between 16200-17000 bp. Notably, the mitogenomes generated are of *Brachylagus idahoensis*, *Ochotona rufescens, Lepus alleni* (Mexico), *Sylvilagus* sp, unidentified *Lepus* sp. (China), *Lepus tibetanus* (North-East Iran) distinct subpopulations of *O. rufescens* (Iran). Presently, testing is going on a few extant and extinct rodent species. However, access to museum collections for robust sampling is essential for further inspection.

Keywords: Euarchontoglires; Lagomorpha; mitogenome; museomics; phylogenomics; target enrichment.

Wed 24th July 13:45 – 14:00

28 ORAL

Novel gammaherpesviruses in lagomorph species (*Oryctolagus cuniculus*, *Lepus* spp and *Ochotona alpina*).

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Herpesviruses pose an increasing threat to both wild and captive populations. These viruses are ubiquitous and capable of establishing life-long infections in a latent state, with some degree of immune response. Herpesviruses are enveloped, double-stranded DNA viruses belonging to family *Herpesviridae*. Five distinct herpesviruses, known as LeHV-1 to 5, have been described with varying impact on lagomorph populations. While LeHV-4, an alphaherpesvirus, is associated with mortality in the European rabbit (*Oryctolagus cuniculus*), the others are gammaherpesviruses, presenting challenges for diagnosis due to asymptomatic infections that often go unnoticed. LeHV-5 resembles rodent gammaherpesviruses and has been hypothesized to be associated with high morbidity and mortality in Iberian hares (*Lepus granatensis*) when in presence of concomitant infections such as myxomatosis. This study aimed to assess the prevalence and distribution of herpesviruses in lagomorph populations mainly from Europe. Using a generalist nested PCR, we screened >1,000 DNA samples from European rabbit (*O. cuniculus*), hares (*Lepus* spp.), cottontails (*Sylvilagus* spp.), and pikas (*Ochotona* spp.). Results revealed ca. 60 infected animals, including *O. cuniculus*, *L. granatensis*, *L. europaeus*, *L. timidus* and *O. alpina*. Notably, sequencing and analysis of the ~150bp-long fragment were key to identify a potentially novel gammaherpesviruses in *O. cuniculus* and *O. alpina*. The former is ~80% similar to LeHV-5 whilst the latter seems to be closer to rodent rhadinoviruses. These findings significantly contribute to our knowledge of herpesviruses occurrence in wildlife and, in particular, in lagomorphs. Further research on associated diseases is warranted to understand their epidemiological impacts.

Keywords: Herpesviruses; lagomorphs; prevalence; wildlife diseases.

Wed 24th July 14:00 – 14:15

29 ORAL

RNA virome of wild European rabbits (*Oryctolagus cuniculus algirus*): insights into a novel betacoronavirus and zoonotic potential

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Among zoonotic viruses, RNA viruses originating from wildlife represent the primary human emerging pathogens. Yet, and despite the wealth of viruses present in animals without causing overt disease, our focus has been biased towards those causing disease. Viral metagenomics greatly benefited wildlife pathogen surveillance by improving our ability to unbiasedly detect and characterize viruses with zoonotic potential in overlooked species. In this study, we explored the RNA virome of wild European rabbits from the subspecies *Oryctolagus cuniculus algirus* by viral metagenomics. Oropharyngeal swabs were obtained from apparently healthy animals. Viral RNA was extracted and pooled equimolarly to generate libraries for sequencing. The obtained paired-end reads were analyzed using a bioinformatics pipeline for removal of adapters and host contamination, *de novo* assembly and identification of viral contigs. We recovered a viral sequence with ~31kb and highest similarity (92.1%-97.2%) with rabbit betacoronaviruses (RbCoV HKU14) isolated from domestic rabbits (*O. c. cuniculus*) from China in 2007. Although the genomic organization seems conserved, novel insertions and deletions were observed. Using pancoronavirus primers and conventional PCR, we estimated a prevalence of 20% in the Portuguese wild population studied, which is higher than previously reported for *O. c. cuniculus*. While betacoronaviruses had been previously reported in *O. c. cuniculus*, this is the first description in the subspecies *O. c. algirus*. Given the plasticity of betacoronaviruses to mutate, recombine and adapt to new host species, further molecular and functional studies are warranted to characterize this virus in rabbits, which might act as intermediate host species.

Keywords: Coronavirus; leporids; zoonosis.

Wed 24th July 14:15 – 14:30

30 ORAL

MyxoHares: Unravelling the genomic landscape of myxomatosis susceptibility in Iberian hares.

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The Iberian hare, *Lepus granatensis*, plays a crucial role in Iberian ecosystems and is an important game species. Recent myxomatosis outbreaks in 2018 and 2019 caused substantial mortalities, posing a threat to the survival of the species in its native habitats. Given this Myxoma virus outbreak, which originally solely affected European rabbits, it becomes urgent to understand genetic susceptibility and resistance in Iberian hares. Our research, part of the Biodiversity Genomics Europe (BGE) project, aims to use genomic data, including a high-quality reference genome of the Iberian hare, to develop monitoring and conservation programs. By analysing whole-genome sequences of hares affected by myxomatosis and those showing some degree of resistance, we seek to identify genetic markers associated with resistance. Additionally, we will incorporate genomes of unaffected neighbouring species which will contribute to our understanding of possible resistance mechanisms. Furthermore, our study also aims to recover the genomes of myxoma and other DNA viruses present in each animal, exploring the variability of the virus and possible correlations between host and virus genomic variability. This collaborative effort, additionally supported by the European Reference Genome Atlas (ERGA), emphasizes the importance of genomic research in biodiversity conservation. The insights gained will facilitate the development of applications that will help to establish conservation strategies and aid stakeholders in mitigating the spread of the virus among this ecologically significant species.

Keywords: Iberian hare; conservation; Myxomatosis; population genomics; BGE.

Wed 24th July 14:30 – 14:45

31 ORAL

Evolution and expression of a newfound FCRL gene, FCRL7, in the European rabbit.

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Fc receptor-like (FCRL) family members encode immunoreceptors that are involved in the regulation and pathogenicity of numerous diseases. Fc receptor-like 6 (FCRL6) is an inhibitory receptor of cytotoxic T and NK lymphocytes that binds MHCII and has high expression in patients with malignancies and infections. We have now identified a novel FCRL gene, named here FCRL7, in the European rabbit (*Oryctolagus cuniculus*) and twenty other mammal species. However, FCRL7 is missing in several mammal groups like primates. This receptor shares the basic structure of FCRL6, having two to three IG-like domains but is distinguished by its general lack of a transmembrane domain encoding exon, with the exception of the Platypus (*Ornithorhynchus anatinus*) and Australian echidna (*Tachyglossus aculeatus*). Another peculiarity of this novel gene is the absence of the characteristic 21bp second exon that encodes the amino-terminal split signal peptide characteristic of both the FCR and FCRL families. We have confirmed the presence of FCRL7 in the spleen and thymus of *O. cuniculus* by PCR analysis and have initiated detailed transcriptome studies of lymphoid tissues. Initial phylogenetic analyses indicate a closer relationship between FCRL6 and the newfound FCRL7 gene of the same species than between FCRL6 in different species. This, along with its presence in basal mammal species, leads us to believe that FCRL7 might represent a primordial gene that evolved, ultimately giving rise to the origins of FCRL6. The overarching goal of this project is to characterize this novel receptor and determine its structure and functional properties in immunity.

Keywords: European rabbit; Evolution; FCRL7; Gene expression; Immunoreceptors.

Wed 24th July 15:00 - 15:15

32 ORAL

Investigating the potential role of lagomorphs in the transmission of parasites of agricultural significance.

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Lagomorphs commonly utilize pastoral land grazed by domestic livestock creating potential for interspecies parasite transmission, however, their potential role as a wildlife reservoir for parasitic and pathogenic organisms has been poorly studied. A global review of parasites of wild lagomorphs identified 565 parasites, of which 192 were of veterinary (161) and/or zoonotic (129) significance. Almost half (43%) of all species and much of Africa, South America and South-East Asia were entirely data deficient. The metazoan parasite communities of 114 European rabbit (*Oryctolagus cuniculus*) and 41 Irish hare (*Lepus timidus hibernicus*) were examined to investigate the metazoan parasite community of lagomorphs in Ireland to assess their potential role in the transmission of agriculturally relevant parasites. Parasitism was common in both species, with 17 parasites identified in rabbits and 6 in hares with prevalence and intensity of infection influenced by life history traits and seasonal changes. Coinfection with multiple helminth species occurred more frequently in rabbits (83%) than hares (14%). *Trichostrongylus retortaeformis* was common in both lagomorph hosts but differed in its distribution along the small intestine. Modelling the interspecific interactions revealed positive effects of cestodes on *Graphidium strigosum* intensity, *G. strigosum* on *T. retortaeformis* intensity and *T. retortaeformis* on *Passalurus ambiguus* intensity. Only two of the recovered species: the tick*, Ixodes ricinus* and liver fluke, *Fasciola hepatica* were of agricultural significance. Both occurred infrequently suggesting lagomorph populations in Ireland are not a significant reservoir of parasites, but the presence of infected individuals may contribute to parasite dynamics at the local level.

Keywords: Parasite ecology; parasite diversity; wildlife disease.

Wed 24th July 15:15 – 15:30

33 ORAL

Parasitological survey of European brown hare (*Lepus europaeus* Pallas, 1778) breeding facilities from southern Italy.

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Parasites are considered as important regulating factors of the population dynamics of host species, not just in free-ranging wildlife, but also in captive wild species bred for restocking purposes. To date, only few studies have been carried out to assess the parasitic biocenosis of the European brown hare (*Lepus europaeus* Pallas, 1778) in Southern Italy, and just one was focused on captive reared animals. The aim of the present survey was to assess the composition of the endoparasite community in game hares bred for restocking. For this reason, 215 faecal pools were collected in eight different breeding facilities from Southern Italy and were inspected with both qualitative and quantitative coprological techniques to assess the presence of parasitic eggs and larvae. Parasites characterized by a direct life cycle, including six species of coccidia from the genus *Eimeria* and the nematode *Trichostrongylus retorataeformis*, proved to be the most prevalent parasites among all the breeding facilities. Further helminthic infestations by the nematodes *Passalurus ambiguous* and *Strongyloides papillosus*; by the trematode *Dicrocoelium dendriticum*; and by cestodes from the genus *Cittotenia* were also detected, but with overall prevalence lower than 20%. The present study allowed to increase the knowledge on the health status of breeding stocks destined to be release in the wild, and is useful for the optimization of breeding efforts in captivity.

Keywords: *Lepus europaeus*; endoparasites; captive bred wildlife; wildlife parasitology.

Wed 24th July 15:30 – 15:45

34 ORAL

Molecular monitoring of rabbit hemorrhagic disease virus 2 (RHDV2, GI.2) in European brown hares and European rabbits from Catalonia (NE Spain).

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Rabbit hemorrhagic disease virus 2 (RHDV2, GI.2) is a highly pathogenic lagovirus from the family *Caliciviridae* that affects the European rabbit (*Oryctolagus cuniculus*) and other leporid species, causing the rabbit hemorrhagic disease (RHD). RHDV2 emerged in 2010 in France, and spread worldwide, leading to severe declines in wild rabbit populations. A high recombination rate characterizes RHDV2, which is likely associated with its ability to cross the species barrier and infect other sympatric species, such as hares (genus *Lepus*). In the northeast of the Iberian Peninsula, European rabbits coexist with European brown hares (*Lepus europaeus*). In Catalonia, northeastern (NE) Spain, cases of RHDV2 have been detected yearly in brown hares since 2014. Our study aims to evaluate the variability of RHDV2 strains in lagomorphs from Catalonia, disclosing possible spatiotemporal patterns of circulation and exploring epidemiological and ecological factors involved. From 2015 to 2023, carcasses of European rabbits (n=380) and European brown hares (n=118) found dead in the field were studied, from which liver samples were collected. PCR amplification and Sanger sequencing were performed to detect RHDV2 infection and characterize the circulating strains. Additionally, phylogenetic analyses were done to determine relationships between strains. RHDV2 infection was confirmed in 21 brown hares and 49 rabbits, being observed recombinants: GI.1bP-GI.2, GI.4(p16)-GI.1bP-GI.2 and GI.4P-GI.2. Statistical and cluster analyses showed differences in temporal and spatial aggregation between the different genotypes. Our results evidence the circulation of different GI.2 recombinants in leporids from NE Spain and reinforce the importance of performing routine monitoring of their populations to provide insights into RHDV2 epidemiology.

Keywords: genotype; *Lepus europaeus*; *Oryctolagus cuniculus;* rabbit hemorrhagic disease; recombination; sympatric.

Wed 24th July 15:45 – 16:00

35 ORAL

Dynamics of rabbit hemorrhagic disease virus 2 (RHDV2) and rabbit populations in geographically Isolated regions: a case study of Terceira and Santa Maria Islands, Azores.

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Rabbit hemorrhagic disease virus (RHDV; genus *Lagovirus*, family *Caliciviridae*) is responsible for a fatal disease, the rabbit hemorrhagic disease (RHD) in both domestic and wild European rabbits (*Oryctolagus cuniculus*). First documented in China in 1984, RHDV has since been reported worldwide. In 2010, a new genotype (GI.2; known as RHDV2) emerged in France. GI.2 exhibits a distinct antigenic profile and has rapidly disseminated, replacing previously circulating pathogenic strains from genotype GI.1. In the Azores Islands, RHD outbreaks were first reported in 1989 and caused a high mortality on most islands. GI.2 was first detected in late 2014 in Graciosa, followed by the remaining islands (except Corvo) in early 2015. Considering the geographic isolation of the Azores, the presence of GI.2 provides an opportunity to study the co-evolutionary dynamics between virus and host. Here we report a case study in two Azorean islands, Santa Maria and Terceira. While GI.2 outbreaks have been detected annually in Terceira with a continuous decrease in rabbit abundance but maintaining a high percentage of seropositive rabbits, in Santa Maria population abundances remained high until 2022 with no outbreaks or seropositive rabbits detected in our 2021 survey. However, this changed dramatically when an outbreak occurred in 2022, resulting in a high mortality, which was probably due to the absence of resistant rabbits. These findings highlight the impact of virus re-emergence in a naïve rabbit population and the importance of continuous monitoring. This allows more effective management strategies to be implemented in rabbit populations of the Azores.

Keywords: Azores, case-study, dynamic population, outbreak, serology.

Wed 24th July 16:00 – 16:15

36 ORAL

Surveillance for rabbit haemorrhagic disease virus in South Australia: the value of active monitoring.

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An outbreak of disease in a lagomorph population can be monitored both passively and actively, each approach having strengths and weaknesses. After rabbit haemorrhagic disease virus (RHDV1; GI.1) was first passively detected in *Oryctolagus cuniculus* on mainland South Australia in 1995 it has been monitored passively across the state, and actively at specific sites such as at Turretfield, the Coorong region, and in the semi-arid Flinders Ranges. Passive monitoring has largely involved using the media to stimulate and remind the public and veterinarians to source tissue samples for PCR testing. Active monitoring has involved regular spotlight counts of rabbit abundance, and regular serological sampling of rabbit populations either from trapped or shot samples. Active monitoring has also utilised trapping necrophagic fly vectors of RHDV. Trapping fly vectors provided detailed information about circulating strains with less effort compared with physical carcass searches and is suitable for wide-scale citizen scientist efforts. Compared with data collected from carcasses, fly data can detect RHDV over longer time periods and in more locations. It overcomes the difficulty of finding carcasses where populations are small, terrain is complex or scavengers abundant. However, vector monitoring is unable to provide demographic mortality data or identify which circulating strain caused an outbreak, making localised carcass sampling an important complementary tool. Our monitoring of RHDV (GI.1 and GI.2) involved passive monitoring, which achieved a wide geographic scale, but our results highlighted the detailed and much more valuable knowledge we gained from including localised active monitoring.

Keywords: RHDV; calicivirus; *Oryctolagus cuniculus*; Turretfield; fly; burrow; searching.

Thurs 25th July 10:00 – 10:55

37 INVITED PLENARY

Ecology and conservation of pygmy rabbits (*Brachylagus idahoensis*): habitat specialists in a changing environment

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PLENARY SPEAKER BIOSKETCH

Professor of Wildlife Ecology, Department of Fish and Wildlife Sciences, University of Idaho, Moscow, USA. Her research interests include: behavioral ecology and conservation of mammals, viewshed estimation and ecology, wildlife-habitat relationships and the ecology of sagebrush ecosystems. Pygmy rabbit (*Brachylagus idahoensis*) and snowshoe hare (*Lepus americanus*) behavioural ecology and conservation.

University of Idaho

The pygmy rabbit (*Brachylagus idahoensis*) is endemic to the sagebrush-steppe ecosystem of the western USA. The species was petitioned for listing under the US Endangered Species Act in 2003 and again in 2023. A disjunct population in the Columbia Basin, Washington, which is currently listed as an Endangered, is undergoing an intensive reintroduction effort. The ecology of the species differs from sympatric cottontails and jackrabbits in their obligate use of burrow systems, creation of separate natal burrows, and reliance on sagebrush (*Artemisia* spp.) as a primary forage. Pygmy rabbits also shape sagebrush landscapes. Their burrow systems can remain occupied for decades, and the activities of rabbits influence the vegetation and soil properties around burrows resulting in increased seed production and recruitment of sagebrush seedlings. Pygmy rabbits have a broad, although patchy, distribution that includes four relatively large core areas across the western US. Despite habitat specialization, the species exhibits variation in habitat associations across its range. Distributions modeled under future climate scenarios projected substantial reductions in suitable habitat across five ecological regions in Idaho, and pronounced variation among regions in the magnitude and direction of the climate effects. In this talk, I will explore habitat specialization as it shapes our understanding of habitat relationships, current distribution, and implications for future distributions, and discuss how this work can inform conservation of pygmy rabbits and other lagomorphs experiencing changing environments.

Keywords: Climate change; ecosystem engineer; habitat relationships; sagebrush-steppe ecosystem; species distribution models.

Thurs 25th July 11:15 – 11:30

38 ORAL

Preliminary diet analysis of European hares (*Lepus europaeus*) in Denmark: a comparative study using traditional methods and DNA analysis.

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Monitoring wildlife is becoming increasingly important with the escalating rate of species extinction, habitat loss, and climate change. The European brown hare (*Lepus europeaus*) has been in decline in western and central Europe since the 1960s due in large to agricultural intensification. Knowledge of the diet choices of the hare can valuable as it can provides insights into the specific resources and environmental conditions required for them to thrive. The diet choices can help in long-term sustainable management to recreate qualitive habitat for hares. We studied the diet of more than 350 European brown hares in Denmark with both microhistological and DNA analysis of the stomach content. This was done to gain knowledge of the hares diet choices through the seasons. The variation in hare diet throughout the year and in different regions of Denmark can also serve as an indicator of vegetation and biodiversity in different habitats. The present study suggest that DNA analysis will achieve a higher taxonomic resolution and can make future diet studies less time-consuming.

Keywords: DNA analysis; Diet composition; habitat management; Microhistological analysis.

Thurs 25th July 11:30 – 11:45

39 ORAL

Age-specific effects of density and rainfall on reproduction in an Australian population of European rabbits.

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In the European rabbit (*Oryctolagus cuniculus*), as in various other mammals, female reproductive performance is often low in first-season breeders. In general, reproductive activity of young mammalian females, which frequently start reproducing before being fully grown, might be more susceptible to adverse environmental conditions than in older females. We studied age-dependent breeding probabilities in the females of a European rabbit population in South Australia, exploring possible negative effects of population density and ameliorating effects of rainfall. The study population experienced almost annual outbreaks of RHD and irregular outbreaks of myxomatosis. In general, females were able to start reproducing within their season of birth ('same-season females'), although with a low probability. As expected, the seasonal breeding activity followed an inversed U-shaped pattern with peak reproduction during austral winter, although the reproductive probability in same-season females was considerably lower than in older females. We found a positive, time-lagged effect of rainfall acting in an age-specific manner, predominantly promoting the reproductive probability in same-season females. Furthermore, as has been shown in other European rabbit populations, we found indications of a negative density dependence, i.e. a lower reproductive probability when the population density at the onset of the breeding season was high. This was most pronounced in females born during the previous year, which typically occupy low social ranks at least during the early breeding season. In conclusion, our findings underline the importance of considering age-specific environmental effects when studying wild rabbit breeding activity, including in populations prone to regular outbreaks of virulent diseases.

Keywords: Breeding; negative density-dependence; *Oryctolagus cuniculus*; Turretfield; weather effects; young females.

Thurs 25th July 11:45 – 12:00

40 ORAL

Lagomorpha of the Appalachians: Biotic influences on the presence of *Sylvilagus obscurus*.

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The Appalachian cottontail (*Sylvilagus obscurus*) is a small rabbit species endemic to the eastern USA, typically inhabiting the Appalachian Mountains. Existing literature regarding this near threatened species (as classified by IUCN Red List) is notably limited in scope and volume. The documented occurrences in the last decades suggest the distribution range of *S. obscurus* is restricted to altitudes of 700 m a.s.l. and above, however, historically it was reported to be spread in both lower elevations and a wider area. Nowadays both the current and presumed former distribution range of *S. obscurus* is fully covered by the extensive distribution range of *Sylvilagus floridanus*, a species known to figure in majority of documented interference competition among lagomorphs, most of which are with other species of the same genus. This research models the current distribution of *S. obscurus*: 1) utilizing solely abiotic factors (general climatic & landscape descriptors including anthropogenic influence) and 2) combining the former with biotic variables (integrated as occurrence probabilities of other lagomorphs). A comparative study of the predictions made with the modelling strategies reveals a noteworthy improvement of the combined model in terms of matching the prediction hotspots to the IUCN polygons, suggesting the other lagomorphs' distributions may in fact have a role in shaping the range of distribution, and consequently the population viability of *S. obscurus*.

Keywords: Appalachian cottontail; competition; interspecific interaction; *Sylvilagus obscurus*.

Thurs 25th July 12:00 – 12:15

41 ORAL

Ecological habitat correlates of the endangered Hispid hare (*Caprolagus hispidus*) in Nepal.

Arjun Thapa[1,2*], Rabin Bahadur K.C[3], Rajan Prasad Paudel[4], Rabin Kadariya[4], Rima G.C.[3], Ranjita Khadka[5], Laxmi Raj Joshi[4], Shyam Kumar Shah[6], Sagar Dahal[7]

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The hispid hare, an endangered elusive mammal that dwells in the tall grasslands of the Himalayan foothills across in Nepal, India, and Bhutan, faces severe threats from anthropogenic activities and seasonal floods. While previous studies on hispid hare have investigated in Shuklaphanta National Park, only one study has been conducted in Bardia National Park (BNP) over the past decade. Here, we aim to evaluate current distribution pattern of the hispid hare in the Babai Valley in BNP, identify factors influencing their distribution, and evaluate existing threats. We conducted a total of 428 transects (50m × 2m) in a 1km × 1km grid were conducted across 1048.55 hectares of grassland in the valley before and after grassland burning. The hispid hare exhibited a clumped distribution pattern, with recorded pellets in the grassland of Kalinara, Guthi, Sano Shree Phanta, Chitaale Phanta, Ratomate, Rhino Release Site, and Mulghat in BNP. Post-burning, pellet density was higher, indicating a greater population density in summer compared to winter. Our finding revealed a preference for riverbanks in winter and short grassland in summer, while the species tended to avoid forests and edge between grassland and forests. The best-fit model highlighted that grass density, grassland burning, and annual precipitation significantly influence the distribution of the hispid hares. Major threats identified in the field included seasonal grassland burning, summer flood, invasive species, vegetation succession, and predators. We recommend conservation efforts focus on protecting and managing grasslands that provide suitable habitat for the hispid hare.

Keywords: Babai Valley; distribution; grassland; hispid hare; pellet estimation; threats.

Thurs 25th July 13:45 – 14:00

42 ORAL - WLS Travel Bursary Award

Habitat selection of endangered hispid hare - a landscape scale approach: implications for conservation and habitat management

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Effective conservation strategies must take into account the habitat requirements of endangered species, as these taxa tend to inhabit specialised and threatened habitats where species-environment relationships are not well understood. We investigate habitat selection by the endangered hispid hare using a hierarchical multi-level approach, starting from geographic range (current distribution) to micro-scale requirements of the species. We conducted surveys in eight protected areas of India covering entire Terai stretch in the foothills of Himalaya. We used a combination of climatic, landscape, topographic and anthropogenic variables and at micro-scale dominant grass species assemblage, grass height and grass cover to obtain comprehensive understanding of habitat selection. We also studied population of hispid hare using pellet density and decay rate in Manas landscape. The presence of this elusive species in Indian-terai was also validated using DNA extracted from fresh pellets. We found that hispid hare distribution is restricted to the tall successional grasslands within protected Terai areas, namely Manas NP, Jaldapara NP, Dudhwa NP, Pilibhit TR, in India and Suklaphanta, Bardia NP and Chitwan in Nepal. On a geographic scale percentage of tall grassland cover followed by fire intensity, distance from protected area, and annual mean temperature were key in determining hispid hare occurrence. Further investigation within the Manas landscape showed that habitat selection of hispid hare was scale-dependent. There was significant association with fire intensity and occurrence probability of hispid hare. Fire intensity showed a positive relationship with hispid hare occurrence, with highest probability at (0.45-1.09 fire occurrences $km^{-2}yr^{-1}$). However, occurrence sharply declines with further increase in fire intensity on a broad scale. Subsequently, percentage tall grassland cover has positive and human density has negative influence on a smaller scale. On a micro-scale, hares prefer tall grass species assemblages dominated by *Narenga porphyrocoma*. The density of hispid hare in Manas landscape varies from 0.10-0.20 individuals/ha at 95% CI (0.14 ± 0.019 individuals/ha). Our study highlights the need to maintain or enlarge the extent of preferred habitat patches to ensure the viability of these metapopulations. On the macrohabitat scale, rotational burning to ensure the availability of adequate food and cover throughout the year together with managing invasive plant and cattle grazing would be the most effective management action. Transnational and national policy decisions on hydroelectric projects could be critical in shaping the microscale grass community structure of riverine grassland habitat, which is key for hispid hare conservation. Future research should prioritize the impact of dams and barrages on grassland community structure and associated grassland fauna across the Terai.

Keywords: Terai, grassland, lagomorph, multiscale, fire management, protected area, conservation.

Thurs 25th July 14:00 – 14:15

43 ORAL

Distribution range and ecological niches of the genus *Lepus* in Africa and Near East.

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The evolutionary relationships and biogeography the genus Lepus in Africa and Near East have undergone many changes but are still poorly understood, especially for the widespread Cape hare. To date seven species (*Lepus capensis* sensu lato, *L. europaeus, L. fagani, L. habessinicus, L. saxatilis, L. starcki, L. victoriae*) are recognized in the area. Appropriate conservation management measures require clarifying their geographical distribution and environmental niches. We investigate the distribution of the genus *Lepus* in Africa and Near East and analyse potential distribution and ecological niches of the species. To do so, we compiled a spatial database, comprising georeferenced occurrence data from a wide range of sources, including museum collections, literature and online citizen science databases. On this basis, we present gridded distribution maps, and explore the potential distribution of the species using ensemble model predictions built with the BIOMOD2-framework. Finally, we examine differences in ecological niches and check them for plausibility regarding current systematics. Our work identifies knowledge gaps and provides a basis for coordinating and prioritizing future phylogeographic studies as we summarize comprehensive information on representative specimens and their associated environmental conditions across geographic regions.

Keywords: Africa; biogeography; BIOMOD2; environmental niche; Lepus; museum collections; species distribution modelling.

Thurs 25th July 14:15 – 14:30

44 ORAL

Upscaling camera trap distance sampling to the national scale: hares in Ireland.

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Species distribution, population monitoring and surveillance are essential in assessing conservation status while informing policy on wildlife interventions. Camera traps are ubiquitous terrestrial mammal monitoring tools with new advances in abundance estimation including modified Distance Sampling. Typically, camera trap studies are site-specific with capacity in the temporal rather than spatial domain. Here, we deployed a large-scale national array of almost 600 camera trapping stations (at 44 randomly selected sites representative of habitat) throughout Ireland during winter 2018/19. A total of 105,702 hours (equivalent to 12 years) of survey effort generated 1,236 detections of 12 mammal species. We focused on the endemic Irish hare (*Lepus timidus hibernicus*) of conservation concern. The Irish hare was widespread with 253 hares detected at 85% of sites exhibiting a bimodal crepuscular (dawn and dusk) activity. Restricting data to peak activity periods, camera trap Distance Sampling models (right-truncated with a hazard-rate detection function) estimated 3.19 (95%CIs 1.59 - 6.43) hares/km^2 with a national population estimate of 223,000 (111,000 - 449,000) hares. Population densities were highest in the northwest (agriculturally extensive with low human population density) and lowest in the east (intensively farmed with high human population density). These figures are comparable to previous national population estimates using other methods, for example, nocturnal spotlight Distance Sampling surveys suggesting no overall temporal trend in abundance in recent decades. This information was used by government for statutory reporting of the current conservation status of the Irish hare. We demonstrate the roll out and utility of upscaling camera trap Distance Sampling wildlife monitoring and surveillance to the national scale.

Keywords: Abundance estimation; conservation status; density; *Lepus timidus*; population size.

Thurs 25th July 14:30 – 14:45

45 ORAL

Camera trap monitoring of rabbits (*Oryctolagus cuniculus*) and Irish hares (*Lepus timidus hibernicus*) on Rathlin Island prior to eradication of introduced predators.

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Small offshore islands serve as refuges for threatened species. However, they face risks from the incursion of non-native predators. Eradication projects are increasingly being undertaken as a conservation intervention. Though such projects are beneficial for target species of conservation concern, eradications can cause broader impacts on island ecosystems and trophic structure. This project focuses on LIFE Raft - an RSPB-led, EU-funded multi-trophic eradication program on Rathlin Island, Northern Ireland removing non-native invasive brown rats (*Rattus norvegicus*) and feral ferrets (*Mustela furo*). It aims to analyse non-target species' responses over three years: before-during-and-after eradication. This presentation will focus on data collected prior to eradication and discuss the spatial distribution of rabbit (*Oryctolagus cuniculus*) and Irish hare (*Lepus timidus hibernicus*) on Rathlin Island. Data on the distribution of lagomorphs have been obtained from camera trap footage from a comprehensive island wide grid of camera traps leading up to ferret eradication. Distribution of lagomorphs is modelled against ferret detections and removals, and the potential impact of the eradication on these lagomorph populations will be discussed.

Keywords: Conservation interventions; European rabbit; invasive species; Irish hare; population dynamics; spatial ecology.

Thurs 25th July 15:00 – 15:15

46 ORAL

LIFE IBERCONEJO: governance for the European wild rabbit monitoring

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The LIFE Iberconejo aims to improve the management of wild rabbits in the Iberian Peninsula. Rabbit populations in their natural distribution have declined by more than 70% between 2008-2018. At the same time it is the species that causes the most damage to agriculture. Establishing effective management strategies for any species necessitates comprehensive knowledge of population status and the implementation of robust, standardized monitoring systems. However, monitoring efforts have been characterized by disparate methodologies across entities, rendering results incomparable. Furthermore, the absence of consensus on management practices exacerbates the challenge of sustainable rabbit population management in the region. To address the complex issues affecting this species, the LIFE Iberconejo project has establish the European Rabbit Iberian Coordination Committee (ERICC). It comprises 20 entities: 5 national and regional administrations of Portugal and Spain, 5 research centers, 10 associations (3 conservationist, 5 hunting, 2 agricultural); and is supported by the Spanish Ministry of Agriculture, Fisheries and Food. To date, three monitoring protocols have been approved: population, health status, and crops damage. Additionally, good management practices for the species have been agreed upon, both for population promotion and damage prevention, identifying European financing lines. To achieve this consensus, the following participatory process has been followed: 1) collection of existing information, 2) discussion and experience exchange sessions, 3) consensus proposal, 4) field validation, and 5) final proposal. At the same time, efforts have been made towards developing an information flow to automate data analyses, utilizing applications (SMART) and automating necessary statistical analyses.

Keywords: Best practices; data-driven decisions; governance framework; standardized methodologies; wildlife monitoring.

Thurs 25th July 15:15 – 15:30

47 ORAL

The Iberian monitoring system of the European wild rabbit.

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The LIFE Iberconejo project aims to establish a system for managing rabbit populations in the Iberian Peninsula, developing standardised protocols for monitoring the European wild rabbit populations. Three standardised protocols have been approved by the members of the ERICC (European Rabbit Iberian Coordination Committee) for the Iberian monitoring of the species within LIFE Iberconejo project: 1) A population monitoring system based on the integration of different methodologies (game bags, distance sampling) and data sources, merging hierarchical integrated models' framework with software tools to automatize data gathering and analyses. 2) A health status monitoring system focused on detect and prevent outbreaks (passive approach) and monitoring the prevalence of myxomatosis and RHD (active approach). 3) Finally, a damage crop monitoring protocol has been also developed to collect long term data. These data could help to control and manage the social conflict around rabbit populations locally. During 2022 and 2023 population and health monitoring systems have been validated, and will be operational during 2024. Damage crop protocol will be validated during 2024.

Keywords: Agricultural damage; diseases; management; abundance; wildlife monitoring.

Thurs 25th July 15:30 – 15:45

48 ORAL

Abundance and trend estimates using different data sources: the case of the European wild rabbit

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The wild rabbit is a key species in the Iberian Peninsula, with a complex situation. Diseases and changes in land use have led it to a decline in areas where it was historically abundant. However, in anthropic landscapes, it can generate conflicts with agriculture. Thus, the LIFE Iberconejo aims to establish a system for managing rabbits in the Iberian Peninsula, developing standardised protocols for monitoring their populations. On the one hand, we used hierarchical models to integrate different data sources (hunting yields, distance sampling and latrine counts) to estimate rabbit abundances at regional scale. On the other hand, TRIM models allowed us to incorporate covariables and compare among different data sources to estimate rabbit population trends. Hunting yields and distance sampling showed great fit with the abundance model predictions for the season 2021-22 in central Spain, indicating a strong power of these data sources. Latrine counts performed worse in terms of fit, so more effort is required to understand the heterogeneity of the relationship between latrine counts and abundance. Respect to population trend estimations, the different data sources reported similar results. We found a negative trend, with a global decline rate of 36% since the 2000s in central Spain. Habitat type and local abundance were also important factors in explaining changes in population trends. The combination and comparison of different data sources help us to obtain more reliable abundance and population trend estimates. Hunting yields seem to offer more adequate information since it counts with a large historical data series.

Keywords: Distance Sampling, habitat type, hunting yields, integrated hierarchical models, local abundance, wildlife monitoring.

Thurs 25th July 15:45 – 16:00

49 ORAL

Establishing and monitoring island breeding colonies to conserve an imperiled lagomorph.

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Islands have a long history in their use of conserving species and are often used because they have fewer predators and competitors than mainland sites. Less often, islands have been used as breeding colonies to support mainland translocations. In the past decade, two islands in New England have been seeded to establish island breeding colonies for New England cottontail (*Sylvilagus transitionalis*), which is a species of conservation concern. The first island, Patience Island, was initiated in 2012 by mainly releasing first generation captive born animals on the island and annual translocations began in 2016. The second island, Nomans Land Island, was started in 2019 with the release of wild animals from Cape Cod, Massachusetts. Our main objective was to monitor the genetic diversity and population size response of the removal of animals for translocation to ensure the population remained stable. On Patience Island, the New England cottontail's nuclear genetic diversity has remained stable over a decade period, but their mtDNA has decreased at a fast rate. We also radio collared founders to estimate their survival, which decreased as additional animals were released on Patience Island. The survival of founders was higher on Nomans Land Island, which has no mammalian predators, and translocations are planned for 2024. Over the past eight years, 180 New England cottontail have been translocated from Patience Island. Islands have played a critical role in supporting New England cottontail conservation and in the right circumstances could be used for other imperiled species to support their recovery efforts.

Keywords: Captive breeding; change in genetic diversity; effective population size; management; New England cottontail (*Sylvilagus transitionalis*); translocation.

50 POSTER

Distribution range and ecological niches of Leporids in Africa and Near East.

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Systematics and biogeography of leporids in Africa and Near East are still poorly understood, with seven Lepus species (*L. capensis* sensu lato*, L. europaeus, L. fagani, L. habessinicus, L. saxatilis, L. starcki, L. victoriae), four* Pronolagus species (*P. crassicaudatus, P. randensis, P. rupestris, P. saundersiae), Poelagus marjorita* and *Bunolagus monticularis* being recognized to date. The clarification of their systematics, geographical distribution and environmental niches, is key for defining appropriate conservation management measures. In this study, we review the distribution of African leporids, with emphasis on the genus Lepus, and analyse their potential distribution and ecological niches. To this end, we have compiled a spatial database, comprising georeferenced occurrence data from a wide range of sources, including museum collections, literature and online citizen science databases. We present gridded distribution maps based on georeferenced museum specimens and observational data of the species, and explore their ecological niches and potential distribution using ensemble model predictions built with the BIOMOD2-framework. In our work we summarize comprehensive information on African leporid distributions and their associated environmental conditions across regions. Further we highlight knowledge gaps and provide a basis for coordinating and prioritizing future phylogeographic studies.

Keywords: Africa; biogeography; BIOMOD2; environmental niche; museum collections; species distribution modelling.

51 POSTER

Highest densities of mountain hares (*Lepus timidus*) associated with ecologically restored bog but not grouse moorland management.

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Over the last 20 years, ecological restoration of degraded habitats has become common in conservation practice. Mountain hares (*Lepus timidus scoticus*) were surveyed during 2017 - 2021 using 830 km of line transects in the Peak District National Park, England. Historically degraded bog areas were previously reported having low hare numbers. Following bog restoration, we found hare densities of 32.6 individuals km^{-2}, notably higher than neighboring degraded (unrestored) bog with 24.4 hares km^{-2}. Hare density on restored peatland was 2.7 times higher than on bogs managed for grouse shooting at 12.2 hares km^{-2} and 3.3 times higher than on heather moorland managed for grouse shooting at 10.0 hares km^{-2}. Yearly estimates varied most on habitats managed for grouse, perhaps indicative of the impact of habitat management, for example, heather burning and/or possible hare culling to control potential tick-borne louping ill virus in gamebirds. Acid grassland used for sheep farming had a similar density to grouse moorland at 11.8 hares km^{-2}. Unmanaged dwarf shrub heath had the lowest density at 4.8 hares km^{-2}. Hare populations are characterized by significant yearly fluctuations, those in the study area increasing by 60% between 2017 and 2018 before declining by ca. 15% by 2020 and remaining stable to 2021. During an earlier survey in 2002, total abundance throughout the Peak District National Park was estimated at 3,361 (95% CI: 2,431 – 4,612) hares. The present study estimated 3,562 (2,291 - 5,624) hares suggesting a stable population over the last two decades despite fluctuations likely influenced by weather and anthropogenic factors. Mountain hares in the Peak District favored bog habitats and were associated with restored peatland habitat. Wildlife management should be cognizant of hare density variation between habitats, which may have implications for local extinction risk.

Keywords: Blanket bog; distance sampling; grouse moor; habitat degradation; landscape restoration; monitoring; mountain hare; peatland.

52 POSTER

Estimating density of mountain hares using distance sampling: a comparison of daylight visual surveys, night-time thermal imaging and camera traps

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Surveying cryptic, nocturnal animals is logistically challenging. Consequently, density estimates may be imprecise and uncertain. Survey innovations mitigate ecological and observational difficulties contributing to estimation variance. Thus, comparisons of survey techniques are critical to evaluate estimates of abundance. We simultaneously compared three methods for observing mountain hare *Lepus timidus* using Distance sampling to estimate abundance. Daylight visual surveys achieved 41 detections, estimating density at 14.3 hares km^{-2} (95%CI 6.3 - 32.5) resulting in the lowest estimate and widest confidence interval. Night-time thermal imaging achieved 206 detections, estimating density at 12.1 hares km^{-2} (95%CI 7.6 - 19.4). Thermal imaging captured more observations at furthest distances, and detected larger group sizes. Camera traps achieved 3705 night-time detections, estimating density at 22.6 hares km^{-2} (95%CI 17.1 - 29.9). Between the methods, detections were spatially correlated, although the estimates of density varied. Our results suggest that daylight visual surveys tended to underestimate density, failing to reflect nocturnal activity. Thermal imaging captured nocturnal activity, providing a higher detection rate, but required fine weather. Camera traps captured nocturnal activity, and operated 24/7 throughout harsh weather, but needed careful consideration of empirical assumptions. We discuss the merits and limitations of each method with respect to the estimation of population density in the field.

Keywords: Camera traps, cryptic animals, distance sampling, population monitoring, survey methods, thermal imager, uplands

53 POSTER

Habitat adaptation strategies of a protected species: diet assessment of the mountain hare in Scotland.

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Land use and climate change will have profound and widespread effects on the global distribution of plant communities. Understanding how these changes will affect wild herbivore populations is vital if we are to predict their responses and develop evidence-based management and conservation measures for both herbivores and plant communities. The mountain hare (*Lepus timidus*) is found in upland areas of Scotland where it is strongly associated with heather moorland habitats and is also found in woodlands and other habitats. Mountain hares have an intermediate feeding strategy, with a high-quality grass-dominated diet in summer and switching to a low-quality bulk browse-dominated diet in winter. This diet adaptation, along with their wide distribution and presence in different habitat types, makes mountain hares an ideal model species to study how small herbivores may adapt to habitat change. Furthermore, evidence indicates that the gut microbiome plays an important role in host foraging behaviour, nutrition, fitness and supports the host in adapting to ecological and environmental changes. However, little is known about the gut microbiota-host relationship in wild animals, including those species with marked seasonal variation in diet, such as the mountain hare. This interdisciplinary research project will combine genomics, ecology and spatial analyses to assess seasonal changes in diet and gut microbiome composition of mountain hares in different habitats in Scotland. Preliminary results will provide novel insights into the adaptation of this intermediate feeder to changing habitats and help to inform conservation and management strategies for this protected species in Scotland.

Keywords: Climate change, diet, conservation, habitat and land use, mountain hare, plant communities.

54 POSTER

The North American Lagomorph Working Group (NALWG): Monitoring and conservation across the continent

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Many of the 29 species of lagomorphs (pikas, rabbits, hares) in North America are facing multiple threats impacting their persistence on the landscape and have populations with declining or unknown trajectories. Because these species often span multiple state, tribal, and federal boundaries many of the management actions for these groups are varied, yet the threats they face and the appropriate practices used for monitoring species may not be. The North American Lagomorph Working Group (NALWG) aims to close this gap, by bringing together researchers, management agencies, and organizations to develop unified approaches to 1) identify conservation and management priorities; 2) increase cross-state communication, collaboration, and consistency in monitoring, management, and research; and 3) facilitate disease monitoring and management coordination. By bringing together expertise across taxa and units, we hope to provide a better framework for the collection of lagomorph data, the monitoring of trends, and the development of conservation interventions. Given the ecologically important role lagomorphs play in many ecosystems, understanding current species status and threats as well as developing joint efforts towards their management and conservation needs to become a local, state, and federal priority.

Keywords: Climate change; disease; management; monitoring; population dynamics; threats.

55 POSTER

Bidirectional hybridisation and introgression between introduced European brown and endemic Irish hares.

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Introduced non-native species can threaten native species through interspecific hybridisation and genetic introgression. We assessed the prevalence of hybridisation and introgression between introduced European brown hare, Lepus europaeus, and the endemic Irish hare, *L. timidus hibernicus*. Roadkill hares (*n* = 56) were sequenced for a 379bp section of the mitochondrial DNA D-loop and a 474bp segment of the nuclear transferrin (*Tf*) gene. A species-specific indel in the transferrin gene was present in *L.t. hibernicus* and absent in *L. europaeus*. Excluding three hares from which molecular data could not be recovered, 28 hares (53%) were native *L.t. hibernicus*, 7 (13%) were non-native *L. europaeus* and 18 (34%) were hybrids; of which 5 (28%) were first generation (F1) involving bidirectional crosses with mismatched nuclear and mtDNA (3 ♂ *europaeus* x ♀ *hibernicus* and 2 ♂ *hibernicus* x ♀ *europaeus*). Mixed nuclear transferrin sequences suggested 13 (72%) of hybrids were at least 2nd generation (F2) with 9 (69%) possessing *L.t. hibernicus* and 4 (31%) *L. europaeus* mtDNA (the latter indicative of hybrid backcrossing with the non-native). The prevalence of hybridisation at similar mountain-brown hare contact zones throughout Europe is notably lower (4–16%) and typically unidirectional (♂ *europaeus* x ♀ *timidus*). A high prevalence of bidirectional hybridisation and introgression (in association with projected climate change) may favour the introduced species over the native. Genetic surveillance and population monitoring are needed to further explore the potential conservation implications of European brown hare in Ireland.

Keywords: D-loop; hybridisation; introgression; *Lepus*; mtDNA; roadkill; transferrin.

56 POSTER

MitoCatch: Mitogenome extraction from whole genome sequencing.

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Mitochondrial DNA (mtDNA) has been widely used as a genetic marker in phylogenetics and phylogeography due to its non-recombining nature, simplifying evolutionary reconstructions. While limited in its power to reconstruct population history, its physiological importance suggests a potential role in environmental adaptation, possibly linked to its documented propensity to cross species boundaries. This is exemplified in hares (*Lepus* spp.) from Europe, where secondary hybridization has led to recurrent mtDNA introgression across species. Next-generation sequencing enables easy access to the complete mitochondrial genome of multiple individuals, even from low-coverage whole-genome data, due to the multiplicity of copies within each cell. Current methods to recover mitochondrial genomes from short reads sequencing are reference-dependent and/or require data preprocessing. This work introduces an easy-to-use and reference-free pipeline for extraction of complete mitogenomes from WGS data, even at low coverage. The pipeline leverages on Trinity and offers a fast and efficient method for extraction and annotation, yielding a suitable output for direct and easy submission to open online repositories like NCBI. This streamlined and efficient pipeline promises to save researchers valuable time, enabling greater focus on more complex nuclear dataset analysis and evolutionary questions. Using European hares as a case study, we demonstrate the effectiveness of our approach across species and sequencing coverage levels.

Keywords: Bioinformatics; Genomics; Hares; Mitogenome; mtDNA.

57 POSTER

Dynamics and evolution of immune multigene families in Lagomorphs: a comparative genomics approach.

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The diversification of immune system gene families in response to selective pressures throughout the evolution of species plays a crucial role in organisms' adaptive response to diseases. Multigene families follow a dynamic birth-and-death evolution, characterized by frequent duplications, deletions, pseudogenizations and neofunctionalization events. In Lagomorphs, which represent 25-30 million years of evolution encompassing pikas, rabbits and hares, the immune system is known to have played an important role driving organismal diversification, indicative of unique evolutionary responses to selective pressures. Research on the immune system of Lagomorphs has so far been predominantly centred on the European rabbit (*Oryctolagus cuniculus*). The fast increase in the number of available chromosome-level reference genomes, including for Lagomorph species, have opened novel opportunities for comparative genomics studies, enabling detailed comparisons of genomes and gene structures across species. Here, will use a two-stage comparative genomics approach to characterize the evolution of genomes and immune system gene families in Lagomorphs. The first stage will involve comparing the genome structure of different species, using synteny analyses and inferences of phylogenetic orthology, revealing insights into structural rearrangements and genomic architectures. The second stage will focus on analysing and cataloguing multigene immune system families, using synteny analysis, phylogenetic gene trees and measures of genetic distances. This two-stage approach is expected to offer valuable insights into the evolution of genome structure and immune system adaptation in Lagomorphs. Furthermore, it may uncover correlations between genetic factors and susceptibility or resistance to different pathogens or diseases, offering potential applications in disease prevention and management.

Keywords: Comparative genomics; evolution; immune system; multigene families.

58 POSTER

Rabbit haemorrhagic disease virus 2 (RHDV2; GI.2) in Ireland focusing on wild Irish hares (*Lepus timidus hibernicus*): an overview of the first outbreaks and contextual review

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Rabbit haemorrhagic disease virus 2 (RHDV2; GI.2) is a pathogenic lagovirus that emerged in 2010, and which now has a global distribution. Outbreaks have been associated with local population declines in several lagomorph species, due to rabbit haemorrhagic disease (RHD)-associated mortality raising concerns for its potential negative impact on threatened or vulnerable wild populations. The Irish hare (*Lepus timidus hibernicus*) is endemic to Ireland, and is of conservation interest. The first cases of RHDV2 in Ireland were reported in domestic rabbits (*Oryctolagus cuniculus*) in 2016, soon followed by the first known case in a wild rabbit also in 2016, from a population reported to be experiencing high fatalities. During summer 2019, outbreaks in wild rabbits were confirmed in several locations throughout Ireland. Six cases of RHDV2 in wild hares were confirmed between July and November 2019, at four locations. Overall, 27 cases in wildlife were confirmed in 2019 on the island of Ireland, with a predominantly southern distribution. Passive surveillance suggests that the Irish hare is susceptible to lethal RHDV2 infection, and that spillover infection to hares is geographically widespread in eastern areas of Ireland at least, but there is a paucity of data on epidemiology and population impacts. A literature review on RHD impact in closely related Lepus species suggests that intraspecific transmission, spillover transmission, and variable mortality occur in hares, but there is variability in reported resistance to severe disease and mortality amongst species. Several key questions on the impact of the pathogen in Irish hares remain. Surveillance activities throughout the island of Ireland will be important in understanding the spread of infection in this novel host.

Keywords: Rabbit haemorrhagic disease; *Lepus*; wildlife disease; wildlife infectious disease; lagovirus; wild–domestic interface; spillover infection.

59 POSTER

Skull shape diversity in rabbits and the applicability of reference lines for objective interpretation of dental disease.

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Acquired dental problems are among the most frequently encountered diseases in rabbits. Considering the estimated number of unreported cases makes it likely that the prevalence is even higher. As prey species, rabbits generally show little or delayed external signs of distress. Affected rabbits initially appear completely asymptomatic although they have subtle periodontal and/or dental anomalies. This highlights the importance to routinely integrate effective, noninvasive techniques such as skull radiography in the clinical examination routine. In healthy rabbits, the species-specific occlusal reference line according to Böhmer & Crossley marks the physiological occlusal plane of the cheek teeth and allows for objective interpretation of norm- and malocclusion. Despite its proven usefulness, there are exceptions in which the anatomical reference lines according to Böhmer & Crossley appear not to be suitable for application. Here, we addressed this issue by quantifying the cranial morphology of a sample of rabbits (N=80) representing the typical variety in a clinical population, excluding animals with congenital brachygnathia or extremely giant breeds. The most substantial parameter that influences the applicability of the anatomical reference lines is the palatal angle. Next, we will investigate if the palatal angle is related to acquired dental disease. The hard palate is known to vary morphologically in response to variation in masticatory stresses. Diet-induced phenotypic plasticity that results in a different palatal angle may potentially be a factor that causes malocccclusion.

Keywords: Dentition; morphometrics; cranium; malocclusion; teeth; veterinary medicine.

60 POSTER

New morphological data on the cottontail rabbits *Sylvilagus capsalis* and *S. inca* (Lagomorpha: Leporidae) from Peru

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The *Sylvilagus* genus in Peru has recently been studied using craniodental and molecular data, which has led to the conclusion that the species occurring in Peru are *S. capsalis* and *S. inca. S. capsalis* is distributed on the western Andes, while S. inca is found on the eastern Andes. These species are distinct from *S. brasiliensis* sensu stricto However, much of our knowledge is based on a few decades-old specimens and relies heavily on pelage coloration and craniodental characteristics. In this study, we provide new data on various aspects of the anatomy of these species, including external features (such as rhinarium, vibrissae, and mammae), reproductive tract anatomy (uterus, gland penis), soft anatomy (palate, tongue, stomach, caecum), fetal external characteristics, and postcranial skeleton. Most of the specimens (N =14) studied were recently collected in various departments of Peru, including Cajamarca, Lambayeque, Junín, Cusco, Madre de Dios, La Libertad, Ancash, and Amazonas. Our findings reveal several morphological features that have never been documented before and support the concept that *S. capsalis* and *S. inca* are distinct and valid species.

Keywords: Andes, external morphology, lowland forest, soft anatomy, Yungas.

61 POSTER

Comparative anatomy of the maxillary fenestration in Lagomorpha.

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Lagomorpha are unique in having an extensive fenestration of the maxillary bone, which shows a cribriform pattern in Leporidae (facies cribrosa maxillae). Previous studies showed some differences in the extent of fenestration between the different lagomorph genera. However, systematic relevance and functional meaning of the maxillary fenestration are still discussed as comprehensive morphological studies are still pending. Here we provide the first results of a detailed anatomical comparative study of the maxillary fenestration based on µCT scans of 27 species covering all 12 extant lagomorph genera and two fossil species (*Litolagus molidens, Palaeolagus haydeni*). *Ochotona* shows a big fenestra in the posterodorsal part of the maxillary corpus. Among leporids different patterns are evident on the generic level. *Nesolagus, Poelagus* and *Pentalagus* show a dense bony meshwork with tiny foramina, similarly to the stem-lagomorph *Palaeolagus*; this may resemble a plesiomorphic lagomorph pattern. *Caprolagus* is unique in having parallel organized bony rods perpendicular to the nasolacrimal canal. All other studied genera have a larger anterodorsal foramen, ventrally bordered by a distinct bony rod as well as an extensive bony meshwork on the maxillary corpus. However, single species deviate from this pattern. *Litolagus* shows a specific meshwork dominated by larger openings and rods. Our results clearly show that the maxillary fenestration pattern can be a useful character for lagomorph taxonomy and systematics. Both living families can be clearly distinguished; within Leporidae the observed patterns are restricted to specific genera although some of which may have evolved several times independently.

Keywords: Facies cribrosa maxillae; Leporidae; Ochotonidae; stem-lagomorphs; µCT.

62 POSTER

Reproductive performance in the European hare (*Lepus europaeus*): are maternal body conditions decisive?

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In female mammals, reproduction, and in particular lactation, is the energetically most crucial life-history phase. Reproduction is strongly controlled by body reserves and food availability, thus females with better body condition or food supply are alleged to have higher reproductive output. In addition, the growth and mortality of young mammals depends on their postnatal development. Consequently, the degree of precociality affects energetic demands for both mothers and young. To study the reproductive performance of the precocial European hare (*Lepus europaeus*), we analysed relationships between six predictor variables describing maternal and environmental effects and nine response variables relating to reproduction from 217 captive females. We compared the data with those of precocial and altricial mammal species from a broad literature search. For hares, we found: (1) Heavier females had heavier litters at birth. (2) At the end of lactation, the litters of multiparous females were heavier than those of primiparous females. Evaluating our results with the literature for other mammals disclosed that the body condition (i.e., body mass) of females before birth is predictive of reproductive parameters in both precocial and altricial species. In the precocial hare, female body condition is no longer predictive of reproductive parameters at the end of lactation, whereas in altricial species, female body condition remains predictive of reproduction until the end of lactation. We assume that these effects are caused by precocial offspring feeding on solid food soon after birth and, therefore, being less dependent on the mother's body condition during lactation than altricial offspring.

Keywords: Altriciality; breeding; brown hare; Lagomorpha; reproductive strategies; reproductive success.

63 POSTER
Hare coursing in Ireland
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Hare coursing is the pursuit of a hare by muzzled greyhounds under regulation. In recent years in Ireland, between 2,900 to 3,700 hares have been caught from the wild using long-nets and driven beats. Nets 1.5m tall are hung from forked sticks to create a pouch at ground level. These are placed across likely exit routes from an area to be walked over by a line of beaters such that hares flushed from their daily forms run into the net. Target areas include unimproved rough pasture with substantial cover of rushes, *Juncus* species, in which hares shelter during daylight hours. Hares are ear tagged for individual identification, boxed and transported to a local paddock. Captive hares are given about a 75m head start before being pursued by two muzzled greyhounds within an enclosed field where the object is not to kill the hare but turn it from a straight course. The greyhound responsible for turning the hare (identified as the one wearing either a white or red collar) wins the match. The average course lasts less than 40 seconds. Hares escape through a hatch at the end of the coursing field through which the dogs cannot follow before being returned to the paddock. Throughout up to 8 weeks in captivity, hares are supplementary fed with, for example, oats and grain, willow, etc. and receive veterinary care including being dosed with a broad spectrum anthelminthic such as Ivermectin, to rid them of parasitic ticks, lice and worms. The introduction of compulsory dog muzzling, and the sharing of best practice in captive hare husbandry between clubs, improved survival with license returns suggesting over 99% of hares are typically released back into the wild. Coursed and uncoursed hares do not differ in observed mortality rates, movements, home range sizes or dispersal distances after release back into the wild. Habitually the same sites are used year-on-year for the capture and release of hares and they are often owned and managed by farmers and members of a local coursing club. As such, habitat suitable for hares such as rough and semi-improved grassland may be left agriculturally unimproved to maintain hare numbers locally. Predators such as foxes may be controlled, for example, by shooting while other forms of hare hunting may be prohibited locally. Consequently, so-called hare preserves, may be associated with a higher hare population density than comparable areas in the wider countryside. The Irish Coursing Club has collaborated with research to support studies on genomics, population biology and behavioural ecology.

Keywords: Animal welfare; field sports; hunting with dogs; *Lepus timidus*, mountain hare.

64 POSTER

The European hare (*Lepus europaeus*) in the province of La Pampa, Argentina: a pilot study disentangling its role as potential reservoir species of infectious diseases on humans, domestic animals and native wildlife.

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Invasive species affect biodiversity, economy and human or native species health. In this regard, over the last decades the exotic fauna is known to be host to a wide variety of diseases that could be transmitted to humans, domestic animals and other wildlife. In fact, they may involve a serious risk to conservation by maintaining circulation of pathogenic agents in the ecosystems. Here we focus on the European hare (*Lepus europaeus*), a pest species in Argentina with a high potential to participate as a reservoir species in the maintenance of zoonoses. By one-night-stand hunting session, European hare specimens were captured and then transported to INTA laboratories where systematic necropsies were performed. External examination of individuals was carried out in order to search for lesions and identify ectoparasites. Furthermore, by collecting internal organs and tissue samples we aimed to determine the presence of bacteria, viruses and parasites. Preliminary results suggested the likely existence of pathogens relevant from a public health perspective. Thence, the present study will provide updated data on the prevalence of viral, bacterial and parasitic pathogens within different European hare populations in La Pampa. Hence, this will be a step forward for the design and application of monitoring programs that can facilitate a full understanding on dynamics of infectious diseases and diseases spread in the province of La Pampa.

Keywords: European hare; Argentine Pampa; Infectious diseases; parasites; bacteria; virus.

65 POSTER

Cereals in wide rows as an instrument for the propagation of brown hares: a success story from Switzerland.

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For pre-weaning leverets, cereals are low risk crops (compared to eg. grassland), because predators rarely forage there and the use of agricultural machinery is rare. However, the dense stand of cereals hinders hares to enter from May until harvest in July, the months with the highest numbers of leverets. Making cereal fields accessible to hares in spring and summer by sewing them in wider rows than usual should improve the survival of young hares and thus increase the hare population. We studied juvenile brown hare (*Lepus europaeus*) survival rates and their dependence on the proportion of cereals in wide rows, arable land, cereals and fallow land as well as on hare density in spring using mixed linear models. A total of 32 study areas in Northwestern Switzerland were processed in 2020, 2021, and 2023. The average size of the study areas was 376 ha. The percentage of cereals in wide rows ranged from 0% to 21% of the total agricultural surface of the different areas. Of the four spatial variables investigated, only the proportion of cereals in wide rows had a significant positive effect ($p = 0.02$) on the hare population growth rate. A 1% increase in cereals in wide rows results in an average increase in hare growth rate of 3.6%. This effect is weaker in areas with a high hare density in spring than in those with a lower density. We conclude that cereals in wide rows are a helpful instrument for the propagation of brown hares, but other factors also play an important role.

Keywords: Agriculture; cropland; density; land use; leveret; morality; survival; population growth rate; productivity.

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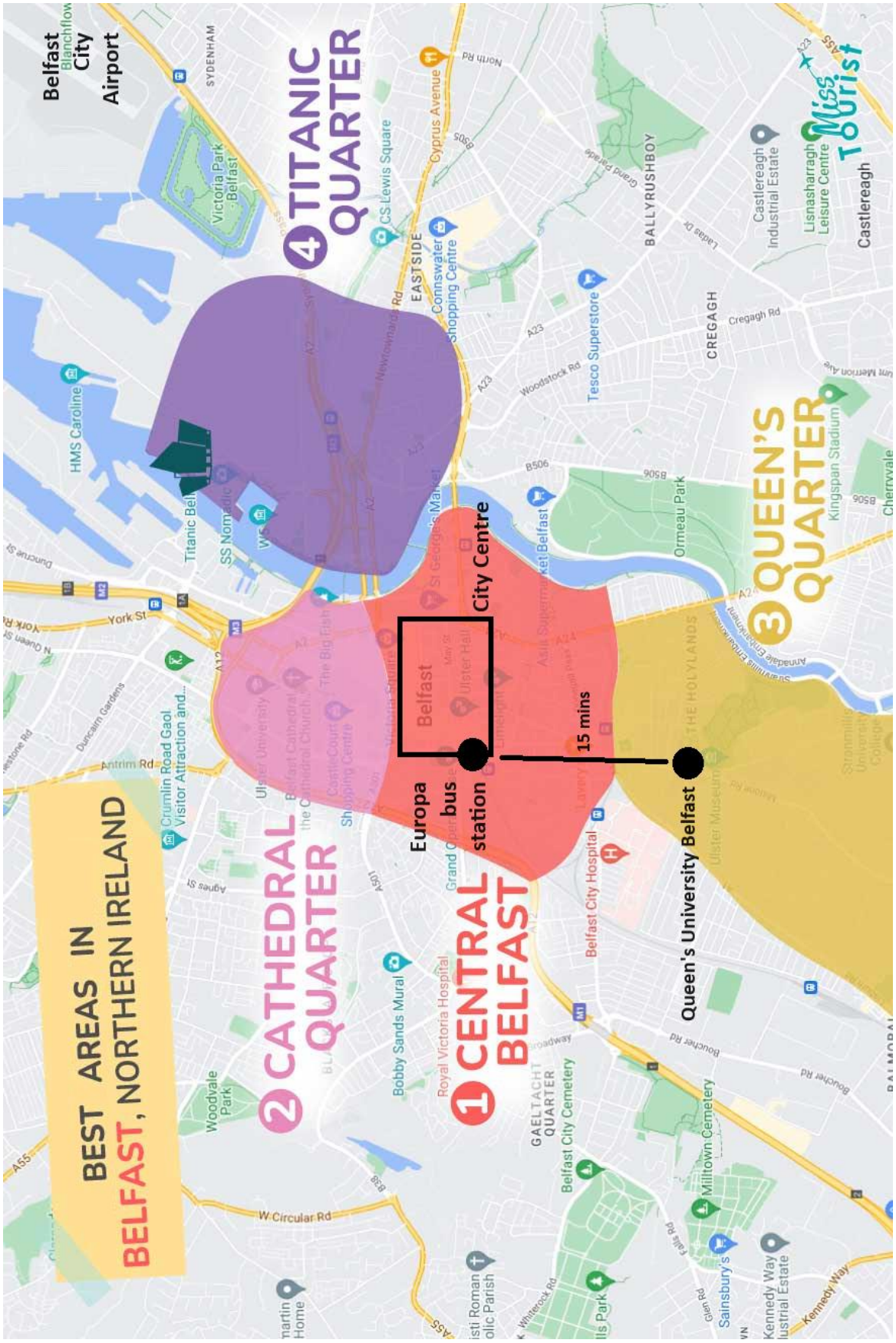
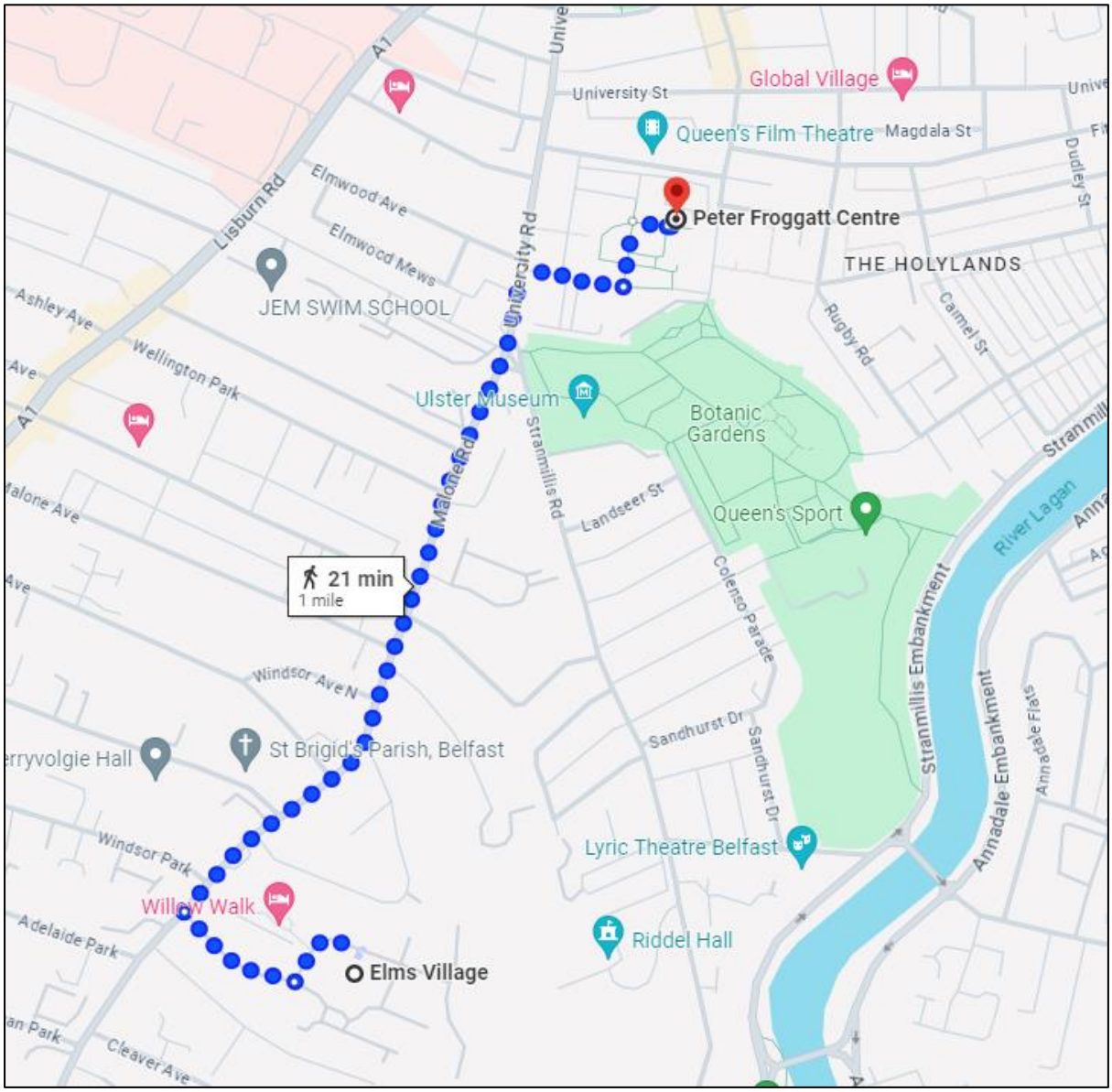
Belfast orientation



QUB Elms Accommodation to the conference

20-minute walk along Malone and University Roads



QUB Campus Map (Main Site)

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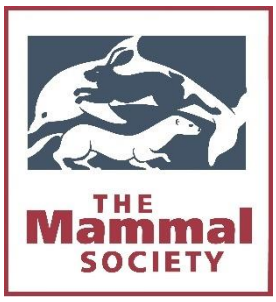
Agriculture, Environment and Rural Affairs

NIEA Northern Ireland Environment Agency
www.daera-ni.gov.uk



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