

# Anthony Caravaggi

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## Career History

**2017-** Postdoctoral researcher; Supporting Hen harriers in Novel Environments (SHINE)  
School of Biological, Earth and Environmental Sciences, University College Cork, Distillery Field, N Mall, Cork, Ireland  
Supervisors: Prof. John O'Halloran, Dr. Sandra Irwin

**2017-** Visiting Research Fellow  
School of Biological Sciences, Queen's University Belfast, Medical Biology Centre, 97 Lisburn Road, Belfast BT9 7BL

## Education

**2012 - 2016** PhD conservation biology/invasion ecology, Queen's University Belfast  
*Quantifying the impact of non-native European hares on the endemic Irish hare*  
Supervisors: Dr. Neil Reid, Prof. Ian Montgomery

**2010 - 2011** MRes Biodiversity and Conservation, University of Leeds  
Research projects:

- 1 *Patrilineal inheritance of parasite resistance in leaf-cutter ants (*Acromyrmex* sp.)*. Supervisor: Dr. William Hughes
- 2 *Factors influencing passerine productivity in managed reed beds*. Supervisor: Dr. Tom Cameron

**2006 - 2009** BSc Zoology with Conservation (Hons), Bangor University  
Thesis: *Dietary and faecal iron levels in captive black-and-white ruffed lemurs*  
Supervisor: Dr. Charles Bishop

## Research Interests

Conservation biology; urban ecology; invasive species; population & community ecology ; movement & spatial ecology; rare and endangered species; sustainability; rewilding; citizen science

## Peer-Reviewed Publications

- 8 Havlin P, **Caravaggi A**, Montgomery WI (*In press*) The diet and abundance of an introduced insular population of Red-Necked Wallabies, *Macropus rufogriseus*. *Canadian Journal of Mammalogy*
- 7 **Caravaggi A**, Montgomery WI, Reid N (2017) Management and control of invasive brown hares (*Lepus europaeus*): contrasting attitudes of selected environmental stakeholders and the wider rural community. *Proceedings of the Royal Irish Academy: Biology & Environment*. 117B: 1-11. doi: 10.3318/bioe.2017.08
- 6 Tennant JP, Graziotin D, Jacques DC, Waldner F, Dugan JM, Mietchen D, Elkhatib Y, Collister LB, Pikas CK, Crick T, Masuzzo P, **Caravaggi A**, et al. (2017) A multi-disciplinary perspective on emergent and future innovations in peer review. *F1000Research*. 6:1151. doi: 10.12688/f1000research.12037.1
- 5 **Caravaggi A**, Banks P, Burton C, Finlay CMV, Hayward M, Haswell, PM, Rowcliffe JM, Wood M (2017) A review of camera trapping for conservation behaviour research. *Remote Sensing in Ecology and Conservation*. doi: 10.1002/rse2.48

4 **Caravaggi A** (2017) remBoot: An R package for Random Encounter Modelling. *Journal of Open Source Software*. 2(10). doi: 10.21105/joss.00176

3 **Caravaggi A**, Leach K, Santilli F, Rintala J, Helle P, Tiainen J, Bisi F, Martinoli A, Montgomery WI, Reid N (2017) Niche overlap of mountain hare subspecies and the vulnerability of their ranges to invasion by the European hare; the (bad) luck of the Irish. *Biological Invasions*. 19(2): 655-674. doi: 10.1007/s10530-016-1330-z

2 **Caravaggi A**, Zaccaroni M, Riga F, Schai-Braun SC, Dick JTA, Montgomery WI, Reid N (2016) An invasive-native mammalian species replacement process captured by camera trap survey Random Encounter Models. *Remote Sensing in Ecology and Conservation*. 2: 45-58. doi: 10.1002/rse2.11

1 **Caravaggi A**, Montgomery WI, Reid N et al. (2015) Range expansion and comparative habitat use of insular, congeneric lagomorphs: invasive European hares *Lepus europaeus* and endemic Irish hares *Lepus timidus hibernicus*. *Biological Invasions*. 17(2): 687-698. doi: 10.1007/s10530-014-0759-1

#### *In review*

**Caravaggi A**, Plowman A, Wright D, Bishop C. The composition of captive ruffed lemur (*Varecia* spp.) diets in UK zoological collections, with reference to the problems of obesity and iron storage disease. *Journal of Zoo Animal Research*

#### *In preparation*

**Caravaggi A**, Vallely M-C, Hogg K, Freeman M, Fadaei E, Reid N, Tosh D. Circadian activity, seasonal occurrence, and predator-prey relationships of free-ranging mammals revealed by camera traps. To be submitted to *Hystrix, Italian Journal of Mammalogy*

**Caravaggi A**, Cuthbert RJ, Ryan RG, Cooper J, Bond AL. The cumulative impacts of introduced house mice on the breeding success of nesting seabirds on Gough Island. To be submitted to *Biological Conservation*

**Caravaggi A**, Turner D, Cameron T. I've got a bad feeling about this: a study into factors affecting reed-nesting birds. To be submitted to *F1000 Research*

**Caravaggi A**. McCarthy A, Irwin S, O'Halloran J. Hen harriers in Ireland: a review (working title).

#### *Other publications*

**Caravaggi A**, James K (2017) Twittersphere: Conferencing in 140 characters. *Nature* [Correspondence] 549: 458. doi: doi:10.1038/549458d

**Caravaggi A** (*in review*) Lagomorpha Life History. In: *Encyclopedia of Animal Cognition and Behavior*, Vonk J, Shackelford TK (eds.) ISBN 9783319550657

**Caravaggi A** (*in review*) Lagomorpha Navigation. In: *Encyclopedia of Animal Cognition and Behavior*, Vonk J, Shackelford TK (eds.) ISBN 9783319550657

## **Funding and Awards**

2017 National hare survey and population assessment, €174,000, National Parks and Wildlife Service (NPWS; Identifier Code 1302\_NHSP17)

2015 Emily Sarah Montgomery Travel Scholarship, £200, Queen's University Belfast

2015 Training and Travel grant, £500, British Ecological Society

2012 Research grant, £2,000, People's Trust for Endangered Species

2012 NIEA funded PhD studentship, £82,720, Queen's University Belfast

2010 NERC Master's scholarship for outstanding candidates, £7,500, University of Leeds

## Presentations

### Invited speaker

2017 **Keynote** The changing face of UK conservation. Mammal Society Student Conference  
2016 **Keynote** UK mammals. Mammal Society Student Conference  
2014 **Guest lecture** Distribution and differential habitat associations of invasive European and endemic Irish hares. Bangor University

### Oral presentations

12 **Caravaggi A**, Montgomery WI, Reid N (2017) An invasion in progress: Impacts of the non-native European hare on the native Irish hare. International Congress for Conservation Biology  
11 **Caravaggi A** (2017) Predation of seabirds by mice on Gough Island. World Seabird Twitter Conference  
10 **Caravaggi A** (2017) University Mammal Challenge: distributed mammal surveys with student scientists. Mammal Society Spring Conference  
9 **Caravaggi A**, Montgomery WI, Reid N (2016) Invasion ecology: quantifying the impact of non-native European hares on the endemic Irish hare. British Ecological Society Annual Meeting, Liverpool  
8 **Caravaggi A**, Hayward M (2016) People and hedgehogs in Wales. North Wales Mammal Symposium, Bangor  
7 **Caravaggi A**, Montgomery WI, Reid N (2016) Invasion ecology: quantifying the impact of non-native European hares on the endemic Irish hare. Mammal Society Spring Conference, Yarnfield  
6 **Caravaggi A** 2015 Quantifying endemic uniqueness and ecological equivalency between native and invasive leporids. 7th European Congress of Mammalogy, Stockholm, Sweden  
5 **Caravaggi A**, Leach K, Santilli F, Rintala J, Helle P, Tiainen J, Bisi F, Martinoli A, Montgomery WI, Reid N (2015) Democratisation of invasive species interventions: assessing attitudes towards lethal control of mammalian invaders. Mammal Society Spring Conference, Lancaster  
4 **Caravaggi A**, Zaccaroni M, Riga F, Schai-Braun SC, Dick JTA, Montgomery WI, Reid N (2015) Using the Random Encounter Model to estimate spatial patterns in invasive and native hare densities in allopatry and sympatry. Mammal Society Student Conference, Lancaster  
3 **Caravaggi A**, Montgomery WI, Reid N (2014) Using the Random Encounter Model to estimate spatial patterns in invasive and native hare densities in allopatry and sympatry. Mammal Society Spring Conference, Birmingham  
2 **Caravaggi A**, Montgomery WI, Reid N (2013) Distribution and differential habitat associations of invasive European and endemic Irish hares. 11th International Mammal Congress, Belfast  
1 **Caravaggi A**, Montgomery WI, Reid N (2013) Invasion ecology: quantifying the impact of non-native European hares on the endemic Irish hare. Mammal Society Student Conference, Staffordshire

### Poster presentations

9 **Caravaggi A**, Vally M-C, Hogg K, Freeman M, Fadaei E, Reid N, Tosh D (2017) Activity and temporal relationships of free-ranging mammals revealed by camera traps. Mammal Society Spring Conference  
8 **Caravaggi A**, Montgomery WI, Reid N (2015) The democratisation of conservation: public attitudes towards lethal control of invasive leporids and implications for species management. 7th European Congress of Mammalogy, Stockholm, Sweden  
7 **Caravaggi A**, Zaccaroni M, Riga F, Schai-Braun SC, Dick JTA, Montgomery WI, Reid N (2015) Optimising camera trap Random Encounter Model survey effort: A case study using an invasive-native species replacement process. Vth International Wildlife Management Congress, Sapporo, Japan

- 6 Beresford NA, Wood MD, Gaschack S, Gulyaichenko EA, **Caravaggi A** (2015) Use of wildlife camera traps to within the Chernobyl Exclusion Zone. Mammal Society Spring Conference, Lancaster
- 5 **Caravaggi A**, Montgomery WI, Reid N (2013) Estimating hare numbers using camera trapping and the Random Encounter Model. 11th International Mammal Congress, Belfast
- 4 **Caravaggi A**, Montgomery WI, Reid N (2012) Invasion ecology: quantifying the impact of non-native European hares on the endemic Irish hare. 2nd All Ireland Mammal Symposium (AIMS), Dublin
- 3 **Caravaggi A**, Montgomery WI, Reid N (2012) Invasion ecology: quantifying the impact of non-native European hares on the endemic Irish hare. 4th World Lagomorph Conference, BOKU, Vienna
- 2 **Caravaggi A**, Hughes W (2011) Patrilineal inheritance of grooming behaviour and parasite resistance in leaf-cutting ants (*Acromyrmex* sp.). Postgraduate Student Forum, University of Leeds
- 1 **Caravaggi A**, Bishop, C (2009) Dietary and faecal iron levels in captive black-and-white ruffed lemurs (*Varecia* spp.). 11th BIAZA Research Symposium, Blackpool Zoo

## Teaching

### Supervision

2017 MRes research project. *Threats affecting breeding hen harriers in Ireland*. University College Cork  
 2017 BSc research project. *Comparing hen harrier growth across Europe*. University College Cork  
 2015 MSc research project. *Behaviour and stress in sympatric hare species*. Queen's University, Belfast  
 2014 MSc research project. *Activity and behaviour of hares in Mid-Ulster*. Queen's University, Belfast  
 2014 Undergraduate residential field course. Queen's University, Belfast  
 2013 MSc research project. *Estimating hare population densities*. Queen's University, Belfast  
 2013 BSc research project. *Resource and habitat partitioning of herbivores*. Queen's University, Belfast  
 2013 Undergraduate residential field course. Queen's University, Belfast

### Module development

2017-18 BL6024 Quantitative skills for biologists using R.  
 Provided quantitative skills required by postgraduate students to successfully conduct and publish their research, with a focus on data analysis and graphing, statistics, and basic modelling, as generally implemented by zoologists and ecologists. Supported by a new R Peer Group mailing list and pop-up clinics

### Instruction and demonstration

2016-17 Course tutor: ornithology, camera traps, social media. Eco-Explore, Cardiff  
 Developed materials and taught courses on UK bird identification, the use of camera traps in ecology, and social media for scientists

2016 Lecturer and field ornithologist. Operation Wallacea, Ecuador  
 Co-developed and delivered a 5-part series of lectures focussing on rainforest biodiversity and conservation, and conducted bird ringing studies including demonstrating techniques and training students in biometric data gathering. Also trained an assistant on mist net extraction and data recording

2015 Otter surveys, MSc, Queen's University Belfast  
 Trained a Master's student in otter survey techniques and field signs, and advised on camera trap survey methodology

2014 Bird surveys, undergraduate module. Queen's University Belfast  
 Developed materials and taught a one-off field-based class, including training and supervision of students

2015 Demonstrator: Introduction to GIS, undergraduate module. Queen's University Belfast  
 2014 Demonstrator: Animal biology, undergraduate module. Queen's University Belfast

## **Professional Activities**

### **Conference organisation**

2017 7th Irish Ornithological Research Conference; organisational team  
2017 Biotweeps Twitter Conference, #BTCon17; conception and organisation  
2016-17 Mammal Society Student Conference; conception and supervision  
2014-15 Mammal Society Student Conference; publicity officer

### **Peer reviewer**

Journal of Zoology; PLOS One; Mammal Research; Remote Sensing in Ecology and Conservation; Mammal Review; Zoo Biology; Global Change Biology; Journal of Natural History; Invasive Species Compendium

### **Training and workshops**

2017 Postgraduate Certificate in Teaching and Learning in Higher Education, University College Cork  
2017 NERC Advanced Training, Systematic Review and Meta-Analysis, University of East Anglia  
2017 Level 3 Teaching Assistant, E-Training Hub  
2017 Public Outreach, Science Made Simple  
2016 Mentor Training, British Ecological Society  
2016 Conservation Ecology Special Interest Group workshop, British Ecological Society Annual Meeting  
2016 Acoustic Analysis, North Wales Mammal Symposium  
2014 Using R, Queen's University Belfast  
2012 Lagomorph Systematics, 4th World Lagomorph Conference

### **Licenses and Certifications**

2014 ASPA laboratory animal handling license (TSA/47/14)  
2014 Emergency first aid  
2014 Field first aid  
2009 Bird ringing 'C' license holder, British Trust for Ornithology 2008 Marine mammal medic, British Divers Marine Life Rescue  
2002 Full manual UK driving license, held without incident or penalty

### **Memberships**

(since)  
2015 South Wales Mammal Group, Welsh Ornithological Society  
2013 Society of Conservation Biology (SCB)  
2012 The Mammal Society, British Ecological Society  
2011 Royal Society of Biology  
2009 The British Trust for Ornithology

### **Organisational and Working Groups**

2017 SCB Participatory and Citizen Science  
2016 Committee member, South Wales Mammal Group  
2016 Student Officer, Mammal Society Council  
2016 British Ecological Society Review College  
2013 SCB Urban Ecology

### **Additional roles**

2016 Community Ecology session chair, British Ecological Society Annual Meeting  
2016 Advisor to National Geographic on red fox ecology  
2016 Coordinator of The Mammal Society's University Mammal Challenge  
2016 British Ecological Society Women in Ecology (WIE) mentor  
2016 Mammal (hares) consultant for The Mammal Society  
2013 Wildlife consultant, Biological records for the North East of Scotland (NESBReC)

2013-17 UK STEM Ambassador  
2012-15 EBEE postgraduate representative, Queen's University Belfast  
2012-15 SBS Athena SWAN committee, Queen's University Belfast  
2008-09 Undergraduate student representative, Bangor University Biological Sciences  
2007-09 Founding committee & publicity officer, Bangor University Zoological Society

### **Media engagements**

#### *Radio*

2017 BBC Coventry & Warwickshire, Wallabies in the UK  
2017 Invited guest, The Edgar Ortega Radio Show, Invasive species and urban wildlife  
2016 SciComm podcast Episodes 7 & 8, with Dr. Mike  
2015 BBC Radio Ulster, Hares at Belfast airport  
2015 BBC News School Report for St. Pius X, Magherafelt's Biodiversity Club  
2015 BBC Radio Ulster, Good Morning Ulster, Invasive species  
2013 RTE Radio 1, Mooney Goes Wild, Hares in Ireland

#### *Television*

2015 Countryfile, BBC  
2013 River Bann, RTE Television

#### *Blog posts*

2017 A brief history of an Early Career Researcher, Errant Science  
2017 Rejected by the Rainforest, I F-ing Love Conservation  
2017 Introducing the University Mammal Challenge, The Mammal Society  
2016 Is there intelligent life on Earth? Save our Souls magazine  
2016 Camera traps reveal a hare-raising situation. RSEC blog, ZSL  
2016 On closer inspection, it looks like a hare transplant. QUBio  
2015 Communities and conservation in developing countries. QUBio  
2015 Putting wildlife in the frame. QUBio  
2015 Dear Alice, the hare might be sane after all. QUBio  
2014 Mountain hare and Irish hare. The Mammal Society  
2014 A receding hare line and a brown toupee. QUBio

### **Outreach**

#### *Community/group talks*

Schools, natural history groups, student groups and local interest groups in Wales, England, Northern Ireland, Ireland, USA and Canada, in person and via video. Including remote project development, mentoring and advisement.

2017 Careers Zone scientist, I'm a Scientist Get Me Out of Here!  
2017 'Meet the Scientist', Culture Night, University College Cork  
2017 Contributed to Rabaiotti D, Caruso N (2017), Quercus books, ISBN: 9781786488275  
2017 Contributing scientist, Skype a Scientist  
2017 Co-created @SciCommGames, Environmental and science communication Twitter games  
2017 Enquiry Zone scientist, I'm a Scientist Get Me Out of Here!  
2017 Partner scientist, Student Science Partnerships, USA  
2016 Invited author, Shropshire Mammal Group newsletter  
2016 Correspondent, Letters to a Pre-Scientist  
2014 Created @Biotweeps, a science communication Twitter project (~12.5k followers)  
2014 Invited expert, multi-school careers advice and speed-networking event  
2013 Created @RinginPlanet, a bird-ringing Twitter aggregator (~2k followers)  
2013 Volunteer science presenter, ornithology, Techniquet, Cardiff  
2013 Bioblitz naturalist, Carmarthen

2013 Conservation zone scientist, I'm a Scientist, Get Me out of Here!  
2013 Bird ringing demonstrator, Wildlife Trust of South and West Wales  
2012 Created and managed the NI Hares Facebook page 2012 Bird ringing demonstrator, Wildlife Trust of South and West Wales  
2011 Bioblitz naturalist, Carmarthen

## Skills

### *Data analysis*

R (packages include MuMIn, lme4, ggplot, remBoot, maptools, raster, SDMTools, StatMatch, pdist, glmmulti, metafor), SPSS, Minitab, Distance, MARK

### *GIS*

R, ArcGIS, QGIS

### *Other software*

MaxEnt, MAVIS NVC, Patch Analyst, GeneMapper, Microsoft office, GitHub, RMarkdown, graphics packages (e.g. Photoshop), bespoke software

### *Statistical*

General linear and mixed-effects models, Principal Components Analysis, Species Distribution Modelling, Discriminant Function Analysis, diversity indices, Mahalanobis and Euclidean distance, cross-correlation functions, model averaging, Random Encounter Models, meta-analysis, other parametric and non-parametric tests

### *Field*

Off-road driving (4x4), multi-taxa (mammal, bird, invertebrate, reptile, amphibian; UK coastal, marine and terrestrial) surveys (e.g. mark and recapture, distance sampling, camera traps, quadrats, scan/focal sampling;) and identification, habitat surveys, animal handling (amphibians, reptiles, invertebrates, and small-to-large birds and mammals), orienteering

### *Laboratory*

Multi-taxa dissection (mammal, bird, amphibian, invertebrate), species identification via microscopy, ethological studies, tissue sampling, DNA manipulation, electrophoresis, atomic absorption and colourimetric spectroscopy, specimen preparation, soil chemical and biological analysis

## Referees

### **Dr. Neil Reid**

School of Biological Sciences, Medical Biology Centre, 97 Lisburn Road. Belfast BT9 7BL  
**Email** neil.reid@qub.ac.uk **Tel** +44 (0)28 9097 2746

### **Prof. Ian Montgomery**

School of Biological Sciences, Medical Biology Centre, 97 Lisburn Road. Belfast BT9 7BL  
**Email** i.montgomery@qub.ac.uk **Tel** +44 (0)28 9097 2214

### **Prof. Jaimie Dick**

School of Biological Sciences, Medical Biology Centre, 97 Lisburn Road. Belfast BT9 7BL  
**Email** j.dick@qub.ac.uk **Tel** +44 (0)28 9097 2286

### **Dr. Tom Cameron**

School of Biological Sciences, University of Essex, Wivenhoe Park, Colchester, CO4 3SQ  
**Email** tcameron@essex.ac.uk **Tel** +44 (0)1206 874074