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The history and development of ecology and ornithology in the Graham Kerr Building

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When the Graham Kerr Building (GKB) first opened in 1923, animal ecology as a recognised discipline within the biological sciences was still very much in its infancy and taught in very few U.K. Universities. The British Ecological Society is the oldest ecological society in the world (established in 1913), and many of the key early figures in it were botanists. However, the publishing of Charles Elton's landmark book *Animal Ecology* (Elton, 1927) provided a scientific basis for the study of the ecology, behaviour, and life histories of animals. After the Second World War, the inspirational work of scientists such as David Lack intertwined ornithology, ecology and evolutionary biology, and interest in both ecology and ornithology expanded relatively quickly. Later, as the negative impacts of increasing intensification of agriculture and pesticide use on the natural environment became increasingly apparent, plus major impacts of land use change, over-exploitation and species persecution, the increasing interest and need for nature conservation brought ecology further into the foreground of biological science. Most recently, the twin crises of biodiversity loss and climate change, plus disease transmission from animals to humans, has meant that the need to understand the impacts we are having on other species and ecosystems, and what we can do to deal with the problems we create, is ever more pressing. Ecology is now a very broad church, and this is reflected in the fact that Zoology in Glasgow now sits within the new School of Biodiversity, One Health and Veterinary Medicine, and ecological thinking is fully integrated into the teaching and research of many colleagues.

Over the years, ecological research has developed considerably in Glasgow, with additional research in behavioural and physiological ecology. This has involved research carried out by, under the supervision of, and in collaboration with, members of the academic staff. In addition, large numbers of independently funded research fellows have also made enormous contributions. So large and far-reaching has the subject become, that it is simply not possible to name all of those involved or all the research topics covered. This chapter mainly focuses on how a broad, fundamental, ecological base developed from the initial focus on avian-centred research, and is based on the academic staff and their interests. It by no means covers everyone or everything that has been done, but hopefully gives a historical record of the development of animal ecology in the GKB.

The first true ecologist at the University of Glasgow was a population ecologist, Anthony (Tony) Dixon, who was appointed to the Zoology academic staff in 1957. Tony studied the population ecology of aphids at the Rowardennan Field Station, Loch Lomond, where he ran a large experimental programme until he moved to the University of East Anglia in 1975. Peter Calow, a physiological and evolutionary ecologist, was appointed in 1972, with a particular interest in the costs of reproduction and a focus on freshwater organisms. Peter then moved from Glasgow to the University of Sheffield in 1984. The next ecologists to be appointed to the permanent academic staff worked primarily in avian ecology, beginning with the appointment of David Houston in 1974 as part of the expansion of Zoology that took place under the then Regius Professor, David Newth. David Houston initially worked with scavenging birds, such as vultures in Africa and crows (and later buzzards) in Scotland. As has been mentioned elsewhere in this volume, David Newth believed that, for a particular sub-discipline to flourish, appointing groups of three staff with cognate interests was a good approach, which indeed it was. One of the areas he specifically chose to develop was research on birds, leading to the appointment of two further staff members who worked primarily in avian ecology: myself (Pat Monaghan) in 1976 and Robert (Bob) Furness in 1978.

Ornithology in Glasgow has encompassed both applied and fundamental research, initially involving work in the field including large scale catching (using cannon-netting) and marking of gulls and shorebirds for studies of behaviour and movements. An "Applied Ornithology Unit" was established in the 1980s, under which conservation work was carried out. There was a large amount of research on seabirds, their population ecology and life histories, including the interaction of seabirds and commercial fisheries, with a focus on the breeding seabirds and industrial sandeel fisheries of the North Sea. Both Bob Furness and I had projects on this topic in Orkney and Shetland, and elsewhere. Bob was especially well known for his detailed long-term studies of the population of great skuas (*Stercorarius skua*) on Foula, Shetland, which ceased only relatively recently. As well as many scientific papers, Bob and I also published a book together on seabird ecology (Furness & Monaghan, 1987). Bob retired early from his university post in 2018 to focus on environmental consultancy work. I also studied the association of gulls with human environments and their potential role in the spread of disease. All three of us "ecological ornithologists" collaborated to varying degrees, while at the same time running independent projects, not always on birds. Ornithological research expanded further in the 1990s. Neil Metcalfe, who did his PhD on shorebirds with Bob, but who then became primarily a fish biologist (Metcalfe, 2024), was appointed in 1992 and has

retained a research interest in birds. Ruedi Nager (initially a postdoc with myself and David Houston in the 1990s) and Stewart White were appointed to the academic staff in the late 1990s. A nice summary of the development of ornithology in Glasgow was published in Scottish Birds (Furness *et al.*, 2011), which described much of the work conducted until then. This includes both long-term individual-based studies of particular bird populations of high conservation concern, such as the great skuas on Foula (Furness, 1987) and red-billed choughs (*Pyrrhocorax pyrrhocorax*) in the Inner Hebrides (see Reid *et al*. (2021) for a recent summary of the chough research, which involves myself and many colleagues based elsewhere). Other Zoology staff, such as Martin Burns, initially an electrophysiologist, were drawn into the bird work. Martin was a wizard in the development of electronic kit for use in the field and laboratory, designing, for example, sophisticated radio tracking capabilities and remote weighing devices disguised as rocks for work on seabirds. Staff in the mechanical workshop (then based in the GKB) also did a great job in helping build the devices. This kind of work was then further developed in the Bioelectronics Unit, run until recently by Nosrat Mirzai, which continues to develop innovative, tailor-made devices to facilitate research and is still located in the basement of the GKB (Mullin *et al*., 2024).

David Houston developed an interest in avian nutrition, especially in relation to egg production, and as part of this work established a colony of zebra finches (*Taeniopygia guttata*) housed in the GKB. David retired in 2011, but researchers in Glasgow carry out research using this species as a model to the present day – for instance my own group has conducted long-term projects following individual birds throughout their lives in studies of ageing biology and effects of early life conditions (Fig. 1). In 1996 Richard Griffiths set up one of the first molecular ecology labs in the U.K. and together with Kate Orr (now Griffiths) developed an innovative and now widely used method of genetically sexing birds using small DNA samples, generally obtained from bird blood (Mable, 2024). This led the ornithology group in Glasgow and elsewhere into new research avenues on avian sex ratios, showing for the first time, for example in field work on lesser black-backed gulls (*Larus fuscus*), that the sex ratio in clutches of eggs can vary with the female's body condition (Nager *et al*., 1999). In parallel, Glasgow became known for experimental work on the costs of egg production in the field and laboratory (Monaghan & Nager, 1997), and on the long-term effects of early life conditions, particularly stress exposure and growth rate on individual life histories (Metcalfe & Monaghan, 2001).

Further development of molecular tools has taken place in Glasgow enabling the study of cellular and organism ageing via telomere attrition, measured mainly from red blood cell DNA, and also molecular approaches to evolutionary biology (see Mable, 2024). Ruedi Nager has continued work on how gulls function in a human-dominated landscape, with his recent research being on diet, habitat use and movements of gulls throughout

Fig. 1. Research using the zebra finch colony enables life-long effects of environmental conditions to be studied from the chick stage through to old age, and across generation. (Photo: Paul Jerem)

their annual cycle. Together with several other Glasgow colleagues, it was shown, using thermal imaging, that skin temperature can be used to measure stress exposure, which they have now used in both captive and wild birds, including northern gannets (*Morus bassanus*) on the Bass Rock and common guillemots (*Uria aalge*) in the Baltic (Herborn *et al.*, 2015). Stewart White is now focused on passerine birds in the wild, both locally and internationally**.** For example**,** the area around Loch Lee, on the border between Angus and Aberdeenshire, has long been a stronghold for the ring ouzel (*Turdus torquatus*), with several papers on this published by University of Glasgow staff and students (Davies *et al*., 2014). Monitoring of the population is ongoing, but sadly the drop in numbers seen in other populations does now appear to be affecting the Loch Lee birds. Stewart has also studied the bearded reedling (*Panurus biarmicus*), another species with a stronghold in Scotland.

More passerine work was developed with the arrival in 2012 of Barbara Helm, known for her work on avian migration and biological rhythms. Barbara built up work that had been developing on nest-box populations of tits in the woodlands around the SCENE field station on Loch Lomondside. While Barbara subsequently moved to Groningen in 2018, the appointment of Davide Dominoni in 2019 has continued work with the nest-box populations. Davide's research seeks to uncover the strategies that birds adopt to cope with global environmental change, and the importance of sensory ecology in this context (Dominoni *et al*., 2020). A particular focus of his research is the effects of increasing worldwide urbanisation, to which end he runs a long-term study on blue tits (*Cyanistes caeruleus*) along a 35-mile urban-rural gradient stretching from the centre of Glasgow to SCENE. Using this system, Davide's research group has shown that reproductive fitness of blue tits and great tits (*Parus major*) is greatly reduced in more urban areas, particularly where native trees are less abundant and consequently insect prey are not sufficient to raise healthy offspring. The urban-rural gradient has also been instrumental in demonstrating how light pollution can alter the daily rhythms of

activity and physiology in passerine birds, and more recently in owls. Davide is currently involved in a large interdisciplinary project called GALLANT (Glasgow as a Living Lab Accelerating Novel Transformation), with the ultimate goal of his part of the project being to understand how environmental and socioeconomic factors shape the diversity and abundance of bird species, and how urban planning can help ensure the wellbeing of wildlife and humans alike. To this end, he collaborates extensively with other researchers, and with the Glasgow City Council and NGOs.

Research such as Davide's illustrates how science continues to move to more interdisciplinary teams rather than being focused on specific taxonomic groups. Birds are of course interesting from many different perspectives and there is much more work on birds in Glasgow than there is space to mention here. Mike Hansell, an ethologist (see Huntingford, 2024), was particularly interested in things that animals build, and Mike and Maggie Reilly (see Reilly, 2024) established a national collection of bird nests as part of the University's Hunterian Museum collection, a valuable resource available nationally and internationally for research.

A strong link to mathematical approaches to ecology and behaviour was triggered by Graeme Ruxton, who had wonderfully eclectic interests and was on the staff from 1996 till his move to St. Andrews in 2012. In recent years, an increasing diversity of ecologists and behavioural ecologists and mathematical modellers has been appointed, many of whom work in the GKB. Seabird ecology continues to be important, as seabird populations have declined for multiple reasons. Furthermore, shores and near-shore marine areas have become increasingly exploited for renewable energy. The highly connected and dynamically interacting colonial systems typical of seabirds are sensitive to environmental disruption, via collision mortality and displacement disturbance for example, and their declines are hard to detect and mitigate. Many scientists in the GKB have worked with conservation biologists to try to address urgent questions that require strong practical and mathematical underpinnings, as well as field research, to develop an accurate predictive reconstruction of the dynamics of species such as the northern gannet (Jeglinski *et al.*, 2023) and have used this multi-disciplinary approach to predict, for example, population level responses of seabirds to environmental disruption at a European level. A key area is the development and application of sophisticated mathematical modelling approaches to understand animal spatial distributions, movements and population fluctuations, initially with the appointment of Dan Haydon in 2004, more recently followed by several others, including Grant Hopcraft, Jason Matthiopoulos, Tom Morrison and Richard Reeve, with interests in animal movement and biodiversity measures. The most recent re-organisation of research groups in the new School of Biodiversity, One Health and Veterinary Medicine has resulted in the formation of a large Ecology and Environmental Change Theme, led by Jason. This brings together research into the theory and practice of ecology, going from individual behaviour through to large-scale, long-term ecosystem change (Fig. 2) and also disease dynamics. This integrative approach is essential if we are to rise to the challenges we face from biodiversity loss and climate change.

Fig. 2. The spatial ecology research includes that of Grant Hopcraft and Tom Morrison on factors influencing the large-scale movements of wildebeest in the Serengeti-Mara. (Photo: Daniel Rosengren)

In the late 1980s the Ornithology Group in Zoology established an Ornithology Christmas Lecture and party, which has remained the main Christmas social event in the GKB as the Zoology Department has morphed from a Department, to a Division, then an Institute, and now a School (Downie, 2024). The GKB is full of collegiate and talented people, who both support each other and party together!

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