**Long-term environmental influences on the ecology and conservation of river birds**

**Lead Supervisor Name**

Professor Steve Ormerod

**Lead Supervisor Contact Details**

ormerod@cardiff.ac.uk

**Lead Supervisor Location/Student Home Institution**

Institution: Cardiff

School: Biosciences

**Full Project Description**

Although covering less than 1% of Earth’s surface, freshwater ecosystems host around 10% of all the Earth’s species and a third of all vertebrates. This includes almost 2000 bird species – roughly 20% of the global total – that depend on inland waters or their margins for all or part of their life cycle. Simultaneously, however, many of these species are exposed to multiple, global environmental stressors on freshwaters that are now responsible for rates of extinction and impairment faster than in any other ecosystem. There is a clear need to understand the processes, to assess the consequences for ecosystems and ecosystem services, and for management strategies to halt or reverse adverse effects. In the UK, Dippers Cinclus cinclus and Grey Wagtails Motacilla cinerea are associated closely with streams and rivers, but now have respectively ‘amber’ and ‘red’ conservation status following population decline since the 1970s. Our research over 35 years has shown that 1) these species are connected integrally to the quality and quantity of invertebrate production in freshwaters (Ormerod & Tyler 1991) and 2) their distribution, abundance and life histories are affected by freshwater ecosystem stressors such as pollution, persistent contaminants, plastics, climatic variation and physical habitat character (Vaughan et al. 2007; Windsor et. 2019). As a result, these or congeneric species are recognised globally as indicators of the quality of rivers and their surrounding catchments. This project will use this detailed knowledge to assess factors responsible for variations in the distribution, abundance and demography of Dippers and Grey Wagtails in time and space in representative areas of their upland range – specifically Mid and South Wales Focusing mostly on rural rivers, we will pay particular attention to growing concerns about the influence of intensifying agriculture on the ecology rivers and river birds to ask: How do the distribution, abundance and demography of river birds relate to land use in space and time, and through what freshwater ecological processes? Specifically, we ask:

1. How does land use affect the breeding performance, demography and fitness (as breeding performance and survival) of river birds?
2. How does land use alter freshwater prey availability and prey use for river birds?
3. How do land use effects on water quality and physical habitat affect river birds?
4. How does land use affect pollutant exposure in river birds?
5. Is there any evidence that mitigation strategies in catchments or riparian zone can offset any adverse effects revealed by i) to iv)?

Working with these aims, the student will lead the specific design of the PhD, aided by extensive, long-term and historical data held by the partners on distribution, abundance, nest-site occupancy, life history, demography, prey use, prey abundance, habitat use and behaviour of the target species, as well as long-term data on river quality (1970s-present). The student will gain direct experience of field experimental design, ornithological fieldwork, river ecology, water quality assessment, contaminants, molecular and conventional assessment of prey use, food webs, GIS, data analysis and writing for publication. As well as being part of the FRESH community, the host institutions have large early-career communities with which the student will interact. Supervisory strategies in the host institutions are clear, but in addition the stakeholder partners offer opportunities for short internships to develop the student's understanding of real-world problem solving. The project is supported by the Universities of Cardiff and Exeter, the RSPB, BTO, NRW, the Wye Preservation Trust and by Dr Stephanie Tyler, who has collected data on river birds for almost 50 years. References: S. J. Ormerod, S. J. Tyler (1991). Predatory exploitation by a river bird, the dipper Cinclus cinclus along acidic and circumneutral streams in upland Wales. Freshwater Biology, 25, 105-116. I. P. Vaughan, D. Noble, S. J. Ormerod (2007). Combining surveys of river habitats and river birds to monitor riverine landscapes. Freshwater Biology. 52, 2270-2284 F. M. Windsor, M. Glόria Pereira, C. R. Tyler & S. J. Ormerod (2019) Persistent contaminants as potential constraints on the recovery of urban river food webs from gross pollution. Water Research, 163, 114858.

**Real Life challenges this project will address**

How to balance the resource exploitation of terrestrial ecosytems for food and fibre production with the conservation, restoration and cultural value of freshwater ecosystems downstream.

**What you should know about this project**

Almost 2000 bird species – 20% of the World's total – depend on inland waters for all or part of their life cycle. Many of these species are exposed to global environmental stressors that cause rates of impairment in rivers, lakes and wetlands faster than in any other ecosystem, yet birds are often overlooked in the freshwater extinction crisis. Using Welsh river birds as a model, this project will investigate the effects of changing land use and river quality on the distribution, abundance, fitness, demography and trophic ecology of Dippers and Grey Wagtails in time and space. The project builds on decades of unique historical data held by the team, while also using modern field and laboratory skills. The University supervisors combine world-class ecotoxicology (Tyler), statistical ecology (Vaughan) and applied freshwater biology (Ormerod), led by a recognised global authority on the ecology of river birds. The project is supported by local and leading NGOs, and by Wales’ largest Government-sponsored environmental body, thus providing strategic context, major opportunities for impact and a potential career pathway for the student beyond the project.

**What expertise you will develop**

Skills development will include:

1. The use of scientific literature
2. Scientific writing, communication and publishing
3. Field experimental design
4. Univariate and multivariate data analysis
5. Field ornithology (bird survey; nest recording; trapping, ringing and recording…)
6. Freshwater and terrestrial invertebrate sampling, analysis and interpretation
7. Molecular and conventional approaches to bird dietary investigation and analysis
8. Hydrochemical sampling and interpretation
9. River habitat survey and interpretation
10. Pollutant chemistry and ecotoxicology
11. Climate science
12. GIS
13. River conservation biology and policy
14. Insight into agronomy and land use

**Why this project is novel**

No previous research has investigated and quantified the long-term, multi-stressor effects of agricultural change on UK river ecosystems as seen through the ecological response of river bird as proven model organisms. We are aware of no similar investigations globally.

**Rest of Supervisory Team:**

**Stakeholder Organisation** River Wye Preservation Trust

**Stakeholder Supervisor** Mark July

**Co-Supervisor 1** Professor Charles Tyler

Affiliation: Exeter

Email: c.r.tyler@exeter.ac.uk

**Co-Supervisor 2** Dr Ian Vaughan

Affiliation: Cardiff

Email: vaughanip@cardiff.ac.uk

**Co-Supervisor 3** Dr Stephanie Tyler

Affiliation: Other

Email: steph\_tyler2001@hotmail.com

**Co-Supervisor 4**  Supervisors from BTO, RSPB and NRW TBD