

Gulls as reservoirs and vectors of zoonotic pathogens and antimicrobial resistance

Project ID: 3606

Supervisory team

Main supervisor: Dr Neeltje Boogert (University of Exeter)

Second supervisor: Dr Amy Thomas (University of Bristol)

Other supervisors: Dr Daniel Padfield (University of Exeter),

Host institution: University of Exeter

Project description: Habitat modification and urbanisation increase human-wildlife interactions, conflict, and the potential for pathogens to cross species boundaries. However, the exact transmission routes that link people and wildlife to cause zoonotic epidemics (e.g. COVID-19, monkeypox) are often poorly understood. Herring gulls are an ideal model system to investigate how, where and when opportunistic wildlife might both acquire and spread pathogens. They feed on everything from fishery discards to landfills and agricultural fields, and frequently interact with humans through stealing food and nesting in urban areas. While there is emerging evidence that gulls transmit pathogens of human health concern (e.g. avian influenza), as well as harbouring bacteria with antimicrobial resistance (AMR), the mechanisms underlying their role in pathogen and AMR transmission are unknown. The objectives of this PhD, which will be tailored to the student's interests, include: 1) Assessing the prevalence of pathogens of human health concern and AMR in a well-characterised urban gull population breeding at Exeter's Penryn campus using sequencing of faecal and blood samples.



Pilot data shows distinct age effects on microbiomes; repeated sampling of the same individuals will reveal how microbiome and pathogen load change from hatching to adulthood. 2) Isolating pathogens from faecal samples and performing microbial assays (e.g. growth rate, survival curves) to understand how well pathogenic organisms survive in/on different substrates (e.g. sea and fresh water, pavements, picnic tables, railings), to quantify the real-world risk posed by gull vectors. 3) Tracking behaviour of gulls and rates of spatial association with conspecifics, avian heterospecifics (e.g. in mixed-species roosts on lakes) and people, using the latest GPS- and Bluetooth technology. This will test how individuals with different microbial and pathogen profiles move in the landscape, and provide insights into sites and routes for acquisition and transmission. 4) Develop epidemiological models that incorporate detailed individual-level biological data on gull microbiome, movement, and social interactions, as well as pathogen survival and human activities, to understand risk to human health. The student will be supervised by a team of experts in behavioural ecology (Boogert), avian pathogens (Thomas), microbial ecology (Padfield), bioinformatics (Harrison) and epidemiological modelling (Hodgson). The generated insights will have real-world applications, and the supervisory team has established links with the media (Boogert) and stakeholders (e.g. poultry farmers, UK

Health Security Agency, Animal and Plant Health Agency, BTO; Thomas) available for the student to have impact.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.