

detecting parasite-parasite interactions

At first glance, some of the research conducted at the Fitztute may seem to have little immediate relevance to birds and their conservation – as is perhaps the case with the study featured in this article. Dr Eléonore Hellard, a post-doctoral fellow at the Fitz, has recently published a paper in the journal *Trends in Parasitology* that provides an ecological framework for assessing parasite-parasite interactions in wild animals.

Host organisms are often infected by multiple parasite species, and their interactions can have far-reaching implications for parasite dynamics, host health and disease management. For example, synergies between *Varroa destructor* mites and the Deformed Wing Virus contributed to the collapse of honeybee colonies. Identifying synergies between parasites may help to prevent population declines, and antagonist parasites may even be used to help fight problematic pathogens. For example, the bacterium *Janthinobacterium lividum* provides amphibians with some level of protection against infections by the devastating chytridiomycosis fungus.

Among birds, infections by avian malaria and the immunosuppressive avian pox virus combine to exacerbate the severity of epidemics, increasing the role of these diseases in instances such as the decline of endemic Hawaiian forest birds. A similar scenario is now feared in the Galápagos, where the pox virus has been present for over a century but avian malaria has only recently been diagnosed in the endangered Galápagos Penguin *Spheniscus mendiculus*.

The ability to detect and understand parasite-parasite interactions is crucial to prevent and manage infectious

diseases. However, most knowledge of parasite-parasite interactions results from experimental and clinical studies of captive individuals. Few studies have assessed parasite interactions in wild populations. Unfortunately, detecting parasite-parasite interactions in the wild is difficult because the interactions occur both at the within-host level (through competition for host resources, interactions via the host immune system, etc.) and at the host population and community levels (through increased mortality of certain hosts).

Hellard and colleagues from the University of Lyon in France highlight the existence of parasite-parasite interactions at all levels of biological organisation and propose a method to use their cascading effect from one level to the next as a way to detect interactions in natural populations. Interactions occurring at one level of organisation can spread to other levels. Even if such cascade effects can be complex and confounding, Hellard argues that assessment at ecological scales may provide a way to survey a wider range of parasites at lower costs and that cascade effects could be used to detect parasite-parasite interactions.

Understanding parasite interactions in wild populations is important because the mechanisms observed in clinical experiments may not occur in natural conditions. Also, the wide range of ecological scales at which parasite-parasite interactions can be studied offers a valuable means to decide which groups of potentially interacting parasites should be studied under controlled laboratory conditions.

Hellard hopes that her article will promote further research into host-parasite interactions. She says 'We need to see



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Detecting interactions between parasites is particularly important where introduced parasites may threaten endemic species, such as the Galápagos Penguin.

parasites as key elements of ecosystems. They should be perceived as evolutionary partners rather than enemies to be eradicated at all costs. We should decipher interactions between parasites and hosts and take advantage of this knowledge. Some antagonistic interactions between parasites may help us to fight pathogens of humans, livestock, wildlife or even plants.'

Hellard developed some of her ideas in this field while studying the incidence of avian malaria in different bird communities in southern Africa.

REFERENCE

Hellard, E., Fouchet, D., Vavre, F. and Pontier, D. 2015. 'Parasite-parasite interactions in the wild: how to detect them?' *Trends in Parasitology*. DOI: 10.1016/j.pt.2015.07.005

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