Wildlife Disease & Contaminant Monitoring & Surveillance Network

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The WILDCOMS newsletter reports recent newsworthy items, publications from member partners and items of interest about wildlife ecology from the UK and overseas. WILDCOMS is funded by NERC and delivered under the UKCEH UK-SCAPE National Capability Programme (grant number NE/R016429/1).

Spotlight on Avian Influenza

Behavioural effects of an immune challenge and what we know about avian influenza by Rosie J Lennon.

Avian influenza is an ongoing threat to bird populations worldwide. Over the last few months, the UK has documented a spate of national cases among several well-known seabird colonies, as well as species residing in terrestrial habitats (RSPB 2023).

The primary concern of course is the impact of the immediate spread and lethality of the virus on wild bird populations. However, as with most diseases, there are also likely to be physiological and behavioural sub-lethal effects – the impacts of which are often less clearcut. Notably, one of the more unusual physiological effects of avian influenza is the observed change in eye colour in individuals that have survived the virus (Lane et al. 2023), as well as weight loss that is a commonly reported symptom (Lane, Jeglinski et al. 2023). But what behavioural effects could be expected alongside the physiological ones?

Recent research conducted at Lund University (Sweden) investigated the impact of an immune-challenge (an injection of bacterial protein that elicits an immune response without causing an infection) on the behaviour of free-living blackbirds *Turdus merula* (Lennon, Ronanki et al. 2023). The study found that immune-challenged birds reduced their activity by an average of 19% for as many as 20 days. In the first 24 hours after the immune challenge, activity was reduced by as much as 59%. The specific sickness behaviour responsible was identified using accelerometers – devices that record the level of activity and whether a bird is mobile or stationary on an hourly basis. These data showed that immune-challenged birds ceased activity on average 0.7 hours earlier than unchallenged birds at dusk, whereas activity at times of the day remained similar.

Comparably, studies investigating behavioural changes in response to avian influenza are limited to snapshot data of migratory species at a larger temporal scale, rather than continuous daily monitoring. There is evidence that individuals infected with the virus reduce daily regional movements, increase stopover time and reduce foraging behaviour (Latorre-Margalef, Gunnarsson et al. 2009, van Dijk, Kleyheeg et al. 2015, Hoye, Munster et al. 2016). However, the longevity of such effects and how these may affect daily activity patterns remains unclear for this particular disease.

A reduction in daily activity is not an unexpected response to an immune-challenge or infection, as it is a well-documented sickness behaviour in aviary studies (Johnson, Curtis et al. 1993, Sköld-Chiriac, Nord et al. 2014, Love, Foltz et al. 2016). However, authors of the Swedish study were surprised at the specificity and longevity of the effect in free-living birds, especially given that the challenge was only mimicked (i.e.,

there was no pathogen to clear). Over a short time-period (1-2 days), behavioural changes could be problematic for animals in energetically or temporally constrained situations (e.g., feeding young, enduring poor body condition, coping with bad weather). Over longer time-periods, any adverse behavioural alterations are likely to incur accumulative fitness costs.

In the case of avian influenza, understanding how sickness behaviours impact our wild birds and whether such behavioural changes ultimately contribute to mortality incidences during an outbreak, is just a small part of a much larger challenge.

For further details of the Swedish study see: Lennon RJ, Ronaki S & Hegemann A (2023) *Immune challenge reduces daily activity period in free-living birds for three weeks* Proceedings of the Royal Society B https://doi.org/10.1098/rspb.2023.0794. Full reference list can be found on the final page of this newsletter.

Above: An avian (and human) participant in the Lund study.

Left: An accelerometer retreived from a recaptured blackbird one year after deploymemt (hence the grubby appearance and missing antenna).

Picture credit: Rosie J Lennon

WILDCOMS Scheme news

Predatory Bird Monitoring Scheme (PBMS)

The impact of Avian Influenza on submission of dead birds of prey to the Predatory Bird Monitoring Scheme by Elaine Potter.

The Predatory Bird Monitoring Scheme (PBMS) relies on members of the public, citizen scientists and other parties interested in wildlife health to submit dead birds of prey found in non-suspicious circumstances. Avian Influenza (AI) has been present for several years; seasonality and migration have an impact on the number of AI cases observed, with higher numbers throughout the winter period. Since autumn 2021, the number of positive cases has risen significantly and where the virus once affected mainly migratory waders, it has become a much bigger issue for multiple species of birds (including birds of prey) across the whole calendar year.

Following government advice to protect public health about not touching dead wild birds, the PBMS closed to public bird submission. We are currently unable to receive raptor samples but are working hard to identify solutions to allow safe collection and submission of dead birds of prey. These specimens are vital to the PBMS and enable us to ensure that gaps in the long term database are kept to a minimum. We are still working though, processing and analysing specimens that were submitted prior to the AI outbreak to allow us to keep monitoring for environmental contaminants. PBMS website *https://pbms.ceh.ac.uk/* and our email *pbms@ceh.ac.uk*

Rodenticide wildlife exposure is a global issue by Shinji Ozaki.

Recently, Australian researchers reported multiple rodenticide exposure cases in various local birds of prey, e.g. tawny frogmouth owls. Second-generation anticoagulant rodenticides (SGARs) are persistent and bioaccumulative compounds widely used against rodent pests. However, SGARs can persist in rodent tissues and can therefore, be transferred to and affect predators. Australian researchers considered the impact of SGARs on wildlife as a new 'Silent Spring' in Australia.

The PBMS team are keen to find out if this is also the case in the United Kingdom (UK). We have reported the time trend of exposure of wildlife to SGARs over decades; in recent years we have mainly focused on red kites and barn owls. Our latest reports show a similar level of exposure and an increasing exposure trend to brodifacoum, a highly toxic and persistent SGAR.

For details of the news article about the Australian case, see: *https://theconversation.com/rat-poison-is-killing-our-beloved-native-owls-and-tawny-frogmouths-and-thats-the-tip-of-the-iceberg-212184*

PBMS latest reports and papers can be found on the *PBMS publication page*.

GB Wildlife Disease Surveillance Partnership - reports are published quarterly.

To access the latest reports see: *https://www.gov.uk/government/publications/wildlife-gb-disease-surveillance-and-emerging-threats-reports*.

The GB Wildlife Disease Surveillance Partnership is made up of the following organisations: Animal and Plant Health Agency (APHA), Scotland's Rural College (SRUC), Institute of Zoology (IoZ), National Wildlife Management Centre of APHA (formerly part of FERA), The Centre for Environment, Fisheries and Aquaculture Science (CEFAS), The Wildfowl and Wetlands Trust (WWT), Natural England (NE) and Forestry England (FE).

WIIS-Scotland

Wildlife Crime Prosecution: The WIIS-Scotland team provided analytical support that contributed to a successful prosecution relating to several poisoning cases from 2019 and 2020. The accused, a waterfowl enthusiast, was found guilty of deliberately poisoning multiple birds of prey and rooks in Dumfries and Galloway. He also pled guilty to possession of highly toxic pesticides and was sentenced to a community payback order and ordered to carry out 216 hours of unpaid work. SASA's Wildlife DNA Forensic team also helped with this investigation by identifying the bait species consumed by the poisoned birds. See links to 2 press articles relating to this case *here* and *here*.

The latest results from WIIS-Scotland 2023 can be found *here*.

Cardiff Otter Project

Unexpected genomic variation in eastern British Eurasian otters (*Lutra lutra*) revealed by whole genome sequencing.

A new publication by Sarah du Plessis (du Plessis et al., 2023) has revealed interesting genetic differences among Eurasian otter (*Lutra lutra*) populations in the east of England and suggests regional differences in the timing of past population bottlenecks.

Previous research has shown that there are four genetically differentiated populations of otter in the UK – North of England and Scotland, Southwest England, Wales, and central and eastern England. These are likely to have formed after chemical contaminants caused a crash in the population between 1950 and 1980. In du Plessis et al., 2023, whole genome sequencing from muscle samples of 45 otters collected between 2016 and 2020 showed two divergent mitochondrial lineages within eastern England which were not found in previous studies using microsatellite approaches, and which appear to have originated in Asia (potentially as an accidental introduction during population reinforcement work in the 1980s-90s). In addition, the genomic evidence suggests that although the population bottleneck in southern England coincides with the known decline in populations due to chemical contamination, population declines in Wales and northern England appear to have started much earlier.

Avian influenza screening

Due to the recent outbreak of avian influenza, the Otter Project is working with Public Health Wales (PHW) virology centre and APHA. We have screened 142 otters for avian influenza and COVID using peripheral swabs (rectal, nasal, and tracheal) prior to post-mortem and deeper swabs (brain, bronchial, and tracheal) during post-mortem. The positive results including date and location at present are as follows: H5N1 – Nottinghamshire, May 2022 (#4195); Cumbria, January 2022 (#4197); Denbighshire, December 2022 (#4255). H5 (further sub-typing not possible) – Gwynedd, December 2020 (#4222); Wiltshire, January 2023 (#4305). Influenza A, type unknown - unlikely to be H5/H7/H9 - Shropshire, August 2019 (#4326). The remaining otters tested have returned negative for avian influenza and COVID. Positive results have largely arisen from post mortem swabs of brain tissue, even where peripheral swabs have been negative – this is likely because of rapid environmental breakdown of the virus, and is good news for our collector network, because it suggests that the risk of infection is low for people handling carcasses. We are liaising with the Worldwide Influenza Centre (WIC) at the Frances Crick Institute, and with the Animal and Plant Health Agency (APHA) to contribute to vital research into how the virus is evolving, and how it presents in mammals.

Wildlife Incident Investigation Scheme (WIIS)

WILDCOMS would like to take this opportunity to wish Libby Barnett a wonderful retirement. Thank you for all of your valued input over the years. We would also like to welcome Sheonaidh Charman who will take over contributing WIIS news for England and Wales to WILDCOMS.

Garden Wildlife Health

GWH focuses on garden birds, amphibians, reptiles and hedgehogs. For this they count on the help of the public to submit reports of sick or dead wildlife of these species and to submit samples for analysis. To report death or illness in garden wildlife see *https://www.gardenwildlifehealth.org/*

GWH have produced a wealth of advice on creating a healthy environment for your garden. See *Amphibians*, *Birds*, *Hedgehogs*, *Reptiles* and *Wildlife friendly gardening*.

Recent WILDCOMS and featured publications

Apaa et al. 2023. Lack of detection of SARS-CoV-2 in British wildlife 2020-21 and first description of a stoat (*Mustela erminea*) Minacovirus *https://doi.org/10.1101/2023.04.28.538769*

Beckmann et al., 2022. Wildlife health outcomes and opportunities in conservation translocations. Ecological Solutions and Evidence *http://doi.org/10.1002/2688-8319.12164*

Common et al., 2022. Disease Surveillance of free-living Eurasian beavers (*Castor fiber*) in England – Oral Presentation. 9th International Beaver Symposium, Brasov, Romania. 19th-22nd September 2022.

Common et al., 2022. Investigating the Eurasian beaver (*Castor fiber*) as a biological indicator of ecotoxicological exposure and effects in England – Poster Presentation. 9th International Beaver Symposium, Brasov, Romania. 19th-22nd September 2022.

Common et al., 2023. Investigating chemicals in, and their pathogenic effects on, beavers (*Castor fiber*) in England. Restoring Beavers to the British Landscape, Exeter: 18th-20th April 2023.

Common et al., 2023. Conservation translocations and the risk from disease. CIEEM in practice, Bulletin of the Chartered Institute of Ecology and Environmental Management 110 (March):19-23

du Plessis et al. 2023. Unexpected genomic variation in eastern British Eurasian otters (*Lutra lutra*) revealed by whole genome sequencing. *https://doi.org/10.1093/molbev/msad207*

Gerard et al., 2022. Plastic ingestion in an emaciated red kite (*Milvus milvus*) in England. Veterinary Record Case Reports: e454. *https://doi.org/10.1002/vrc2.454*

Hayes et al. 2023. The Occurrence and Zoonotic Potential of Cryptosporidium Species in Riverine Hosts. *https://doi.org/10.1186/s13071-023-05827-9*

Holmes et al., 2023. Repeated squirrel pox infection in Welsh red squirrels. Veterinary Record, 192: 128-129. *https://doi.org/10.1002/vetr.2709*

Lean, et al., 2023. Tissue distribution of angiotensin-converting enzyme 2 (ACE2) receptor in wild animals with a focus on artiodactyls, mustelids and phocids. One Health, p.100492. *https://doi.org/10.1016/j.onehlt.2023.100492*

Hoye et al., 2016. Hampered performance of migratory swans: intra-and inter-seasonal effects of avian influenza virus. Integrative and Comparative Biology 56(2): 317-329.

Johnson et al., 1993. Sickness behavior in birds caused by peripheral or central injection of endotoxin. Physiology & behavior 53(2): 343-348.

Lane et al., 2023. High pathogenicity avian influenza (H5N1) in Northern Gannets: Global spread, clinical signs, and demographic consequences. bioRxiv: 2023.2005. 2001.538918.

Latorre-Margalef et al., 2009. Effects of influenza A virus infection on migrating mallard ducks. Proceedings of the Royal Society B: Biological Sciences 276(1659): 1029-1036.

Lennon et al., 2023. Immune challenge reduces daily activity period in free-living birds for three weeks. Proceedings of the Royal Society B 290(2005): 20230794.

Love et al., 2016. Changes in corticosterone concentrations and behavior during *Mycoplasma gallisepticum* infection in house finches (*Haemorhous mexicanus*). General and Comparative Endocrinology 235: 70-77.
RSPB, 2023. Avian Flu (bird flu). Retrieved September 2023, from *https://www.rspb.org.uk/birds-and-wildlife/advice/how-you-can-help-birds/disease-and-garden-wildlife/avian-influenza-updates/.*
Sainsbury et al., 2022. Animal disease and conservation translocations. In: Conservation Translocations. Eds Gaywood M, Ewen J, Holingsworth P, Moehrenschlager A. Cambridge University Press
Sköld-Chiriac et al., 2014. Physiological and behavioral responses to an acute-phase response in zebra finches: immediate and short-term effects. Physiological and Biochemical Zoology 87(2): 288-298.
van Dijk et al., 2015. Weak negative associations between avian influenza virus infection and movement behaviour in a key host species, the mallard *Anas platyrhynchos*. Oikos 124(10): 1293-1303.

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