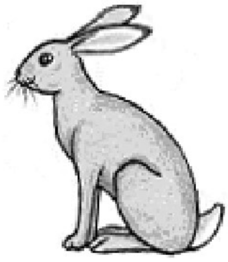
Great Britain Wildlife Health Partnership quarterly report

Disease surveillance and emerging threats



Volume 38: Quarters 3 and 4 – July to December 2022

Highlights

Contents

Introduction and overview

The Great Britain Wildlife Health Partnership comprising the Animal and Plant Health Agency (APHA), Scotland's Rural College (SRUC) Veterinary Services, Institute of Zoology (IoZ), the Centre for Environment, Fisheries and Aquaculture (CEFAS), the Wildfowl and Wetlands Trust (WWT), Natural England (NE), the Forestry Commission England (FCE) and the Garden Wildlife Health (GWH) project produces the GB Wildlife Health Partnership Quarterly Reports.

A full explanation of how data is analysed is provided in the annexes available on GOV.UK.

Issues and trends

The highly pathogenic avian influenza (HPAI) outbreak in Great Britain remained the primary issue in wildlife in Quarters 3 and 4 of 2022. Reports of mass mortalities in coastal populations of wild birds were widespread across Great Britain during Quarter 3, particularly affecting seabirds along the Scottish and Northeast England coastlines. Additionally, reports were widespread for wild birds at inland locations in Great Britain, particularly for species of waterfowl, waders and raptors in Quarter 3 and continuing into Quarter 4.

The Met Office reported the mean temperature in Great Britain in Quarter 3 was above average, most particularly in some eastern counties of England where mean temperatures were nearly 2 °C above average. There were hot spells in each month of Quarter 3, with a new UK record of 40.3 °C at Coningsby (Lincolnshire) on 19 July 2022. During Quarter 4, the Met Office reported that the Autumn was warmer than average. It was the UK's third warmest autumn in a series since 1884, with only 2006 and 2011 having been warmer. The Met Office reported rainfall had been below average across southern and eastern areas of Great Britain by end of August 2022. During Quarter 4, most areas were wetter than average, with double the average rainfall in the south-east occurring in November 2022.

Notifiable diseases

Great Britain AI Wild Bird Surveillance (AIWBS)

Total wild bird surveillance

HPAI H5N1 continued to be the dominant circulating strain during the second and third quarters of 2022 with detections in all devolved administrations of the United Kingdom (UK), including Northern Ireland. From a Great British perspective, the current avian influenza (AI) season continued to be the largest that GB has experienced, from both a wild bird and poultry disease perspective.

The Animal and Plant Health Agency (APHA) carries out year-round surveillance of dead wild birds submitted via public reports and warden patrols as part of its wild bird surveillance programme.

In Great Britain members of the public are encouraged to report findings of dead wild birds using the online reporting system or by calling the Defra helpline (03459 33 55 77).

APHA triages reports and does not collect all birds. They adjust the collection thresholds for dead wild birds for different species to increase or decrease the sensitivity of surveillance.

APHA and their contractors then collect **some** of these birds and test them to help us understand what risk posed to poultry and other captive birds is through understanding how the disease is distributed geographically and in different types of wild bird, not all birds will be collected.

APHA publish a report (updated weekly) on findings of HPAI in wild birds in Great Britain and further information on reports of avian influenza in wild bird in Great Britain and across Europe are available via APHAs outbreak assessments. We are unable to comment on any testing or reports that are not listed at this site as the results will not yet be ready for publication.

APHA have also launched a new interactive map of reported wild bird mortality and findings of avian influenza virus (bird flu) in wild birds and wild mammals and an interactive data dashboard of findings of avian influenza virus in wild birds.

Find out more on disposing of dead wild birds not required for surveillance in our removing and disposing of dead wild birds guidance.

Further guidance on wild bird incidents is available through the Mitigation Strategy for Avian Influenza in Wild Birds in England and Wales.

Report dead wild birds in Northern Ireland to the DAERA Dead Wild Bird Online Reporting Tool.

Reporting Suspicion of Influenza of Avian Origin in Wild Mammals

Avian influenza (bird flu) viruses can also infect mammals.

Find out how we monitor spillover of Avian influenza (bird flu): infection in wild birds and wild mammals.

If members of the public find a dead wild carnivore (for example, fox, otter, pine marten, stoat, weasel, pole cat, mink) or marine mammal (for example, seal, dolphin, porpoise, whale) where the cause of death is unknown, or the animal has shown signs of respiratory or neurological disease prior to death they should report it immediately to APHA by calling:

03000 200 301 if you’re in England,

03003 038 268 if you’re in Wales,

your local Field Services Office if you’re in Scotland.

If you examine a wild mammal or a test a sample from a wild mammal and suspect or detect the presence of avian influenza virus or antibodies to avian influenza virus you must report it immediately to APHA using the telephone numbers above. If you do not report it, you’re breaking the law.

See our guidance on Influenza A (H5N1) infection in mammals: suspect case definition and diagnostic testing criteria.

Marco Falchieri, Avian Virology, APHA Weybridge

Wildfowl and Wetlands Trust's (WWT) role in GB Avian Influenza Wild Bird Surveillance (AIWBS)

During the third and fourth quarters of 2022, WWT continued its passive surveillance efforts for avian influenza across its reserves. Between July and December, a total of 321 deceased wild birds were discovered across nine WWT sites located in Gloucestershire, West Sussex, Greater London, Tyne and Wear, Lancashire, Norfolk, Dumfries and Galloway, Somerset, and Carmarthenshire. Out of the identified birds, 310 were collected, with 196 (63%) of them subjected to swabbing. Among these birds, 108 (35%) were associated with mass mortality events and were collected as part of field clearance operations. Consequently, they were not swabbed; however, they were still included in the sample swabbing process due to factors such as location and similarity in species population to confirmed positive cases, along with supervision by on-duty veterinarians. Additionally, 6 (2%) carcasses were heavily predated upon or in an advanced stage of decomposition, rendering them unsuitable for swabbing. Furthermore, 11 carcasses were not collected due to their presence in inaccessible areas located where following personal protective equipment (PPE) requirements and biosecurity measures would have been challenging.

Sixteen priority target species were sampled during this period. These included species of swan, geese, ducks, gulls and rails. In addition, samples were also obtained from eight non-priority species: one barn owl (*Tyto alba*), one collared dove (*Streptopelia decaocto*), two Eurasian curlew (*Numenius arquata*), one great white egret (*Ardea alba*), one guillemot (Uria aalge), two kittiwake (*Rissa tridactyla*), one little egret (*Egretta garzetta*) and 4water rail (*Rallus aquaticus*).

Highly pathogenic avian influenza (HPAIV H5N1) was confirmed through PCR in 100 deceased wild birds collected at nine surveillance sites. Additionally, 105 were assumed to be positive as part of mass mortality events. Moreover, 6 birds were confirmed as positive for low pathogenic avian influenza (LPAIV) (Table 1). All carcases were swabbed and collected following recommended health and safety guidelines with full PPE, including FFP3 masks and goggles or face visors. Positive AI carcases were disposed of using an approved high-capacity incinerator for Category 1 ABP.

Table 1: Confirmed Highly Pathogenic Avian Influenza (HPAI) H5N1 cases in wild birds at different surveillance sites, detected between July and December 2022

Site location	Total PCR HPAIV (presumed HPAIV)	Species	Total LPAIV (non-HP H5Nx)	Species
West Sussex	10	4 Black-headed gull 2 Canada goose 2 Greylag goose 1 Mallard 1 Mute swan	2	1 Black-headed gull 1 Canada goose
Greater London	13 (20)	10 (17) Canada goose – (2) Greylag goose 1 Grey heron 1 Mute swan 1 (1) Black-headed gull	2	1 Mallard 1 Canada goose
Carmarthenshire	10	6 Greylag goose 2 Mute swan 1 Moorhen 1 Herring gull	-	-
Gloucestershire	24 (30)	13 (24) Greylag goose 6 (3) Canada goose 3 (3) Mute swan 1 Barnacle goose 1 Pintail	-	-
Tyne and Wear	5 (2)	3 (2) Greylag goose 2 Curlew	-	-
Lancashire	21 (47)	7 (27) Whooper swan 6 (18) Greylag goose 2 (1) Mallard 2 (1) Black-headed gull 2 Pink-footed goose 1 Little egret 1 Great white egret	-	-
Norfolk	13	8 Whooper swan 2 Greylag goose 2 Mute swan 1 Canada goose		
Somerset	2 (6)	2 (6) Canada goose *(Another 4 but not collected. Inaccessible)*	2	1 Kestrel 1 Mallard
Dumfrieshire	2	1 Barnacle goose 1 Pink-footed goose	-	-
Total	**100**			

Rosa Lopez, Veterinary Officer (Conservation), Wildfowl & Wetlands Trust (WWT)

Zoonotic Diseases

APHA Diseases of Wildlife Scheme (DoWS); Salmonellosis in wildlife

There is no routine monitoring of *Salmonella* in wild birds or wild mammals. Therefore, all isolates are usually from clinical cases, although *Salmonella* may often not be the primary cause of disease. Occasionally it is isolated from small-scale surveys.

There were two reports of *Salmonella* species detection in wildlife in Great Britain for Quarters 3 and 4 in 2022.

One *Salmonella* isolate (*S*. Enteritidis PT11) was reported in a European hedgehog (*Erinaceus europaeus*). *S*. Enteritidis PT11 is reported to be the most common *Salmonella* spp. isolated from hedgehogs and is common and widespread in hedgehogs in England (Keymer and others., 1991). Robinson and Routh (1999) suggest that *S*. Enteritidis PT11 appears to be endemic in hedgehogs.

There was one isolation of a monophasic type B *Salmonella* (S. 4,12) from a harbour porpoise (*Phocoena phocoena*) submitted by a private laboratory for serotyping. Unfortunately, additional information regarding clinical findings or pathology are unavailable. Monophasic group B *Salmonella* have previously been reported in porpoises found in British waters (Davison and others., 2010).

References

Davison NJ, Simpson VR, Chappell S, Monies RJ, Stubberfield EJ, Koylass M, Quinney S, Deaville R, Whatmore AM, Jepson PD. Prevalence of a host-adapted group B *Salmonella enterica* in harbour porpoises (*Phocoena phocoena*) from the south-west coast of England. *Veterinary Record* 2010*;***167**(5):173-176.

Keymer I, Gibson E and Reynolds D. Zoonoses and other findings in hedgehogs (*Erinaceus europaeus*): a survey of mortality and review of the literature. *Veterinary Record* 1991*;***128**(11):245-249.

Robinson I and Routh A. Veterinary care of the hedgehog. *In Practice* 1999*;***21**:128-37.

Jennifer Cantlay and Sam Holland, APHA Diseases of Wildlife Scheme

Report from Wildlife Zoonoses and Vector Borne Disease Research Group

Passive surveillance for lyssaviruses in UK bats

Seven hundred and forty-one bats were tested for lyssaviruses under passive surveillance during this period. A total of 5 serotine (*Eptesicus serotinus*) tested positive for EBLV-1, 4 of which were from Dorset and one from Somerset. Thirty-six exotic zoo bats were received for testing, all were negative for lyssaviruses. Six suspect bat cases were received during this period, two of which were EBLV-1 positive serotines.

Rabies diagnosis

Five dogs and one cat were received as death in quarantines and tested for lyssaviruses with negative results. Two foxes and one dog were tested as suspect cases for lyssaviruses, all with negative results.

Rabies surveillance in terrestrial wildlife

Vigilance continues for this notifiable disease in UK wildlife but no samples from terrestrial wildlife were submitted for testing this quarter.

West Nile virus surveillance (WNV) and Usutu virus surveillance in wild birds

Tissue samples from 316 wild birds were submitted via APHA, SRUC, IoZ and UK Centre for Ecology & Hydrology and were tested by RT-PCR for WNV with negative results. Tissues from two hundred and two wild birds were also tested by RT-PCR for Usutu virus that yielded 3 positive results.

West Nile virus surveillance in Equids

Ten serum samples were received for WNV serology testing (8 horses for export and 2 horses for TTE) during quarters 3 and 4. One sample was positive for WNV antibodies on IgM ELISA and the remaining samples were negative for WNV antibodies.

Dr Arran Folley and Dr Nicholas Johnson, Vector-borne diseases, APHA Weybridge

Garden Wildlife Health summary

The Garden Wildlife Health (GWH) project team based at IoZ has continued to conduct scanning disease surveillance of garden birds, hedgehogs, reptiles, and amphibians. The disease incident reports (DIRs) received, and PMEs conducted during Quarter 3 2022 are summarised in Tables 2 and 3, and Figure 1, whilst those conducted in Quarter 4 2022 are summarised in Tables 4 and 5 and Figure 2.

Table 2: The numbers of Garden Wildlife Health disease incident reports and postmortem examinations for Quarter 3 2022.

Taxon	Number of disease incident reports	Total Number of animals observed	Number of postmortem examinations
Amphibians	100 across 57 sites	250 (53 sick and 197 dead)	12 across 7 sites
Birds	1011 across 621 sites	1284 (783 sick and 501 dead)	33 across 21 sites
Hedgehogs	157 across 147 sites	184 (26 sick and 158 dead)	9 across 9 sites
Reptiles	1 across 1 site	1 (1 sick and 0 dead)	3 across 3 sites
Total	**1269 across 826 sites**	**1719 (863 sick and 856 dead)**	**57 across 40 sites**

Table 3: Compares the numbers of Garden Wildlife Health disease incident reports for Quarter 3 2021 and 2022.

Taxon	Number Of disease incident reports in Q3	
	2021	2022
Amphibians	73 (39 sick and 103 dead)	100 (53 sick and197 dead)
Birds	1008 (770 sick and 481 dead)	1011 (783 sick and 501 dead)
Hedgehogs	183 (32 sick and 187 dead)	157 (26 sick and 158 dead)
Reptiles	14 (2 sick and 15 dead)	1 (1 sick and 0 dead)
Total	**1278 (843 sick and 786 dead)**	**1269 (863 sick and 856 dead)**

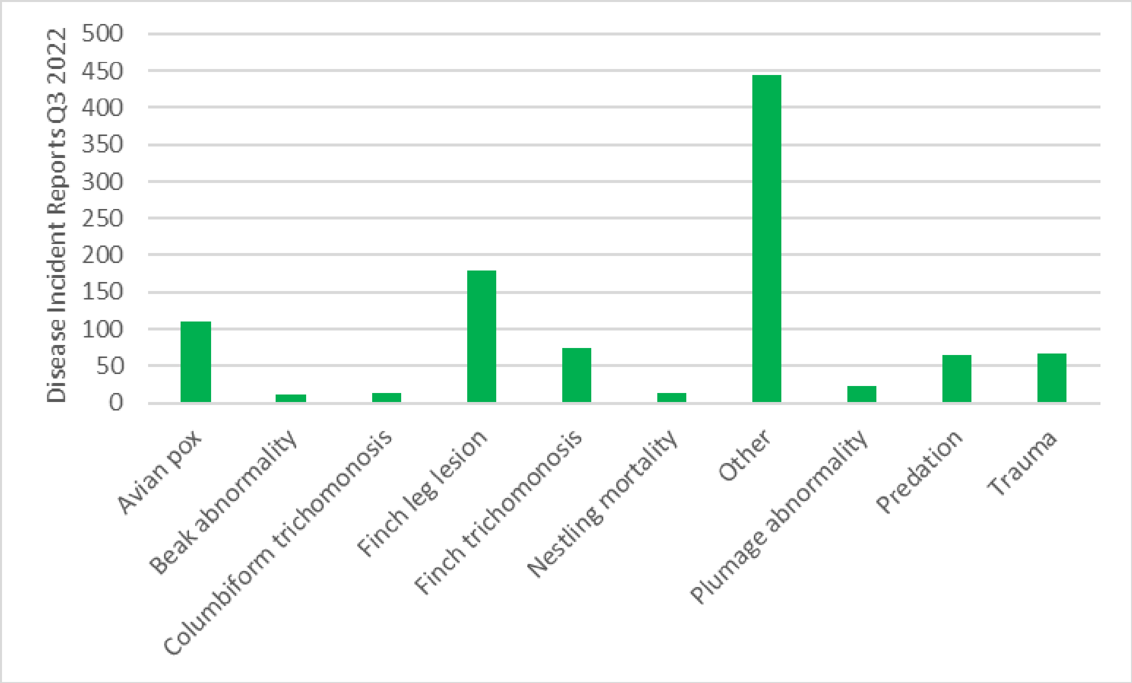


Figure 1: The numbers of Garden Wildlife Health avian disease incident reports allocated suspect diagnoses for Quarter 3 2022, with the category of 'other' mostly comprising reports of birds exhibiting non-specific signs of ill health (e.g. fluffed-up plumage, lethargy). Further information on avian pox, beak abnormality, finch leg lesions, trichomonosis, and plumage abnormality is available by following the respective links.

The composition of avian disease incident reports allocated to the various suspect diagnoses was similar to the seasonal patterns of recent years, with finch leg lesions being the most frequent observation of ill health in garden birds.

Table 4: The numbers of Garden Wildlife Health disease incident reports and postmortem examinations for Quarter 4 2022.

Taxon	Number of disease incident reports	Total Number of animals observed	Number Of postmortem examinations
Amphibians	29 across 20 sites	81 (13 sick and 68 dead)	0 across 0 sites
Birds	873 across 477 sites	1128 (868 sick and 260 dead)	11 across 5 sites
Hedgehogs	93 across 78 sites	103 (17 sick and 86 dead)	6 across 5 sites
Reptiles	1 across 1 site	1 (0 sick and 1 dead)	1 across 1 site
Total	**996 across 576 sites**	**1313 (898 sick and 415 dead)**	**18 across 11 sites**

Table 5: Compares the numbers of Garden Wildlife Health disease incident reports for Quarter 4 2021 and 2022.

Taxon	Number of disease incident reports in Q4	
	2021	2022
Amphibians	26 (5 sick and 33 dead)	29 (13 sick and 68 dead)
Birds	817 (778 sick and 206 dead)	873 (868 sick and 260 dead)
Hedgehogs	110 (16 sick and 109 dead)	93 (17 sick and 86 dead)
Reptiles	3 (1 sick and 3 dead)	1 (0 sick and 1 dead)
Total	**956 (800 sick and 351 dead)**	**996 (898 sick and 415 dead)**

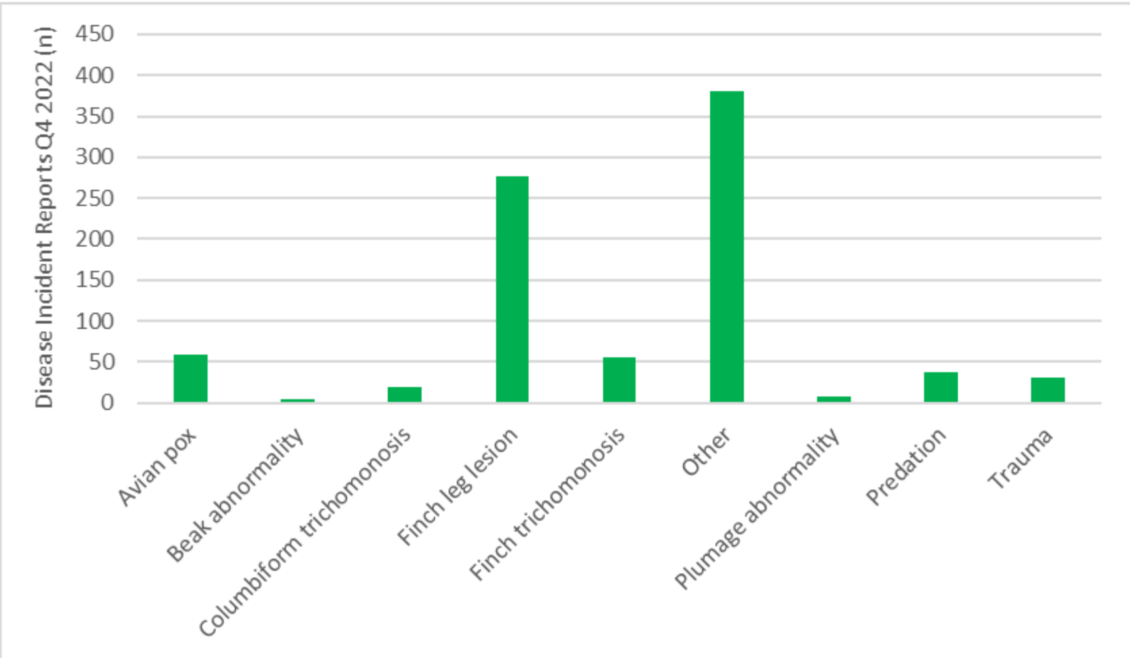


Figure 2: The numbers of Garden Wildlife Health avian disease incident reports allocated suspect diagnoses for Quarter 4 2022.

Institute of Zoology (IoZ)

Mammal reports

Wild mammal reports from IoZ

Sowerby’s beaked whale strandings

During Quarter 3 2022, 2 juvenile Sowerby’s beaked whales (*Mesoplodon bidens*) were reported to have live stranded: Case 1 was a male found in August in Durham, and Case 2 was a female found in September in Devon (Figure 3). Field necropsy findings, as well as results from subsequent histopathological examination in Case 2, were consistent with live stranding as the likely ultimate cause of death in both cases. These Sowerby’s beaked whales, a deep diving species, were found outside of their natural geographic range and in poor body condition with abnormal gastrointestinal contents (largely empty in the Case 1, and only seaweed in the stomach of Case 2 (Figure 4), evidencing aberrant feeding behaviour). In both cases, the inability to find appropriate food due to their presence outside of their natural geographical range is considered to be the cause of their poor body condition and subsequent live stranding.

On average, approximately 8 Sowerby’s beaked whales are reported stranded in the UK annually, with these 2 cases being part of a broader group of strandings reported during July to September 2022 that occurred in Scotland, the Netherlands, Belgium, and Denmark (Dutch News, 2022). The reason for these whales being observed outside of their natural geographic range around the UK and continental European waters is currently unclear. Although there is some summer seasonality to strandings of this species, this cluster of strandings may represent an abnormal event and investigations continue.

References

Beaked whales spotted off Zandvoort; sighting is worrying, experts say. Dutch News (viewed October 2022).

Figure 3: A male Sowerby's beaked whale (*Mesoplodon bidens*) lying on a beach, which live stranded in August 2022 in Durham.

Figure 4: The stomach of a female Sowerby's beaked whale (*Mesoplodon bidens*) shown to contain seaweed, evidencing abnormal feeding behaviour in an animal outside of their natural geographic range.

Institute of Zoology (IoZ)

Wild mammal reports from APHA DoWS

Atypical histiocytosis in a red squirrel (*Sciurus vulgaris*)

Atypical histiocytosis was found as the cause of skin lesions and death in a male red squirrel found dead at a feeder in the upper Eden valley, Cumbria, in an area without a grey squirrel population. When examined, there were multiple, roughly spherical pale masses present throughout the skin and subcutaneous tissues of the head, limbs (Figure 6), tail and ventral thorax. The subcutaneous masses appeared to be associated with skeletal muscles.

Histopathology found severe, multifocal to coalescing, atypical histiocytosis of the skin and lung. This is an uncommon disease which has been found in red squirrels in southwest Scotland previously (Smith and others, 2017) (and, more recently from Cumbria. There is limited evidence of an infectious aetiology underlying this proliferative disorder.

Figure 6: Photograph showing roughly spherical lesions in the skin and subcutaneous tissues of the head and limbs of a red squirrel with atypical histiocytosis.

References

Smith S, Stevenson K, Del-Pozo J, Moss S and Meredith A. Atypical histiocytosis in red squirrels (Sciurus vulgaris). *Journal of Comparative Pathology* 2017;**156** **(**4):446-450.

Ed Fullick, APHA Thirsk

Squirrelpox in a Welsh red squirrel population

Squirrelpox was confirmed in a red squirrel from North Wales (Figure 7). An ill female red squirrel was found on the ground in woodland in North Wales. It was euthanised as it had signs of severe pox virus disease. Gross postmortem examination under the APHA Diseases of Wildlife Scheme found periorbital hair loss and reddening and thickening of the skin. There was swelling and reddening of the lips, with the lower lips severely affected, with crusting of the affected skin. Transmission Electron Microscopy confirmed the presence of Squirrelpox virus particles.

Squirrelpox virus is typically an asymptomatic infection in introduced grey squirrels (*Sciurus carolinensis*). Inter-specific infection into red squirrel (*Sciurus vulgaris*) populations can lead to pathogenic disease. Squirrelpox has caused disease in red squirrels in North Wales in areas where there are habitats supporting both red and grey squirrels. In 2020 for example, there were declines of the red squirrel population of approximately 70 to 80% (Shuttleworth and others. 2022). Fortunately, cases of squirrelpox have not been found on the adjacent island of Anglesey which has the largest red squirrel population in Wales.

Figure 7: Lesions around the eyes and lips in a red squirrel with squirrelpox.

References

Shuttleworth CM, Everest D, Holmes P, Bell S, Cripps R. An opportunistic assessment of the impact of squirrelpox disease outbreaks upon a red squirrel population sympatric with grey squirrels in Wales. *Animals* 2022;**12**(1):99.

Paul Holmes, APHA Shrewsbury

A further case of Rabbit Haemorrhagic Disease Virus 2 (RHDV2) in a brown hare (*Lepus europaeus*) confirmed in Dorset

Rabbit haemorrhagic disease virus 2 (RHDV2) was reported for the first time in two brown hares on farm land in Dorset in September 2018 (Belland others. 2019) and retrospectively as the cause of death of a young female in Perthshire that died in August 2018 (Rocchi and others*.* 2019).

In this new incident 8 dead hares were found on farmland in Dorset in early 2022. Most were too autolysed or predated for useful examination, but a reasonably fresh dead hare was found and frozen for subsequent post mortem examination. Necropsy revealed the stomach was well filled. The lungs were discoloured and there was dark discolouration of the tracheal mucosa (Figure 8). There were no other gross findings of significance. PCR was carried out on a liver sample and PCR RHDV2 DNA was detected confirming RHDV2 infection as the cause of death of this hare. The spike in hare deaths in the area was possibly due to RHDV2.

Figure 8: Photograph showing the discolouration of the lungs and dark discolouration of the tracheal mucosa in a brown hare with Rabbit haemorrhagic disease virus 2 (RHDV2).

References

Bell DJ, Davis MG, Barlow AM, Rocchi M, Gentil M. and Wilson RJ. Rabbit haemorrhagic disease virus type 2 in hares in England. *Veterinary Record* 2019*;***184**:127-128.

Rocchi M, Maley M, Dagleish M. and Boag B. Rabbit haemorrhagic disease virus type 2 in hares in Scotland. *Veterinary Record* 2019*;***185**:23.

Alex Barlow, Wildlife Network for Disease Surveillance (WNDS), University of Bristol Veterinary School

Anaplasma phagocytophilum infection in Roe deer (*Capreolus capreolus*)

Anaplasma phagocytophilum infection was recorded in a severely emaciated young male Roe deer at a wildlife hospital in the Autumn. The deer had a very heavy tick burden (Figure 9) and was estimated at approximately 6 months old. No abnormalities were seen in the carcase nor a parasitological, bacterial or mineral imbalance to explain the emaciation. Quantitative PCR indicated a high level of *A. phagocytophilum* which sequencing revealed to be Ecotype II. Stuen and others (2006) reported a paretic condition in a Roe Deer Calf with a heavy tick burden infected with *A. phagocytophilum.* This might suggest that *A. phagocytophilum* infection is significant in this case, as there were no other significant findings. More data is required to know if there is any possible involvement of *A. phagocytophilum* infection in Chronic Wasting Disease.

Hamšíková and others (2019) reported that *A. phagocytophilum* Ecotype II does not include zoonotic strains and is associated with roe deer in Central Europe.

Figure 9: Roe deer head and neck with multiple ticks attached to the skin.

References

Hamšíková Z, Cornelia Silaghi C, Takumi K., Ivo Rudolf I, Kristyna Gunár K, Sprong H. and Kazimírová M. Presence of Roe Deer Affects the occurrence of *Anaplasma phagocytophilum* Ecotypes in Questing *Ixodes ricinus* in Different Habitat Types of Central Europe: *International Journal of Environmental Research and Public Health* 2019;**16:** 4725.

Stuen S, Moum T, Bernhoft A. and Vene SA. Paretic Condition in an *Anaplasma phagocytophilum* Infected Roe Deer Calf with a heavy tick burden. *Journal of Wildlife Diseases* 2006*;***42**(1):170–174.

Alex Barlow, Wildlife Network for Disease Surveillance (WNDS), University of Bristol Veterinary School, Harriet McFadzean, APHA Starcross VI Centre, Nick Johnson, Vector-Borne Diseases, APHA Weybridge

Calodium hepaticum identified causing hepatic lesions in a wild rabbit *(Orytolagus cuniculus)* and a wood mouse (*Apodemus sylvaticus*)

Calodium hepaticum (previously called *Capillaria hepatica*) lesions were reported in 2 separate cases; in a wild rabbit and a wood mouse. The wild rabbit had been culled due to myxomatosis and was submitted for a student practical for post mortem examination (Figure 10 A and B). The lesioned wood mouse liver was collected in 2002 during sampling of wild mammals in the south-west region of England for a bovine tuberculosis project. *C. hepaticum* has previously been reported in a European brown hare (Barlow and Mullineaux, 2018).

C. hepaticum is a nematode found world-wide but is rarely reported in Great Britain (GB). The main hosts of the parasite are rodents, but disease is occasionally reported in other species including man. The liver is the main organ parasitised and infection is passed on by predation or scavenging a dead infected host. A higher prevalence might be expected in rodents as the main hosts but these are rarely examined at post mortem. A recent paper by Bochyńska and others (2022) reported a disease surveillance exercise carried out on wild rabbits culled for population control in Cambridgeshire. 28 out of 87 had, mostly mild, liver lesions where an aetiological agent could be confirmed by histology. *E. stiedae* were identified in 75% and *C. hepaticum in 25%.*

It should be noted that C. hepaticum is a zoonotic disease, but the last human case was recorded in GB 1967. This patient survived but it can cause severe liver damage and death if not diagnosed in time.

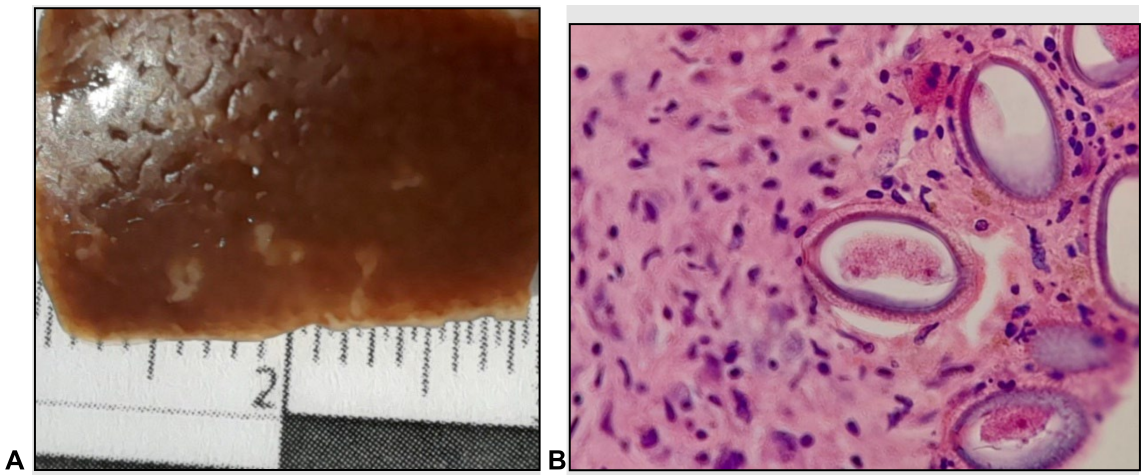


Fig 10: Wild rabbit liver images. A. Gross pathology of liver showing pale firm parasitic tract-like lesions present along the ventral edge of the liver. B. Histological section of the liver with lesions due to *Calodium hepaticum,* the operculated eggs can be identified on the right side of the photo.

References

Barlow A, Mullineaux L. Zoonotic disease in a European brown hare in England. *Veterinary Record* 2018;**183**:163.

Bochyńska D, Lloyd S, Restif O, and Hughes K. Eimeria stiedae causes most of the white-spotted liver lesions in wild European rabbits in Cambridgeshire, United Kingdom. Journal of Veterinary Diagnostic Investigations 2022;**34**(2):199 - 205.

Alex Barlow, Wildlife Network for Disease Surveillance (WNDS), University of Bristol Veterinary School

Seasonal Mortality in European Moles (*Talpa europaea*)

Five European moles were found over the course of a few days on moorland near Skipton, Yorkshire. The last was found by a dog walker. Focal areas of subcutaneous haemorrhage indicated that all four had been killed by predation. The gap measured between the 2 focal lesions in the mole found by the dog walker was approximately 28mm, and the lower jaw canine gap in the dog being walked was 27mm (Figure 11). As this mole was very freshly dead it's likely that the dog killed the mole. It was not possible to determine the animal responsible for the others. The size and gap of the wounds might suggest dog, fox or cat and probably not just one of these species accounting for these deaths. Mortality in moles is most severe in early summer during surface dispersal of juveniles, with starvation and predation being the major causes.

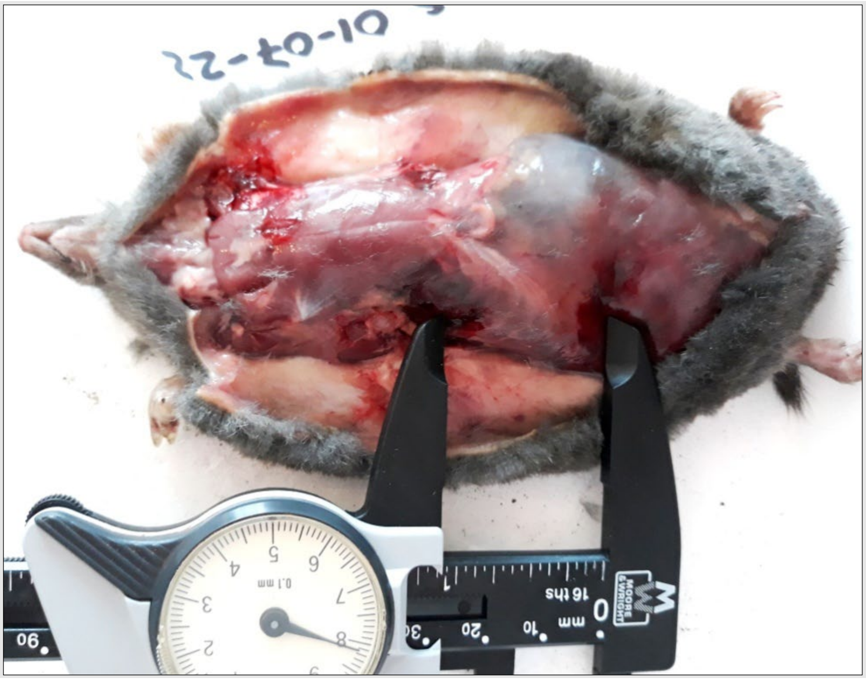


Fig 11: Gross pathology of the mole body showing a 28mm distance between the centres of two focal areas of subcutaneous haemorrhage present over the thorax and anterior abdomen.

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Gorman ML. Mole. In: Mammals of the British Isles: Handbook, 4th Edit., S Harris, D Yalden, Eds., Mammal Society, Southampton. 2008:250-255.

Simpson VR, Davidson N and Dagleish MP. Causes of Mortality and Lesions Observed Post mortem in European Moles (Talpa europaea) in Cornwall, South-west England. *Journal of Comparative Pathology* 2019;**167**:18-25.

Alex Barlow, Wildlife Network for Disease Surveillance (WNDS), University of Bristol Veterinary School

Avian reports

Wildfowl and Wetlands Trust (WWT) Report

Passive surveillance of water birds

Postmortem examinations were performed on 75 wild birds in the third quarter and 45 in the fourth quarter originating from eight WWT sites (Arundel, West Sussex; Llanelli, Carmarthenshire; London Wetland centre, Greater London; Slimbridge, Gloucestershire; Martin mere, Lancashire, Washington, Tyne and Wear; Welney, Norfolk and Steart Marsh, Somerset). A total of 17 target species were examined, which included 32 mallards (Anas platyrhynchos), 20 greylag geese (*Anser anser*), 14 black-headed gulls (*Chroicocephalus ridibundus*), 12 moorhens (*Gallinula chloropus*), seven mute swans (*Cygnus olor*), seven tufted ducks (*Aythya fuligula*), five herring gulls (*Larus argentatus*), four shelducks (*Tadorna tadorna*), two gadwall (*Anas strepera*), two cormorants (*Phalacrocorax carbo*), three whooper swans (*Cygnus cygnus*), one teal (*Anas crecca*), one bewick's swan (*Cygnus columbianus bewickii*), one barnacle goose (*Branta leucopsis*), one common kestrel *(Falco tinnunculus*), one lapwing *(Vanellus vanellus)* and one pochard *(Aythya ferina).*

Five other species were also examined: one oystercatcher (*Haematopus ostralegus*), one black swan (*Cygnus atratus*), one water rail (*Rallus aquaticus*), one blackbird (*Turdus merula)* and one wood pigeon (*Columba palumbus*)

The primary causes of death for the abovementioned species are summarised below (Table 6). The most notable postmortem finding was gross pathologic lesions related with trauma (31%). Mixed lesions observed within this group. Five mallards presented lesions compatible with same-species aggression (skin wounds, missing feathers and bruising around the head and along the back), as well as secondary lesions such as internal haemorrhage and a cracked egg in the oviduct. One tufted duck also presented lesions compatible with inter-species aggression (possibly mallards), as well as a fractured neck. Five other cases of bone fractures included three moorhens, which presented tibiotarsal fractures with internal haemorrhages or swollen joints (hock and, or foot joints). One juvenile Bewick's swan that had an open concomitant radial and ulnar fracture involving the same proximal third of the right antebrachium, as well as complete tibiotarsal fracture of the right limb. Lastly, a black-headed gull also presented an open wing fracture (right elbow). Soft tissue damage was observed in four birds. Two carcasses of a whooper swan and a black-headed gull were found near powerlines with signs of collision: subcutaneous and muscular bruising in the chest and ventral body, and intracranial haematoma. Two mallard and a black swan also had lesions indicative of an impact, the latter also had a low body score and empty digestive tract, which may have been the primary cause for collision. A second black-headed gull had intact skeletal structure but, an oedematous and bruised left wing. Internal haemorrhage in the coelomic cavity, as primary lesion, was observed in 10 birds: 2 moorhens, 3 black-headed gulls, 2 greylag geese, one herring gull, one whooper swan, one blackbird, 3 mallards, one pochard, one shelduck and 3 tufted ducks.

Predation was another predominant primary cause (16%). Most of the predated birds collected displayed an intact skeletal structure and skin, alongside minimal soft tissue or missing sections, and an absence or minimal presence of internal organs. High suspicion of a combination of gull, bird of prey, and to a lesser extent, mustelid predation was observed in many of these cases. These carcasses were often headless and exhibited dorsal puncture wounds and, or degloving lesions. Among this group, 4 out of the 6 mallards also showed minor lesions consistent with same-species aggression, potentially making them more susceptible to predation.

Lesions compatible with avian mycobacteriosis was found in 24 birds (20%): 5 greylag geese, 13 mallards, 2 mute swan, one shelduck, one moorhen, one tufted duck and one teal. Necropsy revealed a characteristic presentation of multi-focal granuloma-like lesions throughout the intestinal mesentery and liver, renomegaly and purulent-mucoid free fluid in the coelomic cavity. Interestingly, the teal was collected from a reserve in Norfolk where no captive birds or close proximity to susceptible groups of birds are located.

Ten birds (11%) exhibited signs of malnutrition along with contributing secondary factors leading to mortality. Among them were five greylag goslings with low body scores, affected by internal parasites (tapeworms), slight external subcutaneous bruising (likely due to interactions with other geese), limited food content within the digestive tract, and severe diarrhoea. These cases raised suspicions of a possible combination of intensified food competition and diminished nutritional resources, potentially exacerbated by the prolonged heatwave. Four black-headed gulls and a herring gull were emaciated with extremely prominent keel and visceral gout, most likely from sustained dehydration and reduced food intake. One mute swan cygnet presented clinical signs indicative of malnutrition and sepsis. The cygnet was observed lethargic, unbalanced and weak days prior to death. During the necropsy, an exceedingly low body score was recorded, along with a swollen right hock and foot, petechial haemorrhages in the myocardium, distended distal intestines and colon, containing serosanguinolent and mucoid content. The presence of bacterial proliferation resulting from a gut infection was suspected, potentially linked to suboptimal water quality where the cygnet was found.

Severe necrotising enteritis was detected in one whooper swan this quarter (0.8%). The whooper swan carcases presented congested intestinal loops, boluses of thickened intestinal content and splenomegaly.

Less common cases during this quarter involve two cormorants presenting pericardial effusion, as well as free serosanguinolent fluid in the coelomic cavity. Additionally, roundworms were found in the gizzard, with minimal food content in the intestines and a presence of diarrhoea. One of the cormorants also exhibited severe air sacculitis. One greylag was euthanised on welfare grounds due to severe lameness related due to skeletal neoplastic process affecting the right hock. Two greylags presented severe keel bruising from collision possibly secondary from a viral infection (pericardial bleed, splenic petechiae, and pancreatic necrosis). In another greylag, caseous fluid from the uropygial gland was collected, swelling in both right and left hock with secondary infection was observed from articular gout and renal disease (pale, enlarged consolidated kidneys). An individual mute swan exhibited a notably prominent keel, along with bilateral pododermatitis or bumblefoot in the left foot. Additionally, swelling of the right hock joint was observed. Moreover, the swan displayed abnormal feather moult, primarily affecting the wings, and a corneal rupture of the right eye. Further findings included twisting and constriction of parts of the liver and intestinal loops by the mesentery, resulting in a partial blockage of the digestive tract.17 wild birds (14%) did not receive a diagnosis due to advanced decomposition, lack of obvious gross abnormalities or multifactorial non-fatal lesions present.

Table 6: Confirmed and suspected causes of wild bird mortality (including morbidity meriting euthanasia on welfare grounds) at Wildfowl & Wetlands Trust (WWT) reserves between July and December 2022.

Primary cause of death/PM findings	Total	Species (and notes)
Trauma	37	6 x black-headed gull, 5 x moorhens, 10 x mallards, 2 x coot, 4 x tufted ducks, 2 x whooper swans, 1 x Bewick's swan, 1 x black swan, 2 x greylag goose, 1 x herring gull, 1 x black-bird, 1 x pochard, 1 x shelduck
Avian mycobacteriosis	24	5 x greylag, 13 x mallards, 2 x mute swan, 1 x moorhen, 1 x teal, 1 x tufted duck, 1 x shelduck
Predation	19	6 x mallards, 5 x moorhens, 1 x herring gull, 1 x greylag, 1 x gadwall, 1 x black-headed gull, 1 x shelduck, 2 x tufted duck, 1 x wood pigeon
Malnutrition (starvation)	11	4 x black-headed gull, 5 x greylag goose, 1 x herring gull, 1 x mute swan
Necrotic enteritis	1	1 x whooper swan
Other	11	5 x greylag geese (neoplasia, viral infection, renal disease with articular gout, hyperaemic pancreas and coelomic free fluid), 2 x mallard (breeding related anorexia and swollen left food), 2 x cormorant (pericardial effusion and possible septicaemia, air sacculitis and coelomitis), 2 x mute swan (vision impairment, serosanguinous ocular discharge, bumblefoot, abnormal moult, constriction of mesentery).
No diagnosis (due to decomposition or lack of or inconclusive gross abnormalities)	17	3 x black-headed gull, 2 x mallard, 1 x water rail, 1 x shelduck, 1 x oystercatcher, 2 x mute swan, 1 x moorhen, 2 x herring gull, 1 x greylag goose, 1 x barnacle goose, 1 x gadwall, 1 x kestrel

Rosa Lopez, Veterinary Officer (Conservation), Wildfowl & Wetlands Trust (WWT)

Wild Bird reports from Scotland

Only one avian case was reported in Quarters 3 and 4. Trichomonosis and infection with *Salmonella* Typhimurium were diagnosed in a juvenile male sparrowhawk (*Accipiter nisus*) which was found in a weak condition and given to an experienced rehabilitator but died very soon after. At necropsy, body condition was very poor, and a 1cm granulomatous mass was found to the left of the tongue/pharynx, with additional smaller lesions on the adjacent upper beak. A further 0.5cm granulomatous lesion was found in the crop. The stomachs were empty and there was scant content in the intestinal tract from which 17 roundworms were removed. *Salmonella* Typhimurium ST19 (10, 7, 12, 9, 5, 9, 2) was isolated from a swab from the crop lesion. Histopathology revealed a chronic fibrinogranulocytic stomatitis, pharyngitis and oesophagitis with protozoal and extensive bacterial infection, consistent with trichomonosis and *Salmonella* infection. A very low residue of brodifacoum (0.003 mg/kg) was found in liver tissue, but whilst the residue is indicative of exposure, anticoagulant rodenticide poisoning was not thought to be involved in the death.

Caroline Robinson, SRUC Veterinary Services

Wild Bird Report IoZ

Garden bird trichomoniasis – an update

The UK breeding greenfinch and chaffinch populations have undergone marked population declines of -65% and -34% respectively over the period 2010 to 2020 (Harris and others, 2022). A recent collaborative study, published by the British Trust for Ornithology and IoZ, provides evidence that these extensive population declines have been largely caused by finch trichomonosis (Hanmer and others, 2022). An integrated population model found that reduction in adult finch survival was the key driver for the decline of both greenfinch and chaffinch, consistent with disease-mediated impact. In addition, reductions of adult finch survival were most marked in areas of human habitation where supplementary feeding is common. Due to the route of transmission of the parasite in fresh saliva, with the potential for indirect transmission via contaminated food and water, these findings implicate supplementary feeding stations as playing a role in the spread of trichomonosis.

Consequently, the potential negative effects of supplementary feeding need to be considered and strategies to mitigate parasite transmission at shared food and water sources devised. Best practice feeding guidelines and an updated 'Trichomonosis in garden birds' disease factsheet are both available on the Garden Wildlife Health website and have been promoted through a press release and popular science articles.

Trichomonosis causing oesophageal lesions was suspected or confirmed in six greenfinches, one chaffinch and one goldfinch (*Carduelis carduelis*) from seven sites across England and Wales, that died in Quarter 3 2022. Finch trichomonosis remains the most frequently diagnosed infectious disease affecting passerines by the GWH project.

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Institute of Zoology (IoZ)

Usutu virus persistence in the UK - an update

As previously reported, USUV Africa 3.2 lineage was detected for the first time in wild birds in the UK in summer 2020 (Folly and others*,* 2020). Following this, a multidisciplinary team was established which detected USUV RNA in *Culex pipiens s.l.* mosquitoes at the index site (ZSL London Zoo), highlighting that this ornithophagic vector species was likely to be involved in transmission of the virus. The investigation also identified a regional cluster of blackbird disease incident reports in Greater London in 2020, which was contemporaneous with a reduction in the reporting rate and number of blackbirds observed in gardens in Greater London (Lawson and others*,* 2022). These findings have since been corroborated by the recent Breeding Bird Survey 2021, which identified a 39% decline in blackbirds in the Greater London region over the period 2019 to 2021 (Harris and others*,* 2022). Whilst causality cannot be ascribed, these findings support a hypothesis of disease-mediated population decline.

During 2021, tissue samples collected from postmortem examination from one hundred and seventy-five birds were screened for USUV. One blackbird from Greater London was positive for USUV RNA, and a molecular clock highlighted that the 2021 sequence shared a most recent common ancestor (MRCA) with the original 2020 USUV UK detection. To investigate potential sustained transmission of USUV in the UK, archived sera from birds kept at ZSL London Zoo were screened to detect the presence of USUV-specific neutralising antibodies. Ten serum samples, all of which were taken after the 2020 USUV UK outbreak, from 7 birds had USUV-specific antibodies, suggesting that these birds had been exposed to circulating USUV. In each case USUV was considered and excluded as a differential for the cause of presentation in all clinical cases at the time of their examination and blood sampling. Twenty-nine serum samples, which were drawn before the 2020 USUV UK detection, showed no evidence of USUV exposure. A total of 4,966 mosquitoes collected between May 2021 and January 2022 inclusive, were screened for USUV but none were positive, therefore prevalence in the vector community may have been low or absent during sampling (Folly and others, 2022). Combined, these results suggest that USUV had overwintered in the UK between 2020 and 2021.

Finally, as USUV has been identified again in the UK in 2022, and that this recent detection shares a MRCA with our 2020 and 2021 sequences, it is likely that the UK is permissive for the persistence of USUV. Whether the virus will become established in the long-term, or how far it will spread geographically, remains unknown. Ongoing surveillance of birds and mosquitoes continues to help inform our understanding of both the emergence and impact of this virus in the UK.

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Institute of Zoology (IoZ) and APHA

Systemic isosporiasis in a house sparrow (*Passer domesticus*)

In December 2022, a single adult female house sparrow (*Passer domesticus*) was found dead in Greater London. Upon postmortem examination, the bird was found to be in good body condition with ample internal body fat deposits, despite having a mostly empty gastrointestinal tract (indicating that it had not fed well recently). The spleen was observed to be mildly enlarged and mottled dark-pink to dark-red in colour (Figure 12A), and the liver had multiple dark-red lesions throughout the parenchyma (Figure 12B).

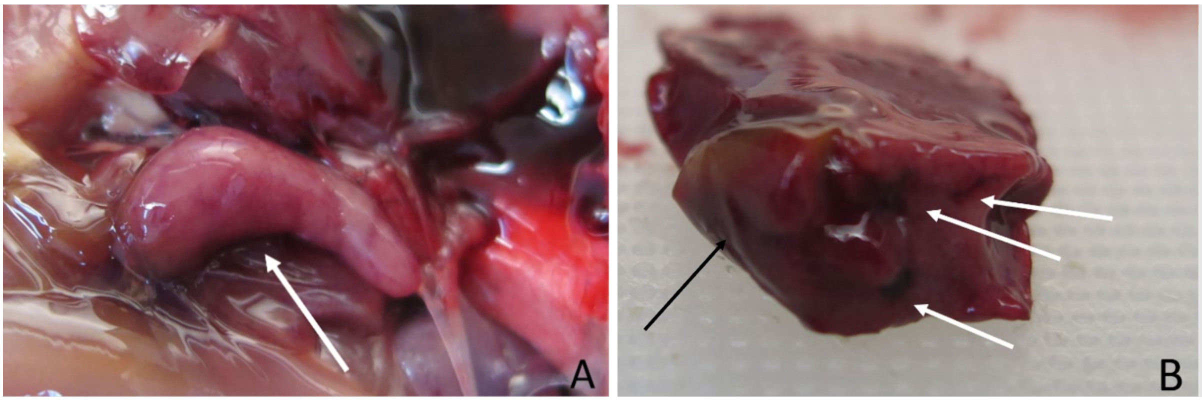

Figure 12: Gross pathology of the spleen and liver of a house sparrow (*Passer domesticus*) examined at postmortem in December 2022, which was diagnosed with systemic isosporiasis. A: The spleen (white arrow) *in situ*, showing mild enlargement and a mottled dark-pink to dark-red appearance; B: The liver, with multiple dark-red lesions observed on the serosal surface (black arrow) and cut surface (white arrows).

Histopathological examination of the spleen showed marked proliferation of lymphocytes in the red pulp, and severe depletion of the lymphocytes from the white pulp (Figure 13A). Large numbers of similar lymphocytes were multifocally present in the portal areas and sinusoids of the liver with single protozoan merozoites occasionally observed within parasitophorous vacuoles inside the lymphocytes (Figure 13B). These changes are consistent with a diagnosis of systemic isosporiasis.

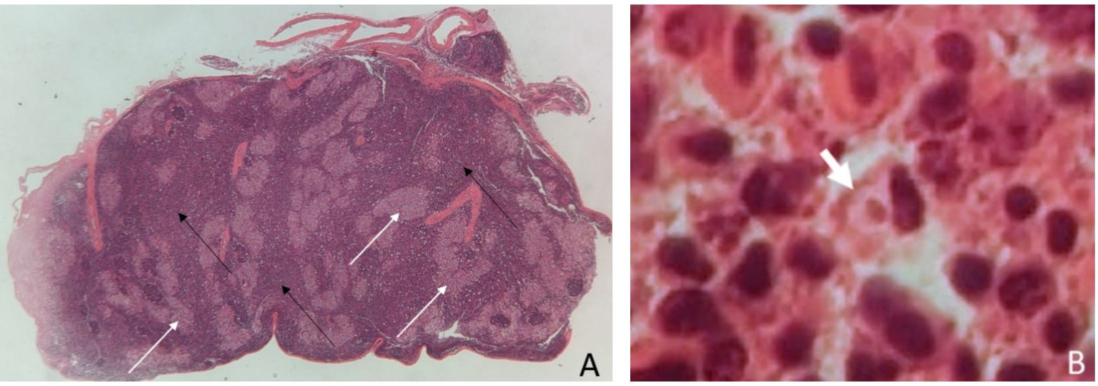

Figure 13: Histopathological images of the spleen of a house sparrow (*Passer domesticus*) examined postmortem in December 2022, that was diagnosed with systemic isosporiasis. A: Low magnification (2x) image showing marked proliferation of lymphocytes in the red pulp (black arrows) of the spleen, and severe depletion of the lymphocytes from the white pulp (white arrows); B: High magnification (40x) image, showing a single protozoan merozoite (white arrow), which were occasionally observed within parasitophorous vacuoles inside the lymphocytes.

Systemic isosporiasis (previously known as atoxoplasmosis) is a common parasitic infection of passerines, and *Isospora* spp. parasites are considered endemic in free-ranging birds, with prevalence varying between species and geographic location (Cushing and others, 2011). A recent study investigated the cause of death and the presence of systemic isosporiasis in passerines, both captive and free-ranging, that died at ZSL London Zoo (Flach and others, 2022). Results confirmed that systemic infection with *Isospora* species is generally of low pathogenicity and most likely coevolved with their hosts. However severe disease might occur secondary to immunosuppression, or following a coinfection with another pathogen, which can be fatal for the infected bird (Flach and others, 2022). A retrospective study using PCR and sequencing to detect and characterise *Isospora* spp. infections in garden birds, and histological examination to appraise the significance of infection to host health, is underway in collaboration with the Royal Veterinary College using the Garden Wildlife Health project sample archive.

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Institute of Zoology (IoZ)

Traumatic injuries to a white-tailed eagle (*Haliaeetus albicilla*) as a result of collision with a wind turbine

An adult white-tailed eagle (*Haliaeetus albicilla*) was submitted to the Disease Risk Analysis and Health Surveillance team (DRAHS) in July 2022 from Moray, Scotland, having been found next to a wind turbine after a period of extreme fog; an adult white-tailed eagle had been sighted in the area several times in the 6week period prior to the event.

On external examination, open comminuted fractures to the right radius and ulnar were noted (Figure 14), along with a complete, closed fracture to the right tibiotarsus. These injuries are suggestive of trauma, and it is likely that this white-tailed eagle collided with the wind turbine due to poor visibility/impaired vison in the fog.

Figure 14: An open comminuted fractures to the right radius and ulnar of white-tailed eagle (*Haliaeetus albicilla*).

The skin was firmly adhered to the underlying subcutaneous tissue across the carcass, suggestive of dehydration, and both the proventriculus and ventriculus were empty, therefore the bird had not recently fed. These findings, together with the overall good body condition of the bird, are indicative of dehydration or starvation over a short period of time, subsequent to severe trauma impairing the eagle's ability to feed.

Collisions with wind turbines are a recognised threat to large, soaring raptors. White-tailed eagles have been reported with high mortality rates at wind power plants, possibly due to their gregarious nature and tendency to live at a higher density in coastal areas (Helander and others, 2003; Krone and others, 2018). It has been suggested that nest sites at least 3km away from wind turbines and alongside a safe flight corridor to feeding grounds reduce the risk of such collisions (Krone and others, 2018). However, in white-tailed eagles translocated to England, the risk of collisions with wind turbines as a population hazard was estimated to be low in a disease risk analysis undertaken by the DRAHS team in 2021 (Common and others, 2021). Given the drive for sustainable ways to produce energy, it is possible that wind farms may pose a greater threat to large, soaring birds in the UK in the future.

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Institute of Zoology (IoZ)

Wild Bird reports from APHA DoWS

Suspected botulism in waterfowl

An adult female mallard (*Anas platyrhynchos*) was submitted for wild bird avian influenza surveillance. The bird was retrieved from a lake with a history of numerous sick birds and deaths reported in mallard, cygnets and geese. The mallard was tested for avian influenza virus and following a negative result underwent postmortem examination.

The carcase was severely autolysed and no lesions were detected. The bird had not been eating. Duck virus enteritis virus (DVE) was not detected by PCR on liver. The history of summer mass mortality in waterfowl in the absence of detection of gross lesions, avian influenza and DVE was suggestive of botulism. APHA does not routinely test for botulism which is a diagnosis based on clinical presentation and absence of other diseases. Information about botulism and how to help control it were provided.

Trichomonosis in a Tawny owl *(Strix aluco)*, feral pigeons *(Columba livia)* and a kestrel (*Falco tinnunculus*)

Lesions typical of trichomonosis were seen in the oropharynx of a kestrel, a tawny owl and four feral pigeons, all received from different locations. Pale yellow to cream coloured caseonecrotic lesions were present, of varying severity in the oropharynx of each bird. Histopathology in one of the wood pigeons confirmed severe necrotising pharyngitis associated with trichmonads. In this bird the severe necrosis and cellular debris were totally obliterating the pharynx and proximal oesophagus. Severe cases of the disease restrict feeding and swallowing, as shown in Figure 15.

Trichomonosis, caused by *Trichomonas gallinae* infection, is known to affect pigeons and doves in the UK along with birds of prey that feed on birds infected with the parasite. In the summer of 2005, Trichomonosis was detected for the first time in British finch species with subsequent epidemic spread. This parasite is thought to be responsible for significant declines in greenfinch and chaffinch populations. More information regarding Trichomonosis along with current research findings can be found in the garden bird trichomoniasis update from the IoZ above.

Figure 15: Gross pathology to show lesions typical of trichomonosis in the oropharynx of a feral pigeon.

Paul Holmes, APHA Shrewsbury

Death due to predation in a Tawny owl (*Strix aluco*) with oral trichomonosis

A tawny owl (female, adult, 0.36kg) was submitted under the Avian Influenza surveillance scheme. Recent feed remains including several small limb bones were present in the gizzard. Bite wounds with associated haemorrhage, were present in the intercostal muscles and there were several blood clots in the body cavity. The liver was also haemorrhagic. A large focally-extensive caseonecrotic pale brown mass was present in the oropharynx (Figure 16). This bird had a chronic oropharyngeal lesion which would have significantly compromised its ability to feed; despite this there was evidence of recent prey in its gizzard. It had lost condition and was likely to have been weak; the actual cause of death was trauma and internal haemorrhage cause by a predator; the lesions in the intercostal muscles are consistent with attack by a predator. Histopathology of the oral mass confirmed a severe necrotising oropharyngitis with trichomonads consistent with trichomonosis.

Figure 16: An open mouth view to show the chronic oropharyngeal lesion due to trichomonosis in a Tawny owl that died due to predation.

Arthur Otter, APHA Shrewsbury

‘Window collision’ confirmed in a Goshawk (*Accipiter gentilis*)

A goshawk was submitted for examination under the Avian Influenza in Wild Birds Surveillance Scheme. Postmortem examination revealed that the bird had been in good bodily condition but had died due to extensive internal haemorrhage (Figure 17). Further history was obtained which described the bird having been found dead underneath a large window. The remains of a pigeon were also found in the same place. It is likely that the bird accidently flew into the window, and this resulted in trauma and death due to the internal haemorrhage. Goshawks are large hawks, with broad wings and they can hunt at high speed and catch prey in flight with their long legs and talons. It is suspected that this bird flew into the window of the building while hunting. They are scarce birds, with only approximately 280-430 breeding pairs in the UK. [Read more about Goshawks on the RSPB website.]

Figure 17: Severe internal haemorrhage in a Goshawk due to trauma.

Paul Holmes, APHA Shrewsbury

Amphibian reports

Amphibian reports from IoZ

Ranavirus infection in amphibians – an update

Ranaviruses are a group of viruses which are listed in the OIE Aquatic Animal Health Code, that primarily affect amphibians, but some can also affect reptiles and fish. In Great Britain, adult common frogs (*Rana temporaria*) are most frequently reported with ranavirosis. Affected animals may show signs of skin reddening, ulceration, or haemorrhage, or present with no external signs.

In Quarter 3 2022, ranavirus was detected in liver samples from four common frog multiple mortality incidents using molecular methods: postmortem examination identified signs indicative of haemorrhage in affected animals and ranavirosis was diagnosed as the likely cause. These incidents occurred in regions in which amphibian ranavirosis has been previously reported (Price and others, 2016), predominantly in south east England.

These recent cases of ranavirosis were diagnosed in August and September 2022, consistent with the typical seasonal summer peak for this disease. Published data from *in vitro* and *in vivo* studies have formed the basis of predictions that higher temperatures are likely to drive more frequent and severe ranavirosis incidents, raising concern that climate change may lead to disease outbreaks over a wider geographic range and extended season in Great Britain (Price and others, 2019). It is plausible that the long heat wave of summer 2022 may have predisposed to the occurrence of these ranavirosis incidents.

Sequence characterisation of the ranavirus lineage responsible for these 2022 incidents is pending; however, cases of amphibian ranavirosis diagnosed in recent years in England have been found to be due to Frog Virus 3-like viruses, as with the majority of those confirmed in this country since the first detection in the 1990s (Price and others, 2017).

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Institute of Zoology (IoZ)

Any enquiries regarding this report should be sent to APHA's Surveillance Intelligence Unit by emailing SIU@apha.gov.uk

More information about scanning surveillance reports is available on APHA's Vet Gateway. at http://apha.defra.gov.uk/vet-gateway/surveillance/index.htm

APHA is an executive agency of the Department for Environment, Food and Rural Affairs, and also works on behalf of the Scottish Government and Welsh Government.