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Monitoring the occurrence of certain animal diseases can highlight the potential for zoonotic transmission and provide an indication of human, environmental and foodborne health risks. These FZ2100 project reports, which primarily relate to farmed animal species, summarise the surveillance activities of the Animal and Plant Health Agency (APHA) and the SRUC Veterinary Services in Scotland, for non-statutory zoonoses and infections shared between man and animals in Great Britain, using data gathered by the network of Veterinary Investigation Centres. Quantitative diagnostic data for all of GB is provided by the Veterinary Investigation Diagnostic Analysis (VIDA) surveillance system. Summaries of joint veterinary/medical investigations into incidents and outbreaks of zoonotic disease and associated activities are also included. This report covers the 12 month period between January and December 2020.

The Zoonoses and Veterinary Public Health project (FZ2100) is funded by Defra, the Scottish Government and the Welsh Government through the APHA’s Bacterial Diseases and Food Safety portfolio and also uses returns from scanning surveillance projects. Non-statutory zoonoses are defined as any zoonoses for which no specific animal-health derived legislation exists, and so excludes Salmonella, which is a reportable zoonosis and those diseases which are compulsorily notifiable in certain animal species, e.g. brucellosis or TB. Information concerning notifiable or reportable zoonoses is recorded elsewhere, some under specific projects such as FZ2000 (Salmonella).

1. General scanning surveillance

1.1 Non-statutory Zoonoses VIDA data for Great Britain: January-December 2020

This table (collated 27/01/2021) summarises clinical diagnoses of non-statutory zoonoses and infections shared between animals and humans from specimens submitted to APHA and SRUC veterinary investigation centres between January and December 2020 and compares the findings with the data from 2018 and 2019. It includes rare zoonotic infections and those for which zoonotic potential are confined predominantly to immuno-compromised individuals. Diagnoses use strict criteria and are recorded (once only per incident) using the VIDA system. The list is subject to selection, submission and testing bias. It is not definitive and excludes notifiable or reportable diseases (notably salmonellosis, which is recorded elsewhere). It is intended only as a general guide for veterinary and public health professionals to the diagnosed occurrence of animal-associated infections in predominantly farmed animal species in GB.

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<td>Yersiniasis (incl. fetopathy)</td>
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<td>9</td>
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</tr>
</tbody>
</table>

NR – Not recorded    Shaded boxes indicate a diagnosis is not available for that species

1 Includes both domestic and wild birds  2 Mammals only
Common minor diseases of zoonotic importance, such as orf and ringworm, are grossly underestimated by the VIDA recording and reporting system, as it is unusual for practicing veterinary surgeons to submit material for diagnosis.

More detailed specific information on scanning surveillance diagnoses and trends for endemic diseases is available from:

http://apha.defra.gov.uk/vet-gateway/surveillance/index.htm

1.2 Highlights from APHA and SRUC disease surveillance centres

This section provides a summary of the main items of zoonotic interest from material submitted to the APHA (England and Wales) and SRUC Veterinary Services (Scotland) between January and December 2020.

Further information is provided in the quarterly reports by the APHA species groups and the monthly surveillance reports in the Veterinary Record derived from scanning surveillance, which can be found at:

http://apha.defra.gov.uk/vet-gateway/surveillance/reports.htm

2. Specific scanning and targeted surveillance and other studies

2.1 Campylobacter

Human campylobacteriosis is usually caused by the thermophilic *Campylobacter* species *C. jejuni* and *C. coli*, which can be found in a wide range of livestock, poultry and wildlife species. Poultry and poultry meat products are the main sources for human infection, and campylobacteriosis is the most commonly reported bacterial cause of food poisoning in the UK, with over 65,000 cases reported in 2018. This report does not cover food-borne illness related to *Campylobacter* infection.

However, non-thermophilic *Campylobacter* strains (such as *C. fetus*) can also (rarely) cause severe systemic illness in people.

Please note that only *Campylobacter* fetopathy numbers are detailed in Table 1 above.

England & Wales

There were 66 isolates from ovine abortions were obtained in 2020. The majority of these abortions were due to *C. fetus fetus* (48 isolates), 14 were *C. jejuni* and four were *C. coli*. 
There were three isolations from bovine abortions, two of which were *C. mucosali* and one *C. hyointestinalis*. There was one *C. jejuni* isolate from a duck, an antelope and an okapi, *C. fetus fetus* was isolated from an okapi and *C. coli* from a red squirrel.

**Scotland**

SRUC isolated *C. fetus* from six ovine abortions and *C. jejuni* was isolated from one ovine abortion. *Campylobacter fetus fetus* was isolated from two bovine abortions.

SRUC Veterinary Services had four isolations of *Campylobacter* from bull sheath washings; one *C. fetus fetus*, one *C. jejuni* and two *C. sputorum*.

From 191 canine faecal samples collected in Scotland with Campylobacter isolated, 123 were *C. upsaliensis*, 55 were *C. jejuni*, six were *C. lari*, four were *C. coli* and 3 three were *Campylobacter* sp.

*Campylobacter* was isolated from seven feline faecal samples; three of which were *C. jejuni* and four were *C. upsaliensis*. *Campylobacter* sp. was isolated from the faeces of a lemur.

### 2.2 Leptospirosis

Targeted surveillance by APHA for leptospirosis is variously achieved by analysis of results from: (1) RT-PCR for pathogenic leptospires on appropriate diagnostic samples, sequencing and denaturing high pressure liquid chromatography (DHPLC); (2) Microscopic agglutination test (MAT) antibody testing on sera submitted for disease diagnosis, monitoring and export (mainly dogs). Diagnostic MAT titres are considered seropositive at 1/100 or above (1/50 for *L. Hardjobovis* in cattle) and; (3) Bulk milk tank antibody testing (by ELISA) of samples submitted from dairy herds for monitoring purposes. The latter two methods are influenced by vaccination (dogs and cattle); MAT results are also very dependent on the range of serology (pools or single serovars) undertaken.

1. Between January and December 2020, a total of 289 specimens from 126 separate submissions (kidneys from 217 pigs, 59 cattle, 4 sheep, 3 common seals, an alpaca, a red panda, a fox and a badger; livers from two pigs) were examined by real-time PCR for pathogenic leptospires. Leptospires were detected in six samples all from separate submissions; 3 pig kidneys and a pig liver, plus a kidney from a badger and a red panda. Thirty-three of the samples submitted were unsuitable for testing.

2. A total of 4,329 *Leptospira* serology tests were carried out in 2020 and serum samples originated from a range of species. Some serum samples were tested for antibodies to more than one serovar, depending on the request of the submitter.
1,177 tests were performed on dog serum samples, with 14.5% positive results. The highest number of tests requested was for *L. Canicola* (575 tests), of which 8.0% had a positive result, followed by *L. Icterohaemorrhagiae* (136 tests carried out; 7.4% positive results) and *L. Bratislava* (118 tests carried out; 11.0% positive results). It should be noted that a positive serological result for a dog can be due to either a positive vaccination status (as these three strains are included in some or all UK dog vaccines) or recent seroconversion following acute disease.

1,435 tests were performed on bovine serum samples, with 13.2% positive results. The highest number of requested tests were for *L. Hardjo* (987 tests), of which 12.7% tested positive.

1,647 tests were performed on porcine serum samples, with 4.4% positive results. *L. Bratislava* was the serovar with the highest number of positive results (66 out of 413 requested tests; 16.0% positive results).

3. Between January and December 2020, 21 (25.6%) of 82 bulk milk *L. Hardjo* antibody tests undertaken for monitoring purposes were negative, 17 (20.7%) were low positive, 5 (6.1%) were mid positive and 39 (47.6%) were high positive. In 2019, figures (100 tests) were 25% negative, 20% low positive, 10% mid positive and 45% high positive. The significance of these observations is heavily influenced by vaccination status and selection, although it is thought unlikely that fully vaccinated herds contributed many samples.

### 2.3 Mycobacteria (excluding *M. bovis*)

Since *Mycobacterium bovis* became notifiable in all species in 2006, the number of samples examined by APHA Weybridge has increased, particularly from pets and camelids. Samples from pigs are mainly submitted by meat inspectors.

*Mycobacterium avium* was isolated on four occasions in 2020 from pigs. Additionally, *Mycobacterium avium* complex was isolated on seven occasions, from four pigs, a deer, a llama and a cat.

*Mycobacterium microti* was isolated on six occasions in 2020; from three alpacas, two cats, and a pig. *Mycobacterium sinensis* was isolated on four occasions; from two llamas, an alpaca and a pig. *Mycobacterium smegmatis* was isolated once from a cat.
2.4 Q fever

Diagnosis of Q fever is undertaken using PCR to confirm the presence of *Coxiella burnetii*, typically following the identification of suspicious acid-fast bodies in MZN stained smears of foetal tissues. Confirmation of Q fever as a cause of fetopathy requires histopathology and immunohistochemistry of placental tissue, in addition to a positive PCR result. In each case where a clinical diagnosis is made, public health colleagues are informed of the incident and the zoonotic potential of this organism is highlighted to the farmer and private veterinary surgeon, with the provision of an advisory sheet:

Q fever: Information for farmers

There were three caprine submissions which tested positive for *C. burnetii* by PCR, from two separate holdings. Only one of the caprine submissions was subsequently confirmed with Q fever as the cause of the abortion.

One bovine submission tested positive and was subsequently confirmed as the cause of the abortion, as well as developmental abnormalities.

2.5 *Streptococcus suis*

*Streptococcus suis* isolates from diagnostic material submitted to APHA and SRUC Veterinary Investigation Centres are typed further for disease surveillance purposes. The numbers and serotypes from porcine diagnostic material submitted during the period January to December 2020 are shown below, with data for previous years for comparison. UT = untypeable

| Year | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | UT | 1/2 | Total |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 2018 | 35 | 47 | 6  | 4  | 1  | 1  | 11 | 2  | 5  | 2  | 16 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | UT | 1/2 | 140 |
| 2019 | 34 | 48 | 8  | 7  | 2  | 1  | 19 | 2  | 8  | 3  | 10 | 1  | 2  | 2  | 1  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | UT | 1/2 | 155 |
| 2020 | 12 | 47 | 6  | 4  | 3  | 29 | 5  | 8  | 1  | 2  | 11 | 4  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | UT | 1/2 | 152 |

*Streptococcus suis* type 2 again predominated, as in previous years, but there is a notable spread across serotypes.
2.6 Toxoplasmosis

The European Food Safety Authority (EFSA Journal 2007, 583, 1-64) highlighted the significance of toxoplasmosis as a foodborne zoonosis and the need to improve surveillance in this field. Serological examinations for *Toxoplasma gondii* using the latex agglutination test (LAT) are undertaken by the APHA on sera submitted to VICs. The findings presented below provide a summary of the serological status of samples submitted for diagnosis, monitoring and screening purposes during the period January to December 2020, but do not constitute a structured survey. Positive samples, as defined here, have LAT titres of 1/64 or greater and indicate a history of exposure to this protozoan parasite. Toxoplasmosis as a cause of fetopathy in sheep may also be diagnosed through antigen testing of placental tissue, and in sheep and goats through IFAT testing of fetal blood or body fluid.

During 2020, a total of 136 sera were received from 27 separate sheep, 5 separate goat submissions and one pig submission of which 65 (47.8%) tested positive for *T. gondii*, comprising of 65 sheep from 20 submissions. This is compared to 166 serum submissions in 2019.

NB. Positive serology is not confirmatory of *Toxoplasma* as the cause of abortion nor presence of toxoplasmosis, but indicates exposure to the parasite and/or vaccination.

Please consult the Table in section 1 which includes results for fetopathy due to toxoplasmosis.

3. Investigations into zoonotic and potentially zoonotic incidents

Protocols for the investigation of zoonotic disease incidents in England and Wales are set out in the following document:

*Guidelines for the Investigation of Zoonotic Disease (England and Wales)*

There is similar guidance on the investigation and management of zoonotic disease in Scotland:


Advice for members of the public planning a trip to animal-associated visitor attractions and other information can be found on the PHE Zoonoses Webpages.

The number of outbreak investigations conducted during 2020 was much reduced compared to previous years. This is very unusual and likely as a result of a combination of factors linked to the ongoing Covid-19 outbreak, such as reduced opening and visits to open/petting farms and increased vigilance around hand hygiene.
Collaborative working with public health colleagues and disease investigation remains a priority.

### 3.1 Cryptosporidiosis

Investigations to assist in human outbreaks of Cryptosporidiosis linked to direct contact with animals are undertaken at the request of Consultants in Communicable Disease Control (CsCDC) of PHE/PHW (CsPHM in Scotland) and in collaboration with the National Cryptosporidium Reference Unit, Swansea, and follow jointly agreed guidelines.

No reported incidents this year.

### 3.2 STEC

Shiga toxin-producing *E. coli* (STEC, formerly known as VTEC) outbreak investigations are undertaken, according to agreed guidelines, at the request of CsCDC of PHE/PHW (CsPHM in Scotland) where an animal-associated source is suspected. These investigations often also involve collaboration with other organisations, including the Environmental Health Departments of Local Authorities and the Health and Safety Executive. Determination of phage type (PT), shiga toxin (ST) type, and comparison of human and animal isolates by whole genome sequencing (WGS) analysis are performed by the Gastrointestinal Bacteria Reference Unit (GBRU), PHE Colindale. If isolates from animals circumstantially implicated in outbreaks have an indistinguishable WGS profile to those from human cases, this is taken as confirmatory evidence of a causal association. Other STEC (VTEC) PTs or WGS types may be detected incidentally during the investigation of animal premises.

No new investigations into STEC outbreaks were conducted during 2020.

### 3.3 *Corynebacterium ulcerans*

*Corynebacterium ulcerans* was first isolated from cases of throat infection in humans in 1926, with zoonotic outbreaks initially associated with direct contact with farm animals or consumption of unpasteurised milk. The organism can produce diphtheria toxin which is capable of producing human disease with the same clinical signs as cutaneous or respiratory diphtheria caused by *C. diptheriae*. More recently, *C. ulcerans* has been isolated from the oral cavity of domestic pets such as dogs and cats, and current zoonotic outbreaks are investigated by APHA and SRUC Veterinary Services in Scotland by throat swabbing of in-contact companion animals.

In 2020 APHA were involved in much fewer zoonotic investigations of cases of toxigenic *Corynebacterium ulcerans* infections. There was just one with a human index case with companion animal contact and two cases with the animal being the index case.
In late February Public Health England (PHE) contacted APHA following the isolation of toxigenic \textit{Corynebacterium ulcerans} from skin lesions on the feet of a 99-year-old gentleman who was hospitalised with a history of cardiac insufficiency. One dog was present in the household which has close contact with the case and there was no evidence of other likely sources of infection. Following contact with the private veterinary surgeon by APHA, the dog an eight-year-old Whippet, had a throat swab taken and the swab was submitted to APHA Starcross for initial culture. No \textit{C. ulcerans} organisms were isolated.

In Quarter 2, APHA was contacted by PHE who had in turn been contacted by a private laboratory who had identified \textit{C. ulcerans} in a nasal swab from a German Shepherd dog, who had had a three month history of nasal discharge and sneezing. The isolate was subsequently confirmed as toxigenic by PHE Colindale. A second dog in the household showed no similar clinical signs and human contacts were asymptomatic. Both dogs were treated with a suitable antibiotic for a 10 day period and both dogs were then throat swabbed four days after completion of the antibiotic course. The swabs were processed by APHA Starcross and there was no evidence of \textit{C. ulcerans} in the post-treatment swabs. PHE arranged swabbing of the human contacts with negative results and a human immunisation protocol was established.

In Quarter 4, PHE contacted APHA following the isolation of toxigenic \textit{C. ulcerans} from a stray Persian cat which had been found in a car park in mid-July and was submitted to an RSPCA Hospital for treatment for a nasal discharge. The cat received antimicrobial therapy and antiviral treatment and remained in the Hospital for one week. The cat was then fostered by three consecutive owners, including a veterinary nurse and her sister.

The cat was re-admitted to the RSPCA Hospital in mid-September 2020 with a persistent nasal discharge and underwent rhinoscopy. The chronic nasal discharge continued and a swab taken at the end of October 2020 tested positive for toxigenic \textit{C. ulcerans}. An antibiotic sensitivity profile for the isolate has been carried out at the referral laboratory with the isolate forwarded to Colindale for the toxigenic testing. Each of the foster homes had other animals, however the index cat had been in isolation during its times at the Hospital. The number of in-contact animals and their level of contact was investigated further by PHE who also carried out human contact tracing, including the veterinary staff at the Hospital particularly those involved in the rhinoscopy and questions asked regarding the level of PPE worn. No cases of human disease were reported following swabbing and prophylactic diphtheria vaccinations were undertaken. APHA attended several IMT teleconferences and offered advice and assistance in culturing swabs from the in-contact cats, and the index cat during and after a course of antimicrobial therapy. None of the in-contact cats showed the presence of \textit{C. ulcerans} and the final post-treatment swabs in the index case were negative for the presence of \textit{C. ulcerans}, with this cat having made a full recovery from clinical disease.

These latest examples of APHA involvement is in contrast to the more typical scenario where \textit{C. ulcerans} is initially identified in humans, with asymptomatic domestic pets identified as potential carriers of infection.
3.4 *Brucella canis*

During 2020, a series of unconnected incidents of *Brucella canis* suspicions/ reports in dogs were received by APHA since June. However as there is no legal requirement to report *Brucella canis* in dogs, other cases may have been diagnosed but not reported to officials, and potentially additional infected dogs became ill but testing was not considered/pursued. APHA investigation of the received case reports has led to one imported dog with suggestive clinical signs being negated and ten incidents being identified through testing with six bacteriologically confirmed by the APHA Brucella laboratory at Weybridge.

The first incident was identified at a premises in south west England with over twenty dogs and which undertook some breeding. Diagnosis, initially via serology but subsequently confirmed by bacterial culture from fresh abortion material, was finally made after a number of abortions had occurred in the preceding months and years. Subsequent serological testing identified that all remaining dogs at the site were positive via at least one test method (SAT, RSA and ELISA). Although some of the dogs present were not UK-sourced, epidemiological investigation did not conclude that any of these specific imported dogs were the index case. Other dogs present, all serologically positive, were UK-born but whether they had been bred elsewhere and so brought the infection onto the premises is not yet apparent. The wide spread of infection in this case is probably due to the exposure of all dogs to highly infectious abortion material. This case is also the first time dog-to-dog transmission of *Brucella canis* has been identified in Great Britain (GB).

Dogs associated with this site were also at several other homes in the locality. At one of these homes a dog, believed to have been mated on the initially identified premises, also aborted and this material was also *B. canis* culture positive. This dog had also never been abroad. This isolate was matched with the isolate from the initial site by whole genome sequencing providing supporting evidence that this was the first reported case of *B. canis* spreading to multiple premises in GB via reproductive transmission (as the dogs were unrelated). A number of additional dogs were sero-positive on several of these other associated sites. APHA and PHE worked closely with the local authority to create a control plan to limit onward transmission to people and other dogs. This includes keeping the dogs on site rather than exercising them on public land and neutering those that have not already been castrated or spayed to minimise the risk of a positive-testing animal transmitting the infection. The only way to completely stop the risk of onward transmission by an infected animal is euthanasia. Neutering to prevent breeding will also significantly reduce, but not eliminate, the risk of transmission. Apart from the abortions there were few reported clinical signs of *B. canis* infection in the dogs in this incident. There was potential human exposure to *B. canis*, for example owners had handled infectious abortion material without any personal protective equipment (PPE).

There were nine other positive incidents reported to APHA in 2020. Most involved multiple dogs at one or more homes and each incident was initially identified as a dog had clinical disease that led to testing. All involved dogs imported from Romania, some were puppies imported in utero, most imported as puppies with litter mates and all, regardless of age, were moved into the UK by different dog rescue organisations. There were no abortions
(or at least none in GB) associated with these cases as the dogs involved were either too young for breeding or were not used for this. In nearly all cases all familial members of the index cases (siblings, dam) that were located and tested were also shown to be infected. However, no unrelated dogs in contact with positive-testing dogs from these incidents have so far been shown to be infected.

In total, in 2020, approximately 80 dogs were serologically tested for \textit{B. canis} due to their association with these incidents. Of these, approximately 50 were seropositive and, because of the additional epidemiological evidence, considered to be infected. Many of those initially testing as negative have been tested on more than one occasion in order to try to confirm infection status after elapse of a given period of time following potential exposure. Although legislation does not facilitate dog tracing, all imported batches of dogs associated with an initial positive were successfully traced for most incidents as the new owners had kept in touch with owners of litter mates via social media.

Quite a number of the Romania-sourced dogs suffered severe clinical disease. Many owners decided to put their pet to sleep, not just to prevent their dog suffering further, but also due to their concerns about the risk of infection to their family members. Owners of the remaining positive dogs from these incidents have been advised to follow hygiene measures and to limit their dog’s interactions with other dogs and people for the duration of their dog’s life, just as for the initial incident.

In all incidents Public Health agencies (either Public Health England, Public Health Scotland or Public Health Wales) have sought to risk assess the household occupants and also veterinary staff who have had exposures to suspect and positive dogs, and in some cases exposed to \textit{B. canis} culture in private laboratories. Where appropriate based on the risk assessments, testing of exposed people has been undertaken. To date, there has been no confirmed \textit{B. canis} infection in any of these exposed people. At the same time public health information and the potential risks were highlighted to owners and veterinary clinic staff. To highlight the risks posed to dogs, owners and veterinary staff in the UK a letter describing some of the 2020 \textit{Brucella canis} incidents and associated issues and suggested controls has been sent to the Veterinary Record.

### 3.5 \textit{Cysticercus bovis}

In early 2020 APHA was involved in an investigation of a bovine cysticercosis outbreak linked to an indoor beef finisher farm in the North of England. A farm visit investigation was carried out following the report by a slaughterhouse, in Northern England, of a significant level of \textit{Cysticercus bovis} infection in fattened cattle submitted for slaughter from a single farm. Advice was given to the farmer and private veterinary surgeon to help prevent further cases and future outbreaks.