

OIE Collaborating Centres Reports Activities

Activities in 2018

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Title of collaborating centre:	Research, Diagnosis and Surveillance of Wildlife Pathogens
Address of Collaborating Centre:	US Geological Survey US Department of Interior 6006 Schroeder Road Madison, Wisconsin, WI 53711 UNITED STATES OF AMERICA
Tel.:	+1-608 270.24.01
Fax:	+1-608 270.24.15
E-mail address:	jsleeman@usgs.gov
Website:	www.usgs.nwhc.gov/
Name of Director of Institute (Responsible Official):	Dr. Jonathan Sleeman and Dr. Craig Stephen
Name (including Title and Position) of Head of the Collaborating Centre (formally OIE Contact Point):	Dr. Jonathan Sleeman, Center Director, USGS National Wildlife Health Center, and Dr. Craig Stephen, Chief Executive Officer, Canadian Wildlife Health Cooperative
Name of writer:	Dr. Jonathan Sleeman and Patrick Zimmer

ToR: To provide services to the OIE, in particular within the region, in the designated specialty, in support of the implementation of OIE policies and, where required, seek for collaboration with OIE Reference Laboratories

ToR: To identify and maintain existing expertise, in particular within its region

1. Activities as a centre of research, expertise, standardisation and dissemination of techniques within the remit of the mandate given by the OIE

Epidemiology, surveillance, risk assessment, modelling	
Title of activity	Scope
White nose syndrome (WNS)/ <i>Pseudogymnoascus destructans</i> (Pd) Surveillance by the NWHC	NWHC evaluated carcasses of 130 bats from 27 states for WNS, Pd, and other causes of mortality by a combination of histopathology, fungal culture, and PCR. An additional 949 live bats and 2,530 environmental substrates were analyzed in support of nationwide surveillance for Pd. These samples represented 25 species of bats from more than 146 locations and were received from 23 states conducting surveillance during winter hibernation and spring emergence periods. Overall, WNS or Pd was identified in 176 bats from 32 sites in 8 states.
Avian Influenza Surveillance by the NWHC	NWHC tested 534 carcasses as part of its U.S. avian mortality surveillance program. From these tests, 13 birds were positive for the avian influenza virus (AIV) matrix gene. No samples were positive for an H5-subtype of AIV and two were positive for an H7-subtype. Additionally, NWHC analyzed 978 swab-based samples for AIVs in support of the Interagency AIV Surveillance Program. From these tests, 92 samples were positive for the AIV matrix gene, including four that were positive for an H5-subtype of AIV and 13 that were positive for an H7-subtype. Overall, samples were received and analyzed from 37 U.S. States, and as per the diagnostic testing algorithm for National Surveillance, NWHC sent 19 samples identified as positive for H5- and H7-subtypes of AIV to the U.S. Department of Agriculture (USDA) National Veterinary Services Laboratories (NVSL) for confirmatory testing. No samples tested by NWHC during calendar year 2018 (through November 13, 2018) were positive for highly pathogenic AIV.
Newcastle Disease Surveillance by the NWHC	NWHC tested 62 avian carcasses as part of its U.S. avian mortality surveillance program. From these tests, 19 birds were positive for the Newcastle disease virus (NDV) matrix gene.
<i>Batrachochytrium salamandrivorans</i> (Bsal)/ <i>B. dendrobatidis</i> (Bd) Surveillance by the NWHC	4,500 samples from 40 amphibian species in 16 states were collected, and all samples were negative for Bsal based upon real-time PCR diagnostics. We detected <i>Batrachochytrium dendrobatidis</i> (Bd) by real-time PCR in 2,437 of the samples, including both salamander and frog species from all regions of the U.S.
Canadian Wildlife Health Surveillance Program by the CWHC	Wildlife health monitoring activities by the CWHC include a nationwide surveillance program providing a set of observations and signals that have relevance for conservation, public health and economic development. In 2018 the CWHC examined approximately 4400 animals in our targeted and scanning surveillance programs, from all 13 provinces and territories. Diagnostic highlights include Avian Paramyxovirus (Newcastle disease) among Double-crested Cormorants in Ontario and the Canadian Maritime provinces of Nova Scotia and Prince Edward Island (http://blog.healthywildlife.ca/avian-paramyxovirus-newcastle-disease-outbreak-in-double-crested-cormorants-in-ontario-and-the-maritimes/), Ranavirus outbreaks among amphibians and reptiles in Ontario and Quebec, the latter representing the first diagnosis in that province (http://blog.healthywildlife.ca/first-documentation-of-fatal-ranavirus-infections-in-amphibians-in-quebec/), and Rabbit Hemorrhagic disease, the largest reported outbreak of RHDV2 in North America to date (http://blog.healthywildlife.ca/rabbit-hemorrhagic-disease-in-british-columbia/). Complete reporting for both scanning and targeted surveillance can be found at the CWHC website http://www.cwhc-rcsf.ca/index.php
Avian Influenza surveillance among wild birds by the CWHC	In 2018 the CWHC examined 1734 wild birds for avian influenza virus via RT-PCR. This includes 1006 birds found dead from across Canada of which 18 were matrix PCR positive, there were no H5 or H7 positives detected. The remaining 728 samples were collected from live trapped waterfowl from the prairie provinces and British Columbia. 38 of these samples were matrix positive, including 1 H5 positive. All strains were LPAI.
White Nose Syndrome/ <i>P. destructans</i> Surveillance by the CWHC	In 2018 the CWHC examined 209 bats for the causative agent of White Nose Syndrome (<i>P. destructans</i>). Bats were subjected to necropsy and tested via PCR and culture. 14 of the 209 bats were diagnosed with WNS including the emergence of the disease in new jurisdictions, notably Newfoundland and Manitoba.
Amphibian and reptile disease surveillance by the CWHC	The CWHC discovered the first reported case of Snake Fungal Disease (SFD) in Canada in 2015. In 2018 the first reported case of a ranavirus was discovered in the province of Quebec the cause of a mortality event involving Wood Frogs. A total of 274 snakes were tested for SFD, of which 50 were positive for <i>O. ophiodicolae</i> . The majority of positive samples involved the Eastern Foxsnake, all cases were located in southern Ontario.
Zoonotic disease surveillance by the CWHC	In 2018 the CWHC conducted targeted surveillance programs for Rabies and West Nile Virus. 1459 animals were examined for Rabies, 18 were positive via IHC and/or DRIT from multiple jurisdictions in Canada. 1779 wild birds were examined for WNV in Canada (RT-PCR), 169 birds were found positive from multiple jurisdictions, including the province of Prince Edward Island for the first time.
Chronic Wasting Disease surveillance by the CWHC	The CWHC conducts ongoing surveillance for CWD with a long running targeted surveillance program in Saskatchewan. 2018 surveillance is ongoing, approximately 2500 animals (including Mule Deer, White-tailed deer, Moose and Elk) were tested, results are still pending, however, an overall prevalence rate of approximately 10% is expected, with several new geographic ranges being discovered. All samples are tested via IHC.
Training, capacity building	
Title of activity	Scope

International Workshop on Wildlife Diseases and One Health (NWHC)	NWHC Center Director, Dr. Jonathan Sleeman, and scientists, The NWHC hosted an International Workshop on Wildlife Diseases and One Health on May 22-24th at the USGS Powell Center in Fort Collins, Colorado. The three-day workshop consisted of presentations and discussions focused on wildlife diseases and One Health and a field trip to the USFWS National Black Footed Ferret Conservation Center. This workshop was the latest in a series of workshops that the USGS has held in collaboration with the Korea National Institute of Environmental Research under our Letter of Intent. This year presenters represented the USGS, USDA, CDC, NPS, Korea National Park Research Institute, Korea CDC, Korea Animal and Plant Quarantine Agency, Korea National Institute of Environmental Research, Korea National Institute of Ecology, Japan National Institute for Environmental Studies, and the Chinese Academy of Sciences.
Workshop on Epidemiological Tools for Wildlife Disease Outbreak Investigation and Surveillance. at the 2018 International Society for Veterinary Epidemiology and Economic Conference, Chiang Mai, Thailand, November 2018	NWHC and the Thailand-NWHC/MoZWE (Mahidol University) held a joint workshop on wildlife disease outbreak investigation. The curriculum included didactic and practical training on wildlife disease surveillance strategies, outbreak investigation, establishing surveillance networks, interpretation of diagnostic tests, and surveillance design.
University capacity building by the CWHC	The CWHC is situated in Canada's 5 Veterinary Colleges and contributed to 21 veterinary graduate or undergraduate courses and supported the training of 34 graduate students, residents and internships.
Caribbean One-Health training	The CWHC contributes to the development and delivery of a Caribbean One-Health program. In 2018 this included the development of a new project; a critical assessment of harm reduction as a One Health approach to complex problems at the human-animal interface, with a case study at St. Kitts and in partnership with Ross University.
International wildlife health surveillance informal "working group"	In partnership with several organizations and centres, notably the USGS National Wildlife Health Centre, Wildlife Health Australia, the Dutch Wildlife Health Centre and government agencies from various jurisdictions the CWHC promotes and participates in an informal International Wildlife Health Surveillance working group. Notable accomplishments have been the co-development of a technical report (https://pubs.er.usgs.gov/publication/ofr20171038) and pending publication in OIE Scientific and Technical Review regarding wildlife health surveillance objectives and program priorities internationally.
Capacity building in St. Kitts and Nevis	Building capacity for young conservation leaders to protect biodiversity of the Narrows Marine Managed Area of St. Kitts and Nevis.

ToR : To propose or develop methods and procedures that facilitate harmonisation of international standards and guidelines applicable to the designated specialty

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the surveillance and control of animal diseases, food safety or animal welfare

Proposal title	Scope/Content	Applicable area
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US National Response to White Nose Syndrome in Bats	The NWHC serves on the Steering Committee that oversees and coordinates the interagency response.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
US National Response to Highly Pathogenic Avian Influenza in Wild Birds	The NWHC serves on the Steering Committee that oversees and coordinates the interagency response.	<input type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
US National Response to Chytrid Fungus in Salamanders	The NWHC serves on the Steering Committee that oversees and coordinates the interagency response.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
USDA National Animal Health Laboratory Network	The NWHC serves on the USDA National Animal Health Laboratory Network Technical Methods Group.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
Diagnostic Harmonization for White Nose Syndrome	The NWHC is leading an effort to harmonize diagnostic testing for white nose syndrome and the causative agent, including the creation a network of laboratories conducting such testing.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
Canadian Response to White Nose Syndrome	The CWHC serves as Canada's National Scientific Coordinator, leading Canada's response to WNS.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
Canadian National Response to Highly Pathogenic Avian Influenza in Wild Birds	The CWHC serves as Canada's AIV coordinator among wild birds, conducting surveillance, reporting, central data management and communications.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
Pan-Canadian Approach to Wildlife Health	The CWHC developed a National Wild Animal Framework for Action providing a rationale for the development and support of a harmonized approach to wildlife health in Canada. The Strategic goals of the strategy included; 1. increased readiness to identify and reduce wild animal health risks across jurisdictions, 2. Equivalence - reduce disparities in regional capacity, 3. Preparedness - improve anticipation for policy and practice, 4. Protection and prevention, and 5. Collaboration - improve efficiency and effectiveness of public services. This strategy was adopted as Canadian governmental policy and endorsed by Federal/Provincial/Territorial Ministers responsible for biodiversity, natural resources and the environment in June of 2018.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input checked="" type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare

Wildlife Health Information Platform by the CWHC	The CWHC National Wildlife Disease database has redeveloped and is capable of tracking incident and event-based data. This new platform supports Canadian wildlife health needs for disease assurance and enhances its competitiveness by augmenting current surveillance systems with new technology and information streams. In collaboration with Agriculture and Agri-Food Canada a Avian Influenza module of the platform was designed in cooperation with poultry industry and government representatives. The platform (Wildlife Health Information Platform - WHIP) became operational in late 2018.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input checked="" type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
CAHSN and CEZD	The CWHC are founding members of the Canadian Animal Health Surveillance Network (http://www.inspection.gc.ca/animals/terrestrial-animals/diseases/surveillance/eng/1313720601375/1313720675875) and the Community for Emerging and Zoonotic Diseases (https://www.cahss.ca/media/uploads/CEZD/documents/17-01-04_17-29/CEZD_Summary_English_.pdf), sitting on the board of directors and provide strategic advice and surveillance information. These programs link multiple jurisdictions and partners and draws on the disease detection abilities of multiple entities to provide surveillance information on select diseases.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input checked="" type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare

ToR: To establish and maintain a network with other OIE Collaborating Centres designated for the same specialty, and should the need arise, with Collaborating Centres in other disciplines

ToR: To carry out and/or coordinate scientific and technical studies in collaboration with other centres, laboratories or organisations

3. Did your Collaborating Centre maintain a network with other OIE Collaborating Centres (CC), Reference Laboratories (RL), or organisations designated for the same specialty, to coordinate scientific and technical studies?

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
Canadian Wildlife Health Cooperative	Saskatoon, Canada	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Our Collaborating Centres are a Consortium and there is regular contact between the two centres.
USGS - National Wildlife Health Centre	Madison, United States	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Our Collaborating Centres are a Consortium and there is regular contact between the two centres.

4. Did your Collaborating Centre maintain a network with other OIE Collaborating Centres, Reference laboratories, or organisations in other disciplines, to coordinate scientific and technical studies?

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
USDA APHIS Veterinary Services National Veterinary Services Laboratories	Ames, Iowa	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Provide samples and viral isolates of wild bird origin for follow up characterization and to validate diagnostic assays for analysis of samples from wildlife.
Aquatic Animal Diseases Collaborating Centre	Charlottetown, Canada	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Founding member of the Centre. Assist in the centre establishment and frequent interaction between the centre and the CWHC Atlantic regional centre at the University of PEI.
Chronic Wasting Disease Reference Laboratory (CFIA)	Winnipeg, Canada	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	The CWHC serves as a tissue and data bank for Chronic Wasting Disease.
HPAI reference laboratory (CFIA)	Winnipeg, Canada	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	The CWHC collaborates with the Winnipeg lab to provide confirmatory testing for Canada's wild bird AIV surveillance program.
Centre of Expertise for Rabies (CFIA)	Ottawa, Canada	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	The CWHC provides samples and data to the Rabies Centre in collaboration for Rabies surveillance in Canada.

ToR: To place expert consultants at the disposal of the OIE.

5. Did your Collaborating Centre place expert consultants at the disposal of the OIE?

Yes

Name of expert	Kind of consultancy	Subject
Dr. Dan Walsh	Instructor for the 5th Cycle of Workshops for OIE Wildlife Focal points.	Wildlife health information management.
Dr. LeAnn White	Instructor for the 5th Cycle of Workshops for OIE Wildlife Focal points.	Wildlife health information management.

Dr. Katie Richgels	Instructor for the 5th Cycle of Workshops for OIE Wildlife Focal points.	Wildlife health information management.
Dr. Jonathan Sleeman	Instructor for the 5th Cycle of Workshops for OIE Wildlife Focal points.	Wildlife health information management.
Dr. Jonathan Sleeman	Serves as the OIE National Focal Point for Wildlife in the USA.	Wildlife health surveillance and epidemiology.
Dr. Jonathan Sleeman	Serves as a member of the OIE Working Group on Wildlife.	Expertise on wildlife, biodiversity, invasive species, and climate change.
Dr. Bryan Richards	Consultation to assess if CWD satisfies the criteria of Chapter 1.2. of the Terrestrial Animal Health Code, and should then be added to the OIE list.	Expertise on chronic wasting disease.
Dr. Craig Stephen	Serves as OIE focal point for wildlife in Canada.	Veterinary epidemiology.
Dr. Ted Leighton	Former member of the OIE working group on wildlife.	Wildlife health surveillance.
Dr. Stephane Lair	Assistance in preparing workshops for OIE Focal Points for Wildlife.	Wildlife health surveillance.
Dr. Hon Ip	Dr. Hip serves on the OIE-FAO OFFLU Wildlife Influenza Group	Avian influenza

ToR: To provide, within the designated specialty, scientific and technical training to personnel from OIE Member Countries

6. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by the OIE, to personnel from OIE Member Countries?

Yes

- a) Technical visits: 0
- b) Seminars: 0
- c) Hands-on training courses: 2
- d) Internships (>1 month): 0

Type of technical training provided (a, b, c or d)	Content	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
c	5th Cycle of Training for OIE National Focal Points for Wildlife-Vilnius, Lithuania, June 2018. This cycle focused on training on wildlife health information management.	All countries in the European Region	50

c	5th Cycle of Training for OIE National Focal Points for Wildlife-Kasane, Botswana, November 2018. This cycle focused on training on wildlife health information management.	All countries in the Africa Region	50
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ToR: To organise and participate in scientific meetings and other activities on behalf of the OIE

7. Did your Collaborating Centre organise or participate in the organisation of scientific meetings on behalf of the OIE?

No

ToR: To collect, process, analyse, publish and disseminate data and information relevant to the designated specialty

8. Publication and dissemination of any information within the remit of the mandate given by the OIE that may be useful to Member Countries of the OIE

a) Articles published in peer-reviewed journals: 112

Stephen C, Zimmer P, Lee M.(accepted). Is there a due diligence standard for wildlife disease surveillance? A Canadian case study. Canadian Veterinary Journal

Stephen C, Griffith-Cochran L, Wade J. (in press). Addressing the Unique Challenges of Community-Based Capture-Hold-Release Aquariums Through a Facility Health Program. Can J Fish Aqua Sci

Lee M, Byers K, Donovan C, Zabek E, Stephen C, Patrick D, Himsworth C. (in press) Methicillin-resistant Staphylococcus aureus in urban Norway rat populations (Rattus norvegicus) populations: epidemiology and the impacts of kill-trapping. Zoonoses and Public Health; ZPH-Sep-17-301.

Bachand N, Ravel A, Leighton P, Stephen C, Iqbal A, Ndao M, Konecsni K, Fernando C, Jenkins E. Foxes (Vulpes vulpes) as sentinels for parasitic zoonoses, Toxoplasma gondii and Trichinella nativa, in the northeastern Canadian Arctic. 2018. Int J Parasitology: Parasites and Wildlife. Oct 17.

Sleeman J, Richgels K, White CL, Stephen C. (in press) Integration of Wildlife and Environmental Health into a One Health Approach Sci Tech Rev 38 (1), April 2019

Stephen C, Wade J. 2018. Wildlife Population Welfare as Coherence Between Adapted Capacities and Environmental Realities: A Case Study of Threatened Lamprey on Vancouver Island. Front. Vet. Sci. 5:227

Wittrock J, Duncan, C, Stephen C. (2018). A Determinants of Health Conceptual Model for Fish and Wildlife Health. J Wildlife Disease

Stephen C. 2018. Evolving urban wildlife health surveillance to intelligence for pest mitigation and monitoring. Front. Ecol. Evol., 30 August 2018 |<https://doi.org/10.3389/fevo.2018.00127>

Stephen C, Sleeman J, Nguyen N, Zimmer P, Duff JP, Gavier-Widén D, Grillo T, Lee H, Rijks J, Ryser-Degiorgis M-P, Tana T, Uhart M (2018) Proposed attributes of national wildlife health programmes. Rev Sci Tech 37(3)

Stephen C, Wittrock, Wade J. 2018. Using a Harm Reduction Approach in an Environmental Case Study of Fish and Wildlife Health. EcoHealth, 1-4.

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James CA, Pearl DL, Lindsay LR, Peregrine AS, Jardine CM. Risk factors associated with the carriage of *Ixodes scapularis* relative to other tick species in a population of pet dogs from southeastern Ontario, Canada. *Ticks Tick Borne Dis*. 2018 Oct 17. pii: S1877-959X(18)30016-5. doi: 10.1016/j.ttbdis.2018.10.004. [Epub ahead of print] PubMed PMID: 30466965.

Vogt NA, Pearl DL, Taboada EN, Reid-Smith RJ, Mulvey MR, Janecko N, Mutschall SK, Jardine CM. A repeated cross-sectional study of the epidemiology of *Campylobacter* and antimicrobial resistant Enterobacteriaceae in free-living Canada geese in Guelph, Ontario, Canada. *Zoonoses Public Health*. 2018 Oct 4. doi: 10.1111/zph.12529. [Epub ahead of print] PubMed PMID: 30288954.

MacDonald AM, Jardine CM, Bowman J, Susta L, Nemeth NM. DETECTION OF LYMPHOPROLIFERATIVE DISEASE VIRUS IN CANADA IN A SURVEY FOR VIRUSES IN ONTARIO WILD TURKEYS (MELEAGRIS GALLOPAVO). *J Wildl Dis*. 2018 Aug 20. doi: 10.7589/2018-01-013. [Epub ahead of print] PubMed PMID: 30124393.

Vogt NA, Pearl DL, Taboada EN, Mutschall SK, Janecko N, Reid-Smith R, Bloomfield B, Jardine CM. Epidemiology of *Campylobacter*, *Salmonella* and antimicrobial resistant *Escherichia coli* in free-living Canada geese (*Branta canadensis*) from three sources in southern Ontario. *Zoonoses Public Health*. 2018 Nov;65(7):873-886. doi: 10.1111/zph.12511. Epub 2018 Aug 5. PubMed PMID: 30079632.

Clow KM, Finer R, Lumsden G, Jardine CM. Assessing the Repeatability of Tick Dragging as a Method for *Ixodes scapularis* Surveillance. *Vector Borne Zoonotic Dis*. 2018 Nov;18(11):628-631. doi: 10.1089/vbz.2018.2301. Epub 2018 Jul 18. PubMed PMID: 30020860.

Schulte-Hostedde AI, Mazal Z, Jardine CM, Gagnon J. Enhanced access to anthropogenic food waste is related to hyperglycemia in raccoons (*Procyon lotor*). *Conserv Physiol*. 2018 Jun 13;6(1):coy026. doi: 10.1093/conphys/coy026. eCollection 2018. PubMed PMID: 29992022; PubMed Central PMCID: PMC6025200.

Hartnett EA, Léveillé AN, French SK, Clow KM, Shirose L, Jardine CM. Prevalence, Distribution, and Risk Factors Associated With *Macracanthorhynchus ingens* Infections In Raccoons From Ontario, Canada. *J Parasitol*. 2018 Oct;104(5):457-464. doi: 10.1645/17-202. Epub 2018 Jul 11. PubMed PMID: 29979639.

MacDonald AM, Jardine CM, Rejman E, Barta JR, Bowman J, Cai HY, Susta L, Nemeth NM. High Prevalence of *Mycoplasma* and *Eimeria* Species in Free-Ranging Eastern Wild Turkeys (*Meleagris gallopavo silvestris*) in Ontario, Canada. *J Wildl Dis*. 2018 Jun 27. doi: 10.7589/2017-11-273. [Epub ahead of print] PubMed PMID: 29949400.

MacDonald AM, Jardine CM, Susta L, Slavic D, Nemeth NM. Survey for Bacteria and Antimicrobial Resistance in Wild Turkeys (*Meleagris gallopavo*) in Ontario, Canada. *Avian Dis*. 2018 Jun;62(2):184-188. doi: 10.1637/11807-020618-Reg.1. PubMed PMID: 29944396.

Smith K, Oesterle PT, Jardine CM, Dibernardo A, Huynh C, Lindsay R, Pearl DL, Bosco-Lauth AM, Nemeth NM. Powassan Virus and Other Arthropod-Borne Viruses in Wildlife and Ticks in Ontario, Canada. *Am J Trop Med Hyg*. 2018 Aug;99(2):458-465. doi: 10.4269/ajtmh.18-0098. Epub 2018 May 31. PubMed PMID: 29869604; PubMed Central PMCID: PMC6090327.

MacDonald AM, Jardine CM, Thomas PJ, Nemeth NM. Neonicotinoid detection in wild turkeys (*Meleagris gallopavo silvestris*) in Ontario, Canada. *Environ Sci Pollut Res Int*. 2018 Jun;25(16):16254-16260. doi: 10.1007/s11356-018-2093-0. Epub 2018 Apr 27. PubMed PMID: 29704179; PubMed Central PMCID: PMC5984634.

Jardine CM, Buchanan T, Ojkic D, Campbell GD, Bowman J. Frequency of Virus Coinfection in Raccoons (*Procyon lotor*) and Striped Skunks (*Mephitis mephitis*) During a Concurrent Rabies and Canine Distemper Outbreak. *J Wildl Dis*. 2018 Jul;54(3):622-625. doi: 10.7589/2017-04-072. Epub 2018 Mar 8. PubMed PMID: 29517402.

Clow KM, Ogden NH, Lindsay LR, Russell CB, Michel P, Pearl DL, Jardine CM. A field-based indicator for determining the likelihood of *Ixodes scapularis* establishment at sites in Ontario, Canada. *PLoS One*. 2018 Feb 27;13(2):e0193524. doi: 10.1371/journal.pone.0193524. eCollection 2018. PubMed PMID: 29486007; PubMed Central PMCID: PMC5828431.

Rothenburger JL, Himsforth CG, Nemeth NM, Pearl DL, Jardine CM. Environmental Factors Associated with the

Carriage of Bacterial Pathogens in Norway Rats. *Ecohealth*. 2018 Mar;15(1):82-95. doi: 10.1007/s10393-018-1313-x. Epub 2018 Feb 9. PubMed PMID: 29427247.

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Nemeth NM, Oesterle PT, Campbell GD, Ojkic D, Jardine CM. Comparison of reverse-transcription real-time PCR and immunohistochemistry for the detection of canine distemper virus infection in raccoons in Ontario, Canada. *J Vet Diagn Invest*. 2018 Mar;30(2):319-323. doi: 10.1177/1040638717751825. Epub 2017 Dec 28. PubMed PMID: 29284384.

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Clow KM, Weese JS, Rousseau J, Jardine CM. Microbiota of field-collected *Ixodes scapularis* and *Dermacentor variabilis* from eastern and southern Ontario, Canada. *Ticks Tick Borne Dis*. 2018 Feb;9(2):235-244. doi: 10.1016/j.ttbdis.2017.09.009. Epub 2017 Sep 20. PubMed PMID: 29042239.

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Rothenburger JL, Rousseau J, Weese JS, Jardine CM. 2018. Livestock-associated Methicillin-resistant *Staphylococcus aureus* and *Clostridium difficile* in wild Norway rats (*Rattus norvegicus*) from Ontario swine farms. *Canadian Journal of Veterinary Research*. 82(1):66-69.

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- Rothenburger*, J., Himsforth, C., Nemeth, N., Pearl, D., & Jardine, C. (2018). Nematode coinfections, environmental factors and weather impact infection with the zoonotic bacterium, *Bartonella tribocorum*, in urban Norway rats (*Rattus norvegicus*). One Health Congress, Saskatoon, Canada Saskatchewan. [Refereed] [Scope: International]
- Allen*, S., Jardine, C., Colucci, N., FurukawaStoffer, T., Ambagala, A., et al. (2018). Risk assessment for the incursion and establishment of orbiviruses in Ontario Canada: serosurveillance in wildlife and livestock and characterization of current vector composition and distribution. Wildlife Disease Association Conference, St. Augustine, Florida. [Refereed] [Scope: International] Description: ***WDA student scholarship award and WDA travel award***
- Clow*, K., Lumsden*, G., Finer*, R., & Jardine, C. (2018). Assessing the repeatability of tick dragging as a method for *Ixodes scapularis* surveillance. Wildlife Disease Association Conference, St. Augustine, Florida. [Refereed] [Scope: International]
- MacDonald*, A., Jardine, C., Bowman, J., Susta, L., & Nemeth, N. (2018). First detection of lymphoproliferative disease virus in Canada and survey for other viruses in Ontario wild turkeys (*Meleagris gallopavo*). Wildlife Disease Association Conference, St. Augustine, Florida. [Refereed] [Scope: International]
- Nemeth, N., Smith, K., Oesterle, P., Jardine, C., Pearl, D., et al. (2018). Powassan virus in ticks and wildlife in Ontario, Canada, and groundhogs as potential reservoir hosts. Wildlife Disease Association Conference, St. Augustine, Florida. [Refereed] [Scope: International]
- Reist*, M., Giacinti*, J., Parmley, E. J., Roberston, C., Shirose, L., Cristo, D., Jardine, C. (2018). Enhancing wildlife surveillance in Ontario: development and evaluation of the wildlife health tracker. Wildlife Disease Association Conference, St. Augustine, Florida. [Refereed] [Scope: International]
- Sinclair, D., Stephen, C., Parmley, E. J., JonesBitton, A., & Jardine, C. (2018). Defining and measuring wildlife health according to the experts. Wildlife Disease Association Conference, St. Augustine, Florida. [Refereed] [Scope: International]
- Trudeau M*, Lelain C*, Massolo A, Stamler S*, Rothenburger JL. (2018). Investigation of *Echinococcus multilocularis* in Calgary muskrats. American College of Veterinary Pathologists Annual Meeting, Washington D.C., United States
- Lorch, JM, J Segers, H Cai, D Lindner, S McBurney, J Tomy. "Update on harmonization of laboratory protocols, interpretation, and reporting of WNS and Pd results." White-nose Syndrome Annual Meeting, Tacoma, Washington. June, 2018.
- Ryser-Degiorgis M-P, Sleeman J, Nguyen N, Zimmer P, Duff P, Gavier-Widén D, Grillo T, Lee H, Rijks J, Tana T, Uhart M, Stephen C. (2018) Review of requirements of a wildlife health surveillance programme. 8th Meeting of the EWDA Network for Wildlife Health Surveillance in Europe. Larissa, Greece,
- Stephen C. 2018. Harm reduction as a strategy for action in the face of uncertainty and conflict. Wildlife Disease Association Annual Meetings. St. Augustine.

- Stephen C, Wittrock J. (2018). Adapting the determinants of health perspectives to developing and implementing integrated priorities to address social and ecological expectations for fisheries and community health. 5th International One Health Congress. Saskatoon. June.
- Stephen C, Gallagher C. (2018). Harm reduction: A strategy for One Health action in the face of uncertainty and conflict. 5th International One Health Congress. Saskatoon. June.
- Stephen C, Duncan C, Wittrock J, Wade J. (2018) Wildlife influences on the social determinants of health - key to climate change preparedness. 5th International One Health Congress. Saskatoon. June. (Poster)
- Mahase-Gibson A, Oura C, Vokatky A, Stephen C. (2018) Making One Health Operational: The barriers to change and glimmers of hope. 5th International One Health Congress. Saskatoon. June. (Poster)
- Oura C, Vokatky A, Mahasa-Gibson A, Stephen C. (2108) Making One Health operational within the Caribbean Region. 5th International One Health Congress. Saskatoon. June.
- Grillo T and 13 others. 2017. Designing Evidence-based National Wildlife Health Programs (NWHP): An Integral Part of the One Health Approach. Wildlife Disease Association. San Cristobal de las Casas, Chiapas, Mexico.
- St Leger and Raverty, S. Cataract formation with spherophakia in a stranded southern resident killer whale. 12th CL Davis & SW Thompson DVM Foundation Marine Species Histopathology Workshop, Long Beach, CA, May 19, 2018
- St Leger and Raverty, S. Pulmonary mucormycosis in a stranded subadult harbor porpoise. 12th CL Davis & SW Thompson DVM Foundation Marine Species Histopathology Workshop, Long Beach, CA, May 19, 2018
- Published Abstracts from the NWHC
- Hwang, J., Lee, K., Walsh, D., Kim, S., Sleeman, J. M., & Lee, H. Prioritization of disease emergence risk factors for the Republic of Korea using a nationwide survey of subject matter experts: A model for other countries or regions. Prince Mahidol Award Conference, Bangkok, Thailand. February, 2018.
- Hwang, J., Lee, K., Walsh, D., Kim, S., Sleeman, J. M., & Lee, H. Wildlife disease risk assessment and planning of National Wildlife Health Center in Korea. 9th Joint Symposium of Veterinary Research in East Asia, Seoul, Republic of Korea. February 2018.
- Lorch, J. 2018. Ophidiomyces Ophidiicola in Captive Snakes in France: Detection and Partial Characterization. Oral presentation. Yaboumba conference held in Paris, France, March 21-23.
- Russell, R. 2018. When and Where: Estimating the Location and Time of Introduction for Exotic Pests and Pathogens. Oral presentation. International Statistical Ecology Conference held in St. Andrews, Scotland, July 2-6.
- Cole, R. 2018. Life Cycle of Truttaedacnitis Truttae (Nematoda: Cucullanidae) in Rainbow Trout (Oncorhynchus mykiss) in the Colorado River Drainage in Grand Canyon, AZ. Oral presentation. International Symposium on Aquatic Animal Health held in Price Edward Island, Canada, September 2-6.
- c) National conferences: 49
- Stephen C. 2018. Harm reduction as an approach out of stagnation in wildlife health management. Interdisciplinary Approaches to Managing Health of Fish and Wildlife. Columbia Mountains Institute of Applied Ecology. Kimberly. May.
- Stephen C. 2018. Third Generation Public Health. Canadian Institute of Public health Inspectors Conference. London
- Stephen C. 2018. Climate change: Opportunities and needs for cross-sectoral action. BC Zoonoses Symposium. Abbotsford.
- Stephen C. 2018. Can One Health Save the World. Keynote lecture. Centre for Public Health and Zoonoses Annual Meeting. Guelph
- Stephen C. 2018. Conservation as a public health strategy for climate change preparedness. National Collaborating Centre for Environmental Health Webinar series. May.

Daoust, P-Y. "The Canadian commercial seal hunt." 2018 Congress of the International Society for Applied Ethology, Charlottetown, PE. Aug. 3, 2018.

Gray, C, A Egers, W Robbins, L Bourque, M Jones, S Greenwood, G Conboy. "The price is right: Molecular characterization of *Pricitrema zalophi* in grey seal populations in Atlantic Canada." Atlantic Canadian Association of Parasitologists Annual Meeting, Pictou, NS, Oct 20, 2018.

Robbins, W, S Greenwood, A Egers, M Buote, M Jones, D McRuer, G Conboy. Infectivity of spontaneously-shed *Angiostrongylus vasorum* L3 to dogs. Atlantic Canadian Association of Parasitologists Annual Meeting, Pictou, NS, Oct 20, 2018.

Daoust, P-Y. "The North Atlantic Right Whale Mortality Crisis." Whale School Public Lecture Series, Inaugural Lecture. Halifax, NS. Oct 19, 2018.

Jones, MEB. "Wildlife Health in PEI: Past, Present, and Future." Island Nature Trust Annual General Meeting, Invited Lecture. Charlottetown, PE, Sep. 26, 2018.

Bourque, L, and D McRuer. Avian Conservation Public Panel Discussion. AVC Wildlife Service and Island Nature Trust. Sep. 13, 2018.

Daoust, P-Y. "Ballistic tests for adult seals." Sealers' Association Annual Meeting. Moncton, NB, Oct 16-17, 2018.

McBurney, T. "Bats in buildings on Prince Edward Island." Community Museums Association of PEI Workshop, Bedeque, PE, Nov. 9, 2018.

McBurney, T. "Bat woman origin story + bats in Prince Edward Island and beyond!" SHAD Program, School of Sustainable Design Engineering, University of Prince Edward Island, Charlottetown, PE. July 25, 2018. 1 hour.

McBurney, T. "Bats in Prince Edward Island and beyond!" Central Queens Branch of the PEI Wildlife Federation Annual General Meeting, Hunter River, PE. June 14, 2018. 1 hour.

McBurney, T. "Bats in Prince Edward Island and beyond!" Souris and Area Branch of the PEI Wildlife Federation Annual General Meeting, Souris, PE. May 23, 2018. 1 hour.

McBurney, T. "A bat woman origin story." Charlottetown Rural High School Career Day, Charlottetown, PE. March 14, 2018. 1 hour.

Lair, S. Monitoring the health of St. Lawrence Beluga. Conférence Musée du Fjord. October 2018. La Baie, Québec, Canada.

Lair, S. Changes in the regulation regarding the captivity of non-domestic animals in Quebec - implications for veterinarians. Annual conference of the Ordre des médecins vétérinaires du Québec. October 2018. St. Hyacinthe, Québec, Canada.

Lair, S. Health of St. Lawrence Belugas: Evolution of the issues over the last three decades. Colloque 2018 du Parc marin du Saguenay-Saint-Laurent. October 2018. Tadoussac, Québec, Canada.

Lair, S. Wildlife and zoonosis: Risks associated with the handling of wild animal in Quebec. CEGEP Saint-Laurent (college teacher training). 2018. Montreal, Québec, Canada.

Lair, S. Wildlife and zoonosis: Risks associated with the handling of wild animal in Quebec. Association des biologistes du Québec (continuing education for biologists). 2018. St-Hyacinthe, Québec, Canada.

Parmley and Anholt. Wildlife Health Intelligence - Avian Influenza (Part II). Presented to the CAHSS Poultry Working Group and CEZD community

Segers, J. "The wonderfully weird world of bats (and bat research), Atlantic Veterinary College. Charlottetown, PE. November 13, 2018. 1 hour.

Segers, J. "Bats - Super heroes of the night sky, Sugar Moon Farm, Earltown, NS. November 9, 2018. 1 hour.

Segers, J. "Principles of wildlife research - Bats, Atlantic Veterinary College, Charlottetown, PE. November 7, 2018.

1 hour.

Segers, J. "Bats in Canada: A story of heroes and wildlife health, Atlantic Veterinary College Grad Seminar series, Charlottetown, PE. October 16, 2018. 1 hour.

Segers, J. "Bats – Super heroes of the night sky, Trout River Environmental Committee, North Granville, PE. August 29, 2018. 1 hour.

Segers, J. "Wildlife research – studying the real Dark Knight, Atlantic Veterinary College, Charlottetown, PE. July 14, 2018. 1 hour.

Segers, J. "Bats – Super heroes of the night sky, Girl Guide Camp, Murray River, PE. May 26, 2018, 1 hour.

Segers, J. "Bat Research on Prince Edward Island, Stratford Watershed Group. Stratford, PE. April 23, 2018. 30 minutes.

Presentations and Abstracts by the NWHC

George, K. 2018. Evaluating Bat Guano at Summer Roost Sites as an Alternative Sampling Strategy for Surveillance of *Pseudogymnoascus destructans*. Oral presentation. Joint Meeting of the Oregon Chapter of TWS, The Washington Chapter of TWS, Society for Northwestern Vertebrate Biology, and Northwest Partners in Amphibian and Reptile Conservation held in Portland, OR, February 13-16.

George, K. 2018. Evaluating Bat Guano at Summer Roost Sites as an Alternative Sampling Strategy for Surveillance of *Pseudogymnoascus destructans*. Oral presentation. North American Joint Bat Working Group Meeting and 28th Annual Colloquium on the Conservation of Mammals in the Southeastern U.S. held in Roanoke, VA, March 27-29.

Richards, B. 2018. Chronic Wasting Disease-The view From Here. Oral presentation. Ohio Fish and Wildlife Management Association's Annual Conference held in Columbus, OH, January 25-26.

Walsh, D. 2018. Looking Backwards to Know Where You're Going: Using Dynamical Statistical Models to Understand and Forecast Biological Invasions. Blog. Blog for the Society of Industrial and Applied Mathematicians, January 31st.

Russell, R. 2018. Modeling the Effects of White-nose Syndrome on the Bat Community in Wisconsin. Oral presentation. North American Joint Bat Working Group Meeting and 28th Annual Colloquium On the Conservation of Mammals in the Southeastern U.S. held in Roanoke, VA, March 27-29.

Lorch, J. 2018. Fungal Skin Assemblages on Hibernating Bat Species that are Susceptible and Resistant to White-nose Syndrome in North America. Oral presentation. International Mycological Congress held in San Juan, Puerto Rico, July 16-21.

Russell, R. 2018. Statistical Modeling of Diseases in Ecological Communities Using Partial Differential Equations. Oral presentation. Joint Statistical Meeting, July.

Isidora Ayza, M. 2018. Mortality of Little Brown Bats (*Myotis lucifugus carissima*) Naturally Exposed to Microcystin-LR. Oral presentation. Wildlife Disease Association Meeting held in St. Augustine, FL, August 5-10

Lorch, J. 2018. Snake Fungal Disease is Associated with Low Body Condition and High Metabolic Costs. Oral presentation. Wildlife Disease Association Meeting held in St. Augustine, FL, August 5-10.

Richards, B. 2018. What Can Genetic Relatedness Tell Us About Social Behavior, CWD Transmission, and Management Alternatives. Oral presentation. 9th International Deer Biology Congress held in Estes Park, CO, August 5-10.

Lankton, J. 2018. Impacts to Integument from Leg Band-Mounted Telemetry Devices in Whooping Cranes (*Grus americana*). Oral presentation. Wildlife Disease Association Meeting held in St. Augustine, FL, August 5-10.

Lorch, J. 2018. Widespread Mortality of Gulls, Terns, and Auklets in the United States Linked to the Bacterium *Bisgaardia* Taxon 40. Oral presentation. Wildlife Disease Association Meeting held in St. Augustine, FL, August 5-10.

Richgels, K. 2018. Wildlife Disease Surveillance as an Early Warning System for High Consequence Zoonotic and Animal Diseases. Oral presentation. International Conference on Emerging Infectious Disease held in Atlanta, GA, August 26-29.

Walsh, D. 2018. Selective Removal May Lead to Recover of Alling Bighorn Sheep Herds. Oral presentation. 21st Biennial Northern Sheep and Goat Council Symposium held in Whitefish, MT, May 21-24.

George, K. 2018. Evaluating Bat Guano at summer Roost Sites as an Alternative Sampling Strategy for Surveillance of *Pseudogymnoascus Destructans*. Oral presentation. 2018 White-nose Syndrome Workshop held in Tacoma, WA, June 11-14.

Lorch, J. 2018. Update on Harmonization of Laboratory Protocols, Interpretation, and Reporting of *Pseudogymnoascus Destructans* Results. Oral presentation. 2018 White-nose Syndrome Workshop held in Tacoma, WA, June 11-14.

Lorch, J. 2018. Do Microbial Communities Influence the Fate of *Pseudogymnoascus Destructans* (Pd) in Environmental Reservoirs? Oral presentation. 2018 White-nose Syndrome Workshop held in Tacoma, WA, June 11-14.

White, L. 2018. One Health and the Ecosystem Health Perspective. Oral presentation. Midwest Fish and Wildlife Conference held in Milwaukee, WI, January 28-31.

d) Other

(Provide website address or link to appropriate information): 4

The CWHC website provides up-to-date reporting on a number of wildlife diseases <http://www.cwhc-rccsf.ca>

The CWHC produces quarterly reports highlighting surveillance numbers on a 3 month basis, diagnostic highlights, project features and wildlife health news stories. The reports are available at http://www.cwhc-rccsf.ca/quarterly_report.php. The CWHC Annual Report is available at http://www.cwhc-rccsf.ca/annual_reports.php

NWHC Website: <https://www.usgs.gov/nwhc>

Wildlife Health Information Sharing Partnership-event reporting system (WHISPers)

WHISPers is a partner-driven online database for recording current and historical wildlife mortality events in the United States. The system uses geospatial mapping to depict wildlife events that meet the appropriate criteria from data collected by multiple partners. To date, WHISPers has data from over 7,000 events dating back to 1910 from over 43 million affected animals, including over 700 species and 250 diagnoses.

<https://www.nwhc.usgs.gov/whispers/>