



**Report to the Fish and Wildlife Health Committee
of the Association of Fish and Wildlife Agencies
from the USGS National Wildlife Health Center
September 14, 2016**

The USGS National Wildlife Health Center provides national leadership to safeguard wildlife and ecosystem health through dynamic partnerships and exceptional science.

Spring Viraemia of Carp Virus Found in Imported Newts

The USGS National Wildlife Health Center (NWHC) scientists have identified spring viraemia of carp virus (SVCV) in Chinese firebelly newts (*Cynops orientalis*) imported to the U.S. through the international pet trade and have published this [study](#) in the journal *Emerging Microbes and Infections*. Spring viraemia of carp virus is a fish pathogen of economic importance to the commercial aquaculture industry, and its detection in fish must be reported to the World Organisation for Animal Health (OIE). Additionally, this discovery represents the first time that this viral pathogen has been detected in a group of animals other than fish (*i.e.*, amphibians). Spring viraemia of carp virus was first reported in the U.S. in 2002 in both farmed and wild fish populations experiencing mortality events. Despite screening for SVCV and regulating live fish imported into the U.S. since 2006, new detections continue to be reported. This discovery raises the question as to whether translocated amphibians may be cryptic hosts for this exotic viral pathogen and are contributing to its global spread.

The susceptibility of amphibians worldwide to SVCV is not known, but of particular concern is whether SVCV could act as a potential pathogen in already imperiled amphibian populations. If Chinese firebelly newts co-evolved with SVCV, they could be asymptomatic hosts for this viral pathogen which is thought to have originated in Southeast Asia. Under such a scenario, salamanders from other parts of the world, including the U.S., could represent potentially naïve hosts at risk for developing more severe disease upon exposure to this virus. Thus, the potential threat presented by SVCV to native salamander populations outside of Southeast Asia remains uncharacterized. **Contact:** Hon Ip, 608-270-2464, hip@usgs.gov

Virulent Newcastle Disease Virus in Double-Crested Cormorants

The NWHC has recently been receiving reports of sick or dead double-crested cormorants (*Phalacrocorax auritus*), predominantly juveniles, from the Great Lakes Region (Wisconsin, Minnesota, and Indiana). Virulent Newcastle Disease virus (vNDV) has been confirmed by genetic sequencing in twelve cormorants submitted from four counties in Minnesota and two counties in Wisconsin. Of ten counties tested in the Great Lakes Region, three have tested negative for vNDV. Cormorants from one county in Indiana have screened positive for avian paramyxovirus-1 (APMV-1) by matrix PCR and NWHC is in the process of virus isolation to further characterize the virus to determine if it is vNDV. Gulls and pelicans collected with cormorants in one Minnesota county tested positive for salmonellosis and were negative for vNDV. Our experience with previous vNDV outbreaks has shown that sympatric species are rarely affected by vNDV, and cause-of-death determination for the other species (*e.g.*, gulls and pelicans) is on-going. All birds have screened negative for highly pathogenic avian influenza virus. For more information, please see this [Wildlife Health Bulletin](#). **Contact:** NWHC Field Epidemiology Team, 608-270-2480, NWHC-epi@usgs.gov.

White-Nose Syndrome Update, 2015/2016 Surveillance Season

Ongoing national surveillance efforts confirm that the geographic range of bat white-nose syndrome (WNS) and the causative fungus, *Pseudogymnoascus destructans* (*Pd*), have expanded during 2015/2016. Specifically, *Pd* continued to spread among bats at new hibernacula in eastern Nebraska, eastern Oklahoma, and central Iowa, and WNS was confirmed for the first time in Minnesota where *Pd* has been present since 2012. Although not unexpected because WNS has been long-present in New England, WNS was also confirmed for the first time in Rhode Island. As previously reported in a [Wildlife Health Bulletin](#) from April 2016, scientists at the NWHC confirmed WNS in a western subspecies of little brown bat (*Myotis lucifugus alascensis*) from King County,

Washington. The area where this bat was found is approximately 1,300 miles from the previous westernmost detection of *Pd*.

Following this initial detection of *Pd* and WNS in Washington state, scientists from the NWHC, the [Washington Department of Fish and Wildlife](#), and other state and federal agencies have been working to identify strategies suitable for facilitating additional WNS surveillance in the western U.S. to better define prevalence and geographic range of *Pd*. These strategies included testing non-lethal samples collected from hibernating and post-emergent bats, sediment and environmental swab samples collected from bat hibernacula, guano samples collected from post-emergent bats, and screening of bat carcasses that were previously submitted to State Health Department Laboratories for rabies testing. Despite the known presence of *Pd* in Washington, all samples collected from live bats and from environmental and guano samples were negative for *Pd*. However, a single silver-haired bat (*Lasionycteris noctivagans*) submitted to the Washington Department of Health (WDOH) for rabies testing and subsequently transferred to the NWHC was positive for *Pd* by molecular testing (real-time PCR). This bat was originally collected during the same month and in the same county as the Washington bat with previously confirmed WNS. Histological analysis indicated that this second *Pd*-positive bat from Washington lacked lesions indicative of WNS. However, detection of *Pd* on this silver-haired bat by PCR is consistent with previous reports for this species in the eastern U.S. and suggests that silver-haired bats may be a carrier of the fungal pathogen. Overall, 34 bats submitted to the WDOH between November 2015 and June 2016 were received by the NWHC, and one bat from this group (the silver-haired bat described above) tested positive for *Pd*. An additional 65 bats submitted to the WDOH during winter 2014/2015 were also tested and all were negative for *Pd*.

The arrival of WNS to western North America represents a significant change in the geographic distribution of this disease and in the previously established pattern of fungal spread in North America. Phylogenetic analyses indicated that the strain of *Pd* from Washington State was the same as those found in eastern North America. These findings suggest that the fungus may have arrived in Washington from regions of eastern North America where the fungus has become established. The presence of WNS in western North America presents new challenges for conducting WNS surveillance. For example, it can be difficult and impractical in many areas of the western U.S. to collect non-lethal samples during winter and spring from bat species and hibernacula most likely to harbor *Pd*. In such areas, screening bat carcasses opportunistically found on the landscape during winter and spring, including those submitted to State Health Department Laboratories for rabies testing, for presence of *Pd* is recommended. Where feasible, continued non-lethal surveillance when *Pd* prevalence is highest (*i.e.*, during winter and spring) is highly encouraged in states at the edge of known *Pd* distribution and in all other western states. Active surveillance for *Pd* on bats during other times of the year (*i.e.*, during summer and fall) is discouraged because of low likelihood for detection. The phylogenetic study results were published in the journal *mSphere* ([Lorch et al. 2016](#)). USGS distributed a [media release](#) about findings.

Of note, *Pd* has also been recently detected in the hibernaculum environment and on bats from multiple sites across China ([Hoyt et al. 2016. Emerging Infectious Diseases](#)).

The NWHC provides diagnostic and epidemiological assistance to investigate unusual bat mortality events throughout the year. Recent detection of WNS in Washington illustrates the ongoing importance of investigating wildlife mortality events as part of a comprehensive wildlife disease surveillance strategy, and we encourage wildlife managers to report unusual bat mortality or bats displaying clinical signs suggestive of WNS to the NWHC for further investigation. We can also answer questions about designing WNS surveillance and response plans relevant to your state, and with testing samples collected as part of opportunistic or targeted surveillance efforts in accordance with the national *Pd* surveillance strategy. Tribal, state, and federal agencies who have questions about ongoing surveillance efforts or who may wish to participate should contact Anne Ballmann (608-270-2445, aballmann@usgs.gov).

Please visit www.whitenosesyndrome.org for more information about the national multi-agency WNS response effort. A recently completed WNS poster and handout are available for use as needed at <https://www.whitenosesyndrome.org/resource/white-nose-syndrome-poster-available-your-use>

WNS Multi-State Surveillance Project

The NWHC continues to lead a 3-year surveillance project designed to assist state and federal wildlife agencies nationwide with early detection of *Pd* in new areas, and to address specific research priorities identified by partners in conjunction with the [White-Nose Syndrome National Plan](#). During the first two years of the project, swabs from more than 2,100 bats, representing 16 North American species, and 580 environmental substrates from 110 hibernacula in 23 states were returned to the NWHC for analysis. This project has resulted in the detection of *Pd* at 16 hibernacula of previously unknown *Pd* status in six states, including nine sites where there was no physical or behavioral evidence of WNS observed in the bat population. Nearly all detections of *Pd* originated from swabs collected from bats rather than from environmental substrates collected inside of hibernacula. Information on biotic and abiotic factors continues to be collected at all hibernacula surveyed to assess the potential importance of various parameters in contributing to presence of *Pd*. **Contact:** Anne Ballmann, 608-270-2445, aballmann@usgs.gov.

Highly Pathogenic Avian Influenza in North America - 2015 Third Quarter Update

The NWHC continues to play an active role in surveillance and research into the emergence of highly pathogenic avian influenza (HPAI) viruses in North America. In the third quarter of 2015 (July–September), the NWHC tested 391 bird carcasses submitted from mortality and morbidity investigations nationwide. The NWHC also tested 4,758 swab samples from live or hunter-harvested waterfowl, primarily from the Mississippi and Atlantic Flyways, as part of the [Interagency Surveillance Plan for Highly Pathogenic Avian Influenza in Waterfowl in the United States](#).

Nationally, there were no detections of HPAI virus in the third quarter of 2015 through the NWHC's mortality testing or through national surveillance samples collected from live or hunter-harvested birds. [Samples from two mallards \(*Anas platyrhynchos*\) tested PCR positive for the Eurasian lineage HPAI H5 gene](#), which was first detected in North America in late 2014; however, virus was not isolated or sequenced from either sample and these remain unconfirmed. One sample was from a live mallard in Davis County, Utah in July and the second sample was from a hunter-harvested mallard in Morrow County, Oregon in November.

The NWHC is continuing to accept mortality and morbidity event submissions for HPAI testing under our [expanded submission criteria](#). To date, no humans or other mammals have shown signs of disease from these particular viruses but field personnel handling live or dead wild birds should take [appropriate precautions](#).

For more information, see the [USGS Role and Response to Highly Pathogenic Avian Influenza fact sheet](#).

Notes:

- The Interagency Steering Committee for Surveillance for Highly Pathogenic Avian Influenza in Wild Birds recently developed FAQs on HPAI and North American Wild Birds. These are available [online](http://www.nwhc.usgs.gov/disease_information/avian_influenza/2016%2006%20AI%20FAQs_Final.pdf).
- USGS Open-File Report 2016-1121 titled “[USGS Science Strategy for Highly Pathogenic Avian Influenza in Wildlife and the Environment \(2016-2020\)](#)” is now available online. Following the strategy outlined in this report, the USGS will assess avian influenza dynamics in an ecological context to inform decisions made by resource managers and policymakers from local to national levels.
- Please see this [Wildlife Health Bulletin](#) for information about the recent (August 2016) detection of HPAI in a mallard duck from Alaska.

NWHC Co-hosts International Avian Influenza and Other Diseases of Wildlife Workshop

The NWHC and the Korean National Institute of Environmental Research hosted a joint workshop on Highly Pathogenic Avian Influenza (AI) and Other Diseases of Wildlife on August 10 and 11, 2016 in Madison,

Wisconsin. The two-day workshop included presentations by NWHC staff and visiting scientists on current research throughout the world. The workshop also included facilitated discussions on research priorities and proposals for future work.

Scientists from the Korean National Institute of Environmental Research, the Korean Ministry of Environment, and Seoul National University presented on AI research, rabies outbreaks, and the planning for the new National Wildlife Health Center in South Korea. Other international visitors included Dr. Tiggy Grillo, National Coordinator for Wildlife Health Australia and the Australian OIE Focal Point for Wildlife, who provided an overview of AI surveillance in Australia. Other visitors included: Dr. Erica Spackman discussing work with wild waterfowl at Southeast Poultry Research Laboratory, Dr. John Pearce (USGS Alaska Science Center) on migratory pathways and AI dispersal, and Dr. Diann Prosser (USGS Patuxent Wildlife Research Center) on spatial modeling of AI risk factors at the interface of wild and domestic birds in Asia.

The wildlife disease threats we face often have an international origin, and this workshop was an opportunity to continue developing international collaborations. This is especially important as other countries increase their capacity and infrastructure to investigate and research wildlife health issues. **Contact:** Jonathan Sleeman, 608-270-2401, jsleeman@usgs.gov

Chronic Wasting Disease Update

Chronic wasting disease (CWD) is a fatal, contagious, neurodegenerative disease of cervids (Family *Cervidae*), including North American deer (*Odocoileus sp.*), elk (*Cervus canadensis*), and moose (*Alces alces*). The disease continues to be detected in new geographic locations and with increasing prevalence in some areas with long-term monitoring for the disease. Since the beginning of calendar year 2016, CWD has been documented in free-ranging deer and elk populations in new locations in Alberta, Nebraska, Texas, and Wyoming, and was detected for the first time in Arkansas. The disease was also detected in captive white-tailed deer (*O. virginianus*) facilities in Texas and Wisconsin. A [map](#) of the current known distribution of CWD in North America is available from the NWHC. In addition, the first detection of CWD in wild reindeer (*Rangifer tarandus*), and the first documented CWD cases in Europe were announced by the Norwegian Veterinary Institute and the [Norwegian Environment Agency](#).

The first detection of CWD in Arkansas, announced by the Arkansas Game & Fish Commission ([AGFC](#)) in February 2016, was a hunter-killed cow elk taken in 2015 in Newton County. Subsequent to this initial detection, AGFC has conducted outbreak surveillance to determine the geographic distribution of CWD and the disease prevalence within the affected area. To date, CWD has been detected in five contiguous northwestern Arkansas counties in both white-tailed deer and elk, and 23% (62 of 266) of the randomly collected deer samples have been positive. This high level of prevalence, as measured in the initial round of sampling, suggests that CWD has been present and undetected in this population for a protracted period of time. In a second phase of sampling designed to determine geographic distribution, AGFC is collecting samples from vehicle-killed deer, deer found dead, and animals exhibiting clinical signs consistent with CWD.

On April 4, 2016, the Norwegian Veterinary Institute announced detection of CWD in a cow reindeer from the Nordfjella population in southern Norway. Researchers with the Norwegian Institute for Nature Research were capturing reindeer for a telemetry project in March 2016 when they observed the animal. The adult female, sick and in less than average physical condition, died and was submitted for necropsy. Brain samples collected from the reindeer tested positive for CWD by enzyme-linked immunosorbent assay (ELISA), western blotting, and immunohistochemistry (IHC). Caribou (*Rangifer tarandus*) were previously determined to be susceptible to CWD in a [research setting](#) and scientists expressed concern over how the disease would manifest in a highly gregarious cervid species. The detection, from the area of Sogn and Fjordane, is the first report of CWD in free-ranging reindeer and the first report in Europe. Norway routinely samples reindeer as a part of their national surveillance program for CWD and other transmissible spongiform encephalopathies (TSEs).

Subsequent to intensified disease monitoring, the Norway Environment Agency [announced](#), on May 25, 2016, the detection of a CWD-positive moose (*Alces alces*, commonly referred to as elk in Europe) from the Selbu municipality of Sor-Trondelag. This region is approximately 300 kilometers from where the initial CWD-positive reindeer was detected. On June 15, 2016, the Norwegian Veterinary Institute announced a second CWD-positive moose, also from the Selbu region. Both moose were necropsied at the Norwegian Veterinary Institute in Trondheim and their brain tissue tested positive for CWD by ELISA and western blot. Both moose were adult pregnant females. The first moose was euthanized based on clinical signs consistent with CWD. The second case, found dead in a river, was in normal condition and necropsy revealed trauma as the cause of death. At this point, the origin of CWD in Norway and any relationship between the reindeer and elk cases is undetermined. **Contact:** Bryan Richards, 608-270-2485, brichards@usgs.gov

Seabird Mortality Along Southern Coastal Alaska

Since March 2015, the NWHC worked closely with the U.S. Fish and Wildlife Service Region 7 Migratory Bird Management office, field offices, and Refuges, as well as the Alaska Department of Fish and Game, responding to and monitoring large-scale seabird mortality primarily impacting common murrelets (*Uria aalge*) throughout the Gulf of Alaska, Bering Sea, and inland lakes and rivers. Avian mortalities documented from May to September 2015 were also concurrent with whales, pinnipeds, sea otters (*Enhydra lutris*), and fish mortality. Estimated total numbers involved were in the hundreds of thousands.

Between March 2015 and February 2016, 150 avian carcasses were collected by partners and shipped to the NWHC for comprehensive diagnostic necropsies. No further large-scale mortalities have been reported in 2016. The common finding for both juvenile and adult specimens was emaciation and starvation. All carcasses tested negative for highly pathogenic avian influenza virus. Additional laboratory testing has included bacteriological, parasitological, and virological analyses; heavy metal panels; and algal toxin analyses. Histopathologic examinations have been conducted on suitable specimens. Overall, no consistent indications of infectious disease or toxins have been found.

All agencies involved are working to understand complex ecosystem-wide drivers that may be impacting seabirds in the northern Gulf of Alaska. In particular, unusually warm ocean waters first recorded in 2013 have persisted through the winter and represent a significant deviation from normal. These conditions may be causing changes in prey distribution or abundance, resulting in starvation of seabirds. Additionally, potential impacts of harmful algal blooms continue to be investigated.

The NWHC encourages wildlife biologists and resource managers along the west coast of the lower 48 states to be aware that mortalities might become more widespread during migration and as environmental conditions change in spring, and we encourage the reporting of marine bird and mammal mortality events to help determine the overall magnitude and scope of these events and potential impacts to species involved. **Contact:** NWHC Field Epidemiology Team, 608-270-2480, NWHC-epi@usgs.gov.

Determining Causes of Mariana Crow Population Decline (Island of Rota)

The NWHC Honolulu Field Station (HFS) is assisting the U.S. Fish and Wildlife Service to determine causes of declines in critically endangered Mariana crows (*Corvus kubaryi*) on the island of Rota. Since the late 1990s, crow numbers have declined 49%. Recent evidence suggests that infectious disease (the cause of which is yet to be identified) might be playing a role. HFS is collaborating with various institutions including Centers for Disease Control and U.S. Department of Agriculture in attempt to determine what is killing these crows. **Contact:** Thierry Work, 808-792-9520, thierry_work@usgs.gov.

Snowy Owl Mortalities in Wisconsin

Between mid-November 2015 and the end of January 2016, ten snowy owl (*Bubo scandiacus*) carcasses collected in Wisconsin were submitted to the NWHC. All were juvenile birds suffering from advanced emaciation. Although multiple etiologies were detected, including *Salmonella sp.*, *Aspergillus sp.*, *Escherichia coli*, organophosphate exposure, and trauma, the cause of death in the majority of birds was determined to be multi-organ failure secondary to emaciation.

The NWHC is a partner in [Project SNOWstorm](#), a collaborative endeavor between numerous state and federal agencies, academia, and non-governmental organizations that was originally conceived by the Maryland Department of Natural Resources. Formed in the wake of the historic snowy owl irruption of 2013/2014, the goal of this project is to expand knowledge regarding the ecology of wintering snowy owls.

Snowy owls are native to Arctic regions of North America and Eurasia. They nest in the summer primarily north of 60 degrees north latitude. Their primary food source is small mammals, but they are also known to prey upon multiple bird species, including waterfowl, gulls, shorebirds, songbirds, and other raptors. Some individuals overwinter on the breeding grounds, but many birds migrate farther south in response to reduced prey availability during winter months. Irruptions, or larger than normal winter migrations of snowy owls into more southern latitudes, occur periodically in apparent response to resource shortages and may also reflect higher than normal reproductive success the previous summer. The extreme irruption that occurred in the winter of 2013/2014 is thought to be the largest migratory event of snowy owls in the Northeast and Great Lakes regions in a century. Smaller scale irruptions subsequently occurred during the winters of 2014/2015 and 2015/2016. **Contact:** NWHC Field Epidemiology Team, 608-270-2480, NWHC-epi@usgs.gov

***Batrachochytrium salamandrivorans* (Bsal): An Emerging Disease of Salamanders**

Batrachochytrium salamandrivorans (*Bsal*) is an emerging pathogen capable of causing significant morbidity and mortality in salamanders. The U.S. has the largest diversity of salamanders in the world and introduction of *Bsal* to North America could have severe impacts on biodiversity and amphibian conservation. The NWHC is collaborating with multiple federal and state partners, including the multi-agency [Bsal Task Force](#), to conduct diagnostic investigations and monitor for *Bsal* to better understand the fungus and to raise awareness about this threat to our native salamanders. For more information, please see this [Wildlife Health Bulletin](#) from April 2016. For questions regarding *Bsal* surveillance, please contact Dr. Daniel Gear, 608-270-2478, dgear@usgs.gov, or Dr. Natalie Nguyen, 608-270-2400 x2394, ntnguyen@usgs.gov.

Recent Publications Related to *Batrachochytrium salamandrivorans* (Bsal)

Richgels KLD, Russell RE, Adams MJ, White CL, Grant EHC. 2016, Spatial variation in risk and consequence of *Batrachochytrium salamandrivorans* introduction in the USA. *R. Soc. Open Sci.* 3: 150616. <http://dx.doi.org/10.1098/rsos.150616>

This study describes the development of a *Bsal* risk assessment based upon fungal ecology, spatial data on imports and pet trade establishments, and salamander species diversity. The Pacific coast, southern Appalachian Mountains, and mid-Atlantic regions are predicted to have the highest relative risk from *Bsal* exposure. Ongoing priorities include import restrictions and surveillance of high-risk areas. USGS distributed a [press release](#) about this publication.

Grant EHC, Muths E, Katz RA, Canessa S, Adam MJ, Ballard JR, Berger L, Briggs CJ, Coleman J, Gray MJ, Harris MC, Harris RN, Hossack B, Huyvaert KP, Kolby JE, Lips KR, Lovich RE, McCallum HI, Mendelson JR III, Nanjappa P, Olson DH, Powers JG, Richgels KLD, Russell RE, Schmidt BR, Spitzen-van der Sluijs A, Watry MK, Woodhams DC, White CL. 2016, Salamander chytrid fungus (*Batrachochytrium salamandrivorans*) in the United States—Developing research, monitoring, and management strategies: U.S. Geological Survey Open-File Report 2015-1233, 16 p. <http://dx.doi.org/10.3133/ofr20151233>

This publication describes key findings, top research priorities, and outcomes of the first international workshop to identify crucial *Bsal* research and monitoring needs. The workshop was led by the USGS

Amphibian Research and Monitoring Initiative (ARMI) and included individuals from wildlife conservation organizations, resource management agencies, and academic institutions from the U.S. and Europe. The workshop facilitated development of the *Bsal* Task Force and a *Bsal* Strategic Action Plan.

Yap TA, Koo MS, Ambrose RF, Wake DB, Vredenburg VT. 2015, Averting a North American biodiversity crisis: A newly described pathogen poses a major threat to salamanders via trade. *Science*, 349(6247), 481-482. doi: 10.1126/science.aab1052. UCLA: 926087. <http://escholarship.org/uc/item/3bn651f5>

This study analyzed the threat of *Bsal* to North America, the risk of the amphibian trade, and the need for mitigation and response to *Bsal* invasion. Three zones of high risk were identified including the southeastern U.S., western U.S., and the highlands of central Mexico. The five most active ports of salamander importation include Los Angeles, CA, Tampa, FL, New York, NY, Atlanta, GA, and San Francisco, CA. Future studies were recommended to analyze transmission, susceptibility, and other influential variables.

White CL, Forzan MJ, Pessier AP, Allender MC, Ballard JR, Catenazzi A, Fenton H, Martel A, Pasmans F, Miller DL, Ossiboff RJ, Richgels KLD, Kerby JL. 2016, Amphibian: A case definition and diagnostic criteria for *Batrachochytrium salamandrivorans* chytridiomycosis. *Herpetological Review*. 47: 207-209.

This publication provides a case definition for *Bsal* to increase consistency in reporting during surveillance activities for this pathogen. The clinical and histological presentation of disease caused by *Bsal* is provided as are comparison photographs of lesions caused by *Bsal* and the related chytrid fungus *B. dendrobatidis*.

Wildlife Health Information Sharing Partnership – Event Reporting System (WHISPers)

WHISPers, a partner-driven, web-based repository for sharing information about historic and ongoing mortality and morbidity events in wild animals, provides natural resource managers with timely, accurate information on these events to facilitate disease management and planning. The system contains one of the largest wildlife disease databases available in the U.S.; however, since information is opportunistically collected and voluntarily reported to the NWHC, it does not contain all the mortality events that have been documented in North America. Input by partners will improve the temporal, spatial, and biotic coverage of this long-term dataset available to the entire wildlife health community. Beta testing of the data entry and management tools is underway. Summary surveillance data for several major diseases monitored by NWHC will also be available in the coming months through links provided on the [WHISPers](#) site. **Contact:** Neil Baertlein, 608-270-2460, nbaertlein@usgs.gov

Experimental Reproduction of Snake Fungal Disease by Infection of Snakes with *Ophidiomyces ophiodiicola*

In the past decade, snake fungal disease (SFD) has been increasingly recognized as an important emerging disease of wild North American snakes with potential population-level impacts. Until recently, however, a definitive cause of SFD was not known. While the fungus *Ophidiomyces ophiodiicola* is often present within lesions, the association is correlative and a causative relationship had not been established. The NWHC experimentally infected captive-bred corn snakes (*Pantherophis guttatus*) with *O. ophiodiicola* isolated from a wild snake with SFD. Lesions typical of SFD in wild snakes developed; these included raised, crusted scales, epidermal necrosis with intralesional fungal hyphae, epidermal, dermal and intramuscular inflammation, and fungal granulomas. Re-isolation of the fungus from these lesions was successful, fulfilling Koch's postulates to establish *O. ophiodiicola* as a cause of SFD. In addition to developing lesions of SFD, infected snakes exhibited physiological and behavioral changes, such as increased shedding frequency, anorexia, and abnormal basking behaviors. By allowing the examination and observation of infected snakes at known time points post-infection, this study contributes to an understanding of disease development that may help to explain SFD as a cause of mortality in

wild snakes ([Lorch et al. 2015](#)). **Contact:** NWHC Field Epidemiology Team, 608-270-2480, NWHC-epi@usgs.gov.

Zika Virus Research

Zika virus is a zoonotic flavivirus transmitted by mosquitoes that has spread from Central Africa through Southeast Asia, the southern Pacific islands, and most recently to South and Central America. Humans are affected by the virus and serve as the principal reservoir of infection. NWHC scientists will be developing several diagnostic tests to monitor Zika virus in wildlife and, experimentally, will test the ability of the virus to infect birds. Mutation rates are high in flaviviruses and may result not only in increased virulence, but also in the ability of the virus to be acquired by other mosquitoes, such as *Culex* spp. mosquitoes, the primary vector of West Nile virus (WNV) in North America. Mutations may also result in other species becoming reservoir hosts, such as birds, the primary reservoir host of WNV in North America. **Contact:** Erik Hofmeister, 608-270-2476, ehofmeister@usgs.gov.

Sylvatic Plague Vaccine for Prairie Dogs

Laboratory studies have demonstrated that oral vaccination of prairie dogs against plague using raccoon pox-vectored vaccine is feasible, resulting in significant protection against challenge with *Yersinia pestis*, the bacterium that causes sylvatic plague. The Sylvatic Plague Vaccine (SPV) Subcommittee, under the direction of the Executive Committee of the Black-footed Ferret Recovery Implementation Team, is continuing its work to complete development and delivery of the sylvatic plague vaccine as a management tool to combat plague in prairie dogs and promote the recovery of the endangered black-footed ferret. Field trials completed by Colorado Parks and Wildlife and the NWHC in 2012 confirmed the safety of the vaccine in wild prairie dogs and non-target animals. NWHC and numerous federal, state, and tribal partners have completed the third year of field trials to assess vaccine efficacy in free-ranging prairie dogs. Vaccine and placebo baits have been distributed in select prairie dog colonies in seven western states: Arizona, Colorado, Montana, South Dakota, Texas, Utah, and Wyoming. Final analysis of data and samples are currently underway to evaluate vaccine efficacy. Additional field trials to determine optimal use of SPV began in 2016 in western states. **Contact:** Tonie Rocke, 608-270-2451, trocke@usgs.gov.

New USGS Circular

"[Baylisascaris larva migrans](#)" by Kevin Kazacos is now available online. This publication is about the common raccoon roundworm, *Baylisascaris procyonis*, an intestinal parasite, which is the most commonly recognized cause of clinical larva migrans in animals. Baylisascariasis is a zoonotic disease, meaning it is transmissible from animals to humans. This circular is part of a series of publications on zoonotic diseases available from the NWHC and the [USGS Publications Warehouse](#). A printed version of this publication will be available in the near future.

New chapters: 2015 Field Manual of Wildlife Diseases

New and updated chapters of the [USGS Field Manual of Wildlife Diseases](#) are now available online. Chapters will be added online as they are completed. The most recent chapter, "[Recording and submitting specimen history data](#)," was added in 2016.

The updated field manual provides information that will enhance the ecological understanding of wildlife diseases by nonspecialists so various aspects of wildlife disease can be more effectively managed. Other readers, from students to science professionals, may also find the information presented to be of interest and value.

The introduction provides background information regarding the convergence of wildlife disease with wildlife management as a wildlife conservation concern. Section B focuses on concepts associated with disease surveillance and response to outbreaks. Section C contains information on specific techniques for disease surveillance and investigation. Section D, "Diseases of Wild Birds," and others that follow will address specific diseases of concern in various taxonomic groups. Electronic links facilitate timely access to a wide variety of supplemental information.

The complete [1999 Field Manual of Wildlife Diseases – General Field Procedures and Diseases of Birds](#) remains available online.

Disease Webinar Series Sponsored by USGS Ecosystems Mission Area and AFWA

USGS and the [Association for Fish and Wildlife Agencies](#) co-host a monthly webinar series on fish and wildlife diseases. The purpose of this series is to keep partners informed about our current disease research and discuss how USGS science can support disease management efforts. Past Webinar topics include CWD, Avian Influenza, Bsal, WNS, Plague, Fish Diseases, and Online Tools. USGS Ecosystems Mission Area Web site:

<https://www2.usgs.gov/ecosystems/disease/disease.html#webinars>

Disease Investigation Services

To request diagnostic services or report wildlife mortality, please contact the NWHC at 608-270-2480 or by email at NWHC-epi@usgs.gov, and a field epidemiologist will be available to discuss the case. To report wildlife mortality events in Hawaii or Pacific Island territories, please contact the Honolulu Field Station at 808-792-9520 or email Thierry Work at thierry_work@usgs.gov.

A field epidemiologist will be your primary point of contact for questions on disease epidemiology and management. A wildlife pathologist will be your primary point of contact on diagnostic findings and cause of morbidity or mortality. Further information can be found at <http://www.nwhc.usgs.gov/services/>.

The [Wildlife Mortality Reporting and Diagnostic Services Request Worksheet](#) is used by partners to request diagnostic assistance during a wildlife morbidity and event.

To view NWHC Quarterly Wildlife Mortality Reports, please visit:

http://www.nwhc.usgs.gov/publications/quarterly_reports/index.jsp

To be added to the NWHC list to receive [Wildlife Health Bulletins](#) and our [newsletter](#), please contact Gail Moede Rogall at gmrogall@usgs.gov

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