Report to the Fish and Wildlife Health Committee of the Association of Fish and Wildlife Agencies from the USGS National Wildlife Health Center

March 17, 2016

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

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

The Wildlife Health Information Sharing Partnership – event reporting system (WHISPers), developed at the USGS National Wildlife Health Center (NWHC) and available online, is a partner-driven, web-based repository for sharing information about historic and ongoing mortality and morbidity events in wild animals. The system provides natural resource managers with timely, accurate information on these events to facilitate disease management and planning. The records in WHISPers can be searched by species, disease, location (to county level), and event start and end dates. The system currently contains the verified (laboratory diagnosed) records that the NWHC has maintained on wildlife mortality events, which includes event information shared by tribal, state, and federal partners. 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. The next phase of the project currently underway at the NWHC is the development of tools for partners to input and manage information on wildlife mortality events in the WHISPers system. Input by partners will improve the temporal, spatial, and biotic coverage of this long-term dataset available to the entire wildlife health community. Deployment of these tools for partner use is expected later this year. **Contact:** Neil Baertlein, 608-270-2460, nbaertlein@usgs.gov

***Batrachochytrium salamandrivorans*: An Emerging Disease of Salamanders**

A recently described fungal pathogen, *Batrachochytrium salamandrivorans* (Bsal), has been associated with the near extinction of fire salamanders (*Salamandra salamandra*) in the Netherlands and Belgium. Initial infection trials suggest that this fungus is highly pathogenic for some salamander and newt species that occur in North America. International trade of amphibians is thought to be a primary route of spread for Bsal, similar to the closely related chytrid fungus *Batrachochytrium dendrobatidis* (Bd). Indeed, Bsal was most recently detected in commercially traded salamanders in the United Kingdom.

The NWHC has adapted a previously developed molecular assay to detect Bd and Bsal in North American salamanders. The NWHC maintains a large collection of archived amphibian tissues and is in the process of screening these samples to determine if Bsal is already present in the U.S. In addition to the molecular assay, the NWHC is collaborating with amphibian diagnosticians throughout North America to publish a case definition of criteria for confirming Bsal in diagnostic specimens.

NWHC scientists conducted a risk assessment for Bsal to determine where introductions of Bsal are likely to occur and, if introduced, what species would be expected to decline. Results were published in Royal Society Open Science and indicate that the overall risk of Bsal to North American salamanders is high with high potential for introduction and subsequent severe biological consequences. A USGS press release helped to publicize the findings of the risk assessment.

The USGS risk assessment informed a U.S. Fish and Wildlife Service interim rule prohibiting the importation and interstate transport of certain salamander species. For more information, see this link to the interim rule, listed species, and an opportunity for comment on interim rule:
https://www.federalregister.gov/articles/2016/01/13/2016-00452/injurious-wildlife-species-listing-salamanders-due-to-risk-of-salamander-chytrid-fungus

National Surveillance for Bsal

In support of ongoing efforts for early detection of introduction of Bsal to North America, the NWHC is partnering with the USGS Amphibian Monitoring and Research Initiative (ARMI) to implement national surveillance for Bsal. The NWHC is performing the diagnostics for Bsal and helping guide a risk-based surveillance design that follows the results of the recently published risk assessments by Richgels et al. and Yap et al. The NWHC and ARMI plan to test up to 10,000 salamanders for Bsal in 2016. In pilot work with USGS ARMI, the NWHC tested over 500 salamander swabs from 37 sites on the West Coast, Gulf Coast, and Mid-Atlantic region in 2015 and no Bsal was detected. The NWHC also continues to provide epidemiologic investigation and diagnostic services for wildlife mortality and morbidity events, including salamander species listed in the USFWS interim rule. **Contact:** NWHC epidemiology team for guidance on collecting and submitting salamanders: 608-270-2480; nwhc-epi@usgs.gov. **Contact:** LeAnn White, 608-270-2491, clwhite@usgs.gov for Bsal surveillance or diagnostic questions.

North American Highly Pathogenic Avian Influenza Update

Highly pathogenic avian influenza virus (HPAIV) was detected in wild birds at a mortality event in Washington (Pacific Flyway) in December 2014. Subsequent investigation of this event by the NWHC, the U.S. Department of Agriculture (USDA), Washington Department of Fish and Wildlife, and the Washington Animal Disease Diagnostic Laboratory identified three HPAIV H5 viruses in wild waterfowl in this region. One of these viruses, H5N8, was of Eurasian origin and found to be highly related to the HPAIV H5N8 that began circulating in domestic poultry and wild birds in the Republic of Korea during winter 2014. The other two HPAIVs, subtypes H5N2 and H5N1, were found to be reassortants of the HPAIV H5N8 and North American low pathogenic avian influenza viruses. The HPAIV H5N2 was initially found in domestic poultry farms in British Columbia, Canada, where it was responsible for the direct mortality, or euthanasia, of approximately 250,000 birds.

Poultry mortality that began in early March 2015 in Minnesota was the first detection of the HPAIV H5N2 in the Mississippi Flyway. Through June 2015, an additional 212 poultry facilities were infected with this virus, primarily in the Mississippi Flyway states of Minnesota and Iowa, but poultry farms were also affected in Wisconsin, Missouri, Indiana, and Arkansas, along with the Central Flyway states of North Dakota, South Dakota, Nebraska, Kansas, and Montana. In the Pacific Flyway, HPAIV was detected in only two commercial poultry facilities and eight backyard flocks. The farthest east of any outbreak, domestic or wild, was a poultry facility in Ontario, Canada, just north of Lake Erie. In total these outbreaks affected more than 49 million poultry. For wild birds, a total of 98 HPAI positives were detected between December 2014 and June 2015 from a total of 7,084 samples. These were primarily from hunter-harvested waterfowl in the Pacific Flyway, but a total of 21 positive wild birds were found in the Mississippi Flyway. In addition, there were seven reports of captive raptors dying from these viruses after being fed meat from apparently infected wild waterfowl, one of which was the first report of HPAIV in Missouri.

During the spring of 2015, HPAIV H5N2 was detected at three avian mortality events in the Mississippi Flyway. One of these was among Canada geese (*Branta canadensis*) in Michigan that involved a total of 22 birds, 12 of which were HPAI positive. The second event was in snow geese (*Chen caerulescens*) in Missouri with a total mortality of 16 birds with an undetermined etiology and 2 were HPAIV positive out of 2 tested. The third mortality event in Kentucky identified avian cholera as the primary etiology with an estimated mortality of 200 waterfowl. Two birds (snow goose and ring-necked duck [*Aythya collaris*]) of 6 that were examined were positive for HPAIV.

Beginning in July of 2015, the USDA, along with other federal and state partners initiated live bird, hunter harvested, and mortality surveillance in wild birds across the U.S. with the goal of early detection of the reoccurrence of HPAIV. To date, more than 27,000 live and hunter-harvested waterfowl have been tested and 2 have been positive. Both cases involved single waterfowl, one from Davis County, Utah, and the other from Morrow County, Oregon. Both counties also had detections of HPAIV earlier in 2015.

While no poultry facilities have been positive for any of the HPAIV H5 viruses since June 2015, an outbreak of HPAIV H7N8 occurred at a single poultry facility in Dubois County, Indiana, in January 2016. Low pathogenic H7N8 was detected at 9 (1 of which is suspect) nearby poultry facilities during follow-up surveillance in the region by USDA. No HPAIV H7N8 has been detected in wild birds but there have been 6 LPAIV detections since 2008 in North American wild birds. This includes 4 detections in 2015 (1 Kentucky, 1 Nevada, 2 Washington) and 2 from 2008 (1 New Jersey, 1 Washington), although the relationships of these viruses to the poultry virus have not yet been determined.

Although there have been few detections of these HPAIVs in North America in the past 6 months, it is still possible that one or more of these viruses may continue to circulate in North America. The NWHC will continue to provide updates using Wildlife Health Bulletins and FAQs as more information becomes available. The NWHC also continues to monitor for HPAIVs nationwide by testing dead birds submitted for diagnostic evaluation and is the leading partner in mortality and morbidity investigation and associated diagnostic testing within the Interagency Strategic Plan. Mortality investigations will facilitate early detection of HPAI in wild birds and will increase our knowledge of the spatial extent and species involved. Wildlife managers should remain vigilant for wild bird morbidity and mortality events and continue to contact the NWHC to discuss submission and testing of carcasses from events that meet the expanded submission criteria. Wildlife management agencies that investigate morbidity and mortality events independently or in collaboration with other diagnostic laboratories are strongly encouraged to report these events to the NWHC using our reporting form so that information can be captured on a national scale and displayed on WHISPers, a wildlife health information sharing website, to increase situational awareness.

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 additional information, see the fact sheet: USGS Role and Response to Highly Pathogenic Avian Influenza.
Contact: NWHC Field Epidemiology Team, 608-270-2480, NWHC-epi@usgs.gov

Investigating the Role of Peridomestic Species in Highly Pathogenic Avian Influenza Outbreaks: The Interface of Wildlife and Poultry Production
Since the 2015 outbreaks of highly pathogenic avian influenza virus (HPAIV) in Midwestern poultry facilities, there has been speculation regarding the role of wildlife in the transmission and movement of HPAIVs to production operations. The NWHC investigated the potential transmission of HPAIV in wildlife species in three settings in association with an outbreak at a poultry facility: 1) small birds and small mammals on a poultry facility affected by HPAIV in April 2015; 2) small birds and small mammals on a nearby poultry facility that was unaffected by HPAIV; and 3) small birds, small mammals, and waterfowl in a nearby natural area. We captured small mammals, small avian species including house sparrows (*Passer domesticus*) and European starlings (*Sturnus vulgaris*), and waterfowl, obtaining swab samples and sera for virological and serological examination. We also documented wild species having access to poultry depopulation compost. Data from this study highlights the need for additional investigation to define the risks of peridomestic species as reservoirs of HPAIVs, their roles in transmission and movement of HPAI, and the evaluation of biosecurity measures used to safeguard domestic poultry operations. **Contact:** Jeffrey Hall, 608-270-2458, jshall@usgs.gov

2015 Avian Disease Update for the Mississippi Flyway Council Technical Section
From January through December 2015, 72 wildlife mortality events involving migratory birds were reported to the NWHC from within the Mississippi Flyway (of which the NWHC investigated 49 events). This exceeds the average annual number of avian mortality events reported during the previous 5 years (about 44 events) for the Flyway. Although the total estimated mortality of 17,592 was on par with that of the 5-year average (around 14,300) it represents a substantial increase over the previous two years (2013 = 8,800; 2014 = 6,292). This increase may be due, in part, to heightened awareness/sensitivity to wildlife mortality both on the part of agency personnel and the public because of the detection of highly pathogenic avian influenza in North America in the winter and spring of 2015.

Of the 72 avian mortality events, 20 different etiologies were identified. Four etiologies in particular accounted for almost 88% of all mortalities in the Mississippi Flyway; these included avian botulism type C (6,546 birds affected), trematodiasis (6,294), avian cholera (1,287), and emaciation/starvation/suspect (1,284). A single event in Louisiana that began in August 2015, and was ongoing in December, accounted for an estimated 6,500 dead waterbirds. Botulism type C was identified as a cause of death with suspected brevetoxin a possible contributor based on results from the Southeastern Cooperative Wildlife Disease Study (SCWDS). Waterfowl, herons, ibis, egrets, and other waterbirds have all been affected during this single event. Trematodiasis due to *Sphaeridiotrema* spp., *Cyathocoytle bushinesis*, and/or *Leygonimus polyoon* primarily in American coot (*Fulica americana*) and lesser scaup (*Aythya affinis*) reoccurred again in 2015 within the Upper Mississippi River NWR (Pools 5A, 7, 8, 9, 10). In addition a small mortality event in swans attributed to trematodiasis was detected in Waukesha County, Wisconsin, signaling an expansion of the range of the *Sphaeridiotrema* parasites. Spring and fall die-offs have occurred annually on the Mississippi river since 2002 and total estimated waterbird mortality is more than 127,000 individuals since its discovery. **Contact:** Bob Dusek, 608-270-2403, rdusek@usgs.gov

2015 Avian Disease Update for the Central Flyway Council Technical Section

From January through December 2015, 23 avian mortality events, involving an estimated 6,753 migratory birds were reported within the Central Flyway region. This represented 11% of all avian mortalities reported to the NWHC nationwide in 2015. The NWHC directly investigated 20 of these events. Of the 23 avian mortality events, 9 different etiologies were identified. The largest avian mortality event occurred on South Island in Chase Lake NWR (North Dakota)and involved over 2,800 birds, mostly American white pelicans (*Pelecanus erythrorhynchos*), double-crested cormorants (*Phalacrocorax auritus*), and various gull species. Mortality began in late June and continued until mid-September. Three major causes of mortality were identified from this single event: botulism type C, West Nile virus, and salmonellosis. Botulism type C was also identified as the primary cause of death in four other avian mortality events in the Central Flyway during 2015. Estimated mortality among these events ranged from 35 to 800 birds, with the two largest events involving greater than 500 birds each, occurring at Lake Bowdoin, Bowdoin NWR (Montana) and Elephant Butte Reservoir (New Mexico) between August and October. Cyanobacteria (blue-green algae toxicosis), another biotoxin, was suspected in an October die-off event affecting about 200 American coot and Franklin's gulls (*Leucophaeus pipixcan*) at Lake Bryon (South Dakota). In 2015, avian cholera accounted for only 27% of all mortality in the Central Flyway as compared to 80% of avian mortality in the Central Flyway during 2014. The largest cholera die-off occurred at Cheyenne Bottoms WMA and Big Salt Marsh, Quivira NWR (Kansas) in December and involved more than 1,000 birds, mostly geese and ducks. Smaller cholera events also occurred at Nelson Lake, North Dakota (600 birds) and Scottsbluff, Nebraska (12 birds). In contrast to 2014, no pigeon paramyxovirus infections or greater sage grouse (*Centrocercus urophasianus*) mortality were reported in the Central Flyway in 2015.

The NWHC has been involved with several research projects focused on raptors in the Central Flyway. In collaboration with USFWS Region 6 and USGS Forest and Rangeland Ecosystem Science Center, the NWHC is examining bald and golden eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*, respectively) and ferruginous hawks (*Buteo regalis*) found dead in and around prairie dog towns for potential exposure to anticoagulant rodenticides and various heavy metals. The NWHC examined 87 raptor carcasses from the Central Flyway in 2015; trauma (45%), electrocution (26%), and poisoning (17%) were the three leading causes of death. **Contact:** Anne Ballmann, 608-270-2445, aballmann@usgs.gov

White-Nose Syndrome Winter 2015/2016 Update

At the beginning of the 2015/2016 bat hibernation season, white-nose syndrome (WNS) had been confirmed in bats from 26 states and 5 Canadian provinces within the eastern half of North America. Surveillance efforts for *Pseudogymnoascus destructans* (Pd), the fungus that causes WNS, further indicated that the pathogen was present on bats from Minnesota, Mississippi, Nebraska and Oklahoma, although clinical signs of WNS had not yet been observed in bats from these states. North American bat species confirmed positive for WNS remains the same: little brown bat (*Myotis lucifugus*), northern long-eared bat (*M. septentrionalis*), Indiana bat (*M. sodalis*), gray bat (*M. grisescens*), eastern small-footed bat (*M. lebeii*), tri-colored bat (*Perimyotis subflavus*), and big brown bat

(*Eptesicus fuscus*). A complete list of bat species that have tested positive for Pd can be found at https://www.whitenosesyndrome.org/about/bats-affected-wns. Additionally, recent international surveillance efforts have demonstrated presence of Pd at multiple locations in China (Hoyt et. al., 2016, Emerging Infectious Diseases).

The NWHC continues to lead a three-year surveillance project to assist state and federal wildlife agencies nationwide with early detection of Pd, and to address specific research priorities identified by partners in conjunction with the White-Nose Syndrome National Plan. This winter (2015/2016), 122 kits were distributed to collaborating partners in Southeastern, Midwestern, and Western states. During the previous 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. Through subsequent analysis, Pd was detected 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. Additionally, we continue to collect data on biotic and abiotic factors at all surveyed hibernacula to assess the potential importance of various parameters in contributing to presence of Pd.

Please do not hesitate to contact the NWHC for diagnostic and epidemiological assistance to investigate unusual bat mortality events throughout the year. Federal, state, or tribal agencies wishing to participate in the expanded national surveillance strategy for Pd should contact Dr. Anne Ballmann (contact information below) to discuss options for their region.

View the current map of WNS Occurrence by County created by the Pennsylvania Game Commission at http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/. Current NWHC bat submission guidelines are available at: http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/USGS_NWHC_Bat_WNS_submission_protocol.pdf. **Contact**: Anne Ballmann, 608-270-2445, aballmann@usgs.gov

Seabird Mortality Along Southern Coastal Alaska

The NWHC has been working 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 since March 2015 responding to and monitoring large-scale seabird mortality primarily impacting common murres (*Uria aalge*) throughout the Gulf of Alaska, Bering Sea, and inland lakes and rivers. Avian mortalities documented from May to September were also concurrent with whales, pinnipeds, sea otters (*Enhydra lutris*), and fish mortality. Estimated total numbers involved are 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. The common finding for both juvenile and adult specimens was emaciation and starvation. All carcasses have 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 this 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.

Brevetoxin Detected in Green Tree Frogs (Texas)
In September 2015, a mortality event involving American green tree frogs (*Hyla cinerea*) at Padre Island National Seashore, Texas, was reported by the National Park Service. Personnel estimated 30-40 adult green tree frogs died; many showed signs of neurologic impairment including tremors, weakness, and abnormal movements and postures. Two days previously, a red tide event (harmful algal bloom) began along the coastline of the park, roughly 1 km from where the frogs were found, and a storm accompanied by winds, surf, and high tides had occurred the morning of the observed mortality. There was no further green tree frog mortality, but increases in coyote (*Canis latrans*) and ground squirrel deaths at Padre Island National Seashore were noted in the following weeks.

Five green tree frog carcasses were submitted to and necropsied at the NHWC. All had adequate body fat reserves and food in their stomach, suggesting an acute death. Testing for ranavirus was negative. Due to the lack of necropsy findings, the clinical history of neurologic abnormalities, and the concurrent presence of the red tide, brevetoxin was considered as a possible cause of death. Samples sent to the Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute (St. Petersburg) for ELISA testing were preliminarily positive for brevetoxin. Testing performed by Texas A & M University on an additional six frogs and a ground squirrel from this mortality event were also positive for brevetoxin. Testing is on-going to further characterize this finding.

Brevetoxin is produced by *Karenia brevis*, the algal organism responsible for red tides. When present at high enough levels, this toxin can cause large fish die-offs. Mammals that ingest toxin can develop signs of neurological impairment followed by rapid death. The NWHC believes this to be the first documented incident of a harmful algal bloom associated with amphibian mortality. The route of exposure in this terrestrial, freshwater frog species whose diet consists of flies, mosquitos, and other small insects is unclear, but exposure may have resulted from absorption of the toxin through the skin. **Contact**: NWHC Field Epidemiology Team, 608-270-2480, NWHC-epi@usgs.gov.

Aquatic Bird Bornavirus in a Canada Goose (Massachusetts)
In October 2015, a wild Canada goose (*Branta canadensis*) showed signs of neurological impairment while on the grounds of the Capron Park Zoo in Attleboro, Massachusetts. The goose was euthanized and submitted to the NWHC for diagnostic evaluation. Clinical signs included intermittent circling and loss of coordination. No other wild or captive birds were reported to be affected. The necropsy revealed that both the esophagus and the gastrointestinal tract were dilated. Brain tissue tested positive for aquatic bird bornavirus-1 (ABBV-1) via culture and sequencing of the M gene at Texas A&M University. Histopathology revealed a severe non-suppurative meningoencephalitis consistent with ABBV-1 infection. Testing for avian influenza, West Nile virus, bacterial infections, lead toxicosis, and pesticide exposure was negative.

ABBV-1 is known to cause neurologic disease in several goose, swan, and gull species. These birds also may carry the virus subclinically. A related bornavirus infection associated with proventricular dilatation disease in psittacines (parrots) causes a similar array of neurologic and gastrointestinal clinical signs and is often fatal. It is unknown whether ABBV-1 is capable of causing clinical disease in psittacines. **Contact**: NWHC Field Epidemiology Team, 608-270-2480, NWHC-epi@usgs.gov.

Predation on Nesting Laysan Albatross (Midway Atoll)
The NWHC Honolulu Field Station (HFS) is assisting the Midway Atoll National Wildlife Refuge in dealing with the loss of adult Laysan albatross (*Phoebastria immutabilis*) to aggression by non-native mice. The mice chew on the birds while they are nesting, causing wounds and infection, which has led to a noticeable loss of adult breeding birds. The refuge is currently implementing mouse control efforts. HFS is involved with diagnosing cause of death and other measures. **Contact**: Thierry Work, 808-792-9520, thierry_work@usgs.gov.

Investigating the Genetic Diversity of Prion Protein Gene among Subspecies of Bighorn Sheep
The range of bighorn sheep (*Ovis canadensis*) overlaps many of the areas where chronic wasting disease (CWD) is endemic in free-ranging deer, as well as areas where scrapie in domestic sheep has been observed. Given the potential contact that bighorn sheep have with transmissible spongiform encephalopathies (TSEs), risk assessments of the susceptibility of bighorn sheep to both CWD and scrapie are warranted. Determining the sequence of the prion protein gene (Prnp) is one method to assess the potential susceptibility of a host to TSEs. Recent work at the NWHC showed a small number of Rocky Mountain bighorn sheep (*O. canadensis canadensis*) from two herds in Washington all possessed a genotype identical to a scrapie-susceptible domestic sheep ($A^{136}R^{154}Q^{171}$). Using an *in vitro* prion protein conversion assay, we also showed that the species barrier of bighorn sheep to elk (*Cervus Canadensis*) or white-tailed deer (*Odocoileus virginianus*) CWD or domestic sheep scrapie was low, indicating risk of TSE infection of bighorn sheep. Limitations of this previous study were the small number of bighorn sheep sampled, their origin from only two herds, and testing only one subspecies of bighorn sheep. The purpose of this study is to characterize the diversity of Prnp among various subspecies of bighorn sheep, including the endangered Sierra Nevada bighorn sheep (*O. canadensis sierra*), to assess the risk that TSEs could pose to these populations. **Contact:** Daniel Walsh, 608-270-2481, dwalsh@usgs.gov

Cross-species Transmission of Chronic Wasting Disease to Native North American Voles Reveals Prion Strain Diversity
Recent findings at the NWHC have established that meadow voles (*Microtus pennsylvanicus*), native North American rodent species, are susceptible to chronic wasting disease via environmentally relevant exposure routes. This finding demonstrates that natural infection of these scavenging rodents that overlap in range with CWD epizootics is possible and implicates a role for meadow voles as possible reservoir, vector, or bridge species for CWD on the landscape. Interspecies transmission of CWD to meadow voles also revealed the existence of a mixture of CWD strains in white-tailed deer (*Odocoileus virginianus*) isolates from wild populations, suggesting that CWD strain diversity is larger than previously recognized, and may be influenced by the genetic make-up of the cervid host. This finding is important because novel CWD strains may pose unique disease risks and outcomes to cervids, other wildlife, domestic animals and humans. To address this concern, studies are currently underway in collaboration with the U.S. Food and Drug Administration and the U.S. Department of Agriculture to test the susceptibility of a variety of domestic and wildlife species, as well as humanized transgenic mice, to the novel CWD strains identified in this research. Future work will focus on characterizing CWD strain diversity from geographically disparate outbreaks and various affected cervid species toward revealing the currently unknown distribution and prevalence of CWD strains on the landscape. This focus will provide insight into the adaptation and evolution of the CWD agent in regions of interest. This study advances the current understanding of CWD strain diversity and interspecies transmission and has implications for wildlife management as well as environmental, animal, and public health. **Contact:** Christina Carlson, 608-270-2442, cmcarlson@usgs.gov

Identifying Priority Chronic Wasting Disease Surveillance Areas for Mule Deer in Montana
Wildlife biologists at Montana Fish, Wildlife and Parks were interested in developing a targeted cost-effective surveillance program for chronic wasting disease (CWD). Though no cases of CWD have been documented as of February 2016 in the state of Montana, cases have been found less than 50 miles away in Saskatchewan and Wyoming. We identified areas of "high risk" for CWD introduction by overlapping maps of mule deer (*Odocoileus hemionus*) density and estimating the distance to the nearest infected herd. We estimated mule deer density across the state of Montana using aerial survey data to estimate deer numbers, and resource selection functions to distribute the deer across a habitat suitability gradient. We overlapped maps of estimated deer density

and estimated distance to the nearest known infected herd to identify areas where deer densities were predicted to be high and distances to infected herds were minimal. These areas were labelled as high risk areas for potential CWD introduction. This information is being used by the state of Montana to conduct limited surveillance for CWD in mule deer. **Contact:** Robin Russell, 608-270-2474, rerussell@usgs.gov

Russell, R.E., J.A. Gude, N. J . Anderson, J. M. Ramsey. 2015. Identifying priority chronic wasting disease surveillance areas for mule deer in Montana. Journal Wildlife Management. 79:989-997.

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.

This 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 deals with 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 1999 Field Manual of Wildlife Diseases – General Field Procedures and Diseases of Birds remains available online.

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/.

Wildlife Mortality Reporting and Diagnostic Services Request Worksheet

To view, search, and download historic and ongoing wildlife morbidity and mortality event records nationwide visit the Wildlife Health Information Sharing Partnership event reporting system (WHISPers) online database at http://www.nwhc.usgs.gov/whispers/

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 quarterly newsletter, please contact Gail Moede Rogall at gmrogall@usgs.gov

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