Update for the Association of Fish and Wildlife Agencies from the USGS National Wildlife Health Center

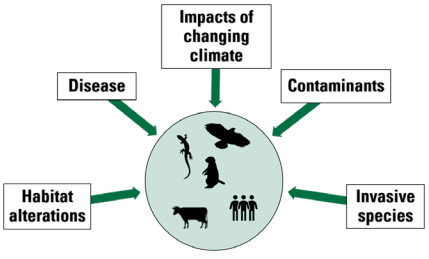
March 2020

New strategic plan for the USGS National Wildlife Health Center

The U.S. Geological Survey (USGS) National Wildlife Health Center (NWHC) has developed a new strategic science plan to guide our efforts to advance wildlife health for the next five years. The plan includes three initiatives focused on innovative solutions to address complex problems impacting wildlife health. We look forward to working collaboratively with you, our partners, to advance wildlife health.

Initiative 1: Take a comprehensive approach to wildlife health to optimize outcomes for animals, humans, and the environment.

Wildlife, human, and domestic animal health are closely interrelated within the context of the health of the environment, and an approach to wildlife health that acknowledges and incorporates these broader components can provide wide-ranging benefits. With this initiative, we will begin to orient towards a broader paradigm of wildlife health inclusive of multiple determinants needed for functioning ecosystems and global health. This initiative will require collaborative partnerships with natural resources, agriculture, public health, social, and environmental sectors as well as collective information sharing with stakeholders and the public on the importance of wildlife health and resilience.



The health of wildlife, domestic animals, and humans is interrelated and influenced by numerous factors. A more holistic view of wildlife health is needed to ensure population resilience and ecosystem services.

Initiative 2: Provide wildlife health intelligence for action.

Wildlife disease remains a central component of wildlife health and understanding the factors that contribute to disease occurrence, and the impacts of disease on populations and ecosystems will continue to be important for promoting wildlife health. The NWHC currently conducts passive surveillance for diseases through a national network of partners who collect essential information on wildlife morbidity and mortality and submit samples for diagnostic evaluation. In order to meet the changing needs of the wildlife health field, we will modify this strategy in collaboration with partners to design a surveillance program that will facilitate early detection of novel pathogens, determine risk factors, and understand disease drivers. This information is needed to make evidence-driven decisions to support resilient populations in the face of wildlife diseases and other emerging health threats.

Initiative 3: Provide wildlife health tools and technology for action.

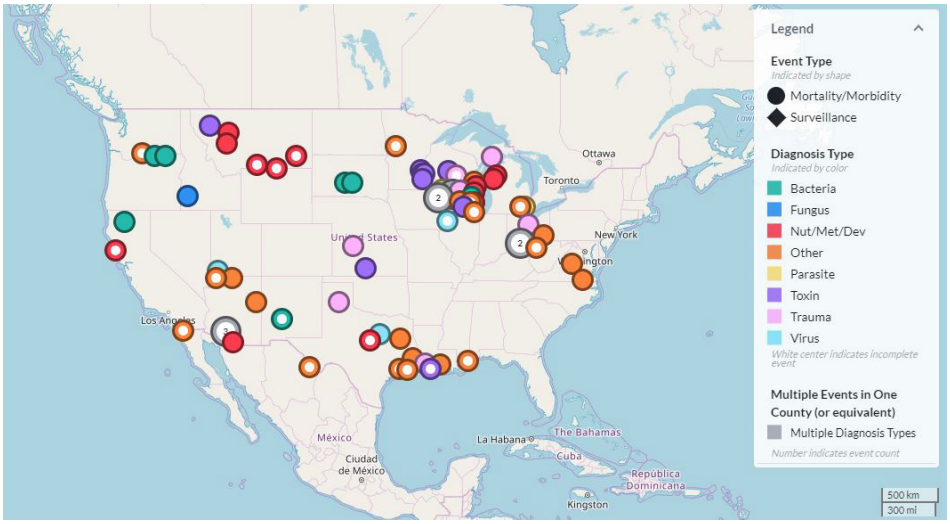
The NWHC will continue to play an important role in pathogen discovery, characterization, development of diagnostic tests and vaccines, and other applied management research to facilitate effective response to disease outbreaks. Additionally, NWHC will explore, develop, and implement new metrics and solutions to assist managers in addressing the wide range of factors (genetic, demographic, environmental, socio-political, etc.) impacting the health of free-ranging wildlife and ecosystems. NWHC will also develop predictive modeling and forecasting tools to allow natural resource managers to make better decisions in the face of uncertainty. Our goal is to provide enhanced tools for managers to assist in decision-making that optimizes health outcomes.

The strategic plan is available online: https://www.usgs.gov/media/files/national-wildlife-health-center-strategic-science-plan-2020-2025.

For questions or to provide feedback, contact: Jonathan Sleeman, jsleeman@usgs.gov.

WHISPers version 2.0 released

Timely awareness of wildlife disease outbreaks can help State, Federal, and Tribal natural resource agencies better understand, manage, and respond to risks. Although individual staff may be aware of current and historic wildlife health issues within their jurisdictions, historically it has been challenging to share this information in real-time with other wildlife professionals and to visualize these events within regional and national contexts. WHISPers, the "Wildlife Health Information Sharing Partnership - event reporting system," is a free, secure tool designed to aid the community of natural resource management professionals in recording and sharing wildlife health event data to better understand potential risks.



WHISPers provides data on wildlife mortality events in the United States.

With input from State and Federal partners, the USGS National Wildlife Health Center released a newly designed WHISPers platform in July 2019. The system houses information on over 8,000 historic and current wildlife mortality events nationwide and allows verified partner natural resource management agencies to add and manage events in the system in real-time. Data security, integrity, and controlled access are central components of WHISPers. Several additional features will be released in early Spring 2020 including notifications to alert users of new events involving species, locations, or diseases of interest; event summary reports; bulk data upload; and within-event collaboration capabilities. Further enhancements will be made following a user experience assessment currently underway by Purdue University and the Science Gateway Community Institute.

WHISPers success depends on a vibrant community of resource management agency users. To learn more about WHISPers and how to join please visit https://whispers.usgs.gov. For more information contact: Bryan Richards, brichards@usgs.gov or WHISPers@usgs.gov.

Development of case definitions for wildlife diseases

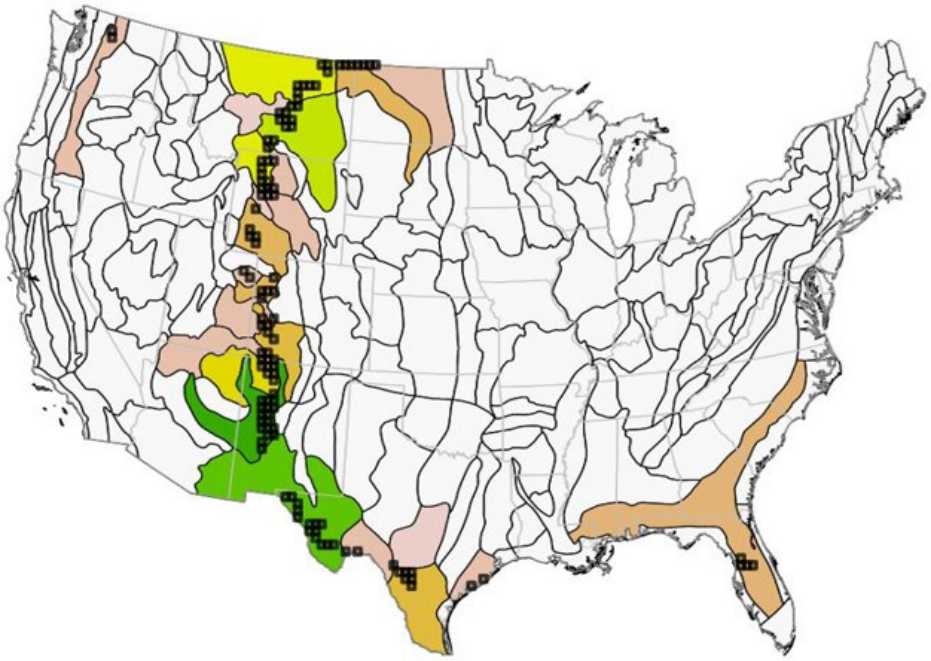
Case definitions provide a standardized set of criteria for diagnosing a "case" of a disease, thereby providing consistency in diagnoses which enable reporting and tracking of diseases across institutions through time. To facilitate sharing of wildlife health information in the United States and Canada, the USGS National Wildlife Health Center (NWHC) and the Canadian Wildlife Health Cooperative (CWHC) recently formed a collaborative working group to develop case definitions for wildlife diseases. In a February 2020 workshop, the group gathered in Madison, Wisconsin to develop a shared case definition template, terminology glossary, and initial drafts of joint case definitions for fifteen infectious and non-infectious avian, mammalian, reptilian, and amphibian wildlife diseases (snake fungal disease, white-nose syndrome, avian cholera, tularemia, trichomoniasis, chronic wasting disease, electrocution, lead poisoning, avian botulism, avian influenza, avian paramyxovirus, canine distemper virus, parvovirus, rabies, and West Nile virus). Travel for this workshop was funded in part by the Canadian Institute for Advanced Research (CIFAR) program "Fungal Kingdom: Threats and Opportunities".

Once finalized, all completed case definitions will be made publicly available. These case definitions will be used by CWHC and NWHC for reporting wildlife diseases. Their use by other institutions is voluntary but if adopted will increase the ability share wildlife disease information among both domestic and international organizations. Case definitions will periodically be reviewed and updated as our understanding of wildlife disease develops and new diagnostic techniques are implemented. For more information about this collaborative case definition effort, contact Kim Miller, kjmiller@usgs.gov.

National white-nose syndrome surveillance

Since Winter 2013/2014, the USGS National Wildlife Health Center (NWHC) has assisted State, Federal, and Tribal wildlife agencies nationwide with active surveillance for *Pseudogymnoascus destructans* (*Pd*), the causative agent of white-nose syndrome (WNS). Nearly 900 sampling kits have been provided to partners over the 6-year period, resulting in analyses of more than 12,000 bat and 4,900 environmental samples collected from 41 states and 441 counties. *P. destructans* has been detected at 174 locations, including 63 sites where clinical signs of the disease were not apparent at the time of sampling. Samples obtained from bats represent >90% of all positive detections as compared to environmental samples. Highlights from the 2018/2019 surveillance season analyzed by NWHC included the first detection of *Pd* in North Dakota (Mercer County) and the first confirmation of WNS in the Western long-eared bat (*Myotis evotis*). The Fringed bat (*M. thysanodes*) was also added to list of species confirmed with WNS in 2019 using an improved DNA microsatellite assay. The bat had been collected and diagnosed with WNS during a previous surveillance season but identified as an unknown *Myotis* species. A total of 13 species of North American bats have now been confirmed with WNS, while *Pd*, in the absence of clinical signs, has been detected on eight additional (sub)species of bats. Pursuant to early results from the 2019/2020 surveillance season, WNS has been confirmed in Texas (Gillespie County), bringing the total to 34 U.S. states and seven Canadian provinces.

Using the previous 10 years of data collected by NWHC and our many partners we also introduced a new, model-derived sampling approach for WNS for the 2019/2020 surveillance season. Benefits of this data-driven approach include improved surveillance efficiency (compared to random sampling) by targeting high risk areas for *Pd* emergence, thereby improving the use of limited surveillance resources and reducing the time to find new hotspots of *Pd* on the landscape. In addition, the new sampling scheme allows for quantitative analyses at a landscape scale necessary for the coordinated disease response planning and resource management actions. The sampling design can be updated to incorporate new pathogen distribution information each season. For more information, contact Anne Ballmann, aballmann@usgs.gov.



Map of the United States showing high priority sampling areas as identified by the *Pd* Strategic Surveillance Model.

Evaluation of guano as a sample substrate for white-nose syndrome surveillance

The USGS National Wildlife Health Center, in collaboration with state and federal partners, has been actively evaluating alternative sample strategies for *Pseudogymnoascus destructans* (*Pd*) surveillance. We determined that *Pd* DNA can be detected in guano deposited at summer roosts of little brown bats (*Myotis lucifugus*) during spring and early summer months in the absence of capturing individual bats. Although *Pd* DNA was only found in guano from states where the fungus was already known to exist, guano was more reliable for *Pd* detection than environmental swabs collected at summer roosts and thus, could serve as alternative sampling strategy for *Pd* surveillance in the future in areas where winter sampling is challenging. For more information, contact Anne Ballmann, aballmann@usgs.gov.

Providing consistent information to managers: Update on harmonization of bat white-nose syndrome diagnostics

When responding to a wildlife disease outbreak, managers depend on clear and consistent diagnostic information to make decisions. However, in the absence of regulatory authority for non-reportable wildlife diseases, standardized diagnostic methods for detecting wildlife pathogens and consistent criteria for interpreting test results are not always available. White-nose syndrome (WNS) is a disease caused by the fungal pathogen *Pseudogymnoascus destructans* (*Pd*) that has spread rapidly and is causing population-level impacts in many species of North American bats. Testing for *Pd* has, historically, been conducted by multiple independent laboratories which use variable testing methodologies and different criteria for interpreting test results. When methodologies and criteria result in inconsistent or conflicting results it can lengthen response times as the discrepancies are resolved. Scientists at the USGS National Wildlife Health Center, in cooperation with the WNS Diagnostic Working Group and the U.S. Fish and Wildlife Service (USFWS) examined the performance characteristics of the qPCR assay most commonly used to detect *Pd* in order to develop consensus standards for WNS diagnostics. Voluntary interlaboratory testing was completed and outcomes were used to establish an agreed-upon, common interpretation language for classifying *Pd* qPCR results. Subsequently, a guidance document was drafted and approved by the WNS Diagnostic Working Group. The language was then incorporated into a revised WNS case definition that is being used for the 2019/2020 sampling season. This language will also be included in a Laboratory Best Practices Handbook for WNS diagnostics targeted for completion by the end of summer 2020. In addition to providing confidence in diagnostic test results needed for wildlife disease management this work serves as an example of successful, voluntary coordination that can be applied to other non-reportable wildlife diseases. For more information please contact Katrina Alger, kalger@usgs.gov.

A moist swab is passed over the surface of the forearm and muzzle of a bat. The swab will be analyzed in the lab for the presence of *Pseudogymnoascus destructans* DNA.

White-nose syndrome vaccine research update

A field study to test the efficacy of several potential vaccine candidates to prevent white-nose syndrome (WNS) in little brown bats is underway in Wisconsin. The vaccine candidates included in the study were authorized for field testing by the USDA Center for Veterinary Biologics after an environmental risk assessment issued a “finding of no significance” in September 2019. More than 300 bats received one of two vaccine candidates or a placebo via oral administration in late fall and early winter at two hibernacula. To identify individuals, bats were fitted with wing bands and passively integrated transponder (PIT) tags. Survival of bats will be assessed visually during late winter surveys and during spring emergence using antenna systems at hibernacula exits. A small group of bats from each treatment group was also placed in rodent-proof cages for more careful and systematic monitoring throughout the winter. Vaccine efficacy will be assessed by comparing survival among groups in the spring. For more details, contact Tonie Rocke, trocke@usgs.gov.

Bat with white-nose syndrome. Credit: U.S. Fish and Wildlife Service

Development of genetic-based tools to address deer and CWD management questions

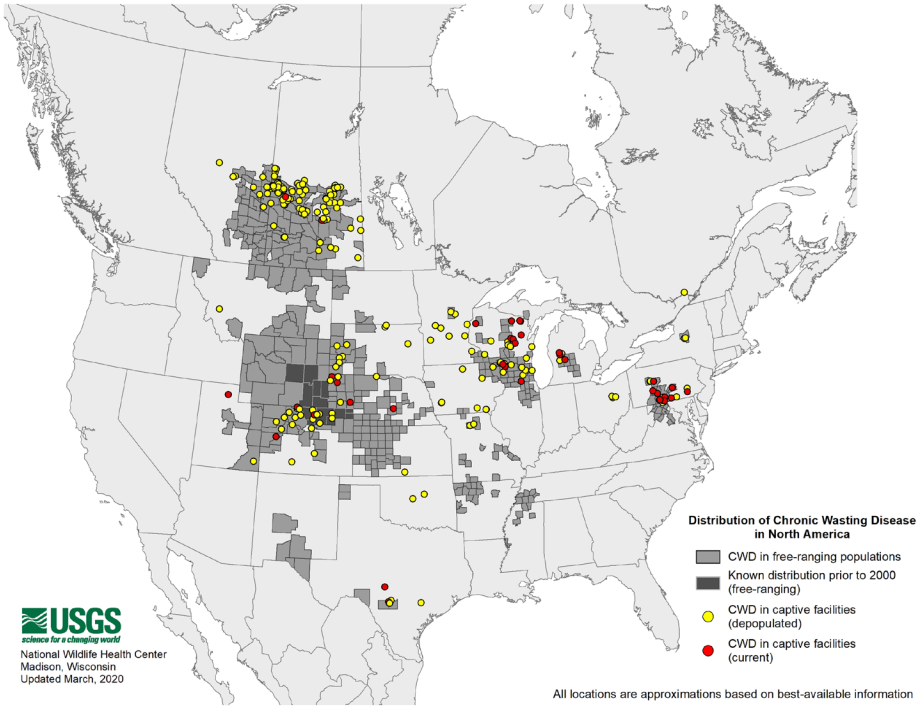
The USGS National Wildlife Health Center is leading a chronic wasting disease (CWD) collaborative research initiative of Midwestern and other state agencies aimed at promoting regional collaboration on deer and CWD research and management. The goal of this initiative is to align CWD efforts across the various agencies to minimize duplication of effort, permit the pooling of resources, and allow the examination of regional-scale questions, while still meeting each member's individual objectives. One joint research endeavor currently being undertaken by the initiative is focused on leveraging recent genetic technological advancements to design a novel suite of efficient, cost-effective, collaborative genomic resources for white-tailed deer that will be commercially available to

White-tailed deer.

wildlife managers and researchers. At a fraction of the cost of current techniques, these tools will be used to address a wide-range of deer and CWD management and research questions including: population assignment of wild deer; distinguishing captive and wild deer; screening prion protein (PRNP) gene variation; and investigating the connection between relatedness, landscape dynamics, and spread of diseases. This project is being funded by the Michigan Department of Natural Resources, Michigan State University, and the Association of Fish and Wildlife Agencies. The Principal Investigators include geneticists from the Michigan Department of Natural Resources (DNR), Iowa State University, National Oceanic Atmospheric Administration (NOAA) Auke Bay Genetics Laboratory, University of Wisconsin-Milwaukee, and Texas A&M University-Kingsville, and involves partners from Iowa, Georgia, Michigan, Minnesota, Mississippi, Missouri, Pennsylvania, South Dakota, and Wisconsin state wildlife agencies. For more information please contact Daniel Walsh, dwalsh@usgs.gov

Chronic wasting disease – Expanding documented geographic distribution

Between January 2019 and February 2020, the documented distribution of chronic wasting disease (CWD) continued to expand. According to state-based 2019 surveillance (which for some states crosses into calendar year 2020) data collated by the USGS National Wildlife Health Center, detections of CWD in free-ranging cervids occurred in 38 new counties in 11 states in the United States. These detections were made in Arkansas (one county), Iowa (four counties), Minnesota (two counties), Mississippi (two counties), Montana (nine counties), North Dakota (two counties), South Dakota (eight counties), Tennessee (four counties), Texas (one county), Virginia (two counties), and Wisconsin (three counties). To date, CWD has been documented in free-ranging cervids in a total of 311 counties in 24 U.S. states. The distribution of CWD



Distribution of documented chronic wasting disease in North America. Updated March 4, 2020.

CWD – Expanding documented geographic distribution, continued

in captive cervid facilities has also expanded, with 19 new facilities in nine states in 2019 and seven additional facilities in six states as of February 2020. Captive facility detections during this time frame occurred in Colorado (two), Iowa (two), Michigan (two), Minnesota (two), Montana (one), Nebraska (one), Oklahoma (one), Pennsylvania (10), South Dakota (two), Texas (one) and Wisconsin (two). To date, CWD has been detected in 128 commercial captive cervid facilities in 17 U.S. states. The current CWD distribution map, based on best-available data, is also available from the USGS National Wildlife Health Center: https://www.usgs.gov/centers/nwhc/science/expanding-distribution-chronic-wasting-disease. For more information contact Bryan Richards, brichards@usgs.gov.

New chronic wasting disease publications available

Escobar, L.E. et al., 2019, The ecology of chronic wasting disease: Biological Reviews. https://doi.org/10.1111/brv.12568

This publication, co-authored by USGS National Wildlife Health Center research biologist Dan Grear, summarizes and synthesizes the current state of knowledge about chronic wasting disease including prion etiology, CWD epidemiology, CWD ecology, and landscape ecology of CWD hosts.

Hopkins, M.C., et al., 2019, Chronic wasting disease—Research by the U.S. Geological Survey and partners (ver. 2.0, November 2019): U.S. Geological Survey Open-File Report 2019–1109, 29 p., https://doi.org/10.3133/ofr20191109.

This new USGS Open-File Report details CWD research by USGS and partners to support management of CWD-affected species and their habitats.

Investigating the effects of harmful algal toxins on wildlife health

Wild bird mortality events have been circumstantially linked to harmful algal toxins via detection of toxins in affected animals. Confirmation, however, has been hampered by limited data on toxin residence time in tissues and tissue lesions associated with toxin exposure. To better understand the effects of algal toxins on wildlife, the USGS National Wildlife Health Center (NWHC) has initiated several research studies to examine the effects of both marine (i.e., saxitoxin) and freshwater (i.e., microcystin-LR) algal toxins.

Experimental trials for saxitoxin were conducted in mallards and zebra finches, both common laboratory avian models, to determine the LD50 (dose at which 50% of birds die) and establish baseline data and methods that can be transferred to other avian species. The calculated LD50 for mallards was 167 ug/kg and for zebra finches it was 237 ug/kg. Saxitoxin was detected in fecal samples, collected from all mallards that survived initial dosing, for up to 48 hours, and two birds had saxitoxin detected in fecal samples at the end of the sampling period (7 days). Toxin was infrequently detected in tissues including heart, kidney, liver, lung, and breast muscle from birds that died acutely (those that died or were euthanized <2 hours after dosing) but was detected throughout the gastro-intestinal tract. No gross or microscopic lesions were observed that could be attributable

Common Murres in a colony in Cook Inlet, Alaska. Common murres are regularly exposed to saxitoxin in Alaskan marine waters and often found dead during mortality events suspected to have been caused by the toxin.

Investigating the effects of harmful algal toxins on wildlife health, continued

to saxitoxin exposure in mallards. Tissue concentrations for zebra finches could not be determined due to their small size but samples were collected to examine for the presence of microscopic lesions and results are pending. Future work will include a collaboration with the USGS Alaska Science Center and others to initiate similar studies in common murres, a common species regularly exposed to saxitoxin in Alaskan marine waters and often found dead during mortality events suspected to have been caused by the toxin.

Similar studies have been initiated to examine effects of microcystin-LR on zebra finches. Finches died acutely (<24 hours after dosing) after being dosed with toxin. Finches exposed to microcystin-LR had both gross and microscopic lesions. On gross examination, the livers of zebra finches that were lethally dosed with microcystin were enlarged and pale, with variable areas of scarlet red due to hemorrhaging. Histopathology revealed acute necrosis in the liver, spleen, and kidney of affected birds.

Future studies are being planned to examine the effect of low-dose chronic exposure (versus high-dose acute exposure) which is thought to be common for free-ranging wild birds and may cause indirect effects such as reduced ability to forage leading to starvation or other chronic long-term consequences. For more information contact Bob Dusek, rdusek@usgs.gov.

Climate change and wildlife health workshop

On January 7-9, 2020, the USGS Northeast Climate Adaption Science Center and the USGS National Wildlife Health Center sponsored a Climate Change and Wildlife Health workshop in Madison, Wisconsin for Federal, State, and Tribal wildlife managers and policy makers, university and wildlife organization scientists and leaders. Presentations on climate change, climatology, and wildlife species responses to climate change were followed by group discussions to identify knowledge gaps and intervention strategies that may enable wildlife to adapt to the effects of climate change. Scientific gaps identified by these groups included the need to define and develop metrics to measure wildlife population health. The need to record wildlife disease events, as well as systematically collect long-term data on wildlife health, and share this data electronically with wildlife health partners was also expressed as an important area for continued development. Lastly, the integration of wildlife disease data with long-term environmental data sets was proposed as a means for assessing changes in disease risk posed by changing climates.

Participants at the Climate Change and Wildlife Health Workshop held January 7-9, 2020 in Madison, Wisconsin.

The 59 workshop participants included scientists from the Department of the Interior's U.S. Geological Survey, U.S. Fish and Wildlife Service, and National Park Service; U.S. Department of Agriculture's Forest Service; National Oceanic and Atmospheric Administration; the Great Lakes Indian Fish and Wildlife Commission; the Native American Fish and Wildlife Society; the Canadian Wildlife Health Cooperative; Arizona, Oregon, Washington, and Wisconsin Departments of Fish and Game or Natural Resources; the Southeastern Cooperative Wildlife Disease Study; Universities including Calgary, Michigan State, Tennessee, Notre Dame, South Florida, and Wisconsin; and organizations including the Association of Fish and Wildlife Agencies, Wildlife Conservation Society, and the Wildlife Disease Association. For more information contact Erik Hofmeister, ehofmeister@usgs.gov.

We are here to help meet your wildlife health needs

The USGS National Wildlife Health Center (NWHC) assists State, Federal and Tribal natural resource partners in the investigation of wildlife morbidity and mortality events in the United States. For routine services, the only cost incurred by partners is for collection and shipment of carcasses to the NWHC. Analyses for each diagnostic case are initiated within an average of 48 hours following receipt of carcasses, and initial findings are communicated back to the submitter within 24 to 48 hours following necropsy. The NWHC can provide management recommendations as well as assist partners with communication and messaging during wildlife mortality events. Investigation of morbidity and mortality events in wildlife is a collaborative effort, and the NWHC thanks AFWA partners for allowing us to assist you in your management decisions. If you are a new partner interested in exploring the services we provide, or if you currently work with us and would like to know more about other capabilities at the NWHC that may meet your agency needs, please contact us at nwhc-epi@usgs.gov or visit our Diagnostic Services page at www.usgs.gov/nwhc/services.

More Information from the NWHC

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