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

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The following information is of a topical nature for wildlife management agencies and entities; many partners and collaborators are involved in gathering and researching the information herein.

Field Investigation Team Summaries: September 2007 to June 2008

Second year of mortality from non-native parasites in Montana (MT)
In mid-September 2007 and for the second consecutive year, significant mortality due to parasites has been observed in American coots on Georgetown Lake (Deer Lodge County: mortality ~1500) and Smith Lake (Flathead County; mortality ~200). The estimated mortality on Georgetown Lake is higher than the mortality estimates in 2006. American coots examined at the NWHC had intestinal impactions and were found to be infected with the non-native trematode *Cyathacotyle bushiensis*. The intermediate host of the this parasite is the non-native faucet snail (*Bithynia tentaculata).* Coccidia spp., a protozoan parasite, was also reported in birds from this event.

Rattlesnake Reservoir (Yellowstone County; mortality ~100), outside of Billings, had mortality between March and April 2008 in multiple duck species from *Sphaeridiotrema globulus*. *Sphaeridiotrema* has been identified in this lake in previous years and it also utilizes the non-native faucet snail as an intermediate host. NWHC parasitologists and Montana Fish, Wildlife, and Park plan to sample snails for parasites at several locations this summer.

Avian cholera outbreaks throughout California (CA)
Several counties in California have reported outbreaks of avian cholera in a variety of waterfowl beginning in mid-December through March 2008. The most commonly afflicted species is American coot, but ruddy ducks, green-winged teal, widgeon, mallard, northern pintail, snow geese, white-fronted geese, and trumpeter swans have been affected. Aleutian Canada geese, removed from the endangered species list in 2001, were involved at the avian cholera outbreak at San Joaquin National Wildlife Refuge in Stanislaus County. Other refuges with avian cholera outbreaks include Butte Sink NWR in Sutter County, Colusa NWR in Colusa County, Sacramento NWR in Glenn County, Salton Sea NWR in Imperial County, Lower Klamath NWR and Tule Lake in Siskiyou County. California Department of Fish and Game investigated mortality in Del Norte, Humboldt, and Sutter Counties and in the San Francisco Bay area. Current mortality estimates are over 7,000 birds. Many of these outbreaks are ongoing so final mortality numbers are not available.

Avian cholera outbreaks in the Central and Mississippi Flyways (NM, KS, NE, MO, IA, TN)
Substantial outbreaks of avian cholera had not been seen in the Mississippi and Central Flyways for several years. Snow geese were a primary species involved and are known carriers of the bacterial agent of avian cholera, *Pasturella multocida.* Other species affected included Ross' and greater white-fronted geese, with multiple species of waterfowl (mallards, northern pintails, teal, etc.). In autumn 2007 and spring 2008, disease events occurred in several locations including Bosque del Apache National Wildlife Refuge in New Mexico, which estimated losses at 4000 birds. Known mortality totaled over 2300 snow geese and 473 Ross' geese. Other areas with substantial losses included Lake McKinney (Kearny Co.) in western Kansas with 550 birds dying, and several waterfowl production areas in the Rainwater Basin Wildlife Management Area in Nebraska losing about 600 birds. Outbreaks occurred at Rush Lake (Palo Alto Co.) in Iowa (mortality of 224 birds); Mississippi Co., Missouri (75 birds); and Black Bayou Refuge, Lake Co., Tennessee (50 birds).

Great Salt Lake mortality in eared grebes and northern shovelers (UT)
Avian cholera outbreaks at the Great Salt Lake gained national attention this year. Of the two events, the first occurred in eared grebes near Promontory Point in November. Surveys conducted by Utah Division of Wildlife Resources estimated 15,000 eared grebes died out of a population of 1.5 million. Previous significant outbreaks occurred in 1994 where 15,000 grebes died; 44,000 in 1998; 30,000 in 2002; and 30,000 in 2004. This event appeared to subside around the beginning of December. A second event started mid-December about 15 miles away near the town of Saltair, Utah. The second event primarily involved northern shovelers with some California gulls and green-winged teal. An estimated 1,500 northern shovelers succumbed to avian cholera. The majority of mortality seemed to be over by the end of the year. Several media sources picked up the story, including the New York Times and Salt Lake Tribune.

Zinc phosphide poisoning in cackling and Canada geese (OR)
Zinc phosphide poisoning was the cause of death in at least 100 cackling and Canada geese in Multnomah and Washington counties in Oregon between August 2007 and April 2008. Zinc phosphide is used as a rodenticide. Most birds were found dead, but those found sick were lethargic, swimming in circles, and unable to escape capture. Birds dying of zinc phosphide appear relatively normal on gross examination. Tissues must be examined for the presence of phosphine gas, a metabolite of phosphide. Zinc phosphide has been an issue in the Willamette Valley of Oregon in recent years as it is used by grass-seed growers against voles.

Red-tailed hawk poisoning in Crook County, Oregon (OR)
Eleven red-tailed hawks were found sick or dead in Crook County in southern Oregon between March and April 2007. A similar event may have happened last year. Hawks were suspected to have fed on birds that were secondarily poisoned by a cattle pesticide treatment. Tests at NWHC showed inhibition of brain cholinesterase, indicating poisoning by an organophosphate. Further tests are being conducted by the USFWS Forensics Lab in Ashland, OR.

White-Nose Syndrome in Bats (MA, NY, VT, NH, CT)

Investigations continue into the cause of a mysterious illness that has resulted in the deaths of thousands of bats since March 2008. At more than 25 caves and mines in the northeastern U.S, bats exhibiting a condition now referred to as "white-nosed syndrome" have been dying. The USGS National Wildlife Health Center recently issued a Wildlife Health Bulletin, advising wildlife and conservation officials throughout the U.S. to be on the lookout for the condition known as "white-nose syndrome" and to report suspected cases of the disease. A Wildlife Disease Specialist from the USGS National Wildlife Health Center (NWHC) met with biologists in some affected areas in March 2008 and collected environmental samples from affected caves and mines in Vermont, New York and Massachusetts. Live, dead and dying bats were documented in and outside of their hibernacula.

Since February 2008, the NWHC has received over 100 bat carcasses, both euthanized and recently dead. Species include little brown, big brown, northern long-eared and eastern pipistrelle bats, and most of these bats have been from New York, Vermont, Massachusetts, and Connecticut.

The most common findings in the bats have been emaciation and poor body condition. Many of the bats examined had little or no body fat. A subset of the bats examined also exhibited changes in the lung that have been difficult to characterize. A majority of bats had microscopic fungal hyphae on the external surfaces of their bodies. The white substance observed on some bats may represent an overgrowth of normal fungal colonizers of bat skin during hibernation and could be an indicator of overall poor health, rather than a primary pathogen. Investigations into the cause of the morbidity, including underlying environmental factors, potential secondary microbial pathogens and/or toxicants, are underway.

H5N1 Highly Pathogenic Avian Influenza

The Federal, State and Tribal partnership formed to develop and implement the National Interagency Early Detection System for Highly Pathogenic H5N1 Avian Influenza in Wild Migratory Birds has continued into the third year of surveillance. Birds have been tested from all 50 states and 6 freely-associated states and territories. While the surveillance focused on waterfowl, shorebirds, gulls and terns, a total of 284 species were sampled. During the 2007 sampling year (April 1, 2007 – March 31, 2008) cooperating agencies collected and analyzed over 90,000 wild bird samples and the highly pathogenic avian influenza H5N1 virus was **not** detected. Samples from 28 birds were positive for low path H5N1 North American lineage avian influenza viruses. Since April 1, 2008, a total of 3,746 birds have been sampled for avian influenza at the NWHC. Of these, five have tested positive for low-path avian influenza based on molecular screening; none of these were H5 positive.

Up-to-date information on the U.S. wild bird surveillance program including the number of birds tested and the wide geographic distribution of samples collected, and information on the low path H5N1 virus isolates detected, can be seen at: http://wildlifedisease.nbii.gov/ai/.

NWHC staff participated in avian influenza table-top exercises hosted by the Washington State Department of Agriculture and another hosted by the Alaska Department of the Environmental Conservation, and presented at international meetings in Moscow and Yakutsk, Russia and Barcelona, Spain.

Surveillance activities for highly pathogenic H5N1 avian influenza are also occurring in Canada. Current information on results of their sampling and testing can be found at the website of the Canadian Cooperative Wildlife Health Center: http://wildlife1usask.ca/en/aiv/index.php

Modeling the Dynamics of Avian Influenza in Wild Birds and Potential Transmission with Domestic Fowl

The objective of this project is to develop a simplified epidemiological model of AI transmission among wild birds and wetland ecosystems and to consider potential routes of transmission between wild and domestic birds. Currently little is known about the many factors that likely influence the dynamics of AI in wild birds. This project will focus on simple models that incorporate rates of virus shedding, infection, and recovery for wild bird populations; input and turnover of virus in wetland systems; and alternative routes of transmission between wild and domestic birds (e.g., common wetlands, use of contaminated water, exposure via field contamination). Model development, complexity, and initial parameter estimation will be based on information or data obtained from published and unpublished reports and on knowledge provided by wildlife disease experts.

Chronic Wasting Disease (CWD) Research

Susceptibility of various small rodent species to CWD
The susceptibility of various small rodent species to CWD has and is being examined by intra-cerebral challenge studies at the NWHC. Meadow voles (*Microtus pennsylvanicus*) are very susceptible to intra-cerebral CWD challenge, with 100% penetrance and a median post-challenge survival time of 270 days. The incubation period shortens significantly upon second passage. Deer mice (*Peromyscus maniculatus*) and white-footed mice (*P. leucopus*) have proven to be relatively resistant to the disease, although resistance is not complete. Red-backed voles (*Myodes gapperi*) challenge studies are still underway, but appear to be no more susceptible than meadow voles. Experiments are being initiated with the University of Wisconsin to further explore the implications of voles' susceptibility to CWD, especially the likelihood of voles acquiring infections via natural routes. Among other things, we will be examining whether soil minerals potentiate the oral infectivity of CWD in voles, as has been demonstrated by Aiken and Pederson for a prion/hamster model system.

Statistical spatial-temporal epidemiological models of CWD
In conjunction with the Wisconsin Department of Natural Resources and other partners, the NWHC has been developing statistical spatial-temporal epidemiological models of CWD epidemics in free-ranging cervids. Substantial progress has been made in developing new statistical "backcasting" models based on dynamic process theory that allow the estimation of the rates at which the disease is growing and spreading. The analyses have discovered that substantial fine-scale spatial heterogeneity exists in infectivity, and spatial patterns in infectivity seem quite stable over time.

Persistence of CWD prions and factors affecting their degradation
An environmental reservoir of infectivity contributes to the natural transmission of chronic wasting disease (CWD) and a growing number of studies suggest that soil serves to preserve infectivity and potentially spread disease. A general paucity in the understanding of the fate of CWD agent (prions) in the environment as well as the mechanism of environmental CWD transmission limits disease management and control efforts. The goal of this study is to test the hypothesis that the fate of prions in the environment is affected by soil, plants and microbes. Results from these studies can provide insight into the mechanisms of CWD transmission in the environment and potentially provide methods for bioremediation of prion-contaminated soil.

CWD Meeting Announcements
Alberta Fish and Wildlife and Saskatchewan Ministry of Environment will co-host a CWD Workshop August 8 & 9 in Edmonton, Alberta. The workshop will immediately follow the Wildlife Disease Association Conference (August 3-8) in Edmonton and will focus on agency responses to detection of CWD.

The Third International CWD Symposium will be held in July 2009 in Park City Utah. The Utah Division of Wildlife Resources has graciously agreed to host the meeting. Conference dates, details and a call for papers are forthcoming.

The USGS is currently planning a CWD surveillance workshop to be held in July 2008. Attendance will be by invitation only and the workshop will focus on providing guidance to states, provinces, tribes and federal agencies conducting CWD surveillance. The major questions to be addressed are (1) how to best conduct detection surveillance in a more efficient and cost-effective manner, and (2) how to best conduct outbreak (monitoring) surveillance in a more efficient and cost-effective manner.

Sage Grouse and West Nile Virus (CO, ID, MT, NV, ND, OR, SD, WY, UT, CA)

Overall, West Nile virus (WNV) mortality has now been reported in sage-grouse in California, Colorado, Idaho, Montana, Nevada, Oregon, North Dakota, South Dakota, Utah and Wyoming, as well as Alberta, Canada. Experimental studies at the USDA National Wildlife Research Center have shown that WNV is usually fatal to sage-grouse, resulting in death within 6 days of infection, although antibody to the virus has been found in live wild sage-grouse. In FY-08, the National Wildlife Health Center is continuing the investigation of WNV in greater sage-grouse, passerines, and wild horses in Nevada and Oregon, as part of a USGS sagebrush biome research program.

Plague Outbreak in Conata Basin, South Dakota

On May 15, 2008, sylvatic plague, which is transmitted by fleas, was confirmed in prairie dog colonies in the Conata Basin Area. U.S. Fish and Wildlife Service indicated that about 9,000 acres of prairie dog habitat have been affected as of June 19, and that some of the affected areas include colonies occupied by black-footed ferrets. Prairie dogs are the main food source for the black-footed ferrets. Strategies to control the outbreak include applying insecticide to reduce the flea populations in prairie dog colonies that have high value to black-footed ferrets, but that have not yet experience plague die-offs. Another strategy is vaccinating some of the ferrets. As of June 15, 19 ferrets have been captured and given the vaccine, which was developed at the USGS National Wildlife Health Center. NWHC staff have been participating in conference calls regarding this outbreak and are closely following events.

Amphibian Diseases: Chytrid Fungus in the Pacific Northwest (CA, OR, WA)

Chytrid fungus is one of a few primary pathogens commonly determined to cause death in amphibians. The pathogen is detected by the examination of amphibian tissues under a light microscope and looking for the physical presence of the fungus. While accurate, such a system is time consuming and it is not practical to examine large numbers of samples. The NWHC modified and brought on board an RT-PCR molecular test that can more rapidly detect fungus in amphibian tissues. In collaboration with USGS, scientists in CA and OR collected swabs from live tadpoles and adult frogs to survey amphibians from specific watersheds for the presence of chytrid fungus. The samples were tested and reports are currently being written.

THANK YOU

The NWHC thanks all the state, federal and tribal agencies who worked with us the past year. We are at your service to provide technical support, field investigation assistance and diagnostic capabilities as your needs dictate.

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