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

March 2013

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

Creating a National Fish and Wildlife Health Network

An integrated, national network for coordinating fish and wildlife disease surveillance, laboratory analysis, information dissemination, communication, and response across federal, state and tribal agencies and other stakeholders is imperative. To achieve this, a multi-disciplinary group of wildlife professionals from federal, state, and non-governmental organizations is proposing to create a National Fish and Wildlife Health Network. This Network will establish a collaborative framework by which government agencies, tribes, universities and professional conservation organizations can cooperate and assist tribal, state, and federal agencies to manage diseases of free-ranging fish and wildlife. The mission of the Network will be achieved through partnerships and the collective adoption of protocols, procedures, and actions to address fish and wildlife health issues. A Coordinating Committee will be established to create, oversee, and coordinate implementation of the Network; the committee will be a partnership of public and private sectors assembled to promote and guide actions of the Network. The primary stakeholders and users of this Network are those tribal, state, and federal government agencies responsible for managing the health of free-ranging fish, terrestrial wildlife, and marine animal populations and their diseases. The Network will initially focus on: 1) wildlife diagnostic laboratory protocols; 2) disease information management and dissemination; 3) coordinated disease surveillance; 4) interagency communication and response plans; and 5) species specific health issues. The Network will address deficiencies in fish and wildlife disease monitoring and prevention programs where they exist, and facilitate the work of existing systems. Creating this Network will be an important step in addressing the critical need to protect the Nation's fish and wildlife health. **Contact:** Jonathan Sleeman, 608-270-2401, jsleeman@usgs.gov.

Wildlife Highlights

White-nose syndrome update for winter 2012/2013

White-nose syndrome (WNS) in cave-hibernating bats has recently been confirmed in several counties in Illinois, Georgia, and South Carolina, and on Prince Edward Island (Canada) during winter 2012/2013 bringing the total number of affected states and Canadian provinces to 22 and 5, respectively. Expansion of WNS now extends west of the Mississippi River to Crawford County, Missouri, and south to Jackson County, Alabama, more than 800 miles (1,300 km) from the presumed index site in Schoharie County, New York. The disease continues to spread into new counties within WNS-endemic states and provinces. Several of these range expansions have been associated with bat mortality or significant decreases in winter bat population counts, while others report only visible manifestation of fungal growth on a small percentage of hibernating bats. An analysis completed by USFWS biologists and collaborators estimates that since 2006, over 5 million bats have died from WNS. Endangered gray bats (*Myotis grisescens*) were added last winter season to the list of cave bat species susceptible to WNS, which includes little brown, northern long-eared, tri-colored, Indiana (endangered), eastern small-footed, and big brown bats. For the latest WNS updates, consult NWHC Wildlife Health Bulletins: http://www.nwhc.usgs.gov/publications/wildlife_health_bulletins/index.jsp. Current bat submission guidelines to NWHC are available at: http://www.nwhc.usgs.gov/disease_information/white-

nose_syndrome/USGS_NWHC_Bat_WNS_submission_protocol.pdf
Contacts: Anne Ballmann, National Wildlife Health Center, 608-270-2445, aballmann@usgs.gov

White-nose syndrome research updates, 2013
USGS scientists are working closely with the USFWS, state natural resource agencies, academic institutions, and non-governmental organizations to lead ongoing disease investigations, research, and development of strategies to mitigate the effects of WNS. Numerous discoveries stemming from collaborative research conducted at the NWHC and contributing to our current understanding of WNS were reported in 2012, including: demonstration, in support of the novel pathogen hypothesis, that a European isolate of *Geomyces destructans* was lethal to North American bats; determination that infection by *G. destructans* disrupts bat hibernation; characterization of the influence of temperature on growth of *G. destructans*; development of an enhanced molecular method (real-time PCR) to detect *G. destructans*; description of numerous non-pathogenic fungal relatives of *G. destructans* commonly found in bat hibernacula; demonstration that bat hibernacula serve as long-term reservoirs for *G. destructans*; and linkage of WNS to electrolyte depletion in hibernating bats. Ongoing WNS research efforts include investigating the fine-scale role of environmental conditions in manifestation of WNS and assessing the risk for disease transmission outside of the hibernation season. **Contact:** David Blehert, National Wildlife Health Center, 608-270-2466, dblehert@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 black-footed ferret. Field trials completed in 2012 confirmed the safety of the vaccine in wild prairie dogs and non-target animals. Work is underway to begin field trials to assess vaccine efficacy in free-ranging prairie dogs in 2013. **Contact**: Tonie Rocke, National Wildlife Health Center, 608-270-2451, trocke@usgs.gov

Fungal Dermatitis of Snakes
Since 2006, a novel fatal disease characterized by skin lesions and facial disfigurement has emerged in snakes from the Northeastern, Upper Midwestern, and Southeastern United States. Post-mortem findings have implicated a fungal pathogen, *Chrysosporium ophiodiicola*, but the causative agent has not been definitively identified. NWHC scientists are collaborating with states and USFWS to establish diagnostic and research capacity to confirm and further characterize the causative agent of this disease, and to determine whether the disease is causing population-level impacts. **Contact:** David Blehert, National Wildlife Health Center, 608-270-2466, dblehert@usgs.gov

Monitoring avian botulism at Great Lakes beaches
Avian botulism is caused by a toxin produced by the bacterium *Clostridium botulinum*, which is widespread in soil. *C. botulinum* is usually dormant, but can germinate in aquatic environments during warm temperatures where there is anoxia (caused by conditions such as decomposing *Cladophora* algae or other vegetation) and available protein sources (e.g., the remains of small animals such as insects and invertebrates). Botulism is one of the most significant causes of wild bird mortality worldwide and avian botulism type E has caused large-scale bird deaths in the Great Lakes since the 1960s.

Scientists from the USGS and the National Park Service (NPS) are collaborating to explore the ecological pathways through which botulism toxin is transported to birds by collecting environmental data and tracking type E botulism related wildlife deaths. Key components of this project are the NPS-Sleeping Bear Dunes and USGS-National Wildlife Health Center AMBLE (Avian Monitoring for Botulism Lakeshore Events)

volunteer beach monitors, who assist in recording timing, numbers, and species of bird carcasses deposited on beaches. In 2012, additional USGS beach monitors were hired and have provided support to the project through increased frequency of monitoring (e.g., daily) at more Great Lakes beach locations throughout the field season.

Botulism type E was confirmed in multiple species submitted to the NWHC for testing during both high and low mortality years, demonstrating that low-level avian botulism type E mortality can occur in the absence of large die-off events. Common loons, long-tailed ducks, horned grebes, double-crested cormorants, and ring-billed gulls were the most frequently found carcasses. Approximately 60% of the bird carcasses tested by the NWHC have returned positive results, indicating that botulism type E is the main driver for these mortality events. This information will help wildlife managers understand the environmental conditions and disease pathways that result in the deaths of birds and other wildlife. This study is funded by the Great Lakes Restoration Initiative. More information about AMBLE can be found at http://www.nwhc.usgs.gov/AMBLE/
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Disease Investigations

Mass mortality of Hieroglyphic River Cooters at rural Mississippi lake (Mississippi)
River cooters are omnivorous, freshwater turtles native to the central and eastern US. They are generally found in rivers with a moderate current, but can also be found in lakes and tidal marshes. An estimated 600 river cooters (*Pseudemys concinna hieroglyphica*) were reported dead at a wooded lake in rural Mississippi in early May 2012. Several private residences with lakeshore access described finding dead turtles all around the lake. The total turtle population density for the location is not known and other turtle species were suspected to reside at the lake as well; however, only river cooters (predominantly adults) appeared to be involved in the die-off. Grass carp had recently been added to the lake to help control aquatic vegetation overgrowth. Common findings among the turtles included good nutritional condition and lack of significant gross or microscopic lesions in multiple tissues. No underlying infectious diseases were detected from bacterial and viral cultures. A variety of parasites were identified but none were at burdens considered likely to have a significant impact on the animal's health. Toxicology analyses were negative for heavy metals and over 40 common toxic compounds. Free microcystin and cylindrospermopsin were detected in the livers of two turtles; these toxins are produced by various cyanobacteria (blue-green algae) and may have been the source of mortality in this event. The relative sensitivity of river cooters to these toxins compared to other species is unknown; a higher sensitivity could explain why only cooters were affected. **Contact:** Anne Ballmann, National Wildlife Health Center, 608-270-2445, aballmann@usgs.gov

Increased Roseate Tern chick mortality observed at Great Gull Island (New York)
Greater than usual chick mortality (75 total) was observed in a well-studied population of Roseate Terns (*Sterna dougalli*) this past spring on Great Gull Island (New York). In previous seasons, fluctuations in the prey base and starvation were suspected to be the cause of chick mortality. Fourteen 2- to 3-day-old chicks were submitted to the NWHC for diagnostic evaluation this season; seven chicks were examined. All chicks were emaciated; some had evidence of hemorrhaging into the intestines, suggesting simple starvation as the cause of emaciation. No underlying bacterial or viral diseases were detected. Roseate Terns of the Northern Atlantic subpopulation are federally listed as endangered. Threats to population recovery include predation at nesting sites, habitat degradation from erosion and/or invasive plants, human disturbance, and contaminants. Great Gull Island supports the largest nesting colony (1,300 pairs) of Roseate Terns in the Northeastern US.
Contact: Anne Ballmann, National Wildlife Health Center, 608-270-2445, aballmann@usgs.gov

Muskrat mortality observed at two northeastern wildlife refuges (Massachusetts)
Approximately 11 adult muskrats (*Ondantra zibethicus*) were found sick or dead on the Assabet River NWR and Great Meadows NWR sporadically over a two month period beginning in mid-March 2012. These two refuges are separated by approximately 8 miles but share a common watershed. Clinical signs observed in affected muskrats included lethargy and lack of awareness of their surroundings. Animals submitted to NWHC for diagnostic evaluation were consistently found to be emaciated. Although tularemia was a concern, bacterial cultures were negative for all animals tested as were viral cultures. One specimen submitted from each of the two refuges had evidence of renal nephrosis and acute kidney failure which was the primary cause of death. The precise etiology for the kidney failure was unclear; however, a small number of suspect calcium oxalate crystals were detected in one individual. Common sources of calcium oxalates are antifreeze (ethylene glycol) or various plants such as Philodendrens, Diffenbachia, Jack-in-the-Pulpit, and skunk cabbage. The origin of suspect oxalate exposure could not be identified, and the number of crystals present was not sufficient to diagnose poisoning by antifreeze. Another interesting finding among several muskrats examined was the presence of the apicomplexan protozoal parasite *Frenkelia* sp. encysted in brain tissues. No inflammation or necrosis was associated with the presence of the parasites as can sometimes occur in this species, so these infections were not thought to have directly contributed to their death. **Contact:** Anne Ballmann, National Wildlife Health Center, 608-270-2445, aballmann@usgs.gov

Mudpuppy mortality at Big Cormorant Lake (Minnesota)
In May 2012, biologists with the Minnesota Department of Natural Resources reported thousands of dead common mudpuppies (*Necturus maculosus*) at Big Cormorant Lake, Becker County, Minnesota. The carcasses were observed on shore up to 10 feet from the water's edge. Since mudpuppies are fully aquatic salamanders that never form air-breathing lungs, instead relying on external gills behind their heads to breathe, this distance from the water suggested that sick animals crawled out of the water before dying. Seven animals were submitted to the NWHC for examination. The primary finding for the examined animals was emaciation. No pathogenic bacteria or viruses were isolated from the tissues, but most of the examined animals had saprolegniasis (watermold skin infections); however, it could not be determined whether the watermold growth occurred before or after death, as only one mudpuppy arrived alive and watermold growth can occur post-mortem on dead, chilled animals. NWHC has been involved with investigations of three other mudpuppy mortality events since 2000 in which a definitive cause of death could not be determined. Although botulism was associated with mortality of other animal species at one of the previous mudpuppy mortality events, botulism tests performed on samples from these mudpuppies were inconclusive. Severe autolysis (decomposition) in the other case interfered with histologic interpretation. Chytrid fungus and ranavirus have not yet been documented in this species. **Contact:** LeAnn White, National Wildlife Health Center, 608-270-2491, clwhite@usgs.gov

Investigating alopecia in polar bears of the South Beaufort Sea (Alaska)
During late March through May of 2012, the USGS Alaska Science Center Polar Bear Project field capture crew observed alopecia on 23 of 82 (28%) bears captured at the boundary of the Southern Beaufort Sea off the North Slope of Alaska. The USGS Polar Bear Project and the NWHC are investigating the occurrence of the alopecia using various samples that were collected from anesthetized bears during the 2012 field season to attempt to determine the cause of these abnormalities and their potential implications for polar bear health. Similar cases of alopecia were previously observed in approximately 19% of the bears captured by the USGS Polar Bear Project in 1999. Histopathologic findings in biopsy samples from 2012 bears were consistent and characterized by epidermal and follicular hyperkeratosis with variable secondary bacterial folliculitis. These findings are most suggestive of hormonal or nutritional abnormalities, such as hypothyroidism or Vitamin A deficiency, as the cause of hair loss in affected bears. Vitamin A deficiency most often results from inadequate dietary intake, while hypothyroidism can occur as a secondary effect of a number of conditions. Documented conditions causing hypothyroidism in bears include exposure to organochlorine (OC) and/or polychlorinated biphenyl (PCB) compounds. Flame retardants (PBDEs) also may suppress thyroid hormone activity due to their chemical similarity to PCBs. Further investigations as to the underlying cause are

underway. **Contact:** Barbara Bodenstein, National Wildlife Health Center, 608-270-2447, bbodenstein@usgs.gov

Pigeon Paramyxovirus in Eurasian Collared Doves (Arizona, Texas, Nevada)
The NWHC, in partnership with Arizona Division of Wildlife, Texas Parks and Wildlife Department, USFWS Las Vegas Field Office, and the Nevada Department of Wildlife, investigated five Eurasian collared dove (*Streptopelia decaocto*) mortality events in Arizona, Texas, and Nevada during late summer through the fall of 2012. Pigeon paramyxovirus (PPMV) was identified as the primary cause of death in these five events and ranged in size from around 100 to 2,300 birds. In addition, two rock dove (*Columba livia*) mortality events in Pennsylvania attributed to PPMV involving about 50 birds were investigated January through March of 2012. The significance of this disease to native dove and pigeon species is unknown and further investigation may be warranted.

Pigeon paramyxovirus belongs to a larger group of avian paramyxovirus serogroup 1 viruses (APMV-1), the same group as Newcastle Disease Virus (NDV). Seventeen dove mortality events have been investigated by or reported to NWHC over the past 11 years in which the PPMV strain of APMV is suspected. The first events occurred in 2001 when large-scale Eurasian collared dove mortality events (3,000-5,000 birds) were investigated by the University of Florida and Florida Fish and Wildlife Conservation Commission on the west coast and panhandle of Florida. Since then, PPMV confirmed and/or suspected mortality events in doves have been documented in Florida (2008), Arizona (2008-2012), Montana (2010), and most recently, Texas, Pennsylvania, and Nevada (2012). **Contact:** Barbara Bodenstein, National Wildlife Health Center, 608-270-2447, bbodenstein@usgs.gov

Newcastle Disease Virus in Double-crested cormorants in the Midwest (Minnesota, North Dakota, South Dakota)
During the summer of 2012, NWHC, in partnership with Minnesota Department of Natural Resources (MNDNR), Minnesota Veterinary Diagnostic Laboratory, National Park Service-Voyageurs National Park, Leech Lake Band of Ojibwe, and Canadian Cooperative Wildlife Health Centre, investigated 13 Newcastle Disease virus (NDV) mortality events in double-crested cormorants (*Phalacrocorax auritus*). There were 11 confirmed positive NDV mortality events in double-crested cormorants in the Midwest (Minnesota, North Dakota, and South Dakota) and at least two in Canada (Saskatchewan and Ontario). An estimated 1,100 cormorants died from NDV in the Midwestern outbreak in 2012. The mortality events in the Midwest varied in size from about 15 cormorants affected at a site in Codington County, South Dakota, to about 400 cormorants affected at a site in Meeker County, Minnesota. The majority of the mortality events took place in Minnesota. The last major NDV outbreak in the Midwest occurred in 2010.

NDV is a member of the avian paramyxovirus-1 serogroup, and strains classified as virulent NDV have the potential to cause disease in poultry. Because of the potential for NDV to affect poultry, the MNDNR in cooperation with USDA Minnesota Wildlife Services performed intensive clean-up efforts of carcasses at several of the sites in Minnesota and closed several of the islands to human traffic to prevent accidental spread of the virus. As is typical during NDV mortality events in cormorants, mortality was observed in other co-nesting species, such as American white pelicans and ring-billed gulls at several of the NDV sites in 2012, but when carcasses of these species were examined, they were found to have other causes of death, including West Nile virus and botulism type C. **Contact:** LeAnn White, National Wildlife Health Center, 608-270-2491, clwhite@usgs.gov

Waterbird mortality at Poplar Island Environmental Restoration Project (Maryland)
Beginning in early August 2012, sick and dead birds, consisting predominantly of mallards (*Anas platyrhynchos*) and shorebirds, occurred at the southern end of Poplar Island. Clinical signs included head droop, weakness, lethargy, prolapsed third eyelids, and paralysis of legs and/or wings, suggestive of avian

botulism. Mortality continued until late October and involved over 20 species of waterbirds; more than 750 birds were affected, of which 86% died. Botulism type C was confirmed in several mallards submitted after the onset of the event; however, a concurrent algal bloom was present on the island with high levels (1,200 – >6,000 ppb) of microcystin detected in the water. Additional algal toxins and heavy metals were not identified in the birds. Varying levels of microcystin were detected in the livers (79-254 ppb) and GI contents (53-54 ppb) of dead birds and the clinical significance of these findings remain unclear due to inconsistent presence of corresponding microscopic lesions in the liver. Liver concentrations of microcystin from this event were within the ranges reported in prior avian mortality events where microcystins were implicated; thus, they were suspected to play a role in this event. Investigation of this event was a collaborative effort among US Fish and Wildlife Service, Maryland Department of Natural Resources, Maryland Environmental Service, New Bolton Center (Univ. of Pennsylvania), Greenwater Labs, USGS National Wildlife Health Center, Southeastern Cooperative Wildlife Disease Study, and Tristate Bird Rescue and Research. **Contact:** Anne Ballmann, National Wildlife Health Center, 608-270-2445, aballmann@usgs.gov

Mysterious skin growth and mortality reported among Florida reptiles

In late July 2012, staff members at Everglades National Park received reports from a local air boat operator of an unusual white, gelatinous substance observed on captive and free-ranging alligators and aquatic turtles. The material was distributed on the heads and bodies of the animals around the feet, eyes, and tails. The presence of this gelatinous substance appeared to be associated with anorexia and mortality. The airboat operator reported observing similar field signs 14 months earlier at another local facility with captive animals. Mortality in one captive population was estimated to be around 30 native reptiles of mixed species. Non-native reptiles housed at the same facility appeared unaffected. No natural mortality could be confirmed among free-ranging reptiles that were reported with this same condition.

An alligator (*Alligator mississippiensis*), snapping turtle (*Chelydra serpentine*), Florida mud turtle (*Kinosternon subrubrumsteindachneri*), and Florida softshell turtle (*Apalone ferox*) with varying degrees of the white material observed on skin surfaces were euthanized and submitted to the NWHC for diagnostic evaluation in August 2012. At least two specimens had recently been captured from the wild. An experienced reptile veterinarian who examined the specimens prior to submission described varying presentations of the white material consistent with calcium deposition, exfoliating skin, or fungal infection, suggestive of poor water quality. During diagnostic necropsies performed at NWHC, external examinations were unremarkable and the only skin abnormalities present were small ulcerations noted on two of the specimens. No white material was observed. Three of the specimens had insignificant loads of gastrointestinal parasites. No viruses were isolated from skin or internal organs. Bacteria and fungi isolates from skin were inconsistent and were considered environmental contaminants. The cause of this morbidity and mortality event among affected reptiles remains undetermined. NWHC encourages continued monitoring of wild reptile populations in the area for clinical signs and/or mortality to allow for additional diagnostic evaluation. **Contact:** Anne Ballmann, National Wildlife Health Center, 608-270-2445, aballmann@usgs.gov

Coral disease outbreak on North Kauai, Hawai'i

In November 2012, the NWHC Honolulu Field Station (HFS) investigated an unusual mortality of corals on North Kauai. Cyanobacteria were incriminated as the most likely culprit, and this was the first time this disease has been documented in epidemic proportions in Hawaii. NWHC distributed a Wildlife Health Bulletin about this outbreak that can be viewed at http://www.nwhc.usgs.gov/publications/wildlife_health_bulletins/WHB_2012-06_Coral_Disease.pdf For more information, see the USGS Top Story, Coral Disease Outbreak in Hawaii. **Contact**: Thierry Work, 808-792-9520, National Wildlife Health Center HFS, thierry_work@usgs.gov

Translocation of Nihoa millerbirds to Laysan Island, Hawai'i
In August of 2012, the NWHC HFS provided veterinary assistance to the USFWS in the successful translocation of critically endangered Nihoa millerbirds from Nihoa to Laysan Island. This effort has resulted in the establishment of a new population of this endangered species thereby aiding its longer term recovery. Wildlife Disease Specialist Thierry Work from the Honolulu Field Station was part of the team that won the Recovery Champion Award for the Nihoa Island Millerbird Translocation to Laysan Island. The award was presented at the Millerbird Debriefing meeting in Honolulu on April 5, 2012. The translocation project was led by a partnership between the U.S. Fish and Wildlife Service and the American Bird Conservancy. Twenty-four of the tiny songbirds were relocated 650 miles northwest by sea from remote Nihoa Island, their last remaining holdout, to Hawai'i's Laysan Island after a 100-year absence. The relocated Millerbirds have now begun nesting and rearing young. More about the project can be found at http://www.fws.gov/pacificislands/nihoamillerbird.html **Contact**: Thierry Work, 808-792-9520, National Wildlife Health Center HFS, thierry_work@usgs.gov

Kittlitz's Murrelet nestling mortalities on Kodiak Island, Alaska
Several apparently healthy Kittlitz's murrelet nestlings on Kodiak Island, Alaska, died suddenly with no apparent cause as determined by field biologists working on a nesting ecology project in 2011 and 2012. Most nestlings were being monitored by remote cameras that indicated nestlings were being fed regularly by adults and died during mild weather conditions. This unexplained mortality accounted for 21% of the overall mortality in 2011. Historically, the majority of chick mortality is attributed to predation and nest abandonment. Nine nestlings (2011=6; 2012=3) were collected and sent to NWHC for diagnostic evaluation. Laboratory tests revealed high levels of saxitoxin in crop content and/or liver in 87% of nestlings, and it was determined that exposure to saxitoxin was likely the cause of death. Camera data indicated that nestlings died shortly after consuming sand lance, which is the fish species commonly associated with the biomagnification of saxitoxin. An individual pigeon guillemot nestling from Protection Island and an adult marbled murrelet from San Juan Island, Washington, were negative for exposure. Wild bird deaths due to saxitoxin exposure have rarely been documented; mortality has been reported in piscivorous birds such as common murres and loons in Washington State, and cormorants, fulmars and gulls in northeastern England. NWHC is interested in receiving reports and specimens from any mortalities involving seabird species to continue to investigate saxitoxins as well as other biotoxins (domoic acid, brevetoxins, etc.) as potential causes of death. **Contact:** Barbara Bodenstein, National Wildlife Health Center, 608-270-2447, bbodenstein@usgs.gov

2012 Avian mortality summaries (presented to Flyway Committees)

Pacific Flyway: Sixty-four mortality events involving migratory birds were within the Pacific Flyway during 2012. Of the 64 avian mortality events, 13 different etiologies were identified that accounted for an estimated 25,000 individual deaths. NWHC investigated 25 of these events. The remaining events were reported to NWHC by partnering agencies. Avian cholera, avian botulism type C, and pigeon paramyxovirus caused the most significant mortalities.

Mississippi Flyway: Fifty-two mortality events involving migratory birds occurred within the Mississippi Flyway during 2012. The NWHC investigated 35 of these events and the rest were reported by partnering agencies. Of the 52 events, 11 different etiologies were identified and total estimated mortality was 16,000 birds. Trematodiasis, avian botulism types C and E, and Newcastle disease virus caused the most significant mortalities.

Central Flyway: Thirty-eight mortality events involving migratory birds occurred in the Central Flyway during 2012. The NWHC investigated 35 of these events; others were reported to us by partnering agencies. Of the 38 avian mortality events, 15 different etiologies were identified and total mortality was estimated to be 10,166 birds. Multiple etiologies were identified in 29% (11/38) of the 2012 avian mortality events. Avian

botulism type C, West Nile virus, Newcastle Disease virus and/or Salmonella spp. were concurrently involved in three of the mortality events.

Atlantic Flyway: Twenty mortality events involving migratory birds occurred within the Atlantic Flyway during 2012. The NWHC investigated 14 of these events. Of the 20 avian mortality events, 10 different etiologies (causes) were identified that accounted for an estimated 1,710 individuals. Estimated total avian mortality declined approximately 33% compared to that reported in 2011 (1,146 individuals). Noninfectious diseases, including natural toxin exposure (avian botulism type C, suspect blue-green algal toxicosis), poisoning, and trauma accounted for 58% of bird mortalities.

Nationwide: Avian botulism type C events were confirmed or suspected in all four migratory bird flyways in 2012. The most significant botulism event occurred in Portland, Oregon at Smith and Bybee Lakes Natural Area involving an estimated 4,000 geese and ducks and a few other species. Some geese also had chronic aspergillosis infection in the upper respiratory system.

There were eleven avian cholera events reported in 2012, all in California. The largest cholera event occurred at Klamath National Wildlife Refuge complex (Tule Lake and Lower Klamath Lake), Siskiyou County, California, during February through April 2012, affecting an estimated 4,000 geese, swans, and ducks.

West Nile virus was detected in 48 states and there were nearly 5,400 human cases (the second highest since first detection in 1999) according to the Centers for Disease Control. In addition to increased prevalence this past year, there was also an increase in the severity of human neuro-invasive cases compared to the recent past. NWHC diagnosed WNV (concurrent with avian botulism type C) in American White Pelicans in Minnesota, Medicine Lake NWR Montana and Chase Lake NWR in North Dakota; mixed species of shorebirds on the Missouri River in South Dakota and Nebraska; a Bald Eagle in Wisconsin; and crows and red-tailed hawks from Massachusetts. NWHC plans to compare 2012 WNV isolates with archived isolates (from previous years) for genetic differences that may explain changes in virulence.

NWHC continues to provide avian influenza testing as part of diagnostic case investigations when appropriate for nationwide avian mortality surveillance. During 2012 NWHC tested 244 dead birds for avian influenza (nationwide). Six detections of low pathogenic strains of avian influenza (AI) were found in waterfowl and gull species. Current protocols at NWHC are to continue AI testing of ducks, geese and swans, any avian species involved in mortality events >500, and when events may involve domestic poultry concerns.

To view NWHC Quarterly Wildlife Mortality Reports, please visit:
http://www.nwhc.usgs.gov/publications/quarterly_reports/index.jsp

Recent NWHC Publications of Interest

2011 USGS Report on Selected Wildlife Diseases
Scientists at the National Wildlife Health Center and University of Wisconsin recently published a USGS report on selected wildlife diseases. This report provides a sample of NWHC data available from our Laboratory Information Management System (LIMS). These data are presented in summary format with minimal statistical analysis and interpretation. The goal is to share these data with wildlife managers and other stakeholders, promote the use of NHWC data, and encourage the sharing of wildlife disease data to improve temporal and geographic surveillance coverage.
U.S. Geological Survey, National Wildlife Health Center, 2011 report of selected wildlife diseases.
2012. Green, David E.; Hines, Megan K.; Russell, Robin E.; Sleeman, Jonathan M.
USGS Scientific Investigations Report: 2012-5271

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Histological observations in the Hawaiian reef coral, *Porites compressa*, affected by Porites bleaching with tissue loss. 2012. Sudek, M., T. M. work, G. S. Aeby, and S. K. Davy. Journal of Invertebrate Pathology 111(2): 121-125.

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