TESTIMONY OF GARY FRAZER, ASSISTANT DIRECTOR FOR FISHERIES AND HABITAT CONSERVATION, U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR, BEFORE THE SENATE ENVIRONMENT AND PUBLIC WORKS SUBCOMMITTEE ON WATER AND WILDLIFE AND THE SUBCOMMITTEE ON OVERSIGHT, REGARDING THREATS TO NATIVE WILDLIFE SPECIES

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INTRODUCTION

Chairman Cardin, Chairman Whitehouse, and Members of the Subcommittee, I am Gary Frazer, Assistant Director for Fisheries and Habitat Conservation of the U.S. Fish and Wildlife Service (Service) within the Department of the Interior (Department). I also serve as co-chair of the Aquatic Nuisance Species Task Force (ANS Task Force). Thank you for this opportunity to testify on threats to native wildlife species. The Service appreciates the Subcommittee's efforts to address invasive species and wildlife disease. Today, my testimony will focus on the threats posed by both invasive species and fish and wildlife diseases, and what the Service is doing to address those challenges.

THREATS TO WILDLIFE FROM INVASIVE SPECIES

The introduction and establishment of invasive species have significantly impacted the health of our native species and ecosystems. Executive Order 13112 defines invasive species as an alien (with respect to the ecosystem under consideration) species whose introduction does or is likely to cause economic or environmental harm or harm to human health. We only need to look at the history of invasive species introductions, from the sea lamprey to the zebra mussel to tamarisk, to understand the broad scope and extensive impact of the problem. The United States continues to see an increasing number of nonnative, potentially invasive species crossing our borders through various pathways. Given the global nature of our economy and transportation systems, we expect this trend to continue. The United States is a leading import market for live animals and the majority of these imported species (more than 80 percent) are not native to the United States. This increases the likelihood or risk of additional invasive species being introduced and becoming established in the environment. Invasive species are among the primary factors that have led to the decline of native fish and wildlife populations in the United States and are one of the most significant natural resource management challenges facing the Service.

It is difficult to estimate the full extent of the environmental damage from nonnative invasive species. However, we know that about 4 in 10 species that the Service protects under the Endangered Species Act are considered to be at risk in large part due to competition with, predation by, or effects on habitat from, invasive species. Invasive species can also alter ecosystem functions. The brown tree snake is a major threat to the biodiversity of the Pacific region. A native of Indonesia, New Guinea, the Solomon Islands, and Australia, the brown tree snake arrived on Guam sometime during the 1940s – 1950s as stowaways on boats. The snakes have since spread across the entire island and have caused or been a major factor in the extirpation of 17 of Guam's native terrestrial vertebrates, including fruit bats, lizards, and 9 of 13 native forest bird species. Insect species that are no longer naturally controlled by native birds and lizards on Guam reduce fruit and vegetable production and their uncontrolled numbers

require greater reliance on pesticides. Brown tree snakes also cause millions of dollars in damage to Guam's infrastructure and economy by climbing power poles and causing power outages. Of major concern is that the brown tree snake could be carried to other Pacific Islands (including Hawaii) and subtropical regions of the continental United States in cargo.

The Service is concerned about the impact of aquatic invasive species to America's sport and commercial fisheries. In the Great Lakes region, the sea lamprey was accidentally introduced in the early 20th century as a result of the construction of shipping canals. This parasitic fish has been extremely destructive to economically important sport fish, including lake trout, salmon, rainbow trout, and walleye. During its life cycle, a single sea lamprey can kill 40 or more pounds of fish, and under certain conditions, 40 to 80 percent of fish die from a single attack by a sea lamprey. Before sea lampreys invaded the Great Lakes, about 15 million pounds of lake trout were harvested in Lakes Huron and Superior annually. However, by the early 1960s, sea lampreys and other factors reduced the catch to 300,000 pounds.

Zebra and quagga mussels are invasive freshwater mollusks that impact both the natural environment and human infrastructure. The mussels impact native species through competition and biofouling, the impairment or degradation of underwater surfaces or equipment as a result of the accumulation of living organisms. They can even cover other living organisms. The St. Croix River, a National Wild and Scenic River in the upper Mississippi River basin, contains the only viable population of the winged mapleleaf clam (*Quadrula frugosa)*. Zebra mussels could wipe out this already endangered species if they become established in the river. The mussels impact civic operations and development by clogging municipal and industrial water systems such as water intakes needed for hydroelectric development and other industries. Both mussel species are easily spread unintentionally by recreational boaters and annually cause an estimated $30 million in damage to water delivery systems in the Great Lakes. In early 2007, quagga mussels were discovered in the Lake Mead National Recreation Area. They have since been found in Arizona, California, Nevada, and all 242 miles of the Colorado River Aqueduct. In January 2008, the first populations of zebra mussels were found in the San Justo Reservoir in California and Lake Pueblo in Colorado. The U.S. Geological Survey (USGS) Nonindigenous Aquatic Species database allows the precise tracking and distribution of occurrences of non-native aquatic species throughout the United States. An alert system was recently developed to allow users to automatically receive email alerts when new occurrences are reported to the database. This database and mapping capability have been vital to tracking the spread of quagga mussels in the western United States and have provided managers with a real-time tool to assist in developing management strategies.

Invasive species are also one of the most significant threats to the National Wildlife Refuge System (NWRS), where they can destroy habitat, displace wildlife, and significantly alter ecosystems. Presently, about 2.4 million acres of NWRS lands are infested with invasive plants. There are at least 4,423 invasive animal populations recorded on NWRS lands as well. A September 2008 report released by the Government Accountability Office listed invasive plants as the number one threat to habitats on refuges and invasive animals as the third greatest threat. Although the NWRS is committed to controlling and eradicating these invasive animals and plants, the task is big and challenging. For example, the Service has treated an average of 13 percent of the acres infested with invasive plants on an annual basis between fiscal years 2004

and 2008, despite the fact that the cost of treating invasive plants and animals on refuges has skyrocketed. Between 2004 and 2009, base funding spent on managing invasive species increased 155 percent from $6 million in 2004 to $15.3 million in 2008.

For example, the invasive, aquatic rodent, nutria was brought to the Chesapeake Bay and to Louisiana to bolster the fur trade. By the early 1990's, the Delmarva Peninsula population was estimated to exceed 150,000 animals. Although harsh winters cut back the population, the rodent's capacity to reproduce allowed it to quickly rebound. Nutria eat aquatic plants, and particularly favor the Olney three-square, saltmarsh hay, and smooth cordgrass marshes in and around the Blackwater National Wildlife Refuge. Nutria damage these wetlands, and have contributed to significant and measurable losses of marsh habitat. Building upon support from Congress, the State of Maryland, the Service, USGS, USDA Wildlife Services, the University of Maryland, and private landowners bordering the refuge worked together to establish the precise damage nutria causes to the marsh, its biology and population dynamics, and methods of control.

By 2004, nutria had been extirpated from the refuge. The project continues as the partners work to remove nutria from all available habitats in the upper reaches of the watersheds feeding into the refuge. Nutria is found in all three peninsula states – Maryland, Virginia, and Delaware – and until it is eradicated, the opportunity remains for these rapidly reproducing animals to repopulate previous cleared habitat. Nutria are found in a total of 16 U.S. states, including the West Coast States of Washington and Oregon, and the Service has been involved in helping other states establish nutria eradication efforts based on the protocol and partnerships established in Maryland.

Addressing the Challenges of Invasive Species

As the old proverb goes, "an ounce of prevention is worth a pound of cure." The proverb resonates particularly well when addressing invasive species. Preventing additional introductions is a primary focus of the Service and is the most effective strategy to protect our nation's wildlife and habitats. The Service has a broad array of programs that complement the efforts of the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) and support our ability to prevent introductions and manage invasive species problems.

The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA), reauthorized by the National Invasive Species Act of 1996, established the Service's Aquatic Invasive Species (AIS) Program as well as the ANS Task Force, which is an interagency Federal Advisory Committee Act (FACA) group with 13 federal and 12 Ex-officio members co-chaired by the Service and the National Oceanic and Atmospheric Administration (NOAA). The ANS Task Force encourages federal and state agencies to establish partnerships with stakeholders at all levels to enhance our collective efforts to address aquatic nuisance species issues. The ANS Task Force relies on the expertise of its six Regional Panels to identify regional ANS priorities; coordinate ANS program activities in each region; make recommendations to the ANS Task Force; and provide advice to public and private interests concerning appropriate methods of ANS prevention and control.

For example, the ANSTF recently tasked its Western Regional Panel (WRP) to develop a quagga/zebra mussel action plan (QZAP) to address the rising threat of this mussel invasion in the west. The WRP unveiled the first draft of the QZAP calling for mandatory inspection and decontamination stations at infested water bodies as well as many other actions. The primary objective of the QZAP is to highlight the actions necessary over the next five years to minimize the impacts of these invasive shellfish on native species, water delivery infrastructure (e.g., municipal, agricultural, and hydro-electric), and other vulnerable resources. The Task Force and the members of the WRP have agreed that it would use the QZAP as the guiding document to direct the western response to these invasive mussels.

The Service's AIS Program was established to help coordinate prevention, control, and management action on invasive species that span geographic and jurisdictional boundaries. The program supports an AIS Coordinator in each of the Service's eight regions who works closely with Service field stations, State invasive species coordinators, nongovernmental groups, private landowners, and many others in their day-to-day activities. This dedicated network organizes cooperative surveillance efforts with other federal, state, and local agencies, universities, and public interest groups to track the distribution of aquatic invasive species. It also conducts a variety of outreach activities to inform the public about the definition, biology, and impacts of aquatic invasive species and what they can do to help prevent their spread. These Regional Coordinators are in tune with both the national priorities of the ANS Task Force and the various emerging regional priorities. Their unique position allows them to play a critical role in bridging the gap between national and regional aquatic invasive species issues and translating the national priorities of the ANS Task Force into on-the-ground projects.

The Service also contributes to the work of the National Invasive Species Council (NISC). Executive Order 13112, issued in 1999, charged all federal departments and agencies to prevent and control invasive species and created (NISC). NISC is co-chaired by the Secretaries of the Interior, Agriculture, and Commerce. NISC members include the Secretaries of State, Defense, Homeland Security, Treasury, Transportation, Health and Human Services, the U.S. Trade Representative, the Administrators of the U.S. Environmental Protection Agency, NASA, and the U.S. Agency for International Development. The Service has significant role in the implementation of the 2008 – 2012 National Invasive Species Management Plan that was issued by NISC on August 1, 2008. This plan coordinates the invasive species efforts and sets out objectives and implementation tasks within five strategic goal areas.

The Service's AIS program also administers the Injurious Wildlife provisions of the Lacey Act (18 U.S.C. Section 42(a)). Species listed as injurious may not be imported or transported across state boundaries by any means without a permit issued by the Service. Permits may be granted for zoological, educational, medical, or scientific purposes. Regulation of intrastate transport or possession is the responsibility of each state, except for those species covered under a Service permit issued by our Division of Management Authority.

The Service's Office of Law Enforcement's (OLE) wildlife inspection program forms an important part of the nation's frontline defense at ports of entry by interdicting injurious wildlife species. Wildlife inspectors are stationed at 38 major U.S. airports, ocean ports, and border crossings, where they monitor imports and exports to ensure compliance with U.S. laws and

regulations. Wildlife inspectors focus on detecting and deterring illegal trade in protected species and preventing the introduction of injurious wildlife. As part of OLE's efforts to prevent such introductions of injurious wildlife, Service special agents investigate illegal interstate commerce of injurious species (including Internet sales) and assist state counterparts with the enforcement of both federal injurious species prohibitions and state laws that ban the introduction, possession, and sale of state-listed injurious wildlife.

The Service is also using partnerships to minimize new introductions and prevent the spread of invasive species. For example, the governments of the United States and Canada, working jointly through the Great Lakes Fishery Commission, have implemented a successful sea lamprey control program on the Great Lakes since 1956. The Service's Fisheries Program has two Sea Lamprey Management Offices located in Marquette and Ludington, Michigan. Jointly funded by the Service and the Great Lakes Fishery Commission, these offices employ approximately 110 staff to implement an integrated sea lamprey control program within the United States portion of the Great Lakes. Sea lamprey abundance has been reduced by 90 percent as a result of the integrated control program. Congress appropriates more than $10 million annually through the State Department for sea lamprey management and research.

For the past 10 years, the Service's Fisheries Program has worked extensively to prevent the introduction and spread of Asian carp. We have supported a feasibility study on barrier options to prevent the introduction of these large fish into the Great Lakes; led the Asian Carp Working Group of the ANS Task Force which completed the National Management and Control Plan for Asian carp; assisted in creating a Rapid Response Plan for Asian carp in New York canals; funded research on the use of pheromones as a deterrent to carp spread and research on native fish alternatives to the use of black carp in aquaculture; and conducted monitoring for early detection and rapid response. USGS researchers studying Asian carp have found that they have spread to 23 States and their numbers are increasing exponentially. In developing control options, researchers are studying carp sensitivity to a variety of chemicals at different life stages (eggs, larvae, etc). Black, silver and large-scale silver carp were listed as injurious wildlife under the Injurious Wildlife provisions of the Lacey Act in 2007. Additionally, the evaluative injurious wildlife process for bighead carp is currently underway.

The Service's Partners for Fish and Wildlife Program provides technical and financial assistance to private landowners and Tribes to restore and protect habitat, including invasive species management and the reintroduction of native plants. From 2003-2008, the Partners for Fish and Wildlife Program was a cooperator in 3,718 habitat improvement projects that involved control of invasive species on approximately 1.3 million acres. The Service's Coastal Program assists communities in conserving coastal resources and forms partnerships to conduct on-the-ground restoration, including invasive species control activities in coastal areas. Between 2003 and 2008, the Coastal Program cooperated in 570 habitat restoration and enhancement projects that involved control of invasive species on approximately 256,287 acres of coastal habitat.

The NWRS invasive species program focuses on early detection and rapid response by engaging Friends groups and volunteers in the fight against invasive species. Over a period of three years, 2,750 volunteers contributed more than 49,000 hours to the treatment, inventory, and restoration of over 211,000 acres of refuge land through its invasives and volunteers competitive grants

program. Additionally, the NWRS has created five Invasive Species Strike Teams to focus employees highly skilled in invasive species management on seeking out and eradicating new infestations of invasive plants and animals. These teams are working to control and manage invasive species in key geographic locations, including south Florida, the Lower Colorado River and New Mexico, the Columbia-Yellowstone-Missouri River basins, North Dakota, and the Hawaiian and Pacific Islands. Another example of the importance of early detection and rapid response to new infestations can be seen in the partnership between the NWRS and USDA's Wildlife Services to eradicate the giant Gambian pouch rat from the Florida Keys. These giant rats, which can grow up to nine pounds in the wild, escaped from a pet owner on Grassy Key. Recognizing a threat to the nearby National Key Deer Wildlife Refuge, the NWRS partnered with Wildlife Services to support trapping the giant rats over the entire island. By eliminating this population before it spread to other islands, millions of dollars in future control efforts were potentially saved.

Education and outreach efforts continue to be critical elements to the success of invasive species prevention and control. The Service and the ANS Task Force have been working for many years on educational outreach programs aimed at preventing additional introductions and controlling the spread of invasive species. The *Stop Aquatic Hitchhikers!* Public Awareness Campaign targets aquatic recreation users and promotes voluntary guidelines to ensure that aquatic nuisance species are not unintentionally spread through recreational activities. To promote prevention of introductions through other high-risk pathways, the Service, the Pet Industry Joint Advisory Council (PIJAC), and NOAA Sea Grant created the Habitattitude™ Initiative. This campaign encourages aquarium hobbyists and water gardeners to be responsible caretakers of their plants and pets and to prevent the release or escape of non-native animals and plants into the wild.

Preventing Invasive Species is the Key

The invasive species issue is complex and represents multiple challenges for the world's conservation community. The complexity is further exacerbated by climate change, water fluctuations and other challenging social issues that compete for scare resources. Additionally, building capacity at multiple levels to complement each is equally as important. As a result, the collective response must be holistic and all-encompassing with an emphasis on prevention.

Preventing non-native species from being introduced or established is the most cost-effective strategy for dealing with invasive species. Control is costly and the conservation community has limited tools for long-term management, particularly aquatic invasive species, once they become established. Everyone can become part of the overall prevention equation through a combination of methods, including government regulatory means such as import screening and injurious wildlife prohibitions, pathway management such as the Hazard Analysis and Critical Control Point methodology, and citizen and private sector prevention efforts through education, outreach, and individual and organizational behavioral change processes.

THREATS TO WILDLIFE FROM DISEASE

Although the source and transmission of many emerging fish and wildlife diseases is not well known, human induced changes to the landscape—especially the introduction of nonnative species, climate change, declining water and environmental quality—are contributing to a surge

in infectious diseases and parasites afflicting animals as seen in the latter part of the 20th century and into the 21st century. In some cases, the impacts on fish and wildlife populations are unprecedented and devastating. The impacts present tremendous challenges for conservation through the mortality of productive individuals—especially in threatened populations—and the loss of their direct and indirect roles in the ecosystem. Diseases that can be transmitted from animals to humans are called zoonotic diseases, and some pose threats to domestic animals as well as humans and wildlife. Since 1970, 40 new infectious diseases have been identified throughout the world. More than 75 percent of diseases currently classified as "new or emerging" are zoonotic. Major health threats to wildlife populations also arise from noninfectious diseases associated with natural toxicants and anthropogenically derived environmental contaminants, such as pesticides, lead, and endocrine disrupting chemicals.

Some pathogens (including parasites) associated with infectious disease are endemic to the United States, others are introduced and the pathogens themselves can be classified as non-native invasive species. Non-native infectious diseases are of particular concern because native wildlife populations are less likely to have developed immunity to these pathogens. As illustrated by the West Nile virus outbreak in 1999, the introduction of a non-native invasive pathogen into the United States population can be difficult to control and can have severe ecological, economic, and even human health impacts.

The range of disease threats to fish and wildlife populations is tremendous, and native species impacts are regional, national, and even global in significance. Today, I will discuss some of the infectious diseases that have most recently emerged or re-emerged in North America, including: White-nose Syndrome, Sylvatic Plague, West Nile Virus, Chronic Wasting Disease, Avian Pox, Malaria, and Viral Hemorrhagic Septicemia.

White-nose Syndrome

White-nose syndrome (WNS) was first documented in January of 2007 in hibernating bats in New York. It has since been documented in hibernating bats in nine states, including Virginia and West Virginia. More than 90 percent of bats in affected caves have died, with a few caves showing close to 100 percent mortality. Thus far, six bat species have been affected, including the federally endangered Indiana bat. The sudden and widespread mortality associated with WNS has never been observed before in any of the more than 1,100 species of bats known to science.

Affected bats display a white, powdery substance on their faces and, on closer examination, many show tissue damage and scarring in their wings. Based on microscopic analysis, the powdery substance and tissue damage is a fungus—a new species only recently described by science. This species grows only in cold temperatures, and unlike most fungi, it invades living tissues. When hibernating, bats lower their body temperature significantly, and they pack tightly together—two factors which seem to promote the spread of the fungus from bat to bat. Although this is likely the primary vector of transmission, WNS may also be inadvertently spread from cave to cave by human activity in caves. Because the high mortality rate associated with WNS and its rapid spread, biologists are concerned that more hibernating species in other states are at risk. Twenty-five species of bats in the United States rely on hibernation to survive winter, and four species and subspecies are federally listed as endangered.

The Service is leading the Department of the Interior's response to the emergence and spread of WNS in bats, supported by the USGS, the National Park Service, the USDA, State fish and wildlife agencies, and numerous other partners. Through its coordination and response framework, the Service is working with more than 50 partner agencies and organizations to identify the mechanisms by which WNS is transmitted, identify how it contributes to mortality in affected bats, monitor its spread, and develop management and containment options for federal and state wildlife managers. To this end, the Department is engaged in a structured decision making process in which bat experts from multiple agencies are weighing various management alternatives against much uncertainty. We expect to have management recommendations in place by September of this year.

Specifically, the Service is collecting and distributing surveillance data and other critical information to other federal agencies, states, partners, and the public; administering several working groups focused on specific elements of the problem; funding key research; and working with stakeholders to identify and conduct collaborative investigations, monitoring, and management actions. The Service serves as the primary resource for the most current information and recommendations for all partners, such as important decontamination protocols. For instance, the Service developed a March 2009 cave access advisory that requested a voluntary moratorium on recreational activities in caves in the nine affected states and the eight neighboring states to minimize the potential spread of WNS. Cave closures have occurred on national park units and National Forests, specifically to reduce the potential of human spread of the disease. Caves supporting wildlife on National Wildlife Refuges are permanently closed to protect all species they support, including bats. The advisory also includes guidelines on scientific activity in caves supporting bat hibernacula.

Investigation into the disease and the implicated fungus species has been conducted at the USGS-National Wildlife Health Center, in collaboration with multiple partners, including the USGS-Fort Collins Science Center, the Service, Symbiology LLC, Cornell University, and conservation agencies from all WNS-affected states. Much of this work was summarized in a paper published in the journal Science. USGS has also led efforts to publish two additional studies that define criteria for diagnosing WNS and that describe and name the fungus that causes the skin infection characteristic of WNS.

To close gaps in scientific understanding of affected bat populations, this fungus, and its affect on bats, the Department has funded research through USGS into several lines of investigation. Data collected during a WNS infection trial are being analyzed to identify mechanisms by which WNS is transmitted. Additionally, an environmental survey is underway to determine the prevalence of the WNS fungus in the eastern United States and to evaluate the potential role of the environment in maintaining the WNS fungus. USGS is preparing to conduct epidemiological studies to determine the origin of the WNS fungus, ecological studies to ascertain whether bats are surviving the disease, and modeling studies to determine the potential for further WNS spread.

Sylvatic Plague

More than half of the species of North American rodents of conservation concern reside within the range of plague outbreaks in western North America. Since its introduction to North America in the early 1900s, sylvatic plague has had a major and sometimes near catastrophic impact on some populations of native mammals.

Plague is a bacterial disease transmitted by fleas, it affects many mammalian species, including humans, and it poses a serious challenge to conservation. For example, recovery of the black-footed ferret —one of the most endangered mammals in North America —is obstructed by plague fostered in colonies of the three prairie dog species (Gunnison's, black-tailed, and white-tailed prairie dogs), upon which the ferret depends for food and in whose burrows they shelter. Plague has reduced these prairie dog species populations to historic lows, and this, as well as the transmission of plague from prairie dogs to ferrets, has caused the near extinction of the ferret. Today, all three prairie dog species are considered "at risk" and have been petitioned for federal listing as threatened or endangered. The loss of these prairie dog species affects the biotic diversity and integrity of the western grasslands that stretch from southern Canada to Northern Mexico, because many animals, including badgers, fox, wolves, hawks, and owls, depend upon prairie dogs.

Plague was first documented in wild animals in the United States near San Francisco and quickly spread through western States to about the 100th meridian where it remained stable for nearly 50 years. From 2005-2008, however, plague moved further eastward into South Dakota, causing large outbreaks on Pine Ridge Indian Reservation and on the portion of the Buffalo Gap National Grassland in Conata Basin, where the largest breeding colony of re-introduced black-footed ferrets resides.

Plague has been responsible for numerous, devastating epidemics in humans throughout the centuries. Worldwide, 1,000-3,000 human cases are reported annually, with 10-20 cases per year in the United States. In 2007, a 37 year old Wildlife Biologist with the National Park Service died of plague after being exposed to the carcass of an infected mountain lion. Increased numbers of plague cases in humans in New Mexico, Arizona, and Colorado coincide with outbreaks in prairie dogs and rock squirrels. As a result of expanding residential development, there has been an upward trend in transmission from wildlife to domestic animals, including increased transmission of plague from domestic cats to their owners and veterinarians. From 1977-1997, 18 human cases resulted from contact with infected cats.

In Conata Basin, primarily on the Forest Service National Grassland in South Dakota near Buffalo Gap, black-footed ferrets have been successfully reintroduced, but this population is threatened by sylvatic plague. To manage the disease, the Service and its partners have applied an insecticide, which disrupts the flea life cycle, to prairie dog burrows. Also, the Service is working in cooperation with USGS and the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) to use a plague vaccine for ferrets. These two techniques have proven successful in maintaining the Conata Basin ferret populations, despite several outbreaks of plague in recent years.

West Nile Virus

In 1999, West Nile virus (WNV) was first documented in birds in New York. By 2004, WNV had spread from the New York City region to almost all of the continental United States, 7 Canadian provinces, and throughout Mexico and to parts of the Caribbean. The virus is transmitted by mosquitoes; the life cycle of the virus primarily involves mosquitoes and wild birds, but it can also spread to humans and livestock through mosquito bites.

West Nile Virus has affected more than 326 bird species. Many of these bird species are highly susceptible to disease and death caused by WNV. Species most susceptible to WNV include crows, jays, magpies, and other species, including several raptors, and it can infect horses and humans. Commonly found in Africa, western Asia, and the Middle East, WNV was never recorded in the Western Hemisphere prior to 1999. It is not possible to determine the number of birds killed by WNV since its introduction to North America, however, hundreds of thousands of dead birds have been submitted in surveillance programs. WNV outbreaks continue in North America, and there is no way to predict how it may affect wildlife populations in the future.

Data reported in 2003 from individually marked populations of crows in New York State and Oklahoma (McGowan, et. al, 2003) show that these populations are experiencing important declines after the initial WNV outbreak. Analysis of breeding bird surveys indicate large-scale declines in WNV "hot spots" but did not indicate declines at the range-wide scale that can be attributed to WNV (Sauer, et. al, 2003) several species of passerine birds following the introduction of WNV into North America. (LaDeau, 2007)

As WNV spread westward from New York, state fish and wildlife agencies and state public health agencies coordinated on surveillance and monitoring of WNV. State and federal laboratories provided technical expertise to test both dead birds and mosquito pools. These agencies worked together with the U.S. Department of the Interior, the U.S. Department of Agriculture, and Department of Health and Human Services to educate the public on how to avoid contracting the disease. While the response to WNV has scaled back in recent years, the threat to wildlife, human, and livestock health remains. Almost all states reported cases of WNV in animals in 2008, and 44 human fatalities occurred that same year. In 2009, one human case has already been identified, and ten states are reporting infections in animals.

Chronic Wasting Disease

Chronic Wasting Disease (CWD) is a contagious disease that affects the brains of deer and elk. Although its impacts on wild deer and elk population dynamics are unknown, modeling suggests that CWD could substantially reduce infected populations by lowering adult survival rates and reducing productivity of these populations. The disease has been found only a few miles from the National Elk Refuge in Wyoming.

Fatal to affected wildlife, CWD has not been found to be transmittable to humans. The agent responsible for the disease may be spread both directly (animal-to-animal contact) and indirectly (soil or other surface to animal). Animals held in contaminated facilities have contracted the disease. It is thought that the most common mode of transmission from an infected animal is via saliva, feces, and urine. CWD has been found in free-ranging deer and elk in Colorado,

Wyoming, Kansas, Nebraska, South Dakota, Utah, New Mexico, Wisconsin, Illinois, New York, West Virginia, Alberta, and Saskatchewan. It has also been documented in deer and elk in game ranches in Colorado, Nebraska, South Dakota, Montana, Minnesota, Wisconsin, Oklahoma, Kansas, New York, Michigan, and in the Canadian provinces of Alberta and Saskatchewan. It is associated with individual, oddly-shaped proteins, called prions, which accumulate in the nervous tissue of the affected animal.

State fish and wildlife agencies have primary jurisdiction over deer and elk species. Individual States are attempting to control the spread of CWD by prohibiting the importation of live deer or elk, limiting the parts of animals that may be taken out of the state by hunters, and quarantining or destroying affected herds.

Avian Pox and Malaria

Environmental stressors such as climate change may exacerbate the emergence and transmission of non-native invasive pathogens to wildlife. Native Hawaiian forest birds, particularly the endemic honeycreepers, face one of the highest rates of extinction in the world. Introduced mosquito vectors and the diseases they carry, including avian malaria and avian pox virus, are widely considered to be primary factors responsible for these population declines and extinctions. The expanding ranges of these diseases pose a major threat to native birds that have not previously been exposed to them.

After being introduced to the Hawaiian Islands, avian malaria was responsible for a wave of extinctions of Hawaiian forest bird species during the 1920s and 1930s. Susceptible native birds below 1500 meter elevation were at continual risk from malaria. Above that elevation mosquitoes were rare, so many native forest birds are those living in higher elevations. Avian pox and malaria transmission in Hawaii depends on climatic conditions, especially seasonal changes in temperature and rainfall that increase or decrease mosquito populations.

A recently published USGS review discusses the likelihood of a forthcoming “disease invasion” by examining the present altitudinal range of avian malaria and pox, honeycreeper distribution, and the future projected range of diseases and honeycreeper habitat with climate change. Climate Change is predicted to expand the distribution of disease vectors, further increasing the risk to native Hawaiian forest birds.

Avian Influenza

While highly pathogenic H5N1 avian influenza (H5N1 HPAI) has not yet been detected in North America, it continues to pose a threat to the U.S. due to ongoing outbreaks in Asia, Africa, and Europe. This virus was first detected in 1997 in Hong Kong, gained resurgence in 2003, and has since spread quickly to over 60 countries. Worldwide, H5N1 HPAI has caused mortality events in thousands of wild birds including swans, geese, passerines, herons, and raptors. Avian influenza viruses rarely cause mortality in wild birds, so the virulent nature of the current strain of H5N1 HPAI is of great concern. The potential impacts of H5N1 HPAI on the North American ecosystem are unknown; however based on experiences in Europe, Asia, and Africa, introduction of the virus would most likely cause mortality events in wild birds as well as creating increased pressure on wild bird populations through surveillance and control activities. Potential routes of

H5N1 HPAI introduction into North America include migratory birds as well as legal and illegal importation of live birds and bird products.

Since 2006, the USFWS Division of Migratory Bird Management has played a key role in the collection of avian influenza biological specimens from wild birds. This work has been conducted on a national scale in collaboration with USGS National Wildlife Health Center, U.S. Department of Agriculture (USDA), state wildlife management agencies, and non-governmental organizations. The USFWS activities are guided by the "*Early Detection and Response Plan for Occurrence of Highly Pathogenic Avian Influenza in Wild Birds*", an 80-page guide to the Service's response to this disease threat last published in 2007.

Viral Hemorrhagic Septicemia

Viral hemorrhagic septicemia (VHS) is considered to be the most important viral disease of finfish worldwide and is listed as a reportable disease by many nations and international organizations. Prior to 1988, the causative agent, viral hemorrhagic septicemia virus (VHSV) was not known to occur outside continental Europe where it remains a major pathogen affecting rainbow trout aquaculture. Subsequently, a North American strain of VHSV was found to be widespread among marine fish on the Pacific coast of North America where it has been shown to be highly pathogenic for marine species, especially herring. Surveys of marine fish in other regions of the world have revealed that VHSV is also common among marine species in the North Atlantic, the Baltic Sea, the North Sea, and Japan.

In 2005-2006, the Great Lakes region reported that wild fish exhibited the disease or, in some cases, a related strain that caused very large fish kills. As of April 2009, VHSV has been isolated from several species of fish in much of the Great Lakes Basin including Lake Huron, Lake Michigan, Lake St. Clair, Lake Erie, Lake Ontario, the Niagara and St. Lawrence Rivers and from inland lakes in New York, Michigan, and Wisconsin. This isolate found in the Great Lakes region is the only strain of VHSV that has been linked to large mortalities among freshwater species. In 2008, an isolate of VHSV was obtained from muskellunge broodstock (a native fish) collected from a reservoir in Ohio that drains into the Mississippi River.

To date, significant disease or mortality has been reported in muskellunge, freshwater drum, goby, burbot, yellow perch, gizzard shad, and smallmouth bass, and VHSV has been isolated from more than 20 additional species in the region. The full effect of the virus on fish populations is not known. However, the presence of a reportable pathogen in the region, the large-scale mortalities among wild species, the potential impacts on commercial aquaculture, the outstanding Great Lakes recreational fisheries and lucrative bait fisheries, and the impending disruptions of interstate and international trade have caused substantial concern among many entities.

Chytridiomycosis in Amphibians

Chytridiomycosis (a.k.a. "Chytrid" or "Bd") is a newly-identified fungal disease that is implicated in the precipitous population declines and species extirpations that have gained global notice since 1970. Bd is believed to have originated in South Africa and initially spread via the commercial trade in clawed frogs, a species used in human pregnancy testing worldwide

beginning in the 1930's. Since its discovery, Bd has been identified in association with amphibian population declines on every continent that supports amphibians, including North America. At least 200 species of frogs are believed to have severely declined or been extirpated as a result of this pathogen. The impact on frogs from Bd represents the most spectacular loss of vertebrate diversity due to a disease in recorded history. It has been described as having the most significant impact of any wildlife disease on wildlife conservation, in terms of the numbers of species it impacts and the tremendous mortality associated with it.

Bd is capable of causing sporadic deaths in some amphibian populations and 100% mortality in others. Although the mechanism by which Bd attacks the host species is imperfectly understood, it appears that the fungus is able to grow and reproduce through amphibian skin. The disease then progresses as the newly generated fungus re-infects the host. Amphibians infected with the fungus exhibit a reddening of the ventral skin, convulsions with extension of hind limbs, accumulations of sloughed skin over the body, sloughing the outer skin layer of the feet and other areas, and occasional small ulcers or hemorrhaging. Affected animals can appear lethargic and can fail to respond normally to threats or other stimu, and they may exhibit abnormal posture. The fungus is believed to kill the animals through the production of lethal toxins and through interference with the exchange of oxygen and carbon dioxide through the skin.

In some instances where Bd has been encountered, 50% of amphibian species and 80% of individuals have disappeared within one year. Currently, there is no effective measure for control of the disease in wild populations; a few species appear able to survive with a Bd infection as larvae or as adults and these animals likely serve as reservoirs and vectors for future outbreaks. Notable among resistant species are worldwide invasive pest species including marine toads, American bullfrogs and the African clawed frog.

There are many gaps in our understanding of Chytridiomycosis; however, the Service is working with partners to improve our understanding of the pathogen and how to treat it, while educating the public and wildlife managers about the disease. USGS research relevant to Chytrid is performed and planned under their Amphibian Research and Monitoring Initiative. In 2007, the Service and Partners in Amphibian and Reptile Conservation (PARC) co-sponsored a landmark International symposium on Amphibian Declines and Bd, bringing over 200 scientists, managers, and others from nine countries representing four continents. Strategies, field protocols and recommendations were generated during this workshop to reduce the spread of the amphibian chytrid fungus at local, regional, national and international levels. These efforts, however, may not come in time to save some amphibian species from dramatic losses worldwide (Stuart and Chanson, *et al.,* 2004; Daszak, 1999).

Response to Fish and Wildlife Disease

The Department of the Interior has long recognized the threat of disease to fish and wildlife populations and to their conservation.

The Department provides cutting edge wildlife disease research and diagnostics through the USGS National Wildlife Health Center in Madison, Wisconsin. The Center provides information, technical assistance, and research on national and international wildlife health issues; monitors disease and assesses the impact of disease on wildlife populations; defines

ecological relationships leading to the occurrence of disease; transfers technology for disease prevention and control; and provides guidance, training and on-site assistance for reducing wildlife losses when outbreaks occur.

Within the Fish and Wildlife Service (Service), the National Wildlife Refuge System is staffed with biologists who are trained to monitor for wildlife morbidity and mortality events. Each refuge has a disease contingency plan that outlines procedures, roles, and responsibilities for responding to a disease outbreak. The Service also employs several disease specialists, including three veterinarians who specialize in mammalian, avian, and fish diseases, respectively.

The Service coordinates closely with USGS, other federal agencies, and our state partners to monitor and respond to wildlife diseases. In the case of avian influenza and white-nose syndrome, the Service is providing a key leadership role in coordinating surveillance, monitoring, and response, but in most cases, state fish and wildlife agencies are in the leadership role. The Service, along with the USGS and USDA-APHIS, assist the states in identifying and managing disease outbreaks when appropriate.

On the aquatic side, the Service's nine Fish Health Centers are on the front-lines of detection and diagnostics of potentially devastating aquatic pathogens and disease. USFWS Fish Health Centers maintain on-site capabilities for rapid response to pathogen detection, screening, and isolation, disease diagnosis, treatment recommendation, infection control via biosecurity implementation, and technical assistance regarding fish health and propagation. USFWS Fish Health Centers have expertise in several laboratory disciplines, including virology, bacteriology, parasitology, histology, epidemiology, pathology, and molecular biology.

The USFWS Fish Health Centers work closely with regional aquatic animal health compacts, state fish and wildlife agencies, Native American tribes, private aquaculture, and university researchers to ensure coordination across state, regional, and international boundaries. A vital part of the Service's proactive and cooperative approach to address emerging aquatic animal health issues is our National Wild Fish Health Survey, a watershed-based sampling protocol for water and fish that began in 1997. Utilizing state-of-the-art equipment, USFWS Fish Health Centers perform diagnostics and laboratory analyses on samples collected by Service personnel, as well as other federal, state, and tribal partners. The data generated from the Survey is essential for informed management decisions to protect America's aquatic resources. Samples of reportable pathogens (VHS, SVC, etc.) are sent to the USDA-APHIS Laboratory in Ames, IA for verification.

To address potential future aquatic pathogens and their management, the Service is working closely with USDA-APHIS and NOAA to develop a National Aquatic Animal Health Plan. Drafted with input from both private and public sectors, the plan is not regulatory in nature but provides a framework on how future regulatory and non-regulatory actions regarding aquatic animal health issues will be formulated. It pledges our shared commitment to promoting and facilitating national aquatic animal health.

The Department, through the Service and the USGS, work very closely with state fish and wildlife agencies on surveillance, diagnosis, and management of fish and wildlife disease. The

nature of state and federal authority over fish and wildlife requires a close and collaborative relationships and capability among all the partners. To this end, the Service and USGS were original partners of the states in development of the National Fish and Wildlife Health Initiative (NFWHI), an initiative of the Association of Fish and Wildlife Agencies. The overarching goals of the NFWHI are to: 1) establish and enhance state, federal, and territorial fish and wildlife agency capability to address health issues of free-ranging fish and wildlife, and 2) minimize the negative impacts of health issues affecting free-ranging fish and wildlife through management, surveillance, and research. The Service and USGS are both on the NFWHI Steering Committee that is guiding implementation of this Initiative.

CONCLUSION

The Department of the Interior, as a steward of the nation's fish and wildlife resources, uses all of its authority and resources to conserve our native living resources. Invasive species and fish and wildlife disease are current threats to fish and wildlife populations that will only grow in significance in the face of changes to the physical environment caused by climate change. Managing these existing stressors to fish and wildlife, and anticipating how they may be exacerbated by a changing environment, are essential aspects of sustaining our nation's fish and wildlife in the face of climate change.

Chairman Cardin, Chairman Whitehouse, and Subcommittee Members, the Department, in cooperation with other federal, state, tribal, and local agencies, and other partners, remains committed to addressing all threats to native fish and wildlife. We appreciate your interest in these issues and look forward to working with you to address these threats to our nation's fish and wildlife. Thank you again for the opportunity to appear before you today. I would be happy to respond to any questions you may have.

References:

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