National Wildlife Disease Program

THE NWDP SYLVATIC PLAGUE UPDATE

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Artwork: Erika Kampe

2010 PLAGUE SEROSURVEILLANCE IN WILDLIFE

Yersinia pestis is a Gram negative flea-borne bacterium and the causative agent of plague. The pathogen is traditionally described as cycling between small mammal species, with a long-term enzootic cycle and occasional epizootic cycling or outbreaks. The enzootic cycle of plague is maintained among rodent hosts and their fleas; however, transmission to humans and other mammals can occur through a flea bite or direct contact and often results in severe morbidity and mortality.

Plague was introduced to the U.S. in the early 1900s during the Third Pandemic and is now found throughout much of the western U.S. Although it appears to exist at very low levels, human infections and wildlife mortality events still occur every year. While the number of human cases is low, undiagnosed infections can still be fatal and there is the risk that a pneumonic plague infection can spread rapidly from person to person in the absence of disease recognition and implementation of appropriate respiratory barriers.

Coyote

Yersinia pestis has been documented to infect more than 200 mammal species, and is thought to persist in a small number of rodents that are relatively resistant to disease. It has been postulated that plague continually cycles, even among susceptible species, but that the loss of a few rodents often goes unnoticed. Carnivores and other species regularly exposed to plague likely mount an immune-response that typically averts mortality, but these species are not believed to maintain the infection nor directly contribute to its transmission. Humans, along with felids, lagomorphs, prairie dogs and other rodents are known to succumb to severe *Y. pestis* infections.

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TABLE 1: MOST COMMON SPECIES TESTED FOR PLAGUE IN 2010

Species	Common Name	Total Collected	Negative	Positive	Seroprevalence
Taxidea taxus	badger	23	20	3	13.04%
Puma concolor	mountain lion	45	40	5	11.11%
Canis latrans	coyote	3643	3300	343	9.42%
Lynx rufus	bobcat	22	20	2	9.09%
Urocyon cinereoargenteus	gray fox	14	13	1	7.14%
Ursus americanus	black bear	25	24	1	4.00%

TABLE 2: WILDLIFE PLAGUE SEROLOGY RESULTS BY STATE - 2010

State	Total Collected	Negative	Positive	Seroprevalence
Arizona	449	446	3	0.67%
California	1	1	0	0.00%
Colorado	359	320	39	10.86%
Florida	9	9	0	0.00%
Hawaii	9	9	0	0.00%
Idaho	160	146	14	8.75%
Indiana	1	1	0	0.00%
Kansas	27	27	0	0.00%
Minnesota	1	1	0	0.00%
Montana	1001	937	64	6.39%
Nebraska	143	138	5	3.50%
New Mexico	1062	910	152	14.31%
Nevada	299	274	25	8.36%
Oklahoma	51	49	2	3.92%
Texas	531	528	3	0.56%
Utah	320	279	41	12.81%
Virginia	1	1	0	0.00%
Washington	1	1	0	0.00%
West Virginia	1	1	0	0.00%
Wyoming	110	95	15	13.64%

(***Plague serosurveillance,*** *continued from page 1)*

Wildlife disease surveillance provides data on plague activity by testing species that typically do not develop symptoms or have limited clinical signs of infection for *Y. pestis* antibodies. These species do, however, mount an antibody response. Antibody presence shows that the animal was exposed to plague at some point in the past. Carnivores, in particular, can offer valuable data on plague activity and the National Wildlife Disease Program (NWDP) wildlife surveillance has primarily focused on coyotes.

Coyotes are adaptable, wide-ranging, opportunistic omnivores found throughout the U.S. They also have a broad diet and are known scavengers, essentially sampling from the environment while coming into contact with multiple rodent species and their fleas. Since they cover large distances, coyotes can act as sentinels for plague by consuming rodents across space and time (although our detection ability is dependent upon length of antibody signal). Sampling a small number of wide-ranging carnivores provides a broader snapshot of disease activity when compared to sampling a large number of rodents. Rodent seroprevalence is often extremely even in plague endemic areas.

The NWDP in conjunction with the Centers for Disease Control and Prevention (CDC) worked on an intensive wildlife sampling campaign for 2010 that resulted in unprecedented numbers of animals being screened for plague from across the western U.S. The NWDP and the CDC tested 4,536 wildlife samples collected in 2010 for plague exposure. Coyotes accounted for 3,643 of these samples and 9.4% had detectable plague antibodies. Substantial plague exposure was seen in other carnivorous species as well, including mountain lions (11.11%), bobcats (9.09%), and badgers (13.04%).

New Mexico had the highest overall seroprevalence (14.31%, all species included) and this area has been considered a plague hot-spot for some time. Colorado (10.86%), Utah (12.81%), and Wyoming (13.64%) also had substantial plague activity. Additional samples submitted at the end of 2010 are still being tested and will soon be added to this dataset. The NWDP also maintains a database that has wildlife surveillance data from the previous five years, including data from additional states and species. This report only focuses on 2010 collections. Data from the intensive 2010 sampling campaign, combined with the long-term dataset from the previous 5 years, will continue to be analyzed and will hopefully provide more information on *Y. pestis* dynamics in the United States.

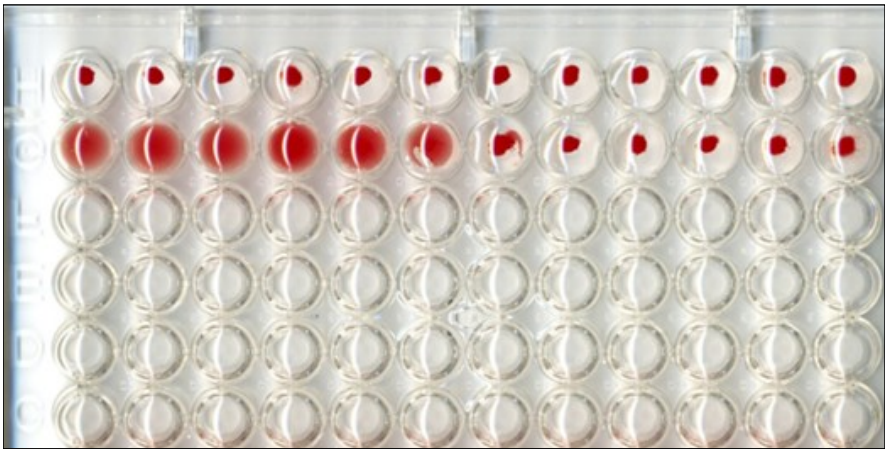
For more information, contact Sarah Bevins:

Sarah.N.Bevins@aphis.usda.gov

Collaborations with State Health Departments on Plague

Part of the NWDP mission is to collaborate with state and other federal agencies, along with non-governmental organizations and officials from other countries, to promote and assist with wildlife disease monitoring programs worldwide. Recently, biologists with the NWDP and multiple state health departments have initiated new collaborations to share data on plague seroprevalence in wildlife.

Several state health departments in the western U.S. conduct their own programs that monitor plague in wildlife. For example, the Washington State Department of Health, in cooperation with the Centers for Disease Control and Prevention, has sampled small groups of wildlife each year, for the past 24 years, to monitor plague activity in Washington. Similar to the NWDP, a majority of their samples come from carnivores. Combining plague data collected by USDA-APHIS wildlife services biologists with the Washington State Department of Health plague database provides greater geographic coverage and increased sample numbers for plague surveillance. These data can be used to alert local government officials to initiate prevention efforts in communities when elevated plague activity is detected in wildlife. Data can also provide timely information to health care providers and veterinarians about increased plague risk, as well as to residents about plague prevention.



Hemagglutination assay used to identify the presence of plague antibodies. Wells with a bead at the bottom are negative, wells with diffuse coloration are positive and dilution across wells reveals the titer.

Correspondingly, the willingness of state health departments to also share their data with the NWDP provides additional coverage for plague surveillance at region-wide scales. The additional results also provide more complete geographic coverage over time. This more robust data set allows the NDWP to run broad-scale analyses on plague data from across the western U.S., examining demographic, temporal, and spatial trends of plague dynamics in wildlife over time. Additional collaborations are underway with Texas and Nevada.

Plague Surveillance for 2011 — The Future

The NWDP has partnered with the Centers for Disease Control and Prevention (CDC) for the last six years to monitor wildlife for exposure to the plague bacteria, *Yersinia pestis*. The CDC has tested more than 4,500 Nobuto strips collected from wildlife across the country in 2010, and even more results are expected from samples submitted later in the year; however, the CDC will only test a limited sample number in 2011.

Testing in 2011 will be limited to regions where plague transmission dynamics are currently unknown because of limited surveillance during previous years. Sample collection can still continue at previous levels or whenever opportunity arises and any samples that are not tested by the CDC upon submission will be stored in the National Nobuto Storage Archive. While archived sample testing is of limited utility in proactive disease management it does offer opportunities for retrospective and geographically targeted analysis as new information and concerns arise. Periodic testing of surveillance samples can also conserve limited financial resources in areas where disease has been longstanding and prevention approaches are limited.

Coyote

While there are only a limited number of recognized human plague cases in the U.S., exposure in wildlife is substantial and an increase in human infections has been seen following epizootic conditions in wildlife. The persistence of plague in wildlife requires continued vigilance by public health officials, and wildlife serosurveillance continues to provide valuable information on the disease.

Interested in Additional Plague Surveillance Data for Your State?

We will be happy to put you in touch with the wildlife disease biologist in your state. Each wildlife disease biologist works closely with state, county, city and tribal entities to improve disease surveillance with the ultimate goal of improving and safeguarding local wildlife, livestock, and human health.

For more information on the Wildlife Services National Wildlife Disease Program in your state, please call 866-4 USDA WS, or contact the following staff:

National Wildlife Disease Program

Tom DeLiberto 970.266.6088
National Coordinator

Tom Gidlewski 970.266.6361
Assistant Coordinator

Dale Nolte 970.266.6049
Assistant Coordinator

Brandon Schmit 970.266.6079
Wildlife Disease Biologist

Kerri Pedersen 970.266.6272
Wildlife Disease Biologist

John Baroch 970.266.6308
Wildlife Disease Biologist

Mark Lutman 970.266.6077
Wildlife Disease Biologist

Dennis Kohler 970.266.6072
Wildlife Disease Biologist

Sarah Bevins 970.266.6211
Wildlife Disease Biologist

Emily Blizzard 970.266.6072
Biological Science Technician

Amelia Lavelle 970.266.6011
Administrative Support Assistant

Mary Kimball 970.980.1546
Budget Analyst

Kirsten Kampe 970.266.6361
Office Automation Clerk, Editor

For All-Hazard Emergencies Involving Wildlife
Call: 970.266.6363
or toll-free 1.877.303.6363

Prairie Dog

Cage Trap

This report was developed in collaboration with the U.S. Centers for Disease Control and Prevention