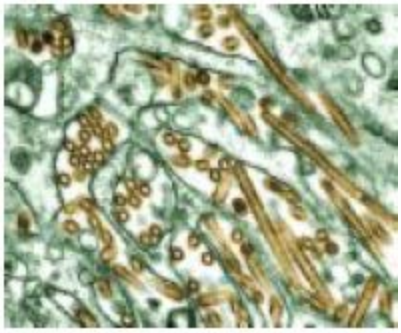
DISEASE CONTINGENCY PLAN

WAUBAY NATIONAL WILDLIFE REFUGE COMPLEX
Waubay NWR
Waubay WMD

SOUTH DAKOTA



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I. BACKGROUND AND INTRODUCTION

A. South Dakota Wildlife Resources

Migratory Birds

The Prairie Pothole Region is legendary as North America's foremost producer of ducks. South Dakota, one of the top duck producing states in the Nation, lies in the heart of this region. Wetland densities in South Dakota can reach as high as 100-150 wetlands per square mile, making it not only an important breeding area for ducks, but also a key breeding and migratory area for over 70 wetland-dependent migratory bird species. South Dakota lies in two migratory bird flyways, the Central and Mississippi flyways.

The Central Flyway is called "the flyway of the Great Plains" as it encompasses the vast region lying between the valley of the Mississippi River and the Rocky Mountains. The Central Flyway is relatively simple, as the majority of the birds that use it make direct north and south journeys from breeding grounds in the North to winter quarters in the South.

South Dakota has four National Wildlife Refuges and five Wetland Management Districts that were set aside for migratory birds with an emphasis on wetland and grassland species.

Large Ungulates

Recent diagnoses of chronic wasting disease in the southwest part of the state have caused a heightened awareness of ungulate diseases in South Dakota. Therefore, Refuges and Wetland Management Districts (WMDs) should have some knowledge and level of preparedness for the potential onset of such diseases. For the purposes of background information, South Dakota provides habitat for elk, white-tailed deer, mule deer, pronghorn, moose, and bison (not free ranging). Elk populations are located primarily in the Black Hills and parts of south-central South Dakota. White-tailed deer are common throughout the state occurring primarily in central and eastern South Dakota and the Black Hills where approximately 75% of deer are whitetails. Mule deer can occur throughout the state but are more common in central and western parts of the state. Pronghorn antelope reach their highest densities in the northeastern part of the state but can also be found in suitable habitats in much of central and western South Dakota. There are no resident populations of moose but wandering animals are often seen in the north and northeast portions of the state. Bison herds are solely in captivity on privately owned ranches and public lands including Badlands National Park. South Dakota Game, Fish and Parks Department (GF&P) is the primary agency responsible for managing ungulates.

B. Waubay National Wildlife Refuge Complex

1. Station Purposes

A. Refuge Purpose

Under Executive Order 7245, dated December 10, 1935, "… as a refuge and breeding ground for migratory birds and other wildlife..."

For Refuge lands under the Migratory Bird Conservation Act, 16 U.S.C. 715 d, as amended, the purpose of acquisition is…for uses as an inviolate sanctuary, or for any other management purpose for migratory birds.

B. Wetland Management District Purposes

"….as Waterfowl Production Areas" subject to "….all of the provisions of such Act [Migratory Bird Conservation Act] … except the inviolate sanctuary provisions…" 16 USC 718 (Migratory Bird Hunting and Conservation Stamp Act)

"…for any other management purpose, for migratory birds." 16 USC 715d (Migratory Bird Conservation Act)

"…for conservation purposes…" 7 USC 2002 (Consolidated Farm and Rural Development Act)

2. Description

Waubay National Wildlife Refuge Complex (Complex) is located in northeastern South Dakota and is comprised of a 4,650 acre Refuge and 39,885 acres of Waterfowl Production Areas (WPAs) located in six counties: Clark, Codington, Day, Grant, Marshall and Roberts (Figure 1). Habitat types within the Complex include freshwater marshes (temporary, seasonal, semi-permanent and permanent), mesic, dry- and wet-mesic tall and mixed-grass prairie, other planted or restored grasslands, native woodlands around permanent lakes and in eastern coulees, 100 acres of cropland, and remnant planted tree rows. Over 16,000 acres of non-managed wetlands are protected within Complex boundaries. There are nine wetlands with working water control structures in the District. These wetlands can be drained but not completely dewatered. When water levels are lowered most rely on snowmelt or spring rains to refill.

The Complex provides migration habitat for a large variety of wetland, prairie, and woodland birds. Thirteen species of waterfowl use Complex lands as migration stopovers. Tundra swans, white-fronted and snow geese are mostly observed only during spring and fall migrations. Tens of thousands of snow geese may gather at various locations throughout the District though not always in the same place from year to year. Canada geese will migrate through as well as nest in the District. Other migratory birds include numerous shorebirds that stop through on their way to more northern breeding sites. With wetland conditions constantly changing concentrations and locations of shorebirds are also constantly in flux. Warblers and other songbirds take advantage of wooded areas for stopovers.

The Western Prairie Fringed Orchid is the only known federally threatened plant species that may be present on the Complex, although it appears to have been extirpated. Bald eagles nest in small numbers in the Complex but currently not on Federal lands. They can also be observed during spring and fall migrations in the District. Piping plovers, a federally threatened species in South Dakota, previously nested in the District but have not been seen recently. The whooping crane only rarely passes through the Complex during its migration. Interior least terns are a rarely seen migrant and Eskimo curlews are considered nearly extinct. Efforts to find American burying beetles in the District have proven unsuccessful and it is believed they no longer occur in this area. Dakota skipper butterflies do occur on some native prairie sites in the Complex and as a candidate species need to be considered in any management plans and activities.

The mix of grasslands and wetlands attract a great variety of breeding raptors, waterfowl, wading and marsh birds, a few shorebirds, and passerines, including many grassland-dependent species. Fifteen species of ducks commonly nest in the area, with mallards, blue-winged teal, and gadwall most common species. Many migratory wetland bird species including great egret, American bittern, Wilson's snipe, and sora rails use the variety of freshwater marshes in the Complex.

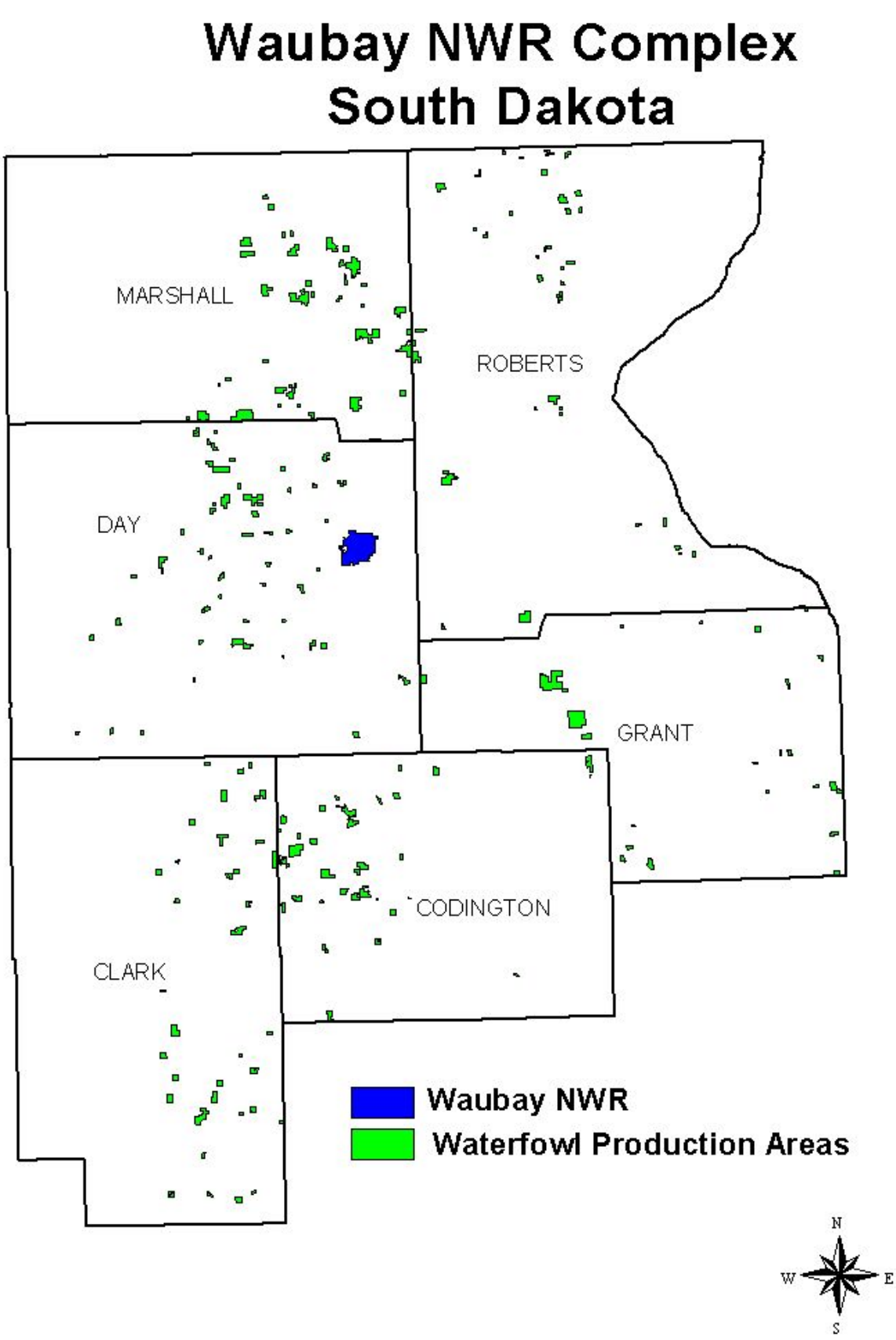

Figure 1. Waubay NWR and WMD Complex

Grasslands provide habitat for a whole suite of prairie obligate birds including bobolink, grasshopper and savannah sparrows, northern harrier, and upland sandpiper. Resident birds include prairie grouse and ring-necked pheasants. A couple hundred geese will often stay throughout the winter at the Big Stone power plant cooling ponds in Grant County.

White-tailed deer, raccoons, skunks, coyotes, badgers, cottontail rabbits, whitetailed jackrabbits and a host of small mammals are the most common mammals in the District.

Amphibians and reptiles abound in the marshes and on the prairies including leopard and chorus frogs, prairie skinks, tiger salamanders, northern plains garter snake, red-bellied snake and others.

3. Climate

The climate is typically continental, characterized by cold winters and hot summers. Winter and summer temperatures can vary from extremes of -43ºF to 104ºF. More normal temperatures range from -26ºF to 95ºF. The average rainfall is 20.9 inches per year and normally heaviest in late spring and early summer. Frequent spells of dry years often alternate with years that are wetter than average. Wetland levels can fluctuate widely with these precipitation changes. Average seasonal snowfall is 30-35 inches. The growing season varies from 109 to 112 days. Small wetlands can freeze up anywhere from late October until the end of November. Waubay and other larger lakes tend to freeze a few weeks later from mid-November up until the end of December during milder winters.

4. Overview of Refuge Management

Management of Complex resources are primarily limited to uplands. Typical management involves defoliation of a part or all of a WPA to reduce plant litter development and invigorate stands of grasses and forbs. This is accomplished through grazing, haying, or burning. This may make one area temporarily unattractive to wildlife but there will be many other areas they can go to within the landscape. Other routine management includes mowing or spraying for weed control. Again, wildlife may be disturbed for short periods of time while management actions occur. Most management occurs during late spring or summer when wildlife populations are scattered for breeding purposes.

Of the many wetlands found in Waubay NWR and WMD, seventeen have water control structures. An additional wetland has an earthen dam with no ability to raise or lower water levels. Currently, eleven of the structures are in good working order and six are either flooded out, in need of repair, or just not usable due to engineering or substrate problems. Of those wetlands with working water control structures, only four have a water source (springs or large lakes) that is reliable on a yearly basis. The remaining wetlands, with or without water control structures, are totally dependent upon annual precipitation, more specifically spring run-off.

Waubay Complex staff has little control over wildlife species that occur on Service lands. The water control structures that are maintained have little effect on the overall landscape and have never attracted large numbers of waterfowl or other waterbirds.

Hunting is allowed on the Refuge to help control local white-tailed deer populations but there is nothing to stop them from traveling in or out of the Refuge. The same goes for the District. Wildlife can travel unencumbered on and off USFWS lands at will.

Most WPAs have access roads to get to them but few have any roads or trails within them. The Refuge is located off of a paved county road with gravel access to Headquarters Island. There is a

mowed trail to the eastern part as well as additional mowed trails to the southwestern part of the Refuge. Most other access to Refuge locations is currently accomplished by boat.

5. Public Use

Waubay NWR is open to public use during daylight hours year round. Most public use is associated with hunting, fishing, wildlife observation and/or photography and environmental education. Deer hunting is the only hunting allowed on the Refuge and fishing is limited to ice fishing. Environmental education occurs mostly in April-May and September. Visitors primarily come during spring or fall months but may also be present in summer and rarely in winter.

Public use in the Wetland Management District is less regulated and less documented. All Waterfowl Production Areas are open to hunting, fishing and trapping in the District in accordance with South Dakota State hunting, trapping, and fishing season regulations. The number of wildlife in the area during a given year dictates the number of hunters and anglers on public land. There are currently no good visitation estimates for WPAs. Most visits to Waterfowl Production Areas occur during September through January when hunting seasons are open for waterfowl, game birds, and big game. Fishing may occur year round but only at a few WPAs with wetlands large enough to sustain fisheries. Bird watching will mostly occur during spring and fall migrations with some visits occurring in summer for breeding birds.

Research projects are usually less than five on the Complex. A Special Use Permit is required for researchers including study locations, duration, and contact information.

II. SURVEILLANCE AND PROCEDURES

A. History

Disease outbreaks occur somewhat irregularly in the Complex and primarily in three counties: Day, Roberts and Codington. Most common is botulism which tends to affect birds at seven or eight major lakes in the District. When climatic conditions are right, salt toxicosis occurs when migrating snow geese are restricted to three highly alkaline lakes in Codington County. West Nile virus first occurred in 2002 and now regularly affects a number of American white pelicans at a breeding colony on Bitter Lake. Listed below are documented disease outbreaks in the Complex. Individual bird or animal deaths are not documented here. Other diseases known to occur in wild animals in the District include rabies, hantavirus and sarcoptic mange. No disease outbreaks have been documented on the Refuge itself.

Table 1. Disease history of Waubay NWR Complex, 1983-2006.

YEAR	DISEASE	SPECIES	LOCATION	COUNTY	# DEAD
1991	avian cholera	C. geese	Big Stone Power plant	Rob	555
1983	botulism	ducks	S. Waubay Lake	Day	300
1983	botulism	ducks	N. Waubay Lake	Day	100
1987	botulism	ducks	S. Waubay Lake	Day	300
1987	botulism	ducks	Bitter Lake	Day	6000
1988	botulism	ducks	Rush Lake	Day	400
1988	botulism	ducks	Grass Lake	Cod	600
1991	botulism	ducks	Grass Lake	Cod	750
1991	botulism	ducks	Little Goose Lake	Cod	1000
1992	botulism	ducks	Little Goose Lake	Cod	700
1992	botulism	ducks	Mud Lake	Rob	1200
1993	botulism	ducks	Mud Lake	Rob	5231
1993	botulism	ducks	Grass Lake	Cod	400

1995	botulism	ducks	Bitter Lake	Day	3933
1995	botulism	ducks	Mud Lake	Rob	100
1995	botulism	ducks	Long Lake	Cod	3560
1996	botulism	ducks	Bitter Lake	Day	454
2003	botulism	ducks	Mud Lake	Rob	1389
1988	necrotic enteritis	snow geese	Bitter Lake	Day	900
1988	necrotic enteritis	snow geese	Long Lake	Cod	500
1990	necrotic enteritis	snow geese	Long Lake	Cod	220
1992	Newcastle disease	d.c.cormorants	S. Waubay Lake	Day	400
1988	salt toxicosis	snow geese	Horseshoe Lake	Cod	150
1988	salt toxicosis	snow geese	Medicine Lake	Cod	1100
1991	salt toxicosis	snow geese	Medicine Lake	Cod	3000
2006	salt toxicosis	snow geese	Lake Nicholson	Cod	1000
1990	unknown	ducks	Grass Lake	Cod	100
2002	West Nile virus	pelicans	Bitter Lake	Day	997
2003	West Nile virus	pelicans	Bitter Lake	Day	365
2004	West Nile virus	pelicans	Bitter Lake	Day	1000*
2005	West Nile virus	pelicans	Bitter Lake	Day	1000
2006	West Nile virus	pelicans	Bitter Lake	Day	1585
					* estimated

B. Risk Factors

The principal species at risk to disease in the Complex are waterfowl and colonial nesting birds because of their tendency to breed or migrate in large numbers and migratory patterns i.e., migrating from places were the risk of contracting diseases may be high. There appears to be a slight bias toward age, gender, and species for some wildlife. Colonial nesters, especially American white pelicans, display an age bias as young birds are generally affected by diseases at a greater rate than older birds. Also some species of waterfowl such as teal and mallards are more susceptible to diseases such as botulism because they tend to feed in areas where infected maggots are present.

The only known turkey farms in the District are the Hillcrest Colony (>70,000 birds produced) located near Garden City and the Fordham Colony (>114,000 birds produced) north of Carpenter, both in Clark County. Smaller poultry farms may occur in the area although exact numbers and locations are largely unknown. The South Dakota Animal Industry Board (SDAIB) has an Animal Health Emergency Management Plan that would address domestic animal safety and procedures in the event of specific disease outbreaks such as Newcastle Disease or Highly Pathogenic Avian Influenza (HPAI). They are developing a surveillance project to sample all aspects of poultry production in South Dakota that will begin in FY 2007.

Eighteen game bird farms are located within the District most of which raise ring-necked pheasants for commercial or non-commercial uses. There are also thirteen big game farms in the six county region most of which raise elk. Bramble Park Zoo is located in Watertown in Codington County where a number of exotic and domestic captive animals are kept. These animals, although caged, may come into contact with wild animals and could be a threat to human health because of high public contact.

Appendix I lists known turkey and game farms in the WMD.

C. Protocol

Depending on the disease status, the level of surveillance will change: detection, assessment or monitoring. Detection level is when specific diseases are not known to be present and surveillance is designed to find early cases of wildlife diseases. Observations of wildlife by staff members can aid in passive surveillance. Refuge personnel are out in the District throughout spring, summer and fall when most diseases occur. Any staff member that observes an injured or symptomatic animal can take note of the condition and location for further investigation. The biologist should be informed in a timely manner so the animals(s) can be collected promptly. Additionally, the biologist should inform the staff of key periods when outbreaks have the potential to occur. This will aid in identifying problem areas quickly and decrease response time should an outbreak occur. In addition, GF&P personnel, and hunters and anglers often notify Refuge personnel when problems are encountered during routine outings.

If a disease has been found on a site, assessment is used to determine the temporal-spatial distribution of the disease, the species affected, and other impacts to wildlife. Certain locations such as Bitter Lake in Day County or Mud Lake in Roberts County have a history of botulism problems. These lakes are monitored more often in late summer to watch for sick and debilitated waterfowl or increased mortality. A research study is currently ongoing at Bitter Lake for the effects West Nile virus is having on juvenile and adult American White Pelicans.

When a disease of interest is well described at a site, surveillance is designed to monitor the natural course of the disease or to monitor the effect of management actions on disease distribution and prevalence. Botulism is Waubay WMDs largest disease problem and there is little that can be done to affect the occurrence of this disease. Some effort has been taken to reduce the incidence on Mud Lake through water level management. However, water levels are constrained by other users and have not been very effective in changing waterfowl use or abundance. Surveillance of Mud Lake is shared between Waubay Complex, Morris WMD in Minnesota, and state GF&P personnel.

Chronic Wasting Disease (CWD) has only been found in deer and elk in the Black Hills. Surveillance for this disease continues in that location and is handled by the state GF&P. Nine years of surveillance and testing of wild deer and elk have shown only 32 CWD positive deer and 15 CWD positive elk out of 12,305 animals tested. The SD GF&P CWD plan calls for continued monitoring of the occurrence and spread of CWD in free-ranging cervids, preventing the further spread of any CWD in free-ranging cervids and eliminating the infection where it exists, and educating the public (SD GF&P Web site).

The goal of South Dakota's HPAI surveillance plan is early detection. The state GF&P is taking the lead on this as a partner with USDA-APHIS, with assistance from Refuges especially where banding activities are already taking place, i.e. Sand Lake NWR. The Central Flyway Council has developed sampling objectives which will be accomplished through banding activities, hunter harvested birds and collection permits. Surveillance needs will be dynamic and may change as the distribution and occurrence of virus changes. Protocols for collecting cloacal and tracheal swabs, the specific samples for HPAI surveillance, as well as specific management options, training needs and other HPAI information are included in Appendix II.

D. Communication and Coordination

The Refuge Biologist and Project Leader will be responsible for staying abreast of emerging diseases, training and PPE needs, and other procedures surrounding surveillance activities in the state. Northern Prairie Wildlife Research Center (NPWRC) will continue as the lead on the American White Pelican West Nile virus study. SD GF&P will continue as the lead on CWD and HPAI surveillance activities in the state. Waubay Complex will provide any assistance and equipment needed to carry out these activities.

III. DISEASE OUTBREAK AND RESPONSE

A. Field Investigation/Initial Response

The initial response to wildlife mortality events vary somewhat by species, but overall require a set of common approaches. Effective disease control operations depend upon early detection of morbidity and mortality, which facilitates the highest and earliest probability of a diagnosis. **Refer to the Wildlife Morbidity/Mortality Response Flowchart (Figure 2) in C. Logistics.**

Once a disease is identified, an immediate and thorough response can be initiated to address the underlying cause of the event. This process begins when either passive or active surveillance indicates sick or dead wildlife on a Refuge, WPA, or other lands. When an event is identified, contacts should be made with the National Wildlife Health Center (NWHC) (Dr. Kathy Converse, 608-270-2445) and the regional wildlife veterinarian (Dr. Tom Roffe, 406-994-5789). A specimen history form should be filled out and intact and fresh specimen(s) should be collected and submitted to the NWHC, Madison, WI. Specific instructions for the collection and shipment of avian carcasses are located in Appendix III. In situations where the Refuge must respond to a mammalian disease outbreak, refer to associated step-down plans or contact the regional wildlife veterinarian. Information about specific diseases is included in Appendix IV.

The Refuge biologist will be responsible for organizing and coordinating all disease management operations. The biologist will work closely with the South Dakota Game, Fish, and Parks during surveillance for diseases such as CWD and HPAI and the National Wildlife Health Center for monitoring of avian diseases. The Project Leader will be responsible for contacting the Service's External Affairs Office to aid in communicating with the public and preparing press releases should an outbreak occur.

1. Personal Protective Equipment

Appropriate personal protective equipment (PPE) must be worn when collecting any sick or dead specimens. At a minimum, the collector should wear latex or nitrile gloves for an individual animal mortality. After collection, all protective material should be washed with a chlorinated solution (10% Clorox: 90% water) and/or double bagged and disposed.

Personal protection required during surveillance and initial response will be based on HPAI risk level assessment. The levels and appropriate PPE include:

Table 2. Management Acceptance of Risk

Risk Criteria	Risk Level		Approval Authority
HPAI not suspected or unlikely	1	Low Risk	Project Leader
HPAI suspected in sick or dead birds	2	Medium Risk	Asst. Regional Director
HPAI confirmed in birds	3	High Risk	Deputy Regional Director
HPAI confirmed in humans	4	Extremely High Risk	Deputy Regional Director

As indicated in the above table, the Service HPAI Response Plan requires an assessment of the level of risk at each station, at a minimum identified in writing by the Project Leader. Higher levels of risk will require the Project Leader to make that determination followed by concurrence at a higher level. The Service HPAI Response Plan requires the Regional Director to develop a regional Crisis Management Team that specifically focuses on the human element and risk to Service employees. The primary responsibilities of this team are to define roles and responsibilities for preparedness and response planning, identify essential services and personnel

in the event of a pandemic, and review protocols and current CDC and epidemiology guidance. Project Leaders have the responsibility to discuss with field personnel the current site-specific HPAI risk assessment and ensure employees are trained in use of appropriate PPE.

Under Risk Level 1, for routine or surveillance work, personal protection procedures and supplies consist of:

- ☞ protective clothing, preferably impermeable coveralls and suits
- ☞ heavy duty rubber work gloves that may be disinfected
- ☞ N95 respirator masks
- ☞ Goggles
- ☞ Rubber boots that can be disinfected or protective foot covers that can be discarded

- → Work in a well-ventilated area if indoors.
- → To the extent possible, handle birds downwind of personnel to decrease the risk of inhaling aerosols such as dust, feathers, or dander.
- → Do not eat, drink, or smoke while handling birds.
- → Wash hands or use hand sanitizer before eating, drinking, or smoking.
- → Notify Project Leader/Supervisor if sick or dead birds are detected or found.
- → If instructed to collect sick or dead birds, follow "collection protocol".

Under Risk Level 2, PPE use consists of:

- → Follow Level 1 guidelines and measures.
- → Elevate to Level 2 protection, i.e. must wear coveralls, rubber boots, and nitrile, latex, or rubber gloves.
- → Minimize exposure to mucous membranes by wearing protective eyewear and mask.
- → Decontaminate and properly dispose of potentially infectious material, including carcasses. (see carcass disposal)

Risk Levels 3 and 4 (HPAI confirmed in birds and humans) require a series of steps be taken at the Refuge and Regional levels. These details will be provided at a later time with the Service's HPAI National Response Plan.

2. Specimen Submission

Collection of samples should be done in the field to reduce the spread of pathogens to uncontaminated areas. While collecting specimens for submission to the NWHC, a *Wildlife Specimen History Form* (Appendix 3) should be completed to determine the onset, course, duration, distribution, species, and other environmental conditions associated with the mortality event. Per instructions on this form, the submitter must contact a representative at the NWHC ***prior*** to sending any specimens. An electronic version of this form is located on the biologist's computer in the "Disease" folder for submission by email.

When possible, submit three or four specimens of freshly dead or euthanized animals. Additionally, investigators should submit specimens of each species affected, and all age cohorts. Place in a cooler with ice packs and ship overnight if feasible. If it is not possible to send shipments immediately, freeze specimens (or follow NWHC instructions) until shipment and use cold packs to keep cool during transport. Do not ship specimens on Fridays unless otherwise instructed (see attached protocol for shipping specimens to the Wildlife Health Lab). When sampling for disease such as CWD or HPAI follow established protocol for collection of samples.

Coolers for specimen shipment as well as ice packs are located in the old shop next to and in the freezer in the southernmost garage. These coolers and ice packs are to be reserved for disease use only. They should not be mixed up with other equipment or food stored in Refuge refrigerators or freezers.

3. Identify Needs

The initial assessment should help to identify the extent and significance of the outbreak. From this information basic needs should be identified. Continue monitoring the mortality event while waiting notification of the results from the NWHC. A table of recent and past mortality events can be viewed at http://www.nwhc.usgs.gov/disease_information/mortality_events/index.jsp.

a. Equipment

Equipment needs will be based on the location of the disease outbreak and most of the carcasses. On smaller wetlands 4 or 6 wheeled All Terrain Vehicles (ATVs) may be the most efficient way to conduct clean-up operations. Shorelines of larger lakes or those with cattail-choked edges are easier to access with an airboat that can get through vegetation and shallow water areas or sites with no boat ramps. Islands can be monitored by regular boat or an airboat, depending on wind and wave conditions. Other equipment that may be needed would be backhoes, front-end or skid steer loaders, fire engines or any other heavy equipment necessary for excavating disposal pits, burning or hauling carcasses or other needs. An equipment list and location, and persons certified to operate them can be found in Logistics Part 3.

b. Personnel

Smaller mortality events can be cleaned-up and monitored with one or two crews of people. Larger events may need a number of different crews over days or weeks to protect animal and human safety. All personnel involved should have the necessary certifications to operate the equipment they are using and trained in PPE use and other safety measures. If respirators will be used, personnel should get the necessary training the winter or spring before disease outbreaks occur. Taking time to train personnel during an outbreak interrupts the clean-up process putting people and wildlife at risk and possibly exacerbating the spread of disease. Minimum training of Service staff will include:

- How to put on, use, remove, disinfect and/or dispose of PPE and clothing
- Proper disinfection techniques for tools, samples, and equipment
- The importance of strict adherence to and proper use of hand hygiene after contact with infected or exposed birds, contact with contaminated surfaces, or after removing gloves
- Proper hand washing
- Sample collection and submission techniques including swabbing birds, use of transport media, proper labeling, storage and shipment to laboratories

See Logisitcs Part 3 for a list of Service employees and equipment they are certified to operate.

c. Disposal

In Priority Order these are the methods to be used:

- On-site treatment (mobile incinerators or burning, mobile digestors)
- On-site burial
- Off-site landfill or off-site treatment (rendering, incineration, or digestion)

In general, the closer to the disease event carcasses can be disposed of the better.

SD law states broadly that animal carcasses must be disposed of "as prescribed by the Animal Industry Board." Carcass disposal may be accomplished by "burning, burial, rendering, or otherwise prescribed by the Board." Individuals, government entities, businesses and industries are required to obtain a permit only if they own or operate a solid waste facility. Farmers and ranchers are allowed to dispose of their wastes on their own land without a permit under the following conditions: 1) if the domestic waste is generated on their property; 2) if the disposal is not a threat to human health or the environment; and 3) if the disposal does not unduly pollute the air or waters of the state. No permit is necessary for water quality aspects; however, the following guidelines should be followed to minimize damage to the aquatic environment:

- Burning on site is acceptable if at least 100' from a water line
- The use of gasoline/diesel are acceptable, however, the preferred accelerant would be propane.
- Ash should be removed from the site and disposed of in an approved landfill.
- A berm should be constructed around the incineration site to contain runoff from heavy rains.

A pit should be dug on-site at a location to be determined by the Project Leader or assistant manager as close to the disease outbreak location as possible. Areas where the water table is high should not be considered as a disposal site. The carcasses should be put into a pit, covered with lime, and then buried. Personnel should wear at least the minimal PPE required when disposing of carcasses.

In the event of a large mortality event or it is deemed beneficial to dispose of carcasses in a landfill, the SD Department of Environment and Natural Resources (DENR) has designated Approved Regional Landfills, which are authorized to take carcasses. Because approved landfills can be managed by the county, city, or privately, each approved landfill has the right to turn down carcasses, even if they are authorized to take them. Therefore, approved landfills should be contacted individually to determine if and what volume of carcasses they would accept in the event of an outbreak. Two of these approved landfills are located in Waubay WMD:

Roberts County Landfill
Contact: Randy Deutsch 605 698-7336
Location: ½ mile south of 121st St on 463rd Ave (or 2 miles east and 2.5 miles south of the intersection of I 29 and Hwy 10)

Watertown Landfill
Contact: Mike Boerger or Diana Ford 605 882-6219 or 605 882-6243
Location: 3 miles south on Hwy 81 and 1.25 east on 175th St

Heavy red garbage bags used for disease cleanup are located in the seed shed. See section C. Logistics for more information on where supplies, PPE, and other pertinent equipment are stored.

d. Biological/Political/Physical Constraints
In considering needs during a disease outbreak some thought must be given to any biological, political or physical constraints. The first rule is to prevent the spread of any

infectious disease to new locations. Use the minimum personnel necessary to accomplish the investigation. Also important is the effect clean up activities may have on nesting birds or young. Minimizing trips to nesting islands and avoiding repeated flushing of adults or young can help to reduce negative impacts. Anglers, hunters, or the general public may become concerned when they observe large numbers of dead animals or witness clean up operations. It is important to contact state GF&P officials and the media when necessary to make the public aware of problem areas and potential management actions that may need to be taken. If at all possible burial pits should be covered each day for public health and safety. Physical constraints could include the health and safety of personnel, especially when working under hot and humid conditions with respirators and other protective equipment, or the ability to get to a location. At times access to some locations may be denied by the landowner(s) or remoteness may make access difficult or unsafe. The Project Leader, in conjunction with Regional office staff or state health personnel, may have to decide when health and human safety override political jurisdiction or landowner rights.

B. Control

Once an outbreak has occurred it is vital that infectious diseases are not spread to new locations. While waiting for diagnoses to come back, every effort must be made to contain the problem under the constraints identified above. Management options may include closing certain areas, manipulating wildlife populations, and/or regulating public use.

1. Management

Wildlife

Management of wildlife populations will depend on whether the disease is infectious or not. Non-infectious diseases like botulism require no special management actions as it is not spread to humans and it is unclear whether clean up actions actually reduce the severity or length of the outbreak. Management actions that may be needed for HPAI would include limiting public use and contact and containing the affected population. The morbidity/mortality response flow chart should be followed.

Based on the best management practice recommended by health professionals and the Regional Veterinarian, the staff can attempt to influence the movement of migratory birds on the Complex by using one or a combination of techniques including, but not limited to: baiting, hazing and water manipulation. However, most WPA wetlands in the District cannot be managed. Capabilities are limited in many situations and pumping might be the only option to de-water an area.

Alternatively, there may be times when the reduction of disease affected populations is necessary to contain or reduce the spread of a disease. In these cases, the Refuge manager may issue a special use permit for the additional harvest of wildlife species. This tool may be used to either remove diseased animals or decrease the chances of a density dependent mortality event taking place.

People

Although all WPAs and parts of the Refuge are open for public uses like hunting, fishing, and bird watching, certain activities can be restricted as needed. The Project Leader has the flexibility to close areas thereby eliminating human disturbance to wildlife or reduce the risk to human health if an outbreak were to happen. Refuge staff will sign closed areas and issue a press release in local papers explaining the details of the closure. The Project Leader will decide on a case by case basis

which public activities will be allowed in the Complex, including research, by using the **Public Use Flowchart in Part C. Logistics**.

a. Regulatory Authority

Managing wildlife populations and habitats to control disease outbreaks is vested with Refuge Complex Manager in 7 RM 17.2: The Refuge Manual (7 RM 17) states that it is "Service policy to prevent or to control wildlife diseases on Refuges wherever practical or possible" and the "Service will take a leadership role...[for] fostering cooperative [wildlife disease] control activities. While some loss from disease is inevitable, management practices will be directed at minimizing these losses. The Service will take a leadership role in developing better methods for wildlife disease control and fostering cooperative control activities.

8 RM 13.5 describes emergency closure procedures, which refer to 50 CFR 25.21. Part (e) of this chapter states that: In the event of a threat or emergency endangering the health and safety of the public or property or to protect resources of the area, the Refuge Manager may close or curtail refuge uses of all or any part of an opened area to public access and use in accordance with the provisions in 25.31 without advance notice.

b. Compatibility

Refuge personnel follow standard disease management procedures to limit impacts to migratory bird populations and submit carcasses to the National Wildlife Health Center for evaluation and determination of cause of death. Standard procedure is to collect carcasses as well as sick and dying birds in order to determine cause of death and to limit exposure of healthy birds to sick and dead birds. This approach to disease management is considered a refuge management activity and a compatibility determination (CD) **is not** required. Due to the potential for human and domestic stock health risks of an HPAI outbreak, and the range of disease management options that may be considered, there should be no assumption that a compatibility determination is not required. Managers always have the option to exercise best management practices (BMPs) to manage a disease outbreak as an emergency in order to protect the health and safety of the public or any fish and wildlife population. If emergency measures are taken that require a compatibility determination it can be completed within 30 days. One example of a management action that could require a CD might be a large scale population reduction measure for targeted surveillance as a result of finding H5N1 in a population.

South Dakota Project Leaders have decided a compatibility determination is not necessary for actions needed to prevent or combat the spread of Chronic Wasting Disease, as CWD-related activities are determined to be management.

The biologist will contact Scott Larson of the Ecological Services FWS Office in Pierre, SD concerning all Section 7 activities. If animals are to be "taken" beyond harvest through hunting the effects will have to be considered. If it is determined that an intra-Service NEPA consultation is needed, the biologist will compile all the required documentation including Section 7 and biological assessments as well as Environmental Assessments (EA) or Environmental Impact Statements (EIS). Many of the management actions may fall under categorical exclusions and therefore be exempt from the EA or EIS process. The biologist will document all determinations of the intra-Service NEPA consultation. Finally, the South Dakota USFWS Ecological Service office will have to be contacted to guarantee all regulations are met concerning the effects of animal disposal. Disposal will be through burning or burial and in compliance with all state and federal regulations.

2. Clean Up

Clean up operations will differ from the initial assessment as personnel will know what they are dealing with and can efficiently act to minimize further spread of disease. Clean up of large disease outbreaks can be coordinated with the state GF&P and/or other Refuges that may share or be near outbreak locations.

a. Equipment

Initial assessments should identify what, how many, and where equipment will be needed and coming from. It is essential that all equipment be decontaminated each day when leaving a disease site. Although this is not necessary when dealing with diseases like botulism, it is a good practice to get into and reduces the chance that pathogens or other problems get spread to uncontaminated sites, especially the Refuge. By treating each outbreak as if it were an infectious disease, both human and wildlife safety will be ensured.

b. Personnel

Any personnel working on clean up activities will be properly trained in equipment and PPE use and safety.

c. Work Areas and Biocontainment

Should a disease outbreak occur in epidemic proportions, a work area will be established at the affected site where contaminated materials are contained and unauthorized and/or improperly protected individuals are not allowed. Personnel working within the containment area will exit such sites through proper bio-containment and disinfection procedures, including proper disposal or disinfection of contaminated clothes, gloves, masks, eye-protection and equipment. Should this step become necessary personnel from the regional office wildlife veterinarian (Tom Roffe 406-994-5789) will be contacted for assistance. More specific control strategies of the bio-contaminated area(s) are listed:

1. Identify the following work areas on the mortality event site:
    a. Clean area – Site where no contaminated materials are allowed
    b. Command post – Communication and coordination location
    c. Briefing Room – quiet/clean area for media/meetings
    d. Parking
    e. Eating Area – Uncontaminated are where food can be eaten/delivered
    f. Staff assembly and rest area
    g. Equipment and supply receiving area

2. Transition area
    a. Decontamination of personnel leaving contaminated areas
    b. Decontamination of equipment leaving contaminated areas

3. Contaminated area
    a. Carcass disposal (burial and/or incineration sites)
    b. Sample processing/shipment area

Protocols must be developed that identify authorized personnel as well as ingress/egress points of access to the mortality event area during disease episodes. (Where exposure is possible during disease episodes, authorized personnel will be those that have received appropriate training and have respirators and the proper PPE. Other refuge staff will assist in support activities outside of area where PPE

is needed or exposure is possible). Ingress/egress points of access will be dependent on disease localities.

Sanitation practices and equipment must be identified and incorporated, including the following:

1) Cleaning and laundering of reusable PPE
2) Waste containment and disposal of contaminated materials
3) Equipment required to disinfect sampling equipment and vehicles
    a) Bucket/brushes for cleaning boots
    b) Sprayers for decontaminating equipment, ATVs, Pickups, boats
        i.)Hand pressurized sprayer
        ii.)ower sprayer (e.g. small fire pumper)

d. Carcass Disposal

Site selection will be made depending on extent of outbreak, location, and ease of disposal. If a landfill or other site off Complex lands will be used proper notification should be made of the appropriate entity.

C. Logistics

1. Communication and Coordination

The point of contact will be the station biologist for initial assessments and routine outbreaks. For large or unusual disease problems the point of contact will be the Project Leader. Other staff that may be involved in disease outbreaks are listed below.

Waubay Complex - Key Staff	**605-947-4521**
Laura Hubers, Biologist	ext. 116
Initial Assesment, NWHC contact, samples, clean up	
Larry D. Martin, Project Leader	ext. 110
Overall supervision, RO and media contacts	
Doug Leschisin, Deputy Project Leader	ext. 117
Contact and supervision if Project Leader is gone	
Jarrod Lee, Safety Officer	ext. 113
Supplies, PPE, employee health and safety	
Dennis Okroi, Administrative Officer	ext.111
Supplies, coordination at Headquarters, Fedex shipments	
Mike Dargatz, Maintenance Worker	ext. 127
Boats, heavy and other equipment, supplies	

See Figure 2. Wildlife Morbidity/Mortality Response Flowchart

At this point in the process, other federal agencies, state agencies, and other pertinent organizations can be notified of the initial response activities if appropriate.

SD Game, Fish & Parks Department

Will Morlock - Wildlife Manager …….……	605-882-5200
Spencer Vaa – Sr. Waterfowl Biologist ……..……	605-328-6302
Local Conservation Officers:	
Day County…….	605-345-3381
Codington Co……..	605-882-5200
Clark Co……..	605-532-3802
Marshall Co…….	605-448-5500
Roberts Co……	605-698-3852
Grant Co……...	605-432-4601

Tribal Contacts

Sisseton-Wahpeton Sioux Tribe Fish & Game……..……..	605-698-3911

National Wildlife Refuges/WMDs and Project Leaders

Sand Lake	Gene Williams…….	605-885-6320
Tewaukon	Jeff King……..	701-724-3598
Madison WMD	Tom Tornow…….....	605-256-2974
Huron WMD	Harris Hoisted…….	605-352-5894
Morris WMD	Steve Delehanty……..	320-589-1001

USFWS – Pilot

James Ward, Huron WMD…….	605-352-5894
cell phone…	605-350-1247

USFWS Contacts:

Tom Roffe, Chief, Wildlife Health…….	406-994-5789
Rod Krey, Refuge Supervisor…….	303-236-4307
Pete Gober, Field Supervisor, Ecological Services……	605-224-8693 x 24
Scott Larson, End. species, ES……	605-224-8693 x 32
Joy Gober, Contaminants, ES…….	605-224-8693 x 27

USGS-National Wildlife Health Center

Kathryn Converse, Wildlife Disease Specialist……..	608-270-2445

Wildlife Morbidity/Mortality Response Flow Chart

Public Use Flow Chart

Media Contacts

Table 3. Media Contacts for Waubay Complex

External Affairs – Region 6				
Sharon Rose	Asst. Reg. Director		303 236-4580	
Newspapers	**City**	**County**	**Phone**	
Reporter and Farmer	Webster	Day	345-3356	
Public Opinion	Watertown	Codington	886-6901	
American News	Aberdeen	Brown	225-4100	
Britton Journal	Britton	Marshall	448-2281	
Clark County Courier	Clark	Clark	532-3654	
Grant County Review	Milbank	Grant	432-4516	
Langford Bugle	Langford	Marshall	493-6441	
Rosholt Review	Rosholt	Roberts	537-4276	
Sisseton Courier	Sisseton	Roberts	698-7642	
South Shore Gazette	South Shore	Codington	756-4200	
Waubay Clipper	Waubay	Day	947-4501	
Wilmot Enterprise	Wilmot	Roberts	938-4651	
Radio	**City**		**Phone**	**Frequency**
Dakota Nation Broadcasting	Sisseton		698-7972	
KBWS	Sisseton		698-3471	102.9
KCGN	Milbank		432-9571	101.5
KDLO	Watertown		882-1597	96.9
KGIM	Aberdeen		229-3632	103.7
KIXX	Watertown		886-9696	96.1
KSDN	Aberdeen		225-5930	
SD Public Radio	Vermillion		800-456-0766	90.9
Television				
KSFY/KABY	Sioux Falls		800-955-5739	
	Aberdeen		225-9200	
Public Broadcasting	Vermillion		800-456-0766	

Initial contact should be with the two largest newspapers: Aberdeen American News and Watertown Public Opinion. News about more localized outbreaks can be sent to smaller newspapers if needed. The Regional Office should be kept apprised of any major outbreaks or any information released to local newspapers.

Data Managment

A summary report will be written for the Refuge files using the Specimen History Form, other field notes and laboratory data for any birds collected in the Complex. The data will be stored electronically on the biologist computer and paper copies filed in the Refuge library. Copies of information will be made available to the Regional Office, Dr. Tom Roffe the Service Wildlife Disease Coordinator, USGS NWHC, state wildlife management agencies, Sam Holland, the state veterinarian, and USDA/APHIS.

The Interagency team for HPAI is developing standardized data reporting and distribution systems. These will be appended to the station Disease contingency Plan when available.

2. Personnel Information

Table 4. Complex staff and certifications

Table 5. Human and Environmental Safety Contacts

3. Equipment and Sources

Table 6. Equipment available at Waubay NWR and certified operators, Dec. 15, 2006

Vehicles	**Location**	**Number**	**Certified Operators**
All Terrain Vehicles	New shop, 4-Stall	6	all staff
Fire Engine	New shop	1	all staff
4-wheel Drive Pickups	all garages	13	all staff
Boats			
Canoe	4-stall	1	Mike Dargatz
Motorboats			Doug Leschisin
John Boat	4-stall?	1	Jarrod Lee
Sea Ox (Deep V-Hull outboard)	4-stall	1	Connie Mueller
Airboat	Morton bldg.	1	Drew Ellis
			Neal Hornseth
			Laura Hubers
Heavy Equipment			
Front End Loader	Outside new shop	1	Mike Dargatz
Backhoe	New shop	1	Neal Hornseth
			Jeff Clark
			Emil Gruba
			Larry Martin
Tractor Truck	Outside new shop	1	Mike Dargatz
Dump Truck	Outside new shop	1	Neal Hornseth
			Jeff Clark
			Emil Gruba
Tractors	Morton bldg.	2	Mike Dargatz
Dozer	Morton bldg. or outside	1	Neal Hornseth
Skid Steer Loader	Morton bldg.	1	Jeff Clark
			Emil Gruba
			Larry Martin
			Jarrod Lee

4. Supplies

Station PPE supplies are kept in the New Shop in the upstairs storage loft. Life vests are also stored in this location. Heavy red garbage bags used for carcass disposal are in the seed shed.

Additional supplies can be purchased from:

Northern Safety Company; gloves, masks, protective suits, goggles
www.northernsafety.com 800 631-1246

Conney Safety Products; rubber boots, tyvek coveralls, gloves, respirator masks
no website 800 356-9100

Regional Cache
Sand Lake is one of 15 regional cache sites that has a supply of PPE & supplies for use by field staff at Sand Lake and neighboring refuges/WMDs in case of a possible avian influenxa mortality event. This is a list of supplies in their cache:

Ansell Technician gloves, 17 mil rubber
Nitrile gloves
REPEL Tyvek fluid tested suits
Tyvek coveralls
Boot covers
N95 Respirators
N100 Respirators
Biohazard bags
Yukon safety glasses
Plastic pails
Scrub brushes
Roccal-D Plus disinfectant

5. Food and Lodging

Restaurants, cafes and lodging are located throughout the District and are too numerous to list. The location and size of the disease outbreak will determine how many people are needed for cleanup operations and where they can get food and lodging. A few of the hotels nearest Refuge Headquarters are listed below as well as the nearest fast food establishments.

Hotels

Waubay

Circle Pines	947-4641
Lakeside Lodge	947-4571

Webster

Northern Lights Motel & Steakhouse	345-2424
Day County Inn & Suites	345-4701
Holiday Motel	345-3323

Fast Food

Webster

Pizza Hut	345-3383
Subway	345-4780
A&W	345-4140

APPENDIX I RISK FACTORS – AREA GAME AND TURKEY FARMS

Attachment 1. Game Bird Farms
Attachment 2. Big Game Farms
Attachment 3. Turkey Producers

APPENDIX II. HPAI INFORMATION

Attachment 1. Region 6 HPAI Coordination and Information Flow
Attachment 2. Avian Influenza Efforts in Region 6
Attachment 3. HPAI Communications
Attachment 4. SD Surveillance Data
Attachment 5. Protocols for Sampling Waterfowl for AI
Attachment 6. Sampling Birds for AI

APPENDIX III. USGS – NATIONAL WILDLIFE HEALTH CENTER INFORMATION

Attachment 1. Specimen History Form
Attachment 2. Specimen Shipment Information and Instructions

APPENDIX IV. SPECIFIC DISEASE ACCOUNTS

Attachment 1. Avian Influenza
Attachment 2. Avian Botulism
Attachment 3. Avian Chlamydiosis
Attachment 4. Avian Cholera
Attachment 5. West Nile Virus
Attachment 6. Chronic Wasting Disease
Attachment 7. SD List of Reportable and Quarantinable Diseases

Avian Influenza

General Background and Description
Avian influenza is an infection caused by avian influenza (AI) viruses. These influenza viruses occur naturally among birds. Wild birds worldwide carry the viruses in their intestines, but usually do not get sick from them. However, avian influenza is very contagious among birds and can make some birds, including chickens, ducks, and turkeys, very sick and kill them.

Infected birds shed influenza virus in their saliva, nasal secretions, and feces. Susceptible birds become infected when they have contact with contaminated secretions or excretions or with surfaces that are contaminated with secretions or excretions from infected birds

Infection with avian influenza viruses in birds causes two main forms of disease that are distinguished by low and high extremes of virulence. The "low pathogenic" form may go undetected and usually causes only mild symptoms (such as ruffled feathers and a drop in egg production). However, the highly pathogenic form spreads more rapidly through flocks of birds. This form may cause disease that affects multiple internal organs and has a mortality rate that can reach 90-100% often within 48 hours.

Avian Influenza A (H5N1) in wild populations
Historically, wild birds have been natural reservoirs for low pathogenic avian influenza viruses and often show little or no signs of disease. Various forms of low pathogenic avian influenza have existed in the United States since the early 1900's. They can cause varying degrees of illness in birds and have not posed a public health threat. If a virus mutates or mixes with another avian influenza virus it can become highly pathogenic, causing higher fatality rates in birds. The HPAI strain of H5N1 currently affecting countries in Asia, Africa, Europe and other geographic areas is highly infectious between birds, but has never been found in the United States.

During 2005, an additional and significant source of international spread of the virus in birds became apparent for the first time, but remains poorly understood. Scientists are increasingly convinced that at least some migratory waterfowl are now carrying the H5N1 virus in its highly pathogenic form, sometimes over long distances, and introducing the virus to poultry flocks in areas that lie along their migratory routes. Should this new role of migratory birds be scientifically confirmed, it will mark a change in a long-standing stable relationship between the H5N1 virus and its natural wild-bird reservoir.

Evidence supporting this altered role began to emerge in mid-2005 and has since been strengthened. The die-off of more than 6000 migratory birds, infected with the highly pathogenic H5N1 virus, that began at the Qinghai Lake nature reserve in central China in late April 2005, was highly unusual and probably unprecedented. Prior to that event, wild bird deaths from highly pathogenic avian influenza viruses were rare, usually occurring as isolated cases found within the flight distance of a poultry outbreak. Scientific studies comparing viruses from different outbreaks in birds have found that viruses from the most recently affected countries, all of which lie along migratory routes, are almost identical to viruses recovered from dead migratory birds at Qinghai Lake. Viruses from Turkey's first two human cases, which were fatal, were also virtually identical to viruses from Qinghai Lake.

Waterfowl, e.g., ducks, geese, and swans (Anseriformes), and shorebirds (Charadriiformes) are particularly susceptible because they are exposed to water that may be contaminated with infected fecal matter, especially at specific sites and seasons, when these birds congregate densely at relatively confined and shallow water bodies. A secondary mode of viral spread is consumption of infected avian host parts by predators, including captive carnivores, avian raptors, and carrion-feeding vertebrates. Infection by

most avian influenza A strains appears to be asymptomatic for the host. Proportions of birds shedding active virus can be high (e.g., >30% in some Canadian duck populations) among juvenile waterfowl gathered in large flocks on lakes and ponds during the summer postbreeding molting period but decrease rapidly during southward migration, falling to 1% to 2% during winter. Nevertheless, shedding of active virus can remain as high as 0.25% by individual birds among northbound spring migrants, sufficient to reinfect northern breeding populations.

Avian Influenza A (H5N1) in Humans
Of the few avian influenza viruses that have crossed the species barrier to infect humans, H5N1 has caused the largest number of detected cases of severe disease and death in humans. However, it is possible that those cases in the most severely ill people are more likely to be diagnosed and reported, while milder cases go unreported. Of the human cases associated with the ongoing H5N1 outbreaks in poultry in Asia and parts of Europe, the Near East and Africa, more than half of those people reported infected with the virus have died. Most cases have occurred in previously healthy children and young adults and have resulted from direct or close contact with H5N1-infected poultry or H5N1-contaminated surfaces. In general, H5N1 remains a very rare disease in people. The H5N1 virus does not infect humans easily, and if a person is infected, it is very difficult for the virus to spread to another person at this time.

While there has been some human-to-human spread of H5N1, it has been limited, inefficient and unsustained. For example, in 2004 in Thailand, probable human-to-human spread in a family resulting from prolonged and very close contact between an ill child and her mother was reported. Most recently, in June 2006, WHO reported evidence of human-to-human spread in Indonesia. In this situation, 8 people in one family were infected. The first family member is thought to have become ill through contact with infected poultry. This person then infected six family members. One of those six people (a child) then infected another family member (his father). No further spread outside of the exposed family was documented or suspected.

Nonetheless, because all influenza viruses have the ability to change, scientists are concerned that H5N1 virus one day could be able to infect humans and spread easily from one person to another. Because these viruses do not commonly infect humans, there is little or no immune protection against them in the human population. If H5N1 virus were to gain the capacity to spread easily from person to person, an influenza pandemic (worldwide outbreak of disease) could begin.

There currently is no commercially available vaccine to protect humans against H5N1 virus that is being seen in Asia and Europe. However, vaccine development efforts are taking place. Research studies to test a vaccine to protect humans against H5N1 virus began in April 2005, and a series of clinical trials is under way.

History specific to SD
As of December 15, 2006 there has been no H5N1 detected in wild or domestic bird populations in North America.

Mortality & description of clinical signs (Poultry)

Low Pathogenic Avian Influenza:
- Little or no clinical signs
- Mild respiratory disease (coughing and sneezing)
- Decreased egg production

High Pathogenic Avian Influenza:
- Sudden death without clinical signs
- Lack of energy and appetite

- Nasal Discharge
- Coughing and sneezing
- Decreased Egg Production
- Swelling of the head, eyelids, combs, wattles and hocks
- Purple discoloration of the wattles, combs and legs
- Poor coordination
- Diarrhea
- Soft-shelled or misshapen eggs

Disease Surveillance
In 2005 the President and staff developed a National Strategy for Pandemic Influenza Preparedness Plan. The interagency plan outlines five specific strategies for early detection of the virus in wild migratory birds, including:

* Investigation of disease-outbreak events in wild birds
* Expanded monitoring of live wild birds
* Monitoring of hunter-killed birds
* Use of sentinel animals, such as backyard poultry flocks
* Environmental sampling of water and bird feces

Because Alaska is at the crossroads of bird migration flyways, scientists believe the strain of highly pathogenic H5N1 currently affecting Southeast Asia would most likely arrive there if it spread to North America via migratory birds. Thus, the plan recommends a prioritized sampling system with emphasis in Alaska, elsewhere in the Pacific Flyway and the Pacific islands, followed by the Central, Mississippi and Atlantic Flyways. In 2006, USDA and its cooperators plan to collect between 75,000 to 100,000 samples from live and dead wild birds. They also plan to collect 50,000 samples of water or feces from high-risk waterfowl habitats across the United States.

Certain Service personnel may be asked to collect samples during other wildlife management activities ie. banding, law enforcement hunter checks, or other monitoring efforts. These will be coordinated through South Dakota's Surveillance State Liaison Gene Williams 605-885-6320.

Safety
For those in direct contact with live or dead wildlife or with contaminated materials from a source identified as a HPAI source:

• Medical evaluation is recommended for all exposed employees; this may include post-exposure prophylaxis (PEP) with antiviral drugs and medical surveillance of exposed workers.

• Instruct workers to be vigilant for the development of fever, respiratory symptoms, and/or conjunctivitis (i.e., eye infections) for 1 week after last exposure to avian influenza-infected or exposed birds or to potentially avian influenza-contaminated environmental surfaces.

• Individuals who become ill should seek medical care and, prior to arrival, notify their health care provider that they may have been exposed to avian influenza. In addition, employees should notify their health and safety representative.

• Individuals who become ill should be advised to stay home until 24 hours after resolution of fever, unless an alternative diagnosis is established or diagnostic test results indicate the

patient is not infected with influenza A virus.

• While at home, ill persons should practice good respiratory and hand hygiene to lower the risk of transmission of virus to others.

• Refer to latest medical recommendations.

Public Use

Confirmation of a disease such as HPAI that could possibly be spread to the public by migratory birds may happen at times when public use on the Refuge is high. Generally, the Refuge is open to the public during the peak migration periods and high bird numbers and high people numbers overlap for a short period. Based on BMPs recommended by the Regional Veterinarian, USDA and public health officials the Manager would have the authority to close System units to public use as described in the Regulatory Compliance section. This action may be needed to reduce disturbance to birds, resulting in a longer stop over, which may help control the spread of disease. See Public Use Decision Tree for Response to Wildlife Morbidity/Mortality Event. Figure 2

News releases and access to media should be requested by the Refuge Manager in conjunction with the Regional Office External Affairs Office in order to effectively communicate the purpose and reason for the closure as well as other details.

References

Information taken from the Centers for Disease Control and Prevention website.
http://www.cdc.gov/flu/avian/gen-info/facts.htm

Avian Botulism

General Background and Description

Avian botulism is arguably the most widespread and recognized wildlife disease in South Dakota. Outbreaks occur sporadically over both time and space, but a number of large wetlands in South Dakota are known for their long-standing history of botulism. Depending on the severity of the outbreak, the disease can impact tens of thousands of waterfowl, shorebirds, and wading birds at a single wetland.

Avian botulism (hereafter, botulism), sometimes referred to as 'limberneck' or 'alkali poisoning', is a disease that can cause substantial mortality of ducks, shorebirds, and other waterbirds. Several 'types' of botulism exist worldwide. The type of botulism that causes waterbird die-offs throughout North America (Type C) can also impact horses, cattle, and poultry, but typically poses little risk to humans. Although almost all birds are susceptible to Type C botulism, waterbirds typically suffer the greatest losses.

Spores of Type C botulism can persist in wetland soils for many years. They can also be found in the tissues of wetland-dwelling animals like insects and healthy birds. The deadly botulism toxin is produced by the bacterium *Clostridium botulinum*, only when a specific virus infects the otherwise dormant spores (Friend and Franson 1999). Natural factors that trigger toxin production are not completely understood. However, botulism outbreaks are thought to be influenced by decaying organic matter (e.g., wetland plants), elevated wetland soil temperatures, and decreasing oxygen levels in wetlands (Friend and Franson 1999). Botulism outbreaks vary greatly in both magnitude and location from year to year. A particular water body may be outbreak-free one year, and littered with thousands of bird carcasses the next. Wobeser and Bollinger (2002) suggest that there are likely many alternative pathways that lead to an outbreak; thus, determining effective management practices is hampered by an incomplete knowledge of the environmental factors that precipitate outbreaks.

History specific to SD

In South Dakota, botulism has been detected since the early 1900's. Outbreaks have occurred throughout the state, with certain locations being more prone to periodic and severe outbreaks, compared to other areas where botulism outbreaks occur rarely and with minimal severity. Most FWS field offices have dealt with one or more botulism outbreaks on wetlands they manage, but outbreaks also occur on non-federal wetlands. Although botulism outbreaks can occur on a variety of wetland habitats, they are most often seen on large, saline wetlands with permanent or semi-permanent water regimes.

Mortality & description of clinical signs

The toxin produced by the botulism bacterium affects the nervous system and results in muscle paralysis of its victims. Two field signs of birds suffering from botulism include:

1) loss of ability to fly, in which case birds such as ducks often propel themselves across the water with their wings
2) paralysis of neck muscles, resulting in the inability of a bird to hold its head erect. The latter often results in a bird's death by drowning, prior to death from respiratory failure caused from the botulism toxin.

Botulism-intoxicated birds also often exhibit a greenish-stained vent from diarrhea and swollen fluid-filled eyelids.

The disease appears to be exacerbated through the carcass-maggot cycle, which includes the following events: 1) C. *botulinum*, from previously ingested spores, vegetates and produces toxin in response to biochemical changes associated with death and decomposition, 2) maggots feed on carcasses and

concentrate toxin, 3) toxic maggots are ingested by birds, and 4) toxicity leads to death, producing additional carcasses and perpetuating the cycle. Because of the botulism toxin's extremely high potency, these events lead to rapid acceleration in the rate of deaths due to botulism. Consumption of as few as one or two toxin-laden maggots may be adequate to kill an otherwise-healthy bird.

If the carcass-maggot cycle is the primary means of botulism proliferation, carcasses are most likely to influence progression of an epizootic where they are present in high numbers. High numbers of carcasses are most likely to occur where significant numbers of birds concentrate, such as wetlands favored by postbreeding, molting, or early migrant waterfowl. Birds that have died from any cause can be a source for botulism toxin through the carcass-maggot cycle.

Botulism outbreaks are often characterized by concentric rings of carcasses with decomposition being greatest at the center and least at the outer edge of the rings. The classic indicator of botulism involves a progression of multiple mortality events over time, as compared to a single acute mortality event associated with certain other diseases. Wave action may displace the characteristic 'rings' of delayed mortality; however, the various stages of decomposition of bird carcasses is a classic field indicator of botulism Type C.

Surveillance

Wetlands with a history of botulism are often checked periodically by FWS and/or GF&P staff, beginning in early July. The majority of surveillance is done in response to an observation or report of dead or sick birds. Active surveillance checks can be done by patrolling wetlands using an airboat or ATV, or by simply 'glassing' wetland edges from a vehicle with binoculars or a spotting scope. Outbreaks are also discovered opportunistically as FWS staff conduct other duties in or around wetland habitats. In many botulism outbreaks, scores of waterbird (e.g., ducks, grebes, gulls, shorebirds) carcasses line the shorelines and are highly visible to the public. Seemingly healthy, as well as sick waterbirds, will often be seen in close proximity to carcasses. Occasionally, botulism outbreaks go undetected until the fall hunting season and are then reported to the FWS or SD GF&P after the disease outbreak has run its course for the season and carcass removal is ineffective. If the wetland involved has no known history of botulism, it often is added to the surveillance list of the responsible FWS station for the following summer.

The presumed significant role of the carcass-maggot cycle in the epizootiology of botulism has been the central factor in development of field procedures for reducing impacts of the disease on migratory bird populations. Management of botulism outbreaks typically involves intensive carcass retrieval with the goal of removing dead birds from the affected lake as quickly as possible. Carcass pickup has been widely accepted as the best approach to minimizing botulism-induced mortality of waterbirds and has been recommended by wildlife health professionals based on knowledge of botulism epidemiology (Friend and Franson 1999). However, substantial time, expense, and effort are expended annually in surveillance activities, based on little data regarding the effectiveness of this management on progression of the disease or survival of migratory birds.

Recently, the significance of carcass removal to waterfowl survival during botulism outbreaks has been challenged (Evelsizer 2002). Evelsizer (2002) suggested that carcass removal did not appear to be an effective technique for managing avian botulism in prairie Canada. The apparent failure of this management was attributed to the inefficiency of carcass removal on large wetlands. Under ideal conditions, no more than 30% of carcasses present were able to be found and collected. What level of carcass pickup efficiency, if any, would have been effective is unknown. Nonetheless, these data have been used to defend the cessation of botulism cleanup efforts in Canada (Delta Waterfowl Foundation 2003). Carcass detection and pickup are likely biased toward detection of large, intact carcasses in unvegetated areas, potentially underestimating carcass presence and density and for shorebirds and

secretive marsh birds. However, no credible data exist regarding efficiency of FWS carcass cleanup crews on Prairie Pothole Region wetlands. Despite the lack of scientifically valid supporting data, the USGS National Wildlife Health Center (NWHC) continues to recommend carcass pickup for botulism control (Rex Sohn, USGS, pers. commun.).

It is recommended that airboats and associated equipment are sprayed off with a 5% bleach solution for decontamination.

Public Use

Since avian botulism is a disease of birds and not known to be transmitted to humans no closure of areas is necessary. Managers may want to consider closing areas where burning of carcasses is conducted during the incinerating period for human safety.

References

Delta Waterfowl Foundation. 2003. Canada abandons botulism cleanup. Delta Waterfowl Magazine, spring 2003. 1pp.

Evelsizer, D.D. 2002. Management of avian botulism and survival of molting mallards. M.S. Thesis. Univ. of Saskatchewan, Saskatoon. 59pp.

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Avian Chlamydiosis

General Background and Description
Avian chlamydiosis is a bacterial disease of pet birds, poultry, and wild birds caused by *Chlamydophilia psittaci* (formerly *Chlamydia psittaci*). In North America waterfowl, herons, and rock pigeons are the most commonly infected wild birds. Other bird groups affected are shorebirds, gulls, alcids and songbirds. Chlamydiosis can be a serious human health problem, particularly to those working with birds. Human symptoms vary from a mild, flu-like infection with a fever, shivering, headaches, anorexia, sore throat, and photophobia to a serious atypical pneumonia with a dry cough and dyspnea.

History specific to SD
During the summer of 1986, more than 400 California Gulls (Larus californicus) and ring-billed gulls (Larus delawarensis), primarily fledglings, died on an island in Lake Sakakawea near New Town, North Dakota. Mortality was attributed largely to chlamydiosis. This is believed to be the first record of epizootic chlamydiosis in gulls and the second report of epizootic chlamydial mortality in wild birds in North America. There is no record of chlamydiosis affecting wild birds in South Dakota.

Mortality & description of clinical signs
When clinical signs occur in birds, they include yellow-to-greenish or watery gray droppings, weight loss, dehydration, lethargy, and ruffled feathers. Young birds tend to be more susceptible than older birds.

Surveillance
Currently, no active surveillance is conducted on South Dakota stations. Response to reports or observation of sick or dead birds follows the steps outlined in the initial response section. The State Veterinarian should be contacted if avian chlamydiosis is detected.

Safety
Most infections are typically acquired from exposure to pet psittacine birds. However, transmission has been documented from poultry and free-ranging birds, including doves, pigeons, birds of prey, and shore birds. Infection with *C psittaci* usually occurs when a person inhales organisms that have been aerosolized from dried feces or respiratory tract secretions of infected birds. Other means of exposure include mouth-to-beak contact and handling infected birds' plumage and tissues. Even brief exposures can lead to symptomatic infection; therefore, certain patients with psittacosis might not recall or report having any contact with birds. Human to human spread has not been reported. Antibiotics such as tetracycline are often prescribed. Tetracycline is effective in both humans and birds.

If chlamydiosis is suspected all personnel involved with clean up activities should wear goggles and respirators or N-100 masks to prevent inhalation of infected materials. The public should be excluded from areas where chlamydiosis has been detected and during clean up activities to reduce exposure and transmission to other areas.

References
Franson, J., and J.E. Pearson. 1995. Probable Epizootic Chlamydiosis in Wild California (Larus californicus) and Ring-Billed (Larus delawarensis) Gulls in North Dakota. *In* Journal of Wildlife Disease, 313.

http://www.addl.purdue.edu/newsletters/2003/Fall/avchlamid.htm
Field Guide to Wildlife Diseases – US Dept of the interior Fish and Wildlife Service Resource Publication 167

Avian Cholera

General Background and Description
Avian cholera is a highly infectious disease caused by the bacterium, *Pasteurella multocida*. Most species of birds and mammals can become infected by one or more strains of cholera; however, avian cholera is primarily caused by the Type 1 strain. Ducks and geese, coots, gulls, and crows are most often affected. Cholera can be transmitted by bird-to-bird contact, contact with secretions or feces of infected birds, or ingestion of food or water containing the bacteria. Aerosol transmission may also occur. The bacteria may survive up to 4 months in soil and water.

Since the 1940s, when avian cholera was first diagnosed in wild birds, the disease has been widely documented across the United States and has spread to Canada and likely Mexico. Most of this expansion has occurred during the past 20-30 years as outbreaks in new geographic areas continue to be documented. Frequently areas with prior outbreaks become the sites for recurring annual losses. Avian cholera epizootics have occurred at all times of the year, but major losses are most frequently observed when waterfowl are concentrated on wintering areas or during spring migration.

History specific to SD
Avian Cholera was first recorded in Brown County in 1975. Periodic outbreaks have occurred on Sand Lake, Lake Andes, and Madison NWR Complexes. In South Dakota there are frequent occurrences resulting in the death of moderate to small numbers of birds. Although cholera is a disease that can kill all waterfowl species, it is most commonly carried by snow geese. It also occurs most often in March and April with smaller occurrences in November and December.

The North American Prairie Pothole Region produces the bulk of North America's duck population. Although shallow wetlands found in the Dakotas are heavily used by migrating waterfowl, widespread availability of wetlands (especially in the spring) may also allow birds to disperse widely, thereby reducing or eliminating potential outbreaks of avian cholera.

Mortality & description of clinical signs
More than 100 species of birds can be affected by the disease with acute mortality occurring shortly (less than 24 hours) following infection. Under crowded conditions, transmission of the bacteria among birds may occur rapidly and explosive die-offs involving hundreds of waterfowl per day have been observed. Chronic infections and low-level mortalities also occur, but these losses are less apparent.

Large die-offs are seen primarily in wild ducks and geese. Often, large numbers of dead birds in good body condition are observed and sick birds may be few to none. Death may be so rapid that birds literally fall out of the sky or die while eating with no previous signs of disease. Sick birds appear lethargic, and when captured may die within minutes. Other signs include convulsions; swimming in circles; throwing the head back between the wings; erratic flight, such as flying upside down or trying to land a foot or more above the water; mucous discharge from the mouth; soiling or matting of the feathers around the vent, eyes, and bill; pasty, fawn-colored or yellow droppings; or blood-stained droppings or nasal discharge.

Hemorrhages may be seen on the heart, liver, gizzard, and intestines. Areas of tissue death appear as white or yellow "spots" on the liver and spleen. The liver may appear darkened or copper in color, and may be swollen and rupture when handled. These lesions are indicative of an acute disease process and are not unique to avian cholera infection. The upper digestive tract may contain recently ingested food, while lower digestive tract may contain a thick yellowish viscous fluid that contains large numbers of *P. multocida* bacteria.

Surveillance
Despite the fact that avian cholera is one of the most important diseases of waterbirds in North America, little is known about host (bird) - agent (*P. multocida*) interactions and the environment. The disease is believed to be transmitted to susceptible birds through direct contact, by ingestion of contaminated water, or the inhalation of water droplets aerosolized when birds take flight. The probability of transmission is likely related to the density and distribution of bacteria and birds, interactions among birds, virulence of the bacteria, bird susceptibility, and ecological conditions that favor persistence of the bacteria in marsh environments. How this disease is maintained during the annual migratory life cycle of waterfowl is unknown. Many biologists believe that the reservoir for the *P. multocida* bacteria is either in the environment where recurrent outbreaks are found or in carrier birds that have survived previous infection. More than 50% of the larger avian cholera epizootics have involved snow geese; although many other species of waterbirds are also affected during these outbreaks. However, convincing evidence for either the carrier or environmental reservoir hypotheses is still lacking.

Conditions that initiate an avian cholera epizootic remain unknown. Epidemiological theory suggests that density of susceptible and infected birds may be an important factor in determining whether an outbreak occurs and the number of birds that become infected and die. Large concentrations of waterfowl may be increased when alternative habitat is lost, intensively managed wetland refuges are created, and agricultural practices provide concentrated food resources. Other stresses such as precipitation, cold temperatures, and lack of food have also been suggested as factors that initiate or prolong avian cholera mortality. Finally, even conditions that eventually lead to cessation of an outbreak, and thus potential control mechanisms, are also unknown.

Despite the considerable interest in disease problems of migratory birds, few firm facts are available to develop management strategies for prevention and control of avian cholera outbreaks. Most recommendations are designed to reduce exposure of susceptible birds. Regular monitoring, especially in enzootic areas, can help to identify early stages of an outbreak. Carcass removal is recommended to reduce contamination of the environment and hence transmission, but its effectiveness in reducing overall mortality has not been tested. Population and habitat management activities that alter bird distribution to reduce crowding or disperse birds away from outbreak areas have also been utilized.

Carcasses should be collected head first by the bill to minimize the amount of fluid discharged into the environment. double bagging should be used to prevent fluids from leaking. Carcasses shouldbe removed promptly to prevent mammalian or avian scavenging to prevent further death or environmental contamination.

Safety
Humans are not at a high risk for infection with the bacterial strain causing avian cholera. Wearing gloves and thoroughly washing hands is recommended when handling these birds or any sick or dead animal.

References
Field Guide to Wildlife Diseases – US Dept of the interior Fish and Wildlife Service Resource Publication 167

USGS National Wildlife Health Center website. URL: http://www.nwhc.usgs.gov

West Nile Virus

General Background and Disease Description
West Nile Virus (WNV) first appeared in the Western hemisphere in 1999 and quickly spread through North America. The virus is a member of the Flavivirus family, and is transmitted through infected mosquitoes. Currently, the disease is established as a seasonal epidemic in North America that flares up in the summer and continues into the fall. More than 290 species of birds, 30 species of mammals, and a few species of reptile have been infected since 1999. Corvids, some owl species, and sage grouse appear especially susceptible.

In the days immediately following infection, virus particles are reproduced and begin circulating in the blood of the victim. Their numbers increase as their reproduction continues; this is the period when some hosts can infect mosquitoes that bite them. The virus is more effective at building up in the blood of some species than others. In some species, the virus can achieve viremias – circulating levels of the virus – high enough to infect mosquitoes. These species may serve as "reservoirs" for the virus in the wild, especially if their high viremias are maintained for durations long enough to infect a couple of mosquitoes. Other species are incidental or "dead-end" hosts that do not participate in subsequent virus transmission; the viremias they produce are not high enough to infect biting mosquitoes. In laboratory studies, at least some individuals of some species did not develop viremias at all. Other species infected under lab conditions developed detectable viremias, but their immune systems produced antibodies that then beat back the virus; virus particles disappeared from the blood as antibodies increased. Individuals of other species are incapable of mounting an effective immune response. Their bodies succumb to the damage wrought by the virus, and they die within a week or two of infection.

Since this virus was not detected in the Western Hemisphere until 1999, it is likely that native bird populations in the U.S. were not previously exposed to the virus. It is not unusual for a new disease to cause high rates of infection or death because they do not have natural immunity to the infection. It is not known if or how long it will take for populations to develop sufficient immunity. Surveys of wild birds completed in the last three years have shown that some birds already have antibodies to WNV.

History specific to SD
WNV was first detected in the carcasses of wild birds in South Dakota during 2001, with the disease being fairly widespread by 2002. In South Dakota, over 40 species of wild birds have tested positive for West Nile Virus. Effects on bird populations are unknown, except in a few notable cases.

Nearly half of American white pelicans nest in several large colonies in the northern plains. The colonial nesting of white pelicans makes them especially vulnerable to factors that can influence productivity, such as disease. WNV has been identified as a significant cause of morbidity and mortality in young American white pelicans at breeding colonies in the northern plains. WNV was first confirmed in young pelicans in 2002. Since then, thousands of young pelicans have died in these nesting colonies. The long term impact of this disease on the regional and possibly continental populations of pelicans remains unknown, but could be devastating. Furthermore, documentation of WNV in pelicans is especially significant because the disease is not known to cause wide-scale mortality events in the young of any other avian species.

A study of the effects of WNV at 3 colonies (Chase Lake NWR, Bitter Lake [Waubay NWR], and Medicine Lake NWR) was initiated in 2004. Preliminary results reveal that the primary mosquito vector, *Culex tarsalis*, usually emerges in significant numbers in early July, and pelican chicks begin to die from WNV about 1–2 weeks later. Chick mortality after mid-July was about 4% before WNV arrived in the region and jumped dramatically (to as high as 44%) in the years since WNV arrived. Consequently, WNV kills older chicks that are no longer vulnerable to other common mortality factors (e.g., severe

weather, gull predation) and typically would have survived to fledge. In 2006, losses to WNV were lower at colonies where conditions were drier and mosquito numbers were down.

Mortality & description of clinical signs
Signs of infection in wildlife can range from no symptoms to severe symptoms of neurologic illness. Commonly reported signs in animals have included: weakness, stumbling, trembling, head tremors, inability to fly/walk, and lack of awareness that allowed them to be easily approached and handled. These signs do not necessarily indicate WNV infection, and the only way to confirm WNV infection is by laboratory testing of tissues for the presence of virus.

WNV infections are described in 3 phases. Phase 1 symptoms include depression, anorexia and consequent weight loss, excessive sleeping, pinching off of incoming feathers, and elevated white blood cell counts. Individuals reaching only this phase are likely to survive. Phase 2 symptoms include, in addition to those of Phase 1, head tremors, green waste products (indicating liver damage), central blindness, mental "dumbness" and a general lack of awareness of surroundings, ataxia (clumsiness), and weakness in legs. Some individuals that reach this phase survive with supportive care; others proceed to Phase 3, where symptoms include more severe tremors, and seizures, and usually death.

Surveillance
Many questions remain unanswered regarding details of transmission cycles, relevant vector biology, the range and responses to infection of host species, the mechanisms underlying the spread of the virus and its ability to "overwinter," and the effects of WNV on bird and other wildlife populations. Because West Nile is an "emerging" virus in the New World, biologists are still in the initial stages of piecing together parts of the puzzle, and still have far to go with respect to understanding what WNV will mean for wildlife populations.

Since 2001, surveillance in South Dakota has been a statewide, multi-agency effort. WNV surveillance in South Dakota focuses on 1) testing dead or sick birds, 2) maintaining an array of sentinel chickens, and 3) trapping female mosquitoes. Beginning in 2005, dead bird collection was focused on birds from the corvid and raptor families. If a person finds a dead bird they should contact the County Cooperative Extension Educator or the Department of Health for testing. The State will pay for shipping and testing until 2 positive results for West Nile are made in each county. Species of interest are crows, blue jays, magpies, hawks, owls and eagles.

Safety
For people working with wildlife in the field, the primary concern for becoming infected with WNV is through the bite of an infected mosquito. The recommendations presented here are meant to reduce the possibility of direct exposure to a variety of zoonotic diseases. The methods for direct transmission include (but are not limited to):

1. Inhalation: inhaling air contaminated with virus contained in body fluids; splashing of body fluids from infected animals.
2. Direct Exposure: contact from infected animals' body fluids to abrasions, cuts in the skin, or mucous membranes (eyes, mouth).
3. Puncture Wounds: cuts from contaminated bones, beaks, claws, etc; punctures and cuts from contaminated equipment (needles, scissors, scalpels, etc.)

These general precautions should be taken while handling all wildlife, especially those that appear sick. Handling wild animals can increase the opportunity for exposure to many diseases.

The direct transmission of WNV from infected animal to biologist outside of the laboratory has not yet

been documented, but enough is known about the nature of WNV to warrant concern. Fecal material, saliva, and blood are the most likely sources of virus infection from handling an infected animal. If you have been in contact with infected animals or contaminated materials, flush and wash the exposed area with soap and water. If you encounter any of the above-mentioned modes of transmission or if illness develops following suspected exposure, see a physician as soon as you can and advise them of your exposure to wild birds and other wildlife. Symptoms of WNV infection can be found at:

http://www.cdc.gov/ncidod/dvbid/westnile/qa/symptoms.htm

Individuals who may be more susceptible to WNV infection, or more susceptible to disease following infection, should take all possible precautions, including excusing themselves from the work in question. This group of individuals may include those that are immune suppressed for any reason (e.g., steroid therapy, chemotherapy, etc.) and those who have a history of respiratory or other health problems. Individuals should contact their physician if they have specific questions or concerns.

Personal Protective Equipment/Procedures - Depending on the circumstances, some or all of the personal protective measures listed here should be used. Personal protective measures include: using mosquito repellent, wearing mosquito resistant clothing (e.g., long pants, long sleeves, bug jackets, head nets), washing of hands, face, and other exposed skin surfaces, using 'surgical type' gloves, wearing coveralls and boots, wearing eye protection or full face shields, and wearing face masks. Measures to reduce exposure to mosquitoes can be found at:

http://www.cdc.gov/ncidod/dvbid/westnile/qa/prevention.htm

Public Use

Mosquitos carrying West Nile virus can be anywhere. The public should be aware of measures to reduce exposure to mosquitos and how to protect themselves both at home and when visiting public lands.

References

SD Department of Health: http://www.state.sd.us/doh/WestNile/

USGS National Wildlife Health Center:
http://www.nwhc.usgs.gov/disease_information/west_nile_virus/index.jsp

Chronic Wasting Disease

General Background and Description

Chronic Wasting Disease (CWD) is a fatal nervous system disease known to naturally infect North American cervids. It belongs to the family of diseases known as transmissible spongiform encephalopathies (TSE) or prion diseases. In animals, TSEs are infectious, while spontaneous and familial forms have yet to be identified. CWD specifically is a TSE of white-tailed deer, mule deer, elk, and moose in North America. Other TSEs include, scrapie, which affects domestic sheep and goats worldwide, bovine spongiform encephalopathy or BSE, which affects cattle in the UK and Europe, and Creutzfeldt-Jakob Disease (CJD) and variant CJD, which affect humans. CWD was first identified as a fatal wasting syndrome in captive mule deer in Colorado in the late 1960s and in the wild in 1981. It was recognized as a spongiform encephalopathy in 1978. There is no epidemiological evidence that CWD is naturally transmissible to humans or animals other than white-tailed deer, mule deer, elk, or moose. Despite this, a recent study indicated that skeletal muscle as well as the central nervous tissue of mule deer can contain infectious prions. In scenarios where humans consume or handle CWD infected meat, they may be susceptible to prion exposure (Angers et al. 2006).

Although the causative agent has not been completely characterized, most available data support the hypothesis that CWD is caused by a prion protein. The disease causes accumulation of protease-resistant protein in the central nervous system and lymphoid tissues, causing severe neurological disease and eventual death. The mode of transmission has not been completely identified although experimental and circumstantial evidence suggests CWD is both infectious and contagious. In contrast to BSE, CWD is not a food-borne disease associated with rendered ruminant meat and bonemeal. Instead data from CWD epidemics in captive deer and elk in research facilities provide strong evidence of lateral transmission, i.e., animal to animal. Most recently, Mathiason et al. (2006) demonstrated that infected blood and saliva transmitted to a non-infected deer resulted in this animal testing positive for CWD. This data is particularly critical in situations where deer and elk concentrate for feeding, specifically in captive or artificial feeding situations. Additionally, prolonged fence-line contact between captive and non-captive cervids likely increases the possibility of transmission. Maternal transmission, if it occurs, must be relatively rare and cannot explain most cases where complete epidemiologic data are available.

History specific to South Dakota

CWD is confirmed in free-ranging cervids in eleven states (Colorado, Illinois, Kansas, Nebraska, New Mexico, New York, South Dakota, Utah, West Virginia, Wisconsin, and Wyoming) and in two Canadian provinces (Alberta and Saskatchewan); It has also been confirmed in captive facilities in eleven states (Colorado, Illinois, Kansas, Minnesota, Montana, Nebraska, New York, Oklahoma, South Dakota, Wisconsin, and Wyoming) and two Canadian provinces (Alberta and Saskatchewan)

Mortality & Description of Clinical Signs

CWD is progressive and always fatal. Symptoms typically occur anywhere from a few weeks to several months before the animal dies. The clinical course of CWD in free-ranging deer and elk is probably shorter than in captivity. Wild cervids must forage, find water, and are susceptible to predation, all factors affecting longevity of sick animals in the wild. Noticeable clinical signs might include: progressive weight loss, stumbling, tremors, lack of coordination, blank facial expressions, excessive salivation, loss of appetite, excessive thirst and urination, listlessness, teeth grinding, abnormal head posture, and drooping ears. Additionally, because of impacts on the central nervous system, animals may demonstrate difficulty in swallowing, resulting in pneumonia caused by aspirating food or saliva into the lungs. Currently the only conclusive diagnosis involves an examination of the brain, tonsils or lymph nodes performed after death or as a tonsilor biopsy in anesthetized deer.

Surveillance

Management guidelines and strategies currently implemented by state and federal agencies vary widely and are rapidly changing. Management of CWD is complicated partly due to the lack of understanding of the disease, incubation period, and legal responsibilities. Currently in South Dakota, Game, Fish & Parks Department takes the lead on surveillance and gathering data to limit both the distribution and occurrence of CWD. SD GF&P continues to engage in coordinated management efforts with other states and agencies, including the U.S. Fish and Wildlife Service. Any surveillance activities (either passive or active) must be coordinated with GF&P. Currently, GF&P personnel conduct active surveillance throughout the deer hunting season, and conducts passive surveillance year-around. So far, CWD has only been found in deer and elk in the Black Hills. Surveillance for this disease continues in that location. Nine years of surveillance and testing of wild deer and elk have shown only 32 CWD positive deer and 15 CWD positive elk out of 12,305 animals tested.

Safety

All Refuge personnel involved with CWD surveillance will be trained in basic sanitary precautions when collecting, handling, and sampling animals or when working with potentially infective materials. Refuge/WMD personnel asked to assist state game and fish agencies in CWD surveillance or management activities will use the following supplies:

a. Disposable coveralls
b. Rubber "irrigation" boots
c. Plastic buckets
d. Clorox mixed to a 5-10 percent solution
e. Boot scrub brushes
f. Nitrile gloves
g. Dust mask with two straps
h. Eye protection from splattered fluids and tissues
i. Plastic trash bags
k. 5-gallon jugs for water in the field

Minimal PPE for work with suspected CWD infected animals includes: rubber boots, coveralls, latex gloves, N95 respirator, eye protection, and appropriate decontamination supplies. Should a disease outbreak occur in epidemic proportions, a work area will be established within the affected area where contaminated materials are contained and unauthorized and/or improperly protected individuals are not allowed. Personnel working within the containment area will exit such sites through proper biocontainment and disinfection procedures, including proper disposal or disinfection of contaminated clothes, gloves, masks, eye-protection and equipment. Should this step become necessary Ecological Services Environmental Quality and/or personnel from the Regional Wildlife Veterinarian's office will be contacted for assistance.

Carcass Disposal

Disposal of carcasses and samples is a major issue and must be done according to established protocol in order to avoid future contamination of clean areas. In addition, vehicles and equipment frequenting CWD infected areas or in contact with CWD animals are another concern.

Disposal of carcasses and samples will be according to SDGF&P specifications and locations. EPA regulations concerning the disposal of CWD carcasses are currently being addressed by the SDGF&P. A thorough evaluation of disposal techniques, conducted by the Wisconsin Department of Natural Resources with assistance from the Wisconsin Department of Health and Family Services indicates that burial in licensed landfills, incineration, and tissue digestion are acceptable methods of disposal

Should CWD reach prevalence on refuge lands requiring intensive management actions, vehicles used for carcass collection and removal will be disinfected weekly by spraying a 5% Clorox solution on the wheels, wheel wells, bed and floor board. Vehicles selected for this purpose should be ones that are not routinely used for off-Refuge transportation. Vehicles used for CWD will be older model pickups used for on-Refuge maintenance activities so that the likelihood of transporting the CWD prions to uninfected areas is minimized. We recognize that chlorine solutions may only have a minimal, if any, effect on the transmissible agent of CWD, but chemicals known to have significant effect on prions infectivity are caustic and not environmentally friendly. Using such standard disinfection procedures may reduce CWD infectivity and certainly are good hygiene practices relative to other infectious agents.

Management Options

Managers should implement strategies to minimize the risk of CWD infection on Service and adjacent lands. Recent research indicates that prions can be passed through saliva and feces, demonstrating that areas of concentrated cervids may be at high risk of infection. Therefore, baiting and artificial feeding activities should not be implemented or continued on Service lands, and discouraged on private lands. Other management recommendations will likely be implemented by the SDGF&P to reduce CWD infection including, lowering deer population levels, and establishing appropriate cervid carcass transport restrictions. Additionally, all state and federal land managers should continue to work together to implement passive and active surveillance efforts for early detection.

In the event that CWD is positively identified in a captive situation, the primary strategy is to dispatch all cervids for subsequent testing. Potentially tonsilor biopsy could be used for testing white-tailed deer, however this is a costly and labor intensive method. All submitted CWD samples will be tested by immunohistochemistry (IHC) test, which is currently considered the "gold standard" for CWD testing. If a wild cervid test positive for CWD the Service will coordinate with the SDGF&P on the appropriate response.

Public Use

If CWD were to be discovered in deer in Waubay Complex, the public would immediately be made aware of the issue. Information regarding testing and safety of eating of hunter killed animals would be widely available.

Reference

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