State of South Dakota

Aquatic Nuisance Species Management Plan

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EXECUTIVE SUMMARY

Aquatic Nuisance Species (ANS) are a source of significant ecological and socio-economic problems throughout North America. South Dakota's aquatic ecosystems have already been invaded by ANS such as Eurasian water milfoil, Asian carp, and purple loosestrife. While their initial impacts have been limited and localized, there is little doubt that these and other ANS pose a serious threat to South Dakota's water resources. The importance of South Dakota's aquatic resources requires a coherent response to the threat posed by ANS. Using guidance from the National ANS Task Force and completed plans from other states, this management plan was developed to address the prevention, control, and effects of Aquatic Nuisance Species (ANS) that have invaded or may invade South Dakota's waters. The South Dakota aquatic nuisance species management plan serves as the initial step in establishing a program to specifically address ANS issues in South Dakota.

The development of a state ANS management plan, as called for in Section 1204 of the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990, provides an opportunity for federal cost-share support for implementation of the plan. NANPCA, reauthorized in 1996 as the National Invasive Species Act (NISA), specifies that state plans identify feasible, cost-effective management practices and measures that can be implemented by the state to prevent and control ANS infestations in an environmentally sound manner.

The goals of this ANS management plan are:

1. To prevent new introductions of ANS to South Dakota.

2. To educate all aquatic users of ANS risks and how to reduce the harmful impacts.

3. To prevent dispersal of established populations of ANS into uninfested waters in South Dakota.

4. To eradicate or control ANS to minimize the adverse ecological, economic, social, and public health effects of ANS in an environmentally sound manner.

5. To support research on ANS in South Dakota, and develop systems to disseminate information.

Included in this plan are: discussions of existing ANS problems; a summary of federal, regional, and state policy concerning ANS; a list of non-indigenous species known to exist in South Dakota; a list of State and regional ANS of priority concern along with a description of their vectors and pathways of introduction and relative levels of risk to South Dakota's aquatic ecosystems.

To ensure that the goals of this plan are being effectively addressed a procedure for monitoring and evaluating the implementation of strategies and tasks will be initiated.

This evaluation will focus on the feasibility and cost-effectiveness of management activities. The plan is a working document and will be periodically updated and expanded based upon the experience gained from implementation, scientific research, and the use of new tools as they become available.

The effort to develop a state ANS management plan for South Dakota was led by the Department of Game, Fish and Parks, Wildlife Division in collaboration with South Dakota State University and members of the Aquatic Nuisance Species Plan Advisory Committee, representing state, federal and tribal agencies and organizations (Appendix A).

INTRODUCTION

Non-indigenous aquatic nuisance species (ANS) are the cause of significant ecological and socio-economic problems for water users in North America. ANS have spread beyond historic ranges and have adversely affected infested waters by threatening the integrity of the water resources. Since non-indigenous ANS have few natural controls in their new habitats, they spread rapidly, destroy native plant and animal habitat, threatening the diversity and abundance of native species, and damaging industrial, agricultural, and recreational activities dependent on surface waters.

A number of these ANS have become established in the United States and represent a threat to the nation's aquatic resources. As the introduction and spread of ANS continues, associated problems intensify and create a wide variety of ecological and socio-economic problems for water users. In 1990, the Non-indigenous Aquatic Nuisance Prevention and Control Act (NANPCA) was passed to address ANS problems in the United States. This legislation provides for federal cost-share support for implementation of state plans. While programs created by this legislation were initially aimed at problems in the Great Lakes region, reauthorization of NANPCA in 1996 as the National Invasive Species Act (NISA) established a national goal of preventing new ANS introductions and limiting the dispersal of existing ANS in all of the states. NISA specifies that state plans identify feasible, cost-effective management practices and measures that can be implemented to prevent and control ANS infestations in an environmentally sound manner. Approval of a state ANS management plan by the Federal Aquatic Nuisance Species Task Force is required for South Dakota to be eligible for federal cost-share support.

According to Rendall (1997), the following points must be considered in addressing ANS issues and establishing ANS management programs. These points have provided guidance in the development of this ANS long-term management plan.

- There are many pathways of introduction and spread for ANS, and most are related to human activities, accidental and intentional. New species continue to be introduced and spread within North America through these pathways.

- Introductions have many costs associated with them: control and management costs; long-term ecosystem changes; and loss of recreational opportunities.

- Often there are few, if any, acceptable controls available for use in natural water bodies once ANS become established., control efforts will be very expensive and eradication is unlikely.

- Prevention is the best course of action. Management plans, education programs, and regulations are strategies that can help prevent the spread of ANS.

The coordinated efforts contained within this plan are designed to protect residents of South Dakota and the state's aquatic resources from the multitude of potential losses associated with ANS plants and animals. This management plan focuses on preventing the accidental introductions of new ANS, limiting the spread of existing ANS, and controlling or eradicating ANS where environmentally and economically feasible. The intentional introduction of non-indigenous species for aquaculture, commercial, or recreational purposes is addressed to insure that these beneficial introductions do not result in accidental ANS introductions, and to improve information sharing among those agencies responsible for regulation of intentional introductions.

It is the intent of the State of South Dakota to prepare for the introduction of destructive ANS currently found in regional waters and take measures to prevent their infestation of state water bodies. With the recent discovery of several destructive ANS in South Dakota, it is realized that a coordinated and effective effort to address this and other ANS introductions is necessary. South Dakota has the opportunity to develop a program to allow the state to quickly and effectively deal with both existing and potential ANS threats before they cause significant environmental and economic damage.

In the United States, zebra mussel control cost municipalities and industries almost $70 million a year between 1989 and 1995 (U.S. General Accounting Office 2001). Over the next 10 years, it is estimated that the zebra mussel invasion will cost an estimated $3.1 billion including cost to industry, recreation, and fisheries (Preliminary Report of the U.S. Commission on Ocean Policy, governors' draft 2004). The costs and effects of exotics in South Dakota have not been determined precisely; however costs are incurred in two main categories. First is the loss in potential economic output, such as reductions in aquaculture, fisheries, and crop production. Second is the direct cost of combating and mitigating the impacts of invasion, including all forms of quarantine, control, and eradication (Mack et al. 2000).

The Aquatic Nuisance Species committee was responsible for developing the South Dakota ANS management plan. Members of the committee assumed an active role in preparation for the plan by reviewing draft plans and providing guidance. A list of the committee members is provided in Appendix A. The South Dakota Department of Game, Fish and Parks (SDGFP), Wildlife Division, was the lead agency assigned to coordinate the drafting of the plan.

This ANS management plan was developed to serve as a guide for state and tribal agencies, local governments, and public and private aquatic resource user groups. It can be used for developing management strategies, designing public awareness/educational materials, and prioritizing activities related to ANS issues. While the Department of Game, Fish and Parks will be the agency responsible for administration of this plan, it is expected that there will be broad participation in ANS programs and activities by various state and local entities. The ANS plan for South Dakota will provide guidance in coordinating these programs and activities.

The South Dakota ANS management plan will be reviewed and revised annually or more frequently if necessary, to address the unexpected arrival of new ANS. Development of new ANS management techniques could warrant alterations in proposed management strategies. The specific tasks employed to accomplish the goals and objectives of the plan must remain flexible to assure efficiency and effectiveness. While this version of the plan is a good starting point for identifying and integrating existing ANS programs, and implementing new programs, future editions will be necessary to achieve South Dakota's ANS management goals.

EXISTING ANS AUTHORITIES AND PROGRAMS

STATE

The State of South Dakota currently has a limited number of statutory and regulatory authorities to address the issue of prevention and control of ANS. Those that exist were developed in response to individual target species and specific concerns as they arose. South Dakota does not have a comprehensive, coordinated, and vigorously enforced policy framework to deal with ANS and their effects. For this reason, one objective of South Dakota's ANS management plan is to identify gaps within state policies and statutes and develop recommendations for improvements. Such improvements may entail developing new legislation and regulations, revising existing authorities, and developing methods for improving enforcement, coordination, and information dissemination regarding new or existing authorities.

South Dakota Department of Game Fish and Parks (SDGFP)

Mission statement: The purpose of the Department of Game, Fish and Parks is to perpetuate, conserve, manage, protect, and enhance South Dakota's wildlife resources, parks, and outdoor recreational opportunities for the use, benefit, and enjoyment of the people of this state and its visitors, and to give the highest priority to the welfare of this state's wildlife and parks, and their environment, in planning and decisions.

Statutes and rules* related to ANS: (Appendix C)

Programs related to ANS

Aquatic nuisance species pages in SD fishing handbook: Pages have been included in the South Dakota fishing handbook regarding current and potential ANS threats in the state. Information on the identification and threats of current ANS (e.g. Asian carp, Eurasian water-milfoil, *Didymosphenia geminata*) are included, along with a list of state water bodies with

established ANS populations. A list of potential ANS (e.g. zebra mussels) that threaten South Dakota waters are also included along with prevention measures boaters and stream anglers can take to aid in the control of exotic species.

SD aquatic nuisance species website: A website describing ANS infestations and management in South Dakota has been created and linked to the South Dakota Game, Fish and Parks website. The ANS website lists infested waters across the state and describes procedures to prevent the spread of ANS. The site also provides a direct link for reporting ANS sightings or concerns. Drafts of the ANS management plan will be posted on the site to allow for ready access for public review. Website address:
http://www.sdgfp.info/Wildlife/AquaticNuisance/AquaticNuisanceSpecies.aspx

Cooperative boat and trailer wash program: An ongoing cooperative partnership between SDGFP, South Dakota Bass Anglers Sportsman Society (SD B.A.S.S), and car wash facilities existing throughout the state. Facilities must have a pull-through bay large enough for easy access by a vehicle towing a boat and trailer and a high pressure, hot wash system. Facilities are provided with a sign indicating their participation. A list of participating facilities is advertised in the South Dakota Fishing Handbook.

Development of SD Department of Game, Fish and Parks, gear handling policy: A set of specific protocols has been established (and recently updated) for boat and assessment gear use and treatment by Wildlife Division personnel in order to prevent ANS introduction or spread as a result of normal work activities (Appendix G).

South Dakota Department of Agriculture

The Department of Agriculture is responsible for the promotion and enhancement of South Dakota Agriculture, and for the implementation of a variety of state laws relating to agriculture.

Statutes and rules related to ANS: (Appendix C)

Programs related to ANS

Listing of ANS plants as noxious weeds: Both salt cedar and purple loosestrife have been listed as noxious weeds by the South Dakota Weed and Pest Commission. This listing has been accompanied by increased public education efforts through pamphlets and news media announcements throughout the state.

Salt cedar control: SD Department of Agriculture has used herbicide treatments to control or eliminate current salt cedar (*Tamarix spp.*) distributions and is currently testing directed biological control measures with the release of small populations of a defoliating beetle specific to salt cedar.

Purple loosestrife SD Department of Agriculture has an established program that raises bio-control agents for purple loosestrife and has used this treatment to actively eliminate a number of infestations.

South Dakota Animal Industry Board

The mission of the South Dakota Animal Industry Board (SDAIB) is to prevent the importation of animal diseases in the state by requiring health certificates, permits, and tests on all imported animals.

Statutes and rules related to ANS: (Appendix C)

South Dakota Department of Environment and Natural Resources

The mission of the South Dakota Department of Environment and Natural Resources (DENR) is to protect public health and the environment by providing environmental monitoring and natural resource assessment, technical and financial assistance for environmental projects, and environmental regulatory services.

Programs related to ANS

Surface water quality program: The primary responsibilities of the program are; regulate (permit) and monitor discharges of wastewater, establish surface water quality standards; and conduct routine monitoring of surface water to ensure the state's natural resources are protected.

Department of Wildlife and Fisheries, South Dakota State University,

The Mission of the SDSU, Department of Wildlife and Fisheries is to determine wildlife and fisheries management research needs, primarily in the Northern Great Plains, and address those needs through basic and applied investigations and graduate student mentoring, so as to promote biodiversity and sustainability of natural resources. To provide the service of transferring information on the sustainable use of wildlife and fisheries resources to a variety of publics; serve professional, governmental, and citizen organizations that are concerned with these natural resources; and promote faculty development.

Programs related to ANS

Influence of an introduced diatom (*Didymosphenia geminata*) and directed control measures on the biological community composition of Rapid Creek. SDGFP, with cooperation from SDSU is currently studying the impact of *Didymosphenia geminata* on benthic and fish community composition of Rapid Creek below Pactola Dam. This research is also studying the effects of control measures (localized nutrient enrichments) on *Didymosphenia geminata* distribution and overall stream biological community composition.

Assessment of summer macroinvertebrate assemblages and densities in the Missouri River between Ft Randall and Gavins Point Dams: SDGFP, USFWS, SDSU, 2005-7. This project was primarily funded by a SD State Wildlife Grant starting July 1, 2005. The project primary goal was a determination of prey availability to juvenile hatchery-reared pallid sturgeon. A concurrent benefit included an active monitoring program for macroinvertebrate ANS; primarily zebra mussels. Active sampling of deepwater benthos and placement of colonization plates in the Missouri River resulted in a spatially expansive monitoring program for zebra mussels in SD and NE. Sample processing occurred during winter 2006-07 and data analysis and report writing are now complete.

Drafting of an aquatic nuisance species risk assessment for South Dakota: The GFP Wildlife Division has contracted with SDSU to research, design, and draft a risk assessment for aquatic nuisance species for the State of SD. This risk assessment will allow the drafters of the State ANS management plan to identify ANS risks relevant to SD and objectively design management practices to most efficiently use resources to prevent and control the most severe threats to the State's critical habitats and biota.

Animal Disease Research and Diagnostic Laboratory (ADRDL), South Dakota State University

The mission of ADRDL is to provide high quality veterinary diagnostic services as a means to promptly and accurately establish causes of animal health problems. This mission encompasses the surveillance and diagnoses of aquatic animal diseases. ADRDL is approved by USDA/APHIS to conduct diagnostic testing for export certification for the Viral Hemorrhagic Septicemia virus (VHS). VHS is on the SD ANS watch list and ADRDL is assisting SDGFP with its survey of the state for this virus.

FEDERAL

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) provides federal funding for implementation of state and regional ANS management plans that have been approved by the Aquatic Nuisance Species Task Force (ANSTF). One of the major USFWS efforts on ANS is **The 100th Meridian Initiative***. The goals of The 100th Meridian Initiative are to: 1) prevent the spread of zebra mussels and other ANS in the 100th meridian jurisdictions and west, and 2) monitor and control zebra mussels and other ANS if detected in these areas. These goals will be attained through the implementation of the following six components: 1) information and education, 2) voluntary boat inspections and boater surveys, 3) involvement of those who haul boats for commercial purposes, 4) monitoring, 5) rapid response, and 6) evaluation. This initiative represents a large-scale focused and coordinated effort, working with federal, state, provincial and tribal entities, potentially affected industries, and other interested parties to address possible pathways of introduction to prevent the spread of zebra mussels. The success of this initiative depends on the commitment of these groups to combat the spread of this destructive invader.

The Aquatic Nuisance Species Task Force (ANSTF) is an intergovernmental organization dedicated to preventing and controlling aquatic nuisance species, and implementing the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990. The various NANPCA mandates were expanded later with the passage of the National Invasive Species Act (NISA) in 1996. The ANSTF consists of 10 Federal agency representatives and 12 Ex-officio members, and is co-chaired by the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration. The Task force coordinates governmental efforts dealing with ANS in the U.S. with those of the private sector and other North American interests via regional panels and issue-specific committees and work groups.

The ANSTF will develop and implement a program for waters of the U.S. with the following five goals:

- develop strategies to identify and reduce the risk of harmful aquatic species being introduced into waters of the U.S.;
- minimize the harmful effects of ANS already introduced into waters of the U.S.;
- facilitate research to address the threat and harmful effects of ANS;
- increase public understanding of the importance of reducing the introduction, spread, and impact of ANS and recommend appropriate domestic and international actions;
- maximize the organizational effectiveness of the ANSTF.

Statutes and rules related to ANS: (Appendix C)

Programs related to ANS

Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, PL 101-646). This law established the ANSTF which is jointly chaired by the USFWS and the National Oceanic and Atmospheric Administration (NOAA). The ANSTF is charged with coordinating state and federal efforts related to ANS, and the efforts of the private sector and Canada. NANPCA was reauthorized and amended in 1996 by passage of the National Invasive Species Act (NISA).

National Invasive Species Act (NISA). This later legislation provides guidance for the preparation of state ANS management plans for submission to, and approval by, the ANSTF. Following approval, the states are expected to use their ANS management plan as a template for federal grant applications for work on invasive species within the state.

Distribution and diet of young of year (YOY) bighead and silver carp on the Upper Missouri River and influence of their presence and absence on native fish diet and distribution: Great Plains U.S. Fish and Wildlife Service, Pierre, SD, 2003-4. This research studies nursery habitat and diets of larval and juvenile, bighead, and silver carp in the Missouri River and their relationship on the native YOY fish community. Sampling above and below Gavins Point Dam on the Missouri River (current upstream limit of Asian carp distribution) was used to compare potential differences in larval fish densities, diets and community composition.

Pallid sturgeon and associated Missouri River fish community monitoring program
A multi agency (state and federal) team of biologists using standardized gears and methods to assess the fish community, including potential detection of ANS. The program has been ongoing in SD downstream of Fort Randall Dam since 2003 (USFWS) and downstream of Gavins Point Dam since 2005 (SDGFP).

Triploid grass carp certification program
The SDFGP regulates all introductions of fish or fish eggs into South Dakota Waters (SDCL 41-13-3). This authority includes the introduction of grass carp for weed control purposes. Only certified triploid (sterile; USFWS) grass carp can be used following inspection and authorization by SDGFP. Proof or origin and certification shall accompany shipment of fish to be introduced. Entities wishing to introduce grass carp

for weed control must follow "Guidelines and Precautions; Introduction of Triploid (sterile) Grass Carp"; SDGFP (1996).

U.S. Corps of Engineers

It is the policy of the Corps of Engineers to develop, control, maintain, and conserve the nation's water resources in accordance with the laws and policies established by Congress and the Administration. The Corps' Zebra Mussel Research Program (ZMRP) was authorized by the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, Public Law 101-646, and is the only federally authorized research program for the development of technology to control zebra mussels. The Corp's ANS programs were integrated into the ANS Task Force to ensure total coordination and leveraging to address all ANS issues.

United States Department of Agriculture - Animal and Plant Health Inspection Service (USDA-APHIS).

A multi-faceted agency with a broad mission area that includes protecting and promoting U.S. agricultural health, regulating genetically engineered organisms, administering the Animal Welfare Act, and carrying out wildlife damage management activities. These efforts support the overall mission of USDA, which is to protect and promote food, agriculture, natural resources and related issues. On Oct. 24, 2006, APHIS issued an emergency order which prohibited the importation of certain species of live fish from two Canadian provinces into the United States and the interstate movement of the same species from the eight states bordering the Great Lakes due to outbreaks of viral hemorrhagic septicemia (VHS).

REGIONAL COOPERATION

The Western Regional Panel (WRP) on ANS*: Formed under a provision of the National Invasive Species Act (NISA). The goal of the WRP is to protect limited western aquatic resources by preventing the introduction and spread of exotic nuisance species into western marine and freshwater systems though the coordinated management and research activities of state, tribal, federal, commercial, environmental, research entities and other regional panels. The WRP was formed to help limit the introduction, spread, and impacts of ANS into western North America. The WRP encompasses an extensive geographic range, all states and provinces west of the l00th Meridian as well as Guam, Hawaii and Alaska.

WRP Goals

- Identify Western Region priorities for responding to aquatic nuisance species.
- Make recommendations to the Task Force regarding an education, monitoring (including inspection), prevention, and control program to prevent the spread of the zebra mussel west of the l00th Meridian.
- Coordinate, where possible, other aquatic nuisance species program activities in the West not conducted pursuant to the Act.
- Develop an emergency response strategy for Federal, State, and local entities for new invasions of aquatic nuisance species in the region.

- Provide advice to public and private individuals and entities concerning methods of preventing and controlling aquatic nuisance species infestations.
- Submit an annual report to the Task Force describing activities within the western region related to aquatic nuisance species prevention, research and control.

The Mississippi River Basin Regional Panel (MRBP) on ANS*: Formed under a provision of NISA to identify priorities for activities, develop and submit recommendations to the national ANSTF, coordinate aquatic nuisance species program activities, advise public and private interests on control efforts, and submit an annual report to the ANSTF describing prevention, research, and control activities in the Mississippi River Basin. This panel includes representatives from federal, state, tribal, and local agencies and from private environmental and commercial interests. **The Mississippi Interstate Cooperative Resource Association (MICRA)** has hosted the MRBP since 2003 under the oversight of the ANSTF. Members states include: AL, AR, CO, GA, IL, IN, IA, KS, KY, LA, MN, MS, MO, MT, NE, NY, NC, ND, PA, OH, OK, SD, TN, TX, VA, WV, WI, and WY.

Goals

- Identify priorities for activities in the Mississippi River Basin (Basin).
- Develop and submit recommendations to the national Aquatic Nuisance Species Task Force (ANSTF) (established via Public Law 101-646).
- Coordinate aquatic nuisance species program activities in the Basin.
- Advise public and private interests on control efforts.
- Submit an annual report to the ANSTF describing prevention, research and control activities in the Basin.

***(SD has representation on the WRP, MRBP panels and The 100th Meridian Initiative)**

DEFINITION AND RANKING OF ANS RISKS IN SOUTH DAKOTA

Summary

Aquatic nuisance species threaten South Dakota's aquatic communities and associated habitats. The SDGFP contracted with Dr. Katie Bertrand, SDSU, to draft an aquatic nuisance species risk assessment that evaluated and prioritized the risks posed by aquatic nuisance species to South Dakota's aquatic environments. The ultimate aim of the risk assessment was to provide criteria with which to draft a state aquatic nuisance species management plan. Specifically, the objectives of the risk assessment include: 1) identification of aquatic nuisance species risks relevant to SD, 2) compilation of aquatic nuisance species biology, vectors, and pathways based on literature and communication with state and regional experts, and 3) qualitative expert ranking of aquatic nuisance species threats. The risk assessment process identified 61 "species of concern", considered most relevant to SD, 13 of which were identified as "species of primary concern".

Background

Risk assessment is a tool used to identify and evaluate priorities and develop strategic plans to address issues across a variety of professional and scientific disciplines. The

Federal Aquatic Nuisance Species Task Force developed a Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process in 1996 (RAM 1996) to estimate the risk associated with the introduction of nonindigenous aquatic organisms and strategically manage for that risk. They defined risk assessment as "a process to evaluate the risk associated with individual pathways and recently established nonindigenous organisms", whereas risk management is "the practical operational approach to reducing both the probability of unintentional introductions and the risk associated with intentional introductions" (RAM 1996). It is recommended that risk assessments be reviewed and revised regularly because perceived threats are constantly changing along with associated assessment criteria.

Methods/Results

The SD ANS risk assessment has combined analyses of vectors, pathways, and species to qualitatively estimate likelihoods of ANS introduction, establishment, and invasiveness in SD. Analyses specifically focused on aquatic organisms relevant to SD and their associated habitats. Pathways are the routes between source and recipient regions, and vectors are the manners in which species are carried along pathways (Mack 2004). Data were obtained primarily from license sales and user surveys; specifically the 2006 SD non-resident angler license, and 100th Meridian Initiative databases.

Interstate pathways of highest intensity for SD included source areas originating in: MN, IA, NE, ND, and CO. In 2006, over 70% of non-resident angler licenses were sold to individuals in these five states. These pathways were associated with at least two vectors: bait, and boat-barge-equipment. These pathway data are supported by the 100th Meridian Initiative boater survey, which indicated that in 1999, 89% of non-resident boaters originated from the states of: IA (38%), NE (31%), and MN (20%). Remaining states were represented by 2% or less of the total non-resident boaters interviewed.

Vectors were selected from the global list of transportation-related, living industry, and miscellaneous vectors compiled by the National Invasive Species Council (NISC 2007). Although ANS have the potential to move along any of the vectors listed by the NISC, only a subset of those vectors were relevant to SD. Vectors selected include: bait (collection, sale, fishing, and disposal), boat-barge-equipment (i.e., stowaways or hitchhikers in holds and surface-fouling organisms on boats and water-based sporting and commercial equipment), intentional stocking, intentional planting, aquaculture, aquarium animals, parasites, sportsmen-outdoor-home-garden shows, plant-animal importation for research, soil-sod-media, and aquatic plant trade.

Literature sources and expert opinion was used to determine ANS that could: 1) be carried within a relevant vector, 2) occur in an important pathway, and 3) potentially survive in SD. Organisms meeting these criteria were assembled into a list of 61 "species of concern" to SD (Appendix D). These species included: 15 plants (includes 1 diatom), 14 invertebrates, and 31 vertebrates and associated vertebrate pathogens or parasites. At least one-third (22) of these species have been introduced or are currently established in SD, the remaining species (39) are in pathways relevant to SD. Intentional stocking was the vector associated with the greatest percentage (34.4%) of introductions, including 15

fishes and 5 invertebrates. The boat-barge-equipment vector was implicated in the movement of nearly 23% of the 61 species, including: 4 fishes, 7 invertebrates, and 2 plants.

This list of species of concern was then examined by a panel of 20 experts in the areas of: invasive species, fisheries science, and fish health, aquatic and semi-aquatic plants (Appendix E). The panel of experts selected 13 species of concern representing the greatest threat to SD for inclusion on a list of "species of primary concern" (listed below). This list of species of primary concern was then subjected to individual, qualitative organism risk assessments based on threat and certainty levels (Appendix F). Panel experts qualitatively rated each species (high, medium, or low risk) and provided uncertainty estimates for probability and consequences of establishment (very certain, reasonably certain, moderately certain, reasonably uncertain, or very uncertain). Literature sources and expert opinion were then used to assemble biological descriptions for each species of primary concern, including information on: native range, current distribution, physicochemical tolerances, life history, trophic ecology, ecosystem effects, and invasion history (listed below). The remaining species of concern (*n*=48) were considered of less potential threat to SD and are described as "species of secondary concern".

Aquatic Nuisance Species of Primary Concern for South Dakota

- **Brittle naiad** (*Najas minor*)
- **Curly pondweed** (*Potamogeton crispus*)
- **Didymo** (*Didymosphenia geminata*)
- **Eurasian water-milfoil** (*Myriophyllum spicatum*)
- **New Zealand mudsnail** (*Potamopyrgus antipodarum*)
- **Rusty crayfish** (*Orconectes rusticus*)
- **Zebra mussel** (*Dreissena polymorpha*)
- **Quagga mussel** (*Dreissena rostriformis bugensis*)
- **Bighead carp** (*Hypothalmichthys nobilis*)
- **Black carp** (*Mylopharyngodon piceus*)
- **Common carp** (*Cyprinus carpio*)
- **Grass carp** (*Ctenopharyngodon idella*)
- **Silver carp** (*Hypothalmichthys molitrix*)
- **VHS** (Viral hemorrhagic septicemia)

Biological Descriptions

Plants / algae

Brittle naiad (*Najas minor*)

Brittle naiad is an annual submersed aquatic plant that primarily reproduces sexually by seeds. This species is native to Eurasia but has been introduced to lakes and streams throughout the Midwest and northeastern United States. Although in some circumstances brittle naiad can provide food and habitat for fishes and aquatic invertebrates, it often represents a threat by growing up to 1 meter above the bottom, effectively out-competing

native aquatic plants. An established population of brittle naiad currently exists in SD in McCook Lake, Union County.

Curly pondweed (*Potamogeton crispus*)

Curly pondweed or curly-leaf pondweed is a submerged aquatic perennial plant native to Eurasia having leaves with crisped or wavy margins (Ode 2006). This species exhibits maximum growth, flowers, and can reproduce vegetatively through structures called turions, in late spring (Sastroutomo 1981). These turions remain dormant until late summer, when they either initiate germination or continue dormancy for up to five years. Curly pondweed grows throughout the winter, even under snow-covered ice (Stuckey 1979). Curly pondweed currently has established populations in SD in Big Stone, Sheridan and Canyon Lakes, Rapid Creek, Angostura Reservoir and in the Missouri River in Lakes Oahe, Sharpe, Lewis and Clark, and below Fort Randall and Gavins Point Dams, and in Burbank Lake, Clay County.

Didymosphenia/ "didymo" (*Didymosphenia geminata*)

Didymosphenia *geminata* or "didymo" is a stalked diatom species native to North America and Europe that occurs primarily in low-nutrient, montane or northern streams. The stalk may attach to rocks, plants, or any other submerged substrate. It is not the diatom cell itself that is responsible for the negative impacts of didymo, but the massive production of extracellular stalk material which can form nuisance growths that extend for greater than 1 km and persist for several months of the year. To the observer, these mats appear as fiberglass insulation, tissue paper, or "rock snot". These dense blooms may out-compete other algal and plant species, through light and nutrient limitation, and may impede the feeding and mobility of aquatic invertebrates and fishes (Spaulding and Elwell 2007). Didymo has been expanding its range over the past several years and developing nuisance populations in North America, Europe, and New Zealand. An established population of *Didymosphena geminata* currently exists in SD in Rapid Creek, Pennington County in the Black Hills.

Eurasian water-milfoil (*Myriophyllum spicatum*)

Eurasian water-milfoil is a submerged aquatic plant that grows in water depths of 1–10 m and tolerates a pH range of 5.4–11 (Aiken et al. 1979). It is native to Europe, Asia, and northern Africa and exotic to the US (Jacono and Richardson 2008). This species primarily reproduces vegetatively through fragmentation and stolons (runners) (Aiken 1979; Madsen et al. 1988). It breaks dormancy in early spring, sometimes out-competing native vegetation by forming a dense canopy. In areas without vegetation, the introduction of Eurasian water-milfoil may increase habitat for aquatic invertebrates and fishes, but in areas where Eurasian water-milfoil replaces native vegetation (e.g., *Potamogeton spp.*) it can reduce aquatic invertebrate diversity and abundance and increase the relative abundance of small-bodied fishes (Keast 1984; Engel 1995). Established populations of Eurasian water-milfoil currently exist in SD in Lake Sharpe on the Missouri River.

Invertebrates

New Zealand mudsnails (*Potamopyrgus antipodarum*)

New Zealand mudsnails are small (adults typically range from 5–12 mm long) gastropod (snail) species that grazes algae from the bottom of standing and moving freshwater habitats and can rapidly assume densities up to 750,000 m^2 through parthenogenesis (asexual reproduction; Hall et al. 2003; Richards 2004). This species competes with native aquatic invertebrates for food and may negatively affect trout feeding because of their lack of palatability and relative abundance compared with native aquatic invertebrates (Vinson *in* press). New Zealand mudsnails do not currently exist in SD.

Dreissenid /zebra and quagga mussels (*Dreissena polymorpha* and *Dreissena rostriformis bugensis*)

Two of the best-known aquatic nuisance species in the US, zebra and quagga mussels, are sessile (non-moving) filter-feeders that reproduce sexually, disperse via larvae called veligers, and occupy a wide range of aquatic habitats. Their primary requirement for colonization is a hard surface to which they can attach. Zebra and quagga mussels are highly opportunistic, reproduce rapidly, and consume large quantities of microscopic aquatic plants and animals from the water column (Trometer et al. 1999). These species are native to the Black, Caspian, and Asov Seas and exotic to the US. Zebra mussel veligers were collected in zooplankton tows below Fort Randall and Gavins Point Dams in 2003, however to this date (2008), no live adult zebra or quagga mussels have been found above Gavins Point Dam on the Missouri River or in any other waterbodies in SD.

Rusty crayfish (*Orconectes rusticus*)

Rusty crayfish is an herbivorous (plant-eating) crustacean that reproduces sexually and is native to the Ohio, Tennessee, and Cumberland River drainages of the US. It has been expanding rapidly from its native range through a number of vectors. This species is generally larger and more aggressive, and may out-compete native crayfishes resulting in changes to aquatic invertebrate communities and possibly influencing higher-order consumers. Rusty crayfish have not been detected in SD to this date.

Vertebrates and associated pathogens

Common carp (*Cyprinus carpio*)

Common carp are native to Eurasia and exotic to the US. They are prolific and widespread bottom-feeding fishes that reproduce sexually. SD anglers do not consider common carp a desirable sport fish, but carp are commercially harvested from SD waters and sold at markets in larger metropolitan areas. In addition to their competition with native fishes, common carp can disrupt benthic (bottom-dwelling) communities and alter the functioning of aquatic ecosystems. Common carp can be found in most waters throughout SD.

Silver/Bighead carp (*Hypophthalmichthys molitrix* and *Hypophthalmichthys nobilis*)

Silver and bighead carp are considered jointly here because of their propensity to hybridize (interbreed) and the similarity of their ecological roles and biology. Both fish

are native to Asia and were originally introduced to the US in the 1970's and 80's to control phytoplankton (algae that are suspended in the water) in nutrient-rich water bodies and as a food fish, but later escaped to the Mississippi River drainage. Both species are prolific spawners and are now widespread in the Mississippi watershed and its tributaries. Silver carp are listed as an injurious species by the US Fish and Wildlife Service under the provisions of the Lacey Act (USFWS 2007a). Silver and bighead carp have been documented in SD in the Missouri River below Gavins Point Dam, in the Big Sioux River through Union and Lincoln counties, in the James River north to Huron, and Lower Vermillion River through Clay and Union counties.

Black carp (*Mylopharyngodon piceus*)

Black carp is a molluscivore (feed on clams and snails) native to eastern Asia that was introduced (most recently of all the Asian carps) to the United States as a biocontrol agent in aquaculture facilities to control snails that can often serve as hosts to parasitic fish diseases. The fish subsequently escaped into the Mississippi river drainage. Black carp are listed as an injurious species by the US Fish and Wildlife Service under the provisions of the Lacey Act (USFWS 2007b). Black carp closely resemble grass carp and are widely tolerant of a range of lentic and lotic freshwater habitats. Currently, black carp have not been detected in SD.

Grass carp (*Ctenopharyngodon idella*)

Grass carp, native to China have been stocked extensively since 1963 (Mitchell and Kelly 2006) as a biocontrol for aquatic plants across a wide array of habitat types (to minimize the threat of natural plant reproduction and the establishment of undesirable plant populations). Grass carp decrease aquatic plant abundance but can increase algal abundance, nitrate-nitrogen and total phosphorus, and may also increase abundances of phytoplankton, zooplankton and benthic (bottom dwelling) animals (Kirkagac and Demir 2004). Grass carp can produce many offspring, and are capable of long-distance migration and dispersal (Fuller et al. 1999). SD requires that only sterile, triploid grass carp are stocked in state waters, however naturally reproducing populations currently exist in Yankton, Hutchinson and Hanson counties.

Viral Hemorrhagic Septicemia (VHS)

Viral hemorrhagic septicemia (VHS) is a serious virus of fresh and saltwater fish (at least 50 species) that is causing concern in the Great Lakes region of the US and Canada. VHS virus is a rhabdovirus (rod-shaped virus) that affects fish of all size and age ranges but does not pose any threat to human health. VHS can cause hemorrhaging of fish tissue, including internal organs, and can cause the death of infected fish. Once a fish is infected with VHS, there is no known cure. Not all infected fish develop the disease, but they can carry and spread the disease to other fish. The virus was apparently present in the Great Lakes region since 2003 where fish kills have been reported since 2005. VHS has been blamed for fish kills in Lake Michigan, Lake Huron, Lake St. Clair (MI), Lake Erie, Lake Ontario, the St. Lawrence River, and some inland waters in NY, WI and MI. The World Organization of Animal Health has categorized VHS as a transmissible disease with the potential for profound socio-economic consequences (New York Department of Environmental Conservation 2008). SD's Fish Health Management Plan

and Risk Assessment Protocols lists VHS as "emergency prohibitive", which are pathogens not known to be present in SD, have the potential to cause severe mortality, and cannot be controlled (Cordes 2006). Current testing throughout the state of SD has not detected the existence of VHS in State waters.

STATUS OF AQUATIC NUISANCE SPECIES IN SOUTH DAKOTA

All non-indigenous species affect native species and habitat in some manner, but not all of them pose a significant threat, and some provide an economic and recreational benefit in certain areas. It is a difficult task to predict the effects that species will have once they are introduced. Although ANS problems are relatively new to South Dakota, 8 of 14 species on our list of "primary concern" mentioned in the previous text (brittle naiad, curly pondweed, Eurasian water-milfoil, didymo, bighead, silver, grass and common carp) have become established and pose threats to aquatic ecosystems in this state. Several species of primary concern, as well as other potentially harmful ANS, exist in bordering states and pose additional threats to South Dakota's water resources.

Priorities for Action

Often, efforts to address ANS problems are implemented after a species has arrived and become widely distributed. As a result, these efforts are often reactive and ineffective. The purpose of this management plan is to expand the scope of efforts in SD to deal with the threats posed by all ANS. The goal of this management plan is to implement a coordinated strategy designed to minimize the risk of further ANS introductions into SD through all known pathways and vectors, develop funding mechanisms to implement and staff a SD ANS management program, stop the spread of ANS already present and eradicate or control ANS to a minimal level of impact. By forming an ANS management program at this time, it is expected that the problems other states have experienced can be minimized or completely avoided. Initially, this plan will focus on the species of primary concern listed above. As this program evolves, the focus will shift to the development and implementation of new programs designed to prevent or control the introduction of any new ANS into SD. By addressing pathways and vectors of introduction for species of primary concern, the introduction of other, lower priority or perhaps unidentified ANS sharing these common pathways and vectors, can also be prevented.

The goal of the South Dakota ANS management plan is to minimize the harmful ecological, economic, and social affects of ANS through prevention and management of introduction, population growth, and dispersal of ANS into, within, and from South Dakota. This goal will be achieved through implementation of a plan that will emphasize prevention of introductions while effectively addressing established ANS populations. The introduction of ANS into state waters may cause environmental, socio-economic, and possible public health effects. Several damaging ANS already have been introduced into South Dakota, and future introductions are highly likely. An effective management plan must:

- stress prevention through education and enforcement;
- recommend funding levels adequate for effective implementation;

- allow for early detection;
- produce interagency and user group collaboration through an invasive species oversight committee;
- provide for easy access to accurate and up to date species distribution and management information;
- incorporate education and research elements;
- protect and restore native plant and animal communities;
- permit appropriate and timely management response to new and existing populations;
- facilitate inter-jurisdictional coordination with state and federal agencies;
- seek cooperative solutions with the private sector and user groups.

It is impossible to address all potential invaders, their impacts, and the constraints and contingencies that may develop. Consequently, this plan is intended to be adaptable to changing circumstances in order to avoid a delayed response which can limit opportunities for the prevention of new introductions and options for control, leaving the state with ANS management problems that are economically costly, technically challenging, and possibly unfeasible to solve. To effectively address ANS problems in South Dakota, prevention of new ANS introductions, and control of existing ANS populations are essential.

MANAGEMENT OBJECTIVES, STRATEGIES, ACTIONS AND COST ESTIMATES

Objective 1: Coordinate, draft, implement and evaluate a comprehensive management plan for South Dakota. *(Group names and acronyms defined in Appendix B)

1A. Problem: There is no clear authority or agency in South Dakota charged with limiting and managing ANS. South Dakota needs an organized and coordinated approach to ANS management to prevent duplication of effort and eliminate gaps in coverage of ANS issues. State ANS management efforts need to be coordinated with regional and national efforts. Gaps in State ANS management include: unclear authorities, uncoordinated activities, lack of defined State ANS management staffing and funding mechanisms.

Strategy 1A1: Coordinate and draft an ANS management plan for SD.

Task 1A1a: Identify key groups and agencies involved in State ANS issues for participation in an ANS Oversight Committee**.**

- ANS Management Plan Oversight Committee (GFP, DENR, DOA, AIB, FWS, SDT, IWL, SDSU): Members will be involved in the development and drafting of an ANS management plan for the State of South Dakota and will ultimately serve on an oversight committee overseeing implementation and future management of ANS issues in South Dakota.

Task 1A1b: Identify key groups and agencies for participation in outreach/education and research subcommittees.

ANS Subcommittees and suggested corresponding objectives: Subcommittees will provide expertise and data to inform the ANS Oversight Committee and State ANS Coordinator.

- Research (GFP, SDSU, NPS, and FWS): This group is currently engaged in the development of an ANS Risk assessment for the State of South Dakota. Future contributions from this group will include the planning, coordination and implementation of ANS research and monitoring.
- Education and Outreach (GFP, DT, DOE, SDDC, EDWDD, IWL; This group will use existing communication and outreach networks and develop new methods to spread awareness of ANS threats both among state residents and out-of-state visitors.

Task 1A1c: Receive preliminary plan approval from Federal ANSTF (9/08).

Task 1A1d: Receive plan approval from Governor (10/08).

Strategy 1A2: Develop and implement an ANS management program for South Dakota.

Task 1A2a: Fund and implement an ANS management program for South Dakota.

Task 1A2b: Create and fund a full time State ANS Coordinator position.

Task 1A2c: Hire and train seasonal ANS Technicians for monitoring and field inspections; to report to SD ANS Coordinator.

Strategy 1A3: Monitor and evaluate South Dakota ANS management program.

Task 1A2b: ANS Oversight Committee will meet annually to review state, regional and national ANS issues and revise plan content to adapt to changes in ANS risk or resources for ANS management.

Objective 2: Prevent the introduction of new ANS into South Dakota waters

2A. Problem: There are several pathways by which new species can arrive in South Dakota. Implementation of a program that reviews and regulates which species are intentionally allowed into South Dakota, and monitors the pathways by which species can be unintentionally transported into the state, is necessary to slow the rate at which new species become established. Understanding how various pathways function as conduits for ANS into South Dakota is critical for intercepting species and preventing introductions. Prevention is the most cost effective and environmentally sound method of addressing this problem. South Dakota currently has no comprehensive program to prevent new ANS introductions or address new species if one should arrive.

Strategy 2A1: Identify ANS that have the greatest potential to infest South Dakota and identify existing and potential pathways that facilitate ANS introductions.

Task 2A1a: Create an ANS Risk Assessment for South Dakota and update as required.

Task 2A1b: Network with other states and regional entities for ANS information.

Strategy 2A2: Review and update regulations.

Task 2A2a: Conduct a coordinated review of existing state ANS laws with regulatory agencies.

Task 2A2b: Update existing and create new statutes and regulations as needed.

Strategy 2A3: Prevent new ANS infestations through field inspections, interviews and regulation enforcement.

Task 2A3a: Provide training and materials to personnel, for boat and recreational equipment inspections and interviews.

Task 2A3b: Operationalize law enforcement staff for equipment inspection and ANS enforcement.

Objective 3: Detect, monitor and eradicate ANS

3A. Problem: South Dakota must be able to rapidly detect new ANS invasions and the spread of established ANS. After an invasive species arrives, a brief window of opportunity exists to eradicate small pioneering populations. By initiating detection and monitoring programs, South Dakota will be able to discover and manage pioneering infestations at a point when emergency response can be implemented and the problem species may be eradicated in a cost effective manner.

Strategy 3A1: Implement a state ANS surveillance program.

Task 3A1a: Conduct surveys to determine ANS distribution.

Task 3A1b: Provide training to state natural resource staff to initiate ANS monitoring programs and incorporate ANS monitoring into existing programs/projects.

Task 3A1c: Provide training and materials to encourage ANS monitoring by the public.

Strategy 3A2: Develop State ANS response protocols to quickly and effectively contain and eradicate pioneering populations.

Task 3A2a: Review existing state response polices and capabilities; make necessary revisions and additions in order to ensure effective containment and eradication of pioneering ANS populations.

Task 3A2b: Create a defined state funding source for fast and effective control and eradication response to future ANS infestations in South Dakota.

Task 3A2c: Establish cooperative policies with regional states and Indian Tribes with adjoining watersheds in order to efficiently eradicate or limit the spread of pioneering ANS populations.

Objective 4: Control and eradicate established ANS that have significant impacts.

4A. Problem: Established ANS populations can spread to uninfested waters, thereby increasing their potential for economic and ecological damage. ANS Management activities are most effective when they are directed at stopping the spread of ANS populations to new waterbodies and limiting their impacts.

Strategy 4A1: Limit the dispersal of established ANS to new waterbodies or to new areas of a waterbody.

Task 4A1a: Develop guidelines to ensure the cleaning of water-based equipment that may spread ANS to uninfested waters (e.g. SDGFP gear handling policy; Appendix G).

Task 4A1b: Support scientific research between state and federal agencies and academic institutions that investigate ANS control strategies and associated environmental impacts**.**

Task 4A1c: Ensure that the control strategies developed and implemented by the state are done in coordination with federal agencies, local governments, inter-jurisdictional organizations, and other appropriate entities.

Task 4A1d: Ensure that control strategies are based on the best available scientific information and conducted in an environmentally sound manner.

Task 4A1e: Establish protocols that will provide guidance in designing and implementing control and eradication strategies.

Strategy 4A2: Develop means of adapting human activities to accommodate infestations of ANS.

Task 4A2a: Support research between state, federal and academic institutions that investigate potential means of adapting human activities to accommodate infestations of ANS where eradication or control is not feasible.

Objective 5: Educate Resource user groups about the ANS risks, impacts and prevention techniques.

5A. Problem: New ANS introductions occur through a variety of pathways, most of which are closely related to human activities. Although some education programs include ANS information, public awareness of these issues and threats in South Dakota is inadequate.

Strategy 5A1: Identify user groups.

Task 5A1a: User groups identified: anglers, boaters (including hunters and trappers), K-16 education system, volunteer monitors, bait shops, resort owners and employees, fishing outfitters, birders, lakefront property owners, scouts/community groups, rural water irrigators, aquaculture groups.

Strategy 5A2: Develop and distribute ANS educational materials for general awareness of ANS problems.

Task 5A2a: Suggestions for ANS awareness materials: trading cards, ID cards to boaters and anglers (laminate and on ring or chain), marketing materials, develop lesson plans tied to state standards and provide training on their use, signs, website, news/magazine/ radio, fishing license could be opportunity to provide information, fishing and hunting handbooks.

Task 5A2b: Create legislative packet to emphasize need for ANS education and awareness.

Strategy 5A3: Develop and distribute ANS educational materials targeted at specific public pathways.

Task 5A3a: List of education materials targeted at specific ANS pathways: signs at boat docks/wash stations, highway rest areas, outdoor expo/sport shows, math-science conferences, bait shops, boating manual, water festivals/environmental fairs and county extension offices.

Strategy 5A4: Develop and distribute ANS identification and management information to natural resource agency staff.

Task 5A4a: Natural resources staff identified: Creel clerks, Parks staff, Biologists, Hatchery staff, Conservation Officers, also Division Directors, Dept. Secretaries and the Governor.

Objective 6: Support research on ANS in South Dakota and develop efficient systems to disseminate information to research and management communities.

6A. Problem: Little is known about the effects of ANS in SD. Research questions relevant to the ANS problem include: determining the risks associated with each pathway of ANS introductions, the environmental conditions necessary for certain ANS to become established in SD waters, the likely interactions between ANS and native species, and which management options will provide the best results in controlling or eradicating ANS populations. Research is needed to quantify and clarify the effect ANS poses to SD water resources.

Strategy 6A1: Support research that: identifies, predicts and prioritizes potential ANS introductions.

Task 6A1a: Identify life histories and impacts of introduced aquatic plants and animals.

Task 6A1b: Identify data critical to preventing the introduction of new ANS.

Task 6A1c: Attend scientific and technical conferences addressing the mechanisms by which new ANS spread.

Task 6A1d: Monitor and support ongoing research efforts attempting to develop control mechanisms for new ANS.

Strategy 6A2: Support research on management alternatives for their effect on ANS and native species.

Task 6A2a: Investigate the relationship between human-induced disturbance of aquatic and riparian systems and ANS invasion, establishment and impacts.

Task 6A2b: Investigate new and innovative methods of managing ANS.

Strategy 6A3: Facilitate the collection and dispersal of ANS data and policies in South Dakota.

Task 6A3a: Provide point of contact for state-wide ANS reporting and create and maintain state ANS database.

Task 6A3b: Utilize the internet to distribute ANS information and research findings via an agency website and email posting to state and regional ANS stakeholders.

IMPLIMENTATION TABLES FOR SOUTH DAKOTA AQAUTIC NUISANCE SPECIES MANAGEMENT PLAN

*(Group names and acronyms defined in Appendix B)

Strategic actions/tasks		Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE)		Planned ($000/FTE)		
Task #	Description				FY08	FY09	FY10	FY11	FY12
Objective 1: Coordinate, draft and implement a comprehensive management plan for SD									
1A1	**Coordinate and draft an ANS management plan for SD**								
1A1a	Identify key Groups and Agencies for participation in ANS Oversight Committee.	State	GFP	DENR, DOA, AIB SDSU, SDT, FWS, IWL					
1A1b	Identify key groups and agencies for participation in outreach/education and research subcommittees.	State	GFP	SDSU, NPS, DT, DOE, DOT SDDC, FWS, IWL, EDWDD					
1A1c	Receive preliminary plan approval from Federal ANSTF (9/08).	State	GFP	FWS					
1A1d	Receive plan approval from Governor (10/08).	State	GFP	OG					
1A2	**Develop and implement an ANS management program for SD**								
1A2a	Fund and implement an ANS management program (Values shown represent total program budget).	State & Fed	GFP	Various	44/0	35/0	55/0	287/1	298/1
1A2b	Create and fund a full time state ANS Coordinator position.	State	GFP					60/1	60/1
1A2c	Hire and train seasonal ANS Technicians for monitoring and field inspections-to report to ANS Coordinator.	State	GFP				30/0	40/0	40/0

IMPLIMENTATION TABLES (continued)

Strategic actions/tasks		Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE)		Planned ($000/FTE)		
Task #	**Description**				**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Objective 2: Prevent the introduction of new ANS into SD waters									
2A1	**Identify ANS that have the greatest potential to infest SD and pathways that facilitate ANS introductions**								
2A1a	Create an ANS risk assessment for SD and update as required.	State & Fed	GFP	SDSU, Various	42/0				
2A1b	Network with states and regional entities for new ANS information.	State	GFP	Various					
2A2	**Review and update regulations**								
2A2a	Conduct a coordinated review of existing state ANS laws with regulatory agencies.	State	GFP	DOA, DENR, AIB					
2A2b	Update existing and create new statutes and regulations as needed.	State	GFP	DOA, DENR, AIB					
2A3	**Prevent new ANS infestations through field inspections, interviews and regulation enforcement**								
2A3a	Provide personnel, training and materials for boat and recreational equipment inspections and interviews.	State	GFP					15/0	20/0
2A3a	Operationalize law enforcement staff for equipment inspection and ANS enforcement.	State	GFP					2/0	3/0

IMPLIMENTATION TABLES (continued)

Strategic actions/tasks		Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE)		Planned ($000/FTE)		
Task #	**Description**				**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Objective 3: Detect, monitor, contain and eradicate ANS									
3A1	**Implement a state ANS surveillance program**								
3A1a	Conduct surveys to determine ANS distribution.	State	GFP	DENR, FWS, SDSU		15/0		15/0	20/0
3A1b	Provide training to natural resource staff to initiate ANS monitoring and also incorporate ANS monitoring into existing programs/projects.	State	GFP	DENR, FWS, SDSU				5/0	5/0
3A1c	Provide training and materials to encourage ANS monitoring by the public.	State	GFP	SDDC, IWL, EDWDD				5/0	5/0
3A2	**Develop state ANS response protocols to quickly and effectively contain and eradicate pioneering populations**								
3A2a	Review existing state response polices and capabilities and make necessary revisions and additions to ensure effective containment and eradication of pioneering ANS populations.	State	GFP	Various					
3A2b	Create a defined state funding source for fast and effective control and eradication response to future ANS infestations in SD.	State	GFP	Various					
3A2c	Establish cooperative policies with regional states and Indian Tribes with adjoining watersheds to efficiently eradicate or limit the spread of pioneering ANS populations.	State	GFP	Various					

IMPLIMENTATION TABLES (continued)

Strategic actions/tasks		Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE)		Planned ($000/FTE)		
Task #	**Description**				**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Objective 4: Control and eradicate established ANS that have significant impacts									
4A1	**Limit the dispersal of established ANS to new waterbodies or to new areas of a waterbody**								
4A1a	Develop guidelines for cleaning of water-based equipment that may spread ANS to uninfested waters.	State	GFP	Various				50/0	50/0
4A1b	Support scientific research between state and federal agencies and academic institutions that investigate ANS control strategies and associated environmental impacts.	State & Fed.	GFP	SDSU, DENR, FWS					
4A1c	Ensure that the control strategies developed and implemented by the state are done in coordination with federal agencies, local governments; inter-jurisdictional organizations and other appropriate entities.	Various	GFP	ACE, DOA, OG, FWS, FS, NPS, DENR, SDT					
4A1d	Ensure that control strategies are based on the best available scientific information and conducted in an environmentally sound manner.	State	GFP	SDSU, DENR, FWS					
4A1e	Establish protocols that will provide guidance in designing and implementing control and eradication strategies.	State	GFP	SDSU, DENR, FWS					
4A2	**Develop means of adapting human activities to accommodate infestations of ANS**								
4A2a	Support research between state, federal and academic institutions that investigate potential means of adapting human activities to accommodate infestations of ANS where eradication or control is not feasible.	State & Fed.	GFP	SDSU, DENR, FWS					

IMPLIMENTATION TABLES (continued)

Strategic actions/tasks		Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE)		Planned ($000/FTE)		
Task #	**Description**				**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Objective 5: Educate resource user groups about ANS risks, impacts and prevention techniques									
5A1	**Identify user groups**								
5A1a	User groups identified (see "Objectives, Strategies, Actions and Cost Estimates").	State	GFP						
5A2	**Develop and distribute ANS educational materials for general awareness of ANS problems**								
5A2a	Trading cards, ID cards to boaters and anglers, develop lesson plans tied to state standards, signs, website, news/magazine/ radio, fishing and hunting handbooks.	State & Fed	GFP	IWL, DOE, SDDC, EDWDD, DT	2/0	20/0	25/0	50/0	50/0
5A2b	Create legislative packet to emphasize ANS education and awareness.	State	GFP	OG					
5a3	**Develop and distribute ANS educational materials targeted at specific pathways**								
5A3a	Signs at boat docks/wash stations, outdoor expo/sport shows, math-science conferences, bait shops, boating manual, water festivals/ environmental fairs and county extension offices.	State	GFP	DOE, SDDC, EDWDD, DT				10/0	10/0
5A4	**Develop and distribute ANS identification and management information to resource agency staff**								
5A4a	List of staff; Creel clerks, Parks, Biologists, Hatchery, staff, Conservation Officers, also Division Directors, Dept. Secretary and the Governor.	State	GFP	FWS, ACE, FS, NPS, DOA, SDSU					

IMPLIMENTATION TABLES (continued)

Strategic actions/tasks		Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE)		Planned ($000/FTE)		
Task #	Description				FY08	FY09	FY10	FY11	FY12
Objective 6: Support research on ANS and develop efficient systems to disseminate information									
6A1	**Support research that: identifies, predicts and prioritizes potential ANS introductions.**								
6A1a	Identify life histories and impacts of introduced aquatic plants and animals.	State	GFP	SDSU, FWS					
6A1b	Identify data critical to preventing the introduction of new ANS.	State	GFP	SDSU, FWS				30/0	30/0
6A1c	Attend scientific and technical conferences addressing the mechanisms by which new ANS spread.	Various	GFP	SDSU, FWS				5/0	5/0
6A1d	Monitor and support ongoing research efforts attempting to develop control mechanisms for new ANS.	State & Fed.	GFP	SDSU, FWS					
6A2	**Support research on management alternatives for their effect on ANS and native species**								
6A2a	Investigate the relationship between human-induced disturbance of aquatic and riparian systems and ANS invasion, establishment and impacts.	State	GFP	SDSU, FWS					
6A2b	Investigate new and innovative methods of managing ANS.	State & Fed.	GFP	SDSU, FWS					
6A3	**Facilitate the collection and dispersal of ANS data and policies in SD**								
6A3a	Provide point of contact for state-wide ANS reporting and create state ANS database.	State	GFP	Various					
6A3b	Utilize the internet to distribute ANS information and research findings via an agency website and email postings to state and regional ANS stakeholders.	State	GFP	Various					

GLOSSARY

Accidental introduction: An introduction of non-indigenous aquatic species that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as the transport of non-indigenous species in ballast water or in water used to transport fish, mollusks, or crustaceans for aquaculture or other purposes.

Aquatic nuisance species (ANS): A non-indigenous species that threatens the diversity and abundance of native species or the ecological stability of infested waters, or commercial, agricultural, or recreational activities dependent on such waters.

Baitfish: Fish species commonly sold for use as bait for recreational fishing.

Ballast water: Any water or associated sediments used to manipulate the trim and stability of a vessel.

Control: Limiting the distribution and abundance of a species.

Ecological integrity: The extent to which an ecosystem has been altered by human behavior; an ecosystem with minimal impact from human activity has a high level of integrity (an ecosystem that has been substantially altered by human activity has a low level of integrity).

Environmentally sound: Methods, efforts, actions, or programs to prevent introductions or to control infestations of ANS that minimize adverse environmental impacts.

Eradicate: The act or process of eliminating an ANS.

Exotic: Any species or other biological material that enters an ecosystem beyond its historic range on the continent.

Great Lakes: Lake Ontario, Lake Erie, Lake Huron (including Lake St. Clair), Lake Michigan, Lake Superior, and the connecting channels (Saint Mary's River, Saint Clair River, Detroit River, Niagara River, and Saint Lawrence River to the Canadian border), and includes all other bodies of water within the drainage basin of such lakes and connecting channels.

Infested: Any waterbody where an aquatic nuisance species is known to occur.

Intentional introduction: All or part of the process by which a non-indigenous species is purposefully introduced into a new area.

Native: A plant or animal species that naturally occurs in South Dakota and has not been introduced from another state or continent.

Non-indigenous species: Any species or other variable biological material that enters an ecosystem beyond its historic range.

Pioneer infestation: A small ANS colony that has spread to a new area from an established colony.

Population: A group of individual plant or animal species occupying a particular area at the same time.

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APPENDIX A

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APPENDIX B

Group Names and Acronyms

Acronym	Group/Agency
ACE	US Army Corps of Engineers
AIB	SD Animal Industry Board
DENR	SD Department of Environment and Natural Resources
DOA	SD Department of Agriculture
DOE	SD Department of Education
DOT	SD Department of Transportation
DT	SD Division of Tourism
EDWDD	East Dakota Water Development District
FS	US Forest Service
FWS	US Fish and Wildlife Service
SDGFP	SD Department of Game, Fish and Parks
IWL	Izaak Walton League
NPS	National Park Service
OG	SD Office of the Governor
OSC	SD ANS Plan Oversight Committee
SDDC	SD Discovery Center
SDSU	SD State University
USDA APHIS	US Department of Agriculture, Animal and Plant Health Inspection Service
SDT	South Dakota Tribes
CCST-DNR	Crow Creek Sioux Tribe-Crow Creek Reservation. Department of Natural Resources
CRST-GFP	Cheyenne River Sioux Tribe–Cheyenne River Reservation Game, Fish and Parks Department
FSST-DNR	Flandreau Santee Sioux Tribe-Flandreau Reservation. Department of Natural Resources
LBST-WFR	Lower Brule Sioux Tribe-Lower Brule Reservation Wildlife, Fish and Recreation
OST-EPP	Oglala Sioux Tribe-Pine Ridge Reservation Environmental Protection Program
OST-PRA	Oglala Sioux Tribe-Pine Ridge Reservation. Oglala Sioux Parks and Recreation Authority
RST-GFP	Rosebud Sioux Tribe–Rosebud Reservation Department of Game, Fish and Parks
SWOT-GFP	(Sisseton-Wahpeton Oyate–Lake Traverse Reservation) Game, Fish and Parks Department
YST-IFWS	Yankton Sioux Tribe–Yankton Reservation. Ihanktonwan Fish and Wildlife Service
BIA	US Bureau of Indian Affairs

APPENDIX C

Statutes and rules related to ANS in South Dakota

South Dakota Department of Game, Fish and Parks

41-13-2 Commission authority required to use plant control chemicals in game fish waters: It is a Class 2 misdemeanor to place chemicals in the public waters of this state containing game fish for the purpose of controlling plants, unless explicit authorization to do so is obtained from the Department of Game, Fish and Parks. The department may prescribe such rules and regulations which in its discretion, are deemed necessary or desirable to safeguard game fish and other animals from the effects of such chemicals. Source: SDC 1939, § 25.0611 as enacted by SL 1961, ch 120, § 2; SL 1977, ch 190, § 588.

41-13-3 Commission authority required to introduce fish or eggs into public waters: It is a Class 2 misdemeanor for any person to transplant or introduce any fish or fish eggs into any of the public waters of this state without express authority of the Department of Game, Fish and Parks. Source: SDC 1939, § 25.0608 as enacted by SL 1961, ch 120, § 2; SL 1977, ch 190, § 589.

41-13-4 Emptying bait container into public waters as misdemeanor: It is a Class 2 misdemeanor for any person to empty the contents of any minnow bucket or other receptacle containing bait into any of the public waters of the state. Source: SDC 1939, § 25.0608 as enacted by SL 1961, ch 120, § 2; SL 1977, ch 190, § 591.

41:07:01:11 Introduction of nonnative fish into state waters prohibited: Possession and transportation of snakehead fish prohibited. No person may release a fish, mollusk, reptile, crustacean, or amphibian not native to South Dakota in any water in the state, other than aquaria, without written authorization from the commission. No person may possess or transport snakehead fish in South Dakota. Source: 8 SDR 58, effective November 30, 1981; 10 SDR 76, 10 SDR 102, effective July 1, 1984; 12 SDR 92, effective December 4, 1985; 16 SDR 114, effective January 18, 1990; 31 SDR 89, effective December 27, 2004; 32 SDR 109, effective December 27, 2005. General Authority: SDCL 41-2-18(1)(2). Law Implemented: SDCL 41-2-18(1)(2), 41-3-1, 41-3-8, 41-3-10, 41-3-12, 41-3-13.

41:07:02:02.01 No bait collected from that portion of the Missouri River below Gavins Point Dam may be transported from there except by legal anglers for use during the same day in the Missouri River below Gavins Point Dam. Source: 4 SDR 31, effective November 27, 1977; 8 SDR 58, effective November 30, 1981; 10 SDR 76, 10 SDR 102, effective July 1, 1984; 30 SDR 99, effective December 22, 2003. General Authority: SDCL 41-2-18(1)(2)(15). Law Implemented: SDCL 41-2-18(1)(2)(15), 41-12-19.
*(Rules regulating baitfish harvest, movement and use in SD are currently being reviewed and revised).

41:09:08 - IMPORTATION OF FISH

41:09:08:01.01. Fish importation prohibited -- Exceptions. A person may not import live fish or any fish reproductive product into the state except for the

following: (1) A person possessing a valid fish importation permit issued by the department; (2) An angler fishing on any boundary water as defined in § 41:07:01:01; or (3) A person importing fish designated for aquaria use. Source: 29 SDR 80, effective December 10, 2002; 34 SDR 179, effective December 24, 2007. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:03.01. Application requirements for fish importation permit -- Validity. A person shall make application for a fish importation permit on forms provided by the department. The application must be received at least ten working days prior to the date of importation if the application is from a new facility or supplier. The application period shall be waived for a fish importation permit if the facility or supplier has a valid fish health inspection certification or fish health report on file with the department. Applications are subject to review by the department's fish health specialist. Source: 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:03.02. Fish health inspection and accepted guidelines. A fish health inspection may only be conducted by a fish pathologist, fish health inspector, or a recognized fish health specialist approved by the department. A fish health inspection shall be conducted according to procedures in "Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens," 2004 Edition. Source: 29 SDR 80, effective December 10, 2002; 32 SDR 109, effective December 27, 2005. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1. Reference: "Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens," 2004 Edition. American Fisheries Society, Fish Health Section, 5410 Grosvenor Lane, Suite 110, Bethesda, Maryland, 20814.

41:09:08:03.03. Diseases of regulatory concern. Fish diseases of regulatory concern are as follows:

(1) Emergency prohibitive diseases:
- (a) Viral hemmorrhagic septicemia – V.H.S. virus;
- (b) Oncorhynchus masou virus – O.M. virus;
- (c) Salmonid rickettsial septicemia – S.R.S. virus;
- (d) Spring viiremia of carp – *Rhabdovirus carpio* – S.V.C. virus; and
- (e) Rhabdovirus disease of northern pike fry – P.F.R.D. virus;

(2) Prohibitive diseases:
- (a) Infectious hematopoietic necrosis – I.H.N. virus;
- (b) Infectious pancreatic necrosis – I.P.N. virus;
- (c) Ceratomyxosis – *Ceratomyxa shasta*;
- (d) Proliferative kidney disease – PKD/PKX agent;
- (e) Epizootic epitheliotropic disease – EED virus;
- (f) Channel catfish herpevirus – C.C.V.D.;
- (g) White sturgeon iridovirus – W.S.I. virus of white sturgeon; and
- (h) Largemouth bass virus – L.M.B.V.; and

(3) Notifiable diseases:

(a) Bacterial kidney disease – *Renibacterium salmoninarum*;

(b) Furunculosis – *Aeromonas salmonicida*;

(c) Enteric redmouth – *Yersinia ruckeri*;

(d) Whirling disease – *Myxosoma cerebralis*;

(e) Shovelnose sturgeon iridovirus – S.S.I. virus of shovelnose and pallid sturgeon; and

(f) Heterosporis – *Heterosposris sp*.

Source: 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:03.04. Importation requirements for fish or fish reproductive products obtained from facility containing salmonids. Before the department may issue to a person a fish importation permit for importation of fish or any fish reproductive product, the person shall submit to the department a current fish health certification or a fish health inspection report from a facility containing salmonids indicating that the facility has been inspected within the past twelve months and that there is no evidence of diseases of regulatory concern or their causative pathogens. If a notifiable disease or causative pathogen is detected at a facility, the department's fish health official may allow the fish or fish reproductive products to be imported if the official determines the requested importation will not cause introduction or spread of any notifiable aquatic animal pathogens to areas they currently do not occur. Non salmonids from the same facility may be subject to sampling. Source: 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:03.05. Importation requirements for fish or fish reproductive products obtained from non salmonid facility. Before the department may issue to a person a fish importation permit for fish or any fish reproductive product obtained from a non salmonid facility, the person shall submit to the department a current fish health certification or a fish health inspection report signed by an inspecting agent approved by the department indicating the absence of any fish disease of regulatory concern, any new fish disease, and exhibition of any clinical sign of disease. Evaluation of the disease history of the originating facility may require a fish health inspection. Source: 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:04. Packaging and shipping procedure. Any live fish or fish reproductive product that requires an importation permit shall be packaged and shipped in the original containers from a facility that has been inspected as provided in this chapter. The original copy of the importation permit must accompany each shipment and shall include a statement of prophylactic treatments used prior to departure from the original facility. The importation permit must be readily accessible to South Dakota authorities. Shipments arranged by a broker may be imported if they are delivered directly from the certified facility, in original containers, to the receiver in South Dakota. Source: SL 1975, ch 16, § 1; 10 SDR 76, 10 SDR 102, effective July 1,

1984; 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:05. Inspection of shipments. Any live fish or fish reproductive product imported under this chapter is subject to inspection either at the place of entry into the state or at other locations suitable to the department. The inspection may include the removal of reasonable samples of fish or any fish reproductive product for biological examination. Source: SL 1975, ch 16, § 1; 10 SDR 76, 10 SDR 102, effective July 1, 1984; 15 SDR 103, effective January 19, 1989; 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:06. Shipments in violation of rules -- Disposal. Any shipment failing to display an importation permit, found to be diseased upon inspection, containing any species not authorized by the import permit, or otherwise in violation of this chapter shall be refused entry, immediately destroyed, or transported out of the state at the direction of the fish health specialist as designated by the secretary. Source: SL 1975, ch 16, § 1; 10 SDR 76, 10 SDR 102, effective July 1, 1984; 15 SDR 103, effective January 19, 1989; 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

41:09:08:07. In-transit shipments exempt -- Exceptions. Any in-transit shipment through South Dakota substantiated by an invoice or shipping document is not subject to the provisions of this chapter. However, such a shipment shall be considered an importation if any repackaging or exchange of containers or water in containers is attempted within the borders of the state. Source: SL 1975, ch 16, § 1; 10 SDR 76, 10 SDR 102, effective July 1, 1984; 29 SDR 80, effective December 10, 2002. General Authority: SDCL 41-2-18(1). Law Implemented: SDCL 41-2-18(1), 41-13-3.1.

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12:62:03:01. Characteristics of noxious weed: A noxious weed possesses the following characteristics: (1) The weed is a perennial; (2) The weed is capable of unique and rapid spreading and growth under adverse conditions; (3) The weed is not controllable without special preventive chemical, mechanical, biological, and cultural practices; (4) The weed is capable of materially reducing the production of crops or livestock; (5) The weed is capable of decreasing the value of the land; and (6) The weed is not native to the state. Source: SL 1975, ch 16, § 1; 10 SDR 83, effective February 7, 1984; 12 SDR 128, 12 SDR 154, effective July 1, 1986; repealed, 22 SDR 52, effective October 25, 1995; readopted, 23 SDR 185, effective May 8, 1997. General Authority: 38-22-7, 38-22-9, 38-22-11.1. Law Implemented: 38-22-7, 38-22-9.

12:62:03:01.06. Statewide noxious weeds: The following weeds are declared to be noxious statewide: (1) Canada thistle; (2) Hoary cress; (3) Leafy spurge; (4) Perennial sow thistle; (5) Purple loosestrife; (6) Russian knapweed; and (7) Salt Cedar. Source: 24 SDR 47, effective October 21, 1997; 31 SDR 191, effective May

29, 2005.General Authority: 38-22-9, 38-22-11.1. Law Implemented: 38-22-7, 38-22-9.

12:51:03:01. Regulated nonnative plant species. The following nonnative plant species, including all plants, plant parts, and seeds capable of propagation, are regulated plant species under SDCL 38-24A-6: (1) Canada thistle (*Cirsiumarvensis*); (2) Common crupina (*Crupinavulgaris*); (3) Dalmation toadflax (*Linariadalmatica*); (4) Diffuse knapweed (*Centaureadiffusa*); (5) Dodder (*Cuscuta spp.*); **(**6) Eurasian water milfoil (Myriophyllumspicatum); (7) Field bindweed (Convolvulus arvensis); (8) Hoary cress (Cardariadraba); (9) Johnsongrass (*Sorghum halepense*); (10) Leafy spurge (*Euphorbia esula* and *E. pseudovirgata*); (11) Multiflora rose (*Rosa multifloral*); (12) Musk thistle (*Carduusnutans*); (13) Perennial pepperweed (*Lepidiumlatifolium*); (14) Perennial sowthistle (*Sonchusarvensis*); (15) Plumeless thistle (*Carduusacanthoides*); (16) Purple loosestrife (*Lythrumsalicaria* and *L. virgatum*); (17) Rush skeletonweed (*Chondrillajuncea*); (18) Russian knapweed (Centaurearepens); (19) Spotted knapweed (*Centaureamaculosa*); (20) St. Johnswort (*Hypericumperforatum*); (21) Yellow starthistle (*Centaureasolstitialis*); and (22) Yellow toadflax (*Linariavulgaris*). Source: 19 SDR 32, effective September 8, 1992. General Authority: SDCL 38-24A-9. Law Implemented: SDCL 38-24A-6, 38-24A-9.

12:51:07:03. Disposal of infested material. Weed seeds, plant parts, soil, and other debris collected when treating regulated articles must be disposed of in a manner that prevents dissemination of the regulated pests listed in chapter 12:51:03. The secretary may order the use of specific means of disposal of infested material in individual cases. Source: 19 SDR 32, effective September 8, 1992; 23 SDR 16, effective August 5, 1996. General Authority: SDCL 38-24A-9. Law Implemented: SDCL 38-24A-12.

38-24A-3. Suppression and control activities authorized. The secretary of agriculture, either independently or in cooperation with counties or political subdivisions thereof, municipalities, farmers' associations or similar organizations, individuals, federal agencies, or agencies of other states, is authorized to carry out operations or measures to locate, suppress, control, prevent, or retard the spread of pests. Source: SL 1971, ch 220, § 3; SL 1992, ch 60, § 2.

38-24A-4. Cooperation with other agencies--Expenditure of funds. The secretary of agriculture is authorized to cooperate with any agency he deems necessary to suppress, control, prevent, or retard the spread of any pest including the right to expend state funds on federal, state, and private lands for such purposes. Source: SL 1971, ch 220, § 9.

38-24A-6. Quarantines and embargoes authorized. The secretary of agriculture is authorized to quarantine this state or any portion thereof when he shall determine that such action is necessary to prevent or retard the spread of a pest within or from this state and to place an embargo on articles from any other state or portion thereof whenever he determines that a pest exists therein and that such action is necessary to prevent or retard its spread into this state. Source: SL 1971, ch 220, § 4.

38-24A-7. Limitation of quarantined area--Extension. The secretary of agriculture may limit the application of the quarantine to the infested portion of the quarantined area and appropriate environs, to be known as the regulated area, and may, without further hearing, extend the regulated area to include additional portions of the quarantined area upon publication of a notice to that effect in such newspapers in the quarantined area as he may select or by direct written notice to those concerned. Source: SL 1971, ch 220, § 4.

38-24A-9. Scope of rules relating to regulated area--Publication of notice. The secretary may promulgate rules pursuant to chapter 1-26: (1) To provide standards and procedures for location, suppression, prevention, retardation, and control of the spread of pests; 2) To provide standards and procedures for plant quarantines and embargoes; (3) To provide restrictions for the movement of pests, hosts, and regulated articles from quarantined or embargoed areas; (4) To provide standards and procedures to seize, treat, or dispose of pests, hosts, or regulated articles; (5) To provide standards for restrictions regarding inspection, disinfection, treatment, and certification of plants from quarantined or regulated areas; and (6) To establish fees for inspection and certification or to recover costs for pest control efforts. In addition to the reporting requirements of chapter 1-26 notice of the rules shall be published in such newspapers in the quarantined area as the secretary may select. Source: SL 1971, ch 220, § 5; SL 1986, ch 326, § 56.

38-24A-9.1. Emergency quarantine measures--Public hearing--Notice--Duration of emergency measures--When chapter 1-26 becomes applicable. Other provisions of this chapter and the provisions of chapter 1-26 notwithstanding, the secretary may adopt emergency measures to quarantine or otherwise control plant infestations on an emergency basis. Such measures shall be subject to a public hearing, which shall be held within twenty-one days of implementation of such measures, but no official decision need be undertaken at the conclusion of such hearing. Notice of such hearing shall be published at least once in at least one official newspaper in the infested area. Such emergency measures shall be valid for a period of ninety days from implementation of the measures. After ninety days, such measures shall be subject to the rule-making procedures of chapter 1-26. Source: SL 1986, ch 326, § 54.

38-24A-10. Movements contrary to quarantine rules prohibited. Following establishment of a quarantine, no person shall move any regulated article described in the quarantine or move the pest against which the quarantine is established, within, from, into, or through this state contrary to rules promulgated by the secretary of agriculture. Source: SL 1971, ch 220, § 5.

38-24A-11. Quarantine violation as misdemeanor. Any person who has knowingly moved any regulated article into this state from any quarantined area of any other state, which article has not been treated or handled under provisions of the quarantine and rules, to remove all possibilities of infestation and damage, in effect at the point of origin, is guilty of a Class 1 misdemeanor. Source: SL 1971, ch 220, § 10; SL 1977, ch 190, § 344.

38-24A-14. Inspection powers of secretary--Notice. To effectuate the purposes of this chapter, the secretary of agriculture may, with a search warrant or the consent of the owner,

make reasonable inspection of any property in this state. The secretary may, without a search warrant, with or without the assistance of any law enforcement agency, stop and inspect, in a reasonable manner, any means of conveyance moving within this state upon probable cause to believe it contains or carries any pest, host, or other article subject to the provisions of this chapter, and may make any other reasonable inspection of any premises or means of conveyance for which no search warrant is required. The secretary may, if he believes that a pest exists, investigate the suspected premises after giving written notice. Such notice is considered given if it is given to the owner or person in charge of the premises by personal service at least one day before entry, or if it is mailed by certified mail addressed to the last known address of the owner at least five days before entry. Source: SL 1971, ch 220, § 8; SL 1986, ch 334, § 4.

38-24A-15. Issuance of search warrants. The appropriate circuit and magistrate courts in this state shall have authority to issue search warrants for such inspections upon a showing by the secretary of agriculture that there is probable cause to believe that there exists in or on the property to be inspected a pest, host, or other article subject to the provisions of this chapter. Source: SL 1971, ch 220, § 8.

38-24A-17. Violation as misdemeanor--Civil liability for damages. Any person who violates any of the provisions of this chapter or who alters, forges, counterfeits, or uses without authority any certificate or permit or other document provided for in this chapter or in the rules of the secretary of agriculture provided for in this chapter, is guilty of a Class 1 misdemeanor. In addition, any person is liable in a civil action for all damage that is occasioned or caused by a violation of this chapter. Source: SL 1971, ch 220, § 10; SL 1977, ch 190, § 345; SL 2001, ch 218, § 1.

South Dakota Animal Industry Board

40-3-14. Rules and regulations of board. The Animal Industry Board may make all such orders for the execution of the powers conferred upon it and the performance of its duties, to effectuate, enforce, and carry out promptly and efficiently the provisions of the statutes relating to its duties, powers, and jurisdiction. The board may likewise amend or repeal all such orders. The board may promulgate rules pursuant to chapter 1-26 concerning: (1) The definition of items used to administer this chapter; (2) Declaratory rulings; (3) The regulation of livestock diseases and parasites; (4) The regulation of bovine tuberculosis; (5) The regulation of the importation of livestock; (6) The regulation and licensure of livestock auctions and stockyards; (7) The regulation and licensure of livestock dealers; (8) The setting of livestock inspection fees; (9) The regulation and licensure of swine dealers; (10) The regulation and licensure of rendering establishments and pet food processing plants; (11) The establishment of swine identification and maintenance of records; (12) The establishment of approved pesticides for ticks, scabies, and screw-worms; (13) The regulation of livestock exhibits; (14) The control of pullorum typhoid control; (15) The use of federal methods and rules for meat inspection; (16) The regulation of refrigerated locker plants; (17) The importation of equine; (18) Preservatives control; (19) The regulation of nondomestic animals; and (20) The procedures for establishing a quarantine. However, the board shall exercise its regulatory and quarantine powers in a manner that affects the minimum geographical area reasonably necessary to control

or eradicate disease. Source: SDC 1939, § 40.0103; SL 1945, ch 170; SL 1981, ch 290; SL 1986, ch 326, § 83; SL 1990, ch 325, § 15.

FEDERAL

U.S. Fish and Wildlife Service

The Lacey Act which prohibits importation and interstate delivery of listed species is enforced by the United States Fish and Wildlife Service. The list of injurious live or dead fishes, mollusks, crustaceans, or their eggs (50 CFR 16.13) includes the following ANS relevant to SD; Zebra mussels (*Dreissena polymorpha*), Live or dead salmonids and their live fertilized eggs or gametes unless certified free of *Oncorhynchus masou* virus and viruses causing viral hemorrhagic septicemia and infectious hematopoietic necrosis, Snakehead (genus *Channa* or *Parachanna*). Black carp (*Mylopharyngodon piceus*), All live forms; live gametes, viable eggs, and hybrids, Silver Carp and Largescale carp

United States Department of Agriculture - Animal and Plant Health Inspection Service (USDA-APHIS).

Emergency order prohibiting the importation of certain species of live fish from two Canadian provinces into the United States and the interstate movement of the same species from the eight states bordering the Great Lakes due to outbreaks of viral hemorrhagic septicemia (VHS).

APPENDIX D

South Dakota Aquatic Nuisance Species of Concern

South Dakota Aquatic Nuisance Species of Concern. Probable vectors by which species were or may be introduced: intentional planting or stocking (I), boat-barge-equipment (BBE), bait (B), aquaculture (AE), plant trade (PT), aquarium (AM), and parasite (PE). Status codes: established (ES), not present (NP), collected (COL).

Aquatic Nuisance Species (*Scientific name)*	**Status in SD**	**Probable vector**
PRIMARY CONCERN		
Brittle naiad (*Najas minor)*	ES	I, BBE
Curly pondweed *(Potamogeton crispus)*	ES	I, BBE
Didymo *(Didymosphenia geminata)*	ES	BBE
Eurasian water-milfoil (*Myriophyllum spicatum)*	ES	I
New Zealand mudsnail (*Potamopyrgus antipodarum)*	NP	I, BBE
Rusty crayfish (*Orconectes rusticu)s*	NP	B
Zebra mussel *(Dreissena polymorpha)*	COL	BBE
Quagga mussel *(Dreissena rostriformis bugensis)*	NP	BBE
Bighead carp *(Hypothalmichthys nobilis)*	ES	AE
Black carp (*Mylopharyngodon piceus*)	NP	I, B
Common carp *(Cyprinus carpio)*	ES	I, B
Grass carp *(Ctenopharyngodon idella)*	ES	I
Silver carp *(Hypothalmichthys molitrix)*	ES	AE
VHS (Viral hemorrhagic septicemia)	NP	I, BBE
SECONDARY CONCERN		
Black alder (*Alnus glutinosa)*	NP	I
Brazilian waterweed (*Egeria densa)*	NP	
Bur reed (*Sparganium glomeratum (Laestad.) L. Neum).*	NP	
European water clover (*Marsilea quadrifolia)*	NP	I
Flowering rush (*Butomus umbellatus)*	ES	I, PT
Purple loosestrife (*Lythrum salicaria)*	ES	I, PT
Salt cedar (*Tamarix spp.)*	ES	I, PT
Water foxtail (*Alopecurus arundinaceus)*	ES	
Yard dock (*Rumex longifolius DC.)*	NP	
Yellow floating-heart (*Nymphoides peltata)*	NP	AM
Yellow iris (*Iris pseudacorus)*	ES	PT
Asian clam (*Corbicula fluminea)*	COL	B, AE

APPENDIX D (Continued)

Aquatic Nuisance Species (*Scientific name)*	**Status in SD**	**Probable vector**
Big-ear radix (*Radix auricularia)*	NP	PT, AM
Calanoid copepod (*Megacyclops viridis)*	NP	BBE
Chinese mystery snail (*Cipangopaludina chinensis malleata)*	NP	AM
European stream valvata (*Valvata piscinalis)*	NP	BBE
Freshwater jellyfish (*Craspedacusta sowerbyi)*	NP	I, PT
Japanese mystery snail (*Cipangopaludina japonica)*	NP	I
Opossum shrimp (*Mysis relicta)*	ES	I
Snail (*Melanoides tuberculata)*	ES	
Spiny water flea (*Bythotrephes longimanus)*	NP	BBE
Water flea (*Daphnia lumholtzi)*	NP	I, BBE
Water flea (*Eubosmina coregoni)*	NP	BBE
Alewife (*Alosa pseudoharengus)*	NP	I
Bowfin (*Amia calva)*	NP	I
Brook silverside (*Labidesthes sicculus)*	NP	
Bullhead minnow (*Pimephales vigilax)*	ES	I, B
Cisco (*Coregonus artedi)*	ES	I
Digenean fluke (*Ichthyocotylurus)*	NP	PE
Digenean fluke/trematode (*Neascus brevicaudatus)*	NP	PE
Goldfish (*Carassius auratus)*	ES	AM
Lake chubsucker (*Erimyzon sucetta)*	NP	I
Monogenetic fluke (*Dactylogyrus amphibothrium)*	NP	PE
Monogenetic fluke (*Dactylogyrus hemiamphibothrium)*	NP	PE
Myxosporidian (*Sphaeromyxa sevastopoli)*	NP	
Nutria (*Myocastor coypus)*	NP	I
Redside shiner (*Richardsonius balteatus)*	NP	B
Round goby (*Apollonia melanostomus)*	NP	BBE
Rudd (*Scardinius erythrophthalmus)*	ES	B
Ruffe *Gymnocephalus cernuus*	NP	BBE
Sacramento perch (*Archoplites interruptus)*	ES	I
Salmonid whirling disease (*Myxobolus cerebralis)*	NP	I
Tench (*Tinca tinca)*	NP	I
Three-spined stickleback (*Gasterosteus aculeatus)*	NP	I, BBE, B
Tubenose goby (*Proterorhinus semilunaris)*	NP	BBE
Western/Eastern mosquitofish (*Gambusia affinis/G. holbrooki)*	NP	I
White catfish (*Ameirus catus)*	NP	I
Zander (*Sander lucioperca)*	ES	I

1784
1785

APPENDIX E

Panel of Experts involved in Aquatic Nuisance Species Risk Assessment for South Dakota*.

Name	Title	Affiliation	E-mail	Phone
Doug Backlund	Database Manager / Biologist	SDGFP	doug.backlund@state.sd.us	605-773-4345
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Katie Bertrand	Assistant Professor	SDSU	katie.bertrand@sdstate.edu	605-688-6121
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Mike Brown	Professor	SDSU	michael.brown@sdstate.edu	605-688-6121
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Gary Larson	Professor	SDSU	gary.larson@sdstate.edu	605-688-4552
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Lynn Schlueter	ANS Coordinator	NDGF	lschluet@nd.gov	701-662-3617
Todd St. Sauver	Regional Fisheries Manager	SDGFP	todd.st.sauver@state.sd.us	605-362-2726
Greg Wanner	Fish Biologist	USFWS	greg_wanner@fws.gov	605-224-8693
David Willis	Department Head	SDSU	david.willis@sdstate.edu	605-688-6121
Stephen Wilson	Resource Management/GIS specialist	NPS	stephen_k_wilson@nps.gov	402-667-5524

*(Group names and acronyms defined in Appendix B)

APPENDIX F

Individual Risk Assessments and Ranking for ANS of Primary Concern

Plants / algae

Brittle naiad (*Najas minor*)

1. Estimate the probability of brittle naiad being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty*:* **VERY CERTAIN**
   Rationale: This species spreads along at least two vectors: intentional planting and boat-barge-equipment. It is currently established in SD and present in other pathways, including MN- and IA-SD (Sturtevant 2008a).

2. Estimate the probability of brittle naiad surviving in transit to SD.
   Rating: **HIGH**, Uncertainty: **VERY CERTAIN**
   Rationale: Brittle naiad has survived transit to and is currently established in SD.

3. Estimate the probability of brittle naiad successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: SDGFP identified an established population in McCook Lake in 2006.

4. Estimate the probability of brittle naiad to spread beyond the colonized area in SD.
   Rating: **MEDIUM,** Uncertainty**: REASONABLY UNCERTAIN**.
   Rationale: SDGFP treated the McCook Lake brittle naiad population with herbicide on two occasions during 2007, which reduced the extent of the infestation and threat of spread beyond the colonized area; however brittle naiad seeds are easily spread to new locations by boats, barges, or equipment

5. Estimate the economic impact if brittle naiad were to establish (or is/was established) in SD.
   Rating: **MEDIUM**, Uncertainty**: REASONABLY UNCERTAIN**
   Rationale: SDGFP spent $1162.34 or $581.17 per lake surface acre, to treat the brittle naiad in McCook Lake. Treatment costs in other aquatic habitats in SD could be similar and additional economic impacts are possible (e.g., reduced lakeshore property value).

6. Estimate the environmental impact if the organism were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **REASONABLY UNCERTAIN**
   Rationale: In McCook Lake, brittle naiad competed with native aquatic plants, forming a dense overstory canopy in some areas. It is uncertain what changes in the native plant and animal communities might have taken place if brittle naiad had been left untreated.

7. Estimate the impact from social and/or political influences if brittle naiad were to establish (or is/was established) in SD.

Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
Rationale: Resource users (e.g., boaters, swimmers, and lakeshore property owners) were immediately concerned with the dense growth of brittle naiad in McCook Lake, and requested that SDGFP take action to correct the problem.

Curly pondweed (*Potamogeton crispus*)

1. Estimate the probability of curly pondweed being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: This species spreads along at least two vectors: intentional planting and boat-barge-equipment. It is established in SD but also occurs in all five of the most-traveled interstate pathways including MN-, IA-, ND-, NE-, and CO-SD (Stuckey 1979; Sturtevant 2008b).

2. Estimate the probability of curly pondweed surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Curly pondweed has survived transit and is currently established in SD.

3. Estimate the probability of curly pondweed successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Curly pondweed populations were established in SD by 1965 and currently occur throughout the state.

4. Estimate the probability of curly pondweed to spread beyond the colonized area in South Dakota.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Curly pondweed has spread from its original colonization area to all but one reservoir of the Missouri River and lakes in the Black Hills region. Its life history suggests that continued spread of curly pondweed from established populations via human-mediated vectors and pathways is likely, especially during the summer months when turions are most abundant and the boat-barge-equipment vector is most active between water bodies.

5. Estimate the economic impact if curly pondweed were to establish (or is/was established) in SD.
   Rating: **MEDIUM,** Uncertainty: **REASONABLY UNCERTAIN**
   Rationale: Costs associated with mediating curly pondweed may be similar to those incurred for the mediation of brittle naiad. However, the current distribution of curly pondweed is much more extensive than that of brittle naiad, suggesting that control efforts could be cost-prohibitive.

6. Estimate the environmental impact if curly pondweed were to establish (or is/was established) in SD.
   Rating: **MEDIUM** Uncertainty: **REASONABLY UNCERTAIN**
   Rationale: Curly pondweed competes with native vegetation, but the outcome of the competitive interaction varies by context. In SD, curly pondweed often initiates germination in advance of native aquatic plants, and forms dense mats

that dominate the aquatic plant community (Ode 2006). If the growth form becomes dense and mat-like, then native species and biogeochemical cycling may be affected; otherwise, the environmental effects of curly pondweed may be diffuse and undetectable.

7. Estimate the impact from social and/or political influences if curly pondweed were to establish (or is/was established) in SD.
Rating: **MEDIUM,** Uncertainty: **REASONABLY UNCERTAIN**
Rationale: Curly pondweed has the potential to outcompete native aquatic plants, form dense mats, and impede resource users. Curly pondweed infestations have in the past triggered public complaints and requests for management and control. As stated previously, the long-term outcomes and related public perceptions have been varied but in general, curly pondweed has not created a great deal of concern from resource users across the state.

Didymosphenia/ "didymo" (*Didymosphenia geminata*)

1. Estimate the probability of didymo being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
Rationale: The primary vector implicated in its spread is boat-barge-equipment (Spaulding and Elwell 2007). It is established in SD (Larson 2007), but details on its distribution in other relevant pathways are poorly understood.

2. Estimate the probability of didymo surviving in transit to SD.
Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
Rationale: Didymo has survived transit to and is currently established in SD.

3. Estimate the probability of didymo successfully colonizing and maintaining a population where introduced in SD.
Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
Rationale: Didymo nuisance blooms were reported in Rapid Creek, SD, beginning in May 2002 and have since been reoccurring (Larson 2007).

4. Estimate the probability of didymo to spread beyond the colonized area in SD.
Rating: **MEDIUM** Uncertainty: **VERY CERTAIN**
Rationale: Although didymo is easily transported along the boat-barge-equipment vector, its habitat requirements are fairly specific. Suitable habitat for this species in SD is likely restricted to Black Hills streams.

5. Estimate the economic impact if didymo were to establish (or is/was established) in SD.
Rating: **MEDIUM,** Uncertainty: **REASONABLY UNCERTAIN**
Rationale: Costs associated with mediating didymo nuisance blooms are not currently known. However, the negative effects of the blooms on trout could influence revenue from angling-related tourism in the Black Hills of SD.

6. Estimate the environmental impact if didymo were to establish (or is/was established) in SD.
Rating: **HIGH,** Uncertainty: **REASONABLY UNCERTAIN**

Rationale: Didymo competes with other algae and plants and if the excess stalk growth results in a dense nuisance bloom, this diatom can have negative effects on aquatic invertebrates and fishes and aquatic ecosystems (Spaulding and Elwell 2007).

7. Estimate the impact from social and/or political influences if didymo were to establish (or is/was established) in SD.
   Rating: **MEDIUM,** Uncertainty: **REASONABLY UNCERTAIN**
   Rationale: Environmental impacts of didymo nuisance blooms, paired with general aesthetic concerns (didymo may superficially resemble fiberglass insulation or raw sewage pollution) generally elicit strong negative responses from resource users (Spaulding and Elwell 2007).

Eurasian water-milfoil (*Myriophyllum spicatum*)

1. Estimate the probability of Eurasian water-milfoil being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: This species spreads along at least two vectors: intentional planting (Couch 1985) and boat-barge-equipment (Invasive Species Program 2008). Eurasian water-milfoil occurs in all five of the most-traveled interstate pathways including MN-, IA-, NE-, ND-, and CO-SD (Jacono 2008).

2. Estimate the probability of Eurasian water-milfoil surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Eurasian water-milfoil has survived transit and is currently established in SD.

3. Estimate the probability of Eurasian water-milfoil successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: SDGFP identified an established, near-shore population of Eurasian water-milfoil in Lake Sharpe in 1999.

4. Estimate the probability of Eurasian water-milfoil to spread beyond the colonized area in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: The population currently established in Lake Sharpe is not as aggressive as others described in the literature; however the invasion history of Eurasian water-milfoil strongly indicates that it does represent a potential nuisance to SD. Missouri River reservoirs, such as Lake Sharpe, are deep, man-made "lake-like" habitats that lack well-developed, native plant communities typical of shallower natural lakes. The potential for Eurasian water-milfoil forming nuisance blooms is much stronger in lakes or slack water habitats with elevated nutrient loading, intense plant management, and elevated motorboat traffic (Nichols 1994), which is typical of many of the glacial lakes of northeastern SD (Dave Ode personal communication).

5. Estimate the economic impact if Eurasian water-milfoil were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **REASONABLY CERTAIN**

Rationale: SD has not currently incurred any costs to mitigate the population in Lake Sharpe. However, more extensive and aggressive Eurasian water-milfoil populations in neighboring states (e.g., MN) elicit research, monitoring and control expenditures, and considerable public concern; it is not unreasonable to anticipate similar economic and social impacts if current infestations expand within SD.

6. Estimate the environmental impact if Eurasian water-milfoil were to establish (or is/was established) in SD.

Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: The negative effects of Eurasian water-milfoil primarily result from a tendency to form canopies of dense growth which can: reduce native plant and invertebrate diversity and abundance (Keast 1984; Smith and Barko 1990; Madsen 1994), reduce water quality, food quality for waterfowl (Aiken 1979), increase survival of larval and juvenile fish and decrease feeding success of larger predatory fish (Lillie and Budd 1992; Engel 1995). Currently, the population in Lake Sharpe does not exhibit these characteristics, however if this species were spread to other more suitable waterbodies in SD, such impacts are more likely to be observed.

7. Estimate the impact from social and/or political influences if Eurasian water-milfoil were to establish (or is/was established) in SD.

Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: Social and/or political effects of Eurasian water-milfoil result from its tendency to form canopies of dense growth that impede recreational boating and residential and commercial water use (e.g. water intake structures; Jacono 2008). More widespread Eurasian water-milfoil infestations would likely prompt a strong negative response from user groups in SD.

Invertebrates

New Zealand mudsnails (*Potamopyrgus antipodarum*)

1. Estimate the probability of New Zealand mudsnails being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).

Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: As the name indicates, this species is native to freshwater lotic and lentic habitats of New Zealand and surrounding islands (Hall et al. 2003). The New Zealand mudsnail is exotic to the U.S. and spreads along the boat-barge-equipment and intentional stocking (transported with stocked fish) vectors (Benson and Kipp 2008). There are no documented occurrences in SD; however New Zealand mudsnails occur in at least two pathways, including MN- and CO-SD (Benson and Kipp 2008). Although the MT-SD pathway was not implicated in this risk assessment as a primary source of ANS, the New Zealand mudsnail is established in MT and could continue its eastward range expansion into SD.

2. Estimate the probability of New Zealand mudsnail surviving in transit to SD.

Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: This species tolerates temperatures from 0–34˚C (Hylleberg and Siegismung1987; Quinn 1994) and has demonstrated survival in the boat-barge-equipment and intentional stocking (i.e., translocation with fish) vectors to colonize much of the western U.S.

3. Estimate the probability of New Zealand mudsnail successfully colonizing and maintaining a population where introduced in SD.

   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

   Rationale: New Zealand mudsnail populations throughout North America consist entirely of parthenogenetic (asexual) females which could successfully colonize a new habitat in SD with the introduction of just one individual (Hall et al. 2003). Although they are not freeze-tolerant, this species has been very successful at colonizing aquatic habitats of the western U.S.

4. Estimate the probability of New Zealand mudsnail to spread beyond the colonized area in SD.

   Rating: **HIGH,** Uncertainty: **REASONABLY UNCERTAIN**

   Rationale: Following its initial colonization of the Snake River in Idaho in the mid-1980s, this species spread to over 50 drainages by 2005 (Richards 2004). Once established in SD, it is likely that the New Zealand mudsnail would spread throughout geothermal aquatic habitats (those that maintain above-freezing temperatures throughout the year) in western SD, particularly in the Black Hills.

5. Estimate the economic impact if New Zealand mudsnail were to establish (or is/was established) in SD.

   Rating: **HIGH,** Uncertainty: **REASONABLY UNCERTAIN**

   Rationale: Trout fishing in the Black Hills is a considerable source of tourism-related income for SD, which could be negatively impacted by the establishment of the New Zealand mudnail (see criteria 6). Zealand mudsnail also has the potential to impair water intake structures through attaching to surfaces in high numbers and causing surface fouling and clogging which could impact residential and commercial water costs and availability.

6. Estimate the environmental impact if New Zealand mudsnail were to establish (or is/was established) in SD.

   Rating: **MEDIUM,** Uncertainty: **REASONABLY UNCERTAIN**

   Rationale: Grazing by New Zealand mudsnails can cause changes in the aquatic primary producer community (e.g. algae and diatoms). Indirect effects could include competition for food and space with native gastropods and impacting food chains for secondary consumers, such as fish. New Zealand mudsnails have quickly come to dominate macroinvertebrate communities in recently invaded habitats (New Zealand mudsnails compose 65-92% of macroinvertebrate production in three rivers in the Greater Yellowstone Area, WY; Hall 2006).

7. Estimate the impact from social and/or political influences if New Zealand mudsnail were to establish (or is/was established) in SD.

   Rating: **HIGH,** Uncertainty: **REASONABLY CERTAIN**

   Rationale: Trout angler interest groups, such as Trout Unlimited, and businesses that benefit from angling-related tourism in western SD could be negatively

impacted by the establishment of New Zealand mudsnail in SD. These groups might represent a vocal and powerful lobby if they perceived that their passion and/or livelihood were compromised by an aquatic nuisance species.

Dreissenid /zebra and quagga mussels (*Dreissena polymorpha* and *Dreissena rostriformis bugensis)*

1. Estimate the probability of Dreissenid mussels being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Dreissenid mussels are known to spread along at least one vector relevant to SD (boat-barge-equipment) and occur in all five of the most-traveled interstate pathways including; MN-, IA-, NE-, and CO-SD (Benson and Raikow 2008; Benson et al. 2008).

2. Estimate the probability of Dreissenid mussels surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: The previously detected zebra mussel veligers (see Biology) provide evidence of the ability for transit to SD. Dreissenid mussels are currently established throughout the US; including aquatic habitats similar to those in occurring SD.

3. Estimate the probability of Dreissenid mussels successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: As stated previously (see criteria 1) adult Dreissenid mussels have not been collected in SD to this date (2008); however recent infestations throughout western states (NM, AZ, CA, CO) and continued spread through regionally infested areas (IA, MN, NE, KS etc.) suggest that veligers and adults are present in vectors and pathways relevant to SD. There is a strong likelihood of their eventual arrival and colonization of the aquatic habitats of this state.

4. Estimate the probability of Dreissenid mussels to spread beyond the colonized area in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Zebra mussels colonized Lakes St. Clair and Erie in 1988 (Ludyanskiy et al. 1993), quagga mussels colonized Lake Erie in 1991 (Mills et al. 1996), and currently, these species occur in at least 24 states (Benson and Raikow 2008; Benson et al. 2008). Given their rapid spread throughout the US, it is likely that Dreissenid mussels would spread throughout SD after initial establishment.

5. Estimate the economic impact if Dreissenid mussels were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: The clogging and damage to water infrastructures (intake pipes, water filtration facilities, and power generating plants) was estimated to cost $100 million per year in the US (Pimentel et al. 2000). SD would likely be affected by similar water infrastructure damage though specific costs are not estimated here.

6. Estimate the environmental impact if Dressenid mussels were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Once established in SD, it is likely that Dreissenid mussels could achieve densities similar to those measured in other locations outside their native range (up to 700,000 m^{-2}; Griffiths et al. 1991). At such high densities, the environmental effects of Dreissenid mussels include, large scale food chain effects resulting from the high consumption of suspended algae and zooplankton, and altered macroinvertebrate and fish community structures, and exclusion of native mussels through competition (Ludyanskiy et al. 1993). Three mussels listed as aquatic species of greatest conservation need in the State Comprehensive Wildlife Conservation Plan (SDGFP 1996; elktoe, rock pocketbook, and creek heelsplitter) would be particularly vulnerable to competition from Dreissenid mussels.

7. Estimate the impact from social and/or political influences if Dreissenid mussels were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: At the high densities often observed outside their native range Dreissenid mussels can have a variety of impacts on humans ranging from negative impacts on recreational boating and swimming, to the clogging of commercial and residential water intake structures (Benson and Raikow 2008; Benson et al. 2008). As a result of the largely successful, national public outreach and education efforts, a newly established population of zebra or quagga mussels would likely elicit a strong, negative response from a variety of resource user groups from across the state.

Rusty crayfish (*Orconectes rusticus*)

1. Estimate the probability of rusty crayfish being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Rusty crayfish are assumed to have spread outside their native range to states including MN (i.e., they occupy the MN-SD pathway) along at least one vector: bait (Hobbs and Jass 1988). It is likely that rusty crayfish may also spread along the plant-animal importation for research, aquaculture, and intentional stocking vectors.

2. Estimate the probability of rusty crayfish surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Rusty crayfish have survived long-distance dispersal to neighboring states, including MN, and it is likely that they are capable of surviving transit to SD as well.

3. Estimate the probability of rusty crayfish successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Because they have successfully established in MN (similar latitude), rusty crayfish could likely successfully at establish in SD. Furthermore, a

population could become established from the introduction of just one fertilized female which could result in 80–575 young (Hobbs and Jass 1988).

4. Estimate the probability of rusty crayfish to spread beyond the colonized area in SD.
   Rating: **MEDIUM,** Uncertainty: **REASONABLY CERTAIN**
   Rationale: Once established in SD, it is possible that rusty crayfish could spread; either slowly, through natural expansion, or quickly through bait capture and movement or movement by aquaculture.

5. Estimate the economic impact if rusty crayfish were to establish (or is/was established) in SD.
   Rating: **LOW,** Uncertainty: **VERY UNCERTAIN**
   Rationale: The most likely economic effect of the establishment of rusty crayfish would result from declining native crayfish harvest, and potential collapse of the crayfish fishery. However, the economic impacts from such a collapse are limited. Another potential economic effect is lost revenue as a result of declining sport fisheries (see critera 6 below).

6. Estimate the environmental impact if rusty crayfish were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **REASONABLY CERTAIN**
   Rationale: Several authors documented the decline of native crayfishes upon the establishment of rusty crayfish in states outside SD (e.g., Lodge et al. 1986). Rusty crayfish can intensely graze aquatic plants, leading to decreases in macrophyte abundance and diversity (Lodge and Lorman 1987) which can have large scale effects on food chain levels, including: other invertebrates, reptiles (including the false map turtle; Bandas and Higgins 2004), fish, and waterfowl.

7. Estimate the impact from social and/or political influences if rusty crayfish were to establish (or is/was established) in SD.
   Rating: **LOW,** Uncertainty: **RELATIVELY CERTAIN**
   Rationale: At this time, it is unlikely that the establishment of rusty crayfish would elicit strong social or political effects in SD.

Vertebrates and associated pathogens

Common carp (*Cyprinus carpio*)

1. Estimate the probability of common carp being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Common carp was introduced to the US and spread to SD and other states along at least two vectors: intentional stocking and bait (Blackwell 2007). It is currently established in SD as well as present in all five of the other most-traveled pathways, including MN-, IA-, NE-, ND-, and CO-SD (Nico et al. 2008b).

2. Estimate the probability of common carp surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: Common carp has survived transit to and is currently established throughout SD.

3. Estimate the probability of common carp successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Common carp likely colonized SD in 1885 and have since maintained populations throughout the state (Blackwell 2007).

4. Estimate the probability of common carp to spread beyond the colonized area in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Common carp occur statewide in SD. After establishment, common carp likely spread beyond the colonized area by anglers collecting and transporting bait (Blackwell 2007).

5. Estimate the economic impact if common carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY UNCERTAIN**
   Rationale: Because common carp have been established for so long in SD, economic impacts are difficult to assess. A positive impact has been the establishment of a commercial fishery, which harvests thousands of pounds from SD lakes each winter for export to larger metropolitan markets (Blackwell 2007). Negative economic impacts can be seen in degraded fisheries and costs of removal and restocking of waterbodies infested with common carp.

6. Estimate the environmental impact if common carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Several authors have documented decreased diversity and abundance of aquatic plants coupled with increased turbidity following establishment of common carp (e.g., Laird and Page 1996). Additionally, common carp may compete with ecologically similar species such as those in the sucker family (Catostomidae) and have indirect negative effects on sight-oriented predators, bottom feeders and nesters, and fishes and birds relying on aquatic plants for food and habitat (Fuller et al. 1999).

7. Estimate the impact from social and/or political influences if common carp were to establish (or is/was established) in SD.
   Rating: **LOW,** Uncertainty: **REASONABLY CERTAIN**
   Rationale: Common carp were established over 100 years ago, and have caused large scale ecological harm to aquatic environments in SD. Although many South Dakotans, especially fishermen, consider them rough fish, most do not see their presence as unusual and many people do not know that they are an exotic species (Shearer 2007). As a result, their social and/or political effects at present can be considered negligible.

Silver/Bighead carp (*Hypophthalmichthys molitrix and Hypophthalmichthys nobilis*)

1. Estimate the probability of silver/bighead carp being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: These species were introduced to the US and spread to SD and other states along at least two vectors: intentional stocking (Freeze and Henderson 1982; Fuller et al. 1999) and bait (Shearer 2007). Silver and bighead carp are currently established in SD as well as present in three other pathways, including: IA-, NE-, and CO-SD (Nico 2008), whereas bighead carp are additionally present in the MN-SD pathway (Nico and Fuller 2008).

2. Estimate the probability of silver/bighead carp surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Silver/bighead carp have survived transit and are currently established in SD.

3. Estimate the probability of silver/bighead carp successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **MODERATELY CERTAIN**
   Rationale: Silver/bighead carp likely colonized and have since maintained a population in SD by migrating upstream through the mainstem of the Missouri River (Nico 2008; Nico and Fuller 2008).

4. Estimate the probability of silver/bighead carp to spread beyond the colonized area in SD.
   Rating: **HIGH,** Uncertainty: **REASONABLY CERTAIN**
   Rationale: Given their success at escape from captivity, upstream migration, and colonization throughout the Mississippi and Missouri Rivers it is likely that both species will eventually become widespread in SD. Both silver and bighead carp would find suitable habitat and ample food to maintain populations throughout the warmwater streams and rivers and the shallow, nutrient rich wetlands, lakes, and reservoirs of SD.

5. Estimate the economic impact if silver/bighead carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **MODERATELY UNCERTAIN**
   Rationale: Although it is difficult to predict the economic effect of these fishes in SD, the potential for lost revenue from angling-related tourism exists. The primary environmental effects of these species (see criterion 6 below) implies that they will compete with native planktivores, some of which are highly valued sport fisheries (e.g., paddlefish *Polyodon spathula*; Fuller et al. 1999).

6. Estimate the environmental impact if silver / bighead carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: As silver and bighead carp extend their ranges in the Missouri River basin, concern is growing over their potential to alter plankton communities and the species dependent on them, notably paddlefish (Polyodon spathula) and threatened native mussel species (elktoe *Alasmidonta marginata*, rock pocketbook

Arcidens confragosus, and creek heelsplitter *Lasmigona compressa*) listed as species of greatest conservation need in SD's State Comprehensive Wildlife Conservation Plan (SDGFP 1996). It is possible that sustained pressure on the plankton community could eventually lead to plankton community collapse and large scale effects on the aquatic food web.

7. Estimate the impact from social and/or political influences if silver/bighead carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **MODERATELY CERTAIN**
   Rationale: Silver carp are infamously known for their propensity to jump out of the water when disturbed potentially causing injury to passing boaters (Shearer 2007). Widespread establishment in SD would likely produce a strongly negative social and political response.

Black carp (*Mylopharyngodon piceus*)

1. Estimate the probability of black carp being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **MEDIUM,** Uncertainty: **MODERATELY CERTAIN**

   Rationale: Black carp have not been collected in SD or in any of the five primary pathways, however their overall risk to native mollusks, resemblance to grass carp and listing by the US Fish and Wildlife Service as an injurious species under the Lacey Act, provided a strong impetus to list them as a species of primary concern to SD.

2. Estimate the probability of black carp surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Black carp escaped aquaculture ponds in Missouri in April of 1994 and as a result there is a chance of their dispersal and survival via natural dispersal as well or through intentional (illegal) stocking, or unintentional capture and transfer as bait.

3. Estimate the probability of black carp successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **MODERATELY CERTAIN**
   Rationale: Grass carp which have environmental requirements very similar to those of black carp have successfully colonized and maintained populations throughout SD, suggesting that black carp could have equal success in SD.

4. Estimate the probability of black carp to spread beyond the colonized area in SD.
   Rating: **MEDIUM,** Uncertainty: **MODERATELY CERTAIN**
   Rationale: Given their success at escape from captivity, upstream migration, and colonization throughout the Mississippi and Missouri Rivers it appears possible that black carp could eventually become widespread in SD.

5. Estimate the economic impact if black carp were to establish (or is/was established) in SD.
   Rating: **MEDIUM,** Uncertainty: **MODERATELY UNCERTAIN**

Rationale: The primary environmental effects of these species (see criteria 6 below) implies that they have the potential to affect desirable sport fisheries and waterfowl populations by reducing the diversity and abundance of native mussels on which fishes and waterfowl feed (Nico and Williams 1996), creating an economic impact to businesses associated with those recreational industries.

6. Estimate the environmental impact if black carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: The primary environmental effects of black carp include: reduced diversity and abundance of native mussels, competition with native fishes, competition with waterfowl that consume mussels, and introduction of parasites (Nico and Williams 1996). The three mussel species (elktoe, rock pocketbook, and creek heelsplitter) listed as species of greatest conservation need in SD's State Comprehensive Wildlife Conservation Plan are particularly threatened by predation by black carp (SDGFP 1996).

7. Estimate the impact from social and/or political influences if black carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **MODERATELY CERTAIN**
   Rationale: Because black carp are federally listed as injurious, each new state occurrence is likely to elicit a strongly negative social and political response.

Grass carp (*Ctenopharyngodon idella*)

1. Estimate the probability of grass carp being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: These species are native to eastern Asia and exotic to the US, but they were introduced to the US and spread to SD and other states along at least two vectors: intentional stocking and escape from aquaculture (Fuller et al. 1999). Grass carp are currently established in SD as well as present in all five other pathways including MN-, IA-, NE-, ND-, and CO-SD (Nico et al. 2008a).

2. Estimate the probability of grass carp surviving in transit to SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Grass carp already survived transit to and established in SD.

3. Estimate the probability of grass carp successfully colonizing and maintaining a population where introduced in SD.
   Rating: **MEDIUM,** Uncertainty: **REASONABLY CERTAIN**
   Rationale: Although SD, like many other states, prohibits the intentional release of diploid (fertile) grass carp into open drainages, grass carp have colonized and have maintained a population in SD since at least 1980 (Fuller et al. 1999).

4. Estimate the probability of grass carp to spread beyond the colonized area in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Given their success at escape from captivity, upstream migration, and colonization throughout the Mississippi and Missouri Rivers it is likely that grass carp will eventually become widespread in SD. Grass carp, as the name implies,

are primarily herbivorous grazers that would find suitable habitat and ample food to maintain populations throughout the warmwater streams and rivers and the shallow, nutrient rich wetlands, lakes, and reservoirs of SD.

5. Estimate the economic impact if grass carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY UNCERTAIN**

Rationale: Although it is difficult to predict the economic effect of these fishes in SD, the potential for lost revenue from angling-related tourism exists. The primary environmental effects of these species (see criterion 6 below) suggests their potential to manipulate a clear-water, plant-dominated fishery into a nutrient rich, turbid (clouded by suspended particles) phytoplankton-dominated fishery, with negative implications for sight-oriented predators (Fuller et al. 1999).

6. Estimate the environmental impact if grass carp were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: Grass carp are efficient grazers that decrease the abundance of aquatic plants, compete with native crayfishes, and can negatively affect fishes through reduced habitat and food availability. They also host parasites and diseases potentially transmitted to native fish communities (Fuller et al. 1999).

7. Estimate the impact from social and/or political influences if grass carp were to establish (or is/was established) in SD.
   Rating: **MEDIUM,** Uncertainty: **MODERATELY CERTAIN**

Rationale: When introduced for control of aquatic plants, grass carp are initially perceived as a positive addition to waterbodies with dense growth of aquatic plant growth. However, in other habitats, grass carp may be responsible for major shifts in aquatic food webs and quality of fisheries. Overall responses would likely be mixed.

<u>Viral Hemorrhagic Septicemia (VHS)</u>

Risk ranking and explanation

1. Estimate the probability of VHS being on, with, or in one of the vectors and pathways to SD and state which vector(s) and pathway(s).
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: VHS can be spread from one waterbody to the next through a variety of means, not all of which are known at this time. One known method of spreading VHS is moving infected fish or water from one waterbody to another. This can be done by importation, stocking, or the use of bait fish. Other potential sources of VHS spreading are natural fish movements, recreational boating/angling, bird assistance, ballast water discharge, and sampling activities. Although the transmission vector is not well-understood, the virus is present in at least one pathway: MN-SD (Cordes 2006).

2. Estimate the probability of VHS surviving in transit to SD.
   Rating**: HIGH,** Uncertainty: **VERY CERTAIN**

Rationale: The recent transmission of VHS in the Great Lakes and continued infestations suggest that the virus could likely survive transit to SD in a number of way vectors (e.g. importation of contaminated fish or fish gametes).

3. Estimate the probability of VHS successfully colonizing and maintaining a population where introduced in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Fishes that were infected in the Great Lakes (e.g., yellow perch and salmonids; see criterion 1 above) are also abundantly present in SD waters and could serve as suitable hosts for VHS to establish successfully.

4. Estimate the probability of VHS to spread beyond the colonized area in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Movement of fish stocks, fish eggs, and equipment used in such transfers could spread the virus from one waterbody to another in SD, potentially infecting a susceptible population of fish.

5. Estimate the economic impact if VHS were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Although it is difficult to predict the total economic effect of these fishes in SD, expenses of viral screening and clean-up of fish die-offs and lost revenue from angling-related tourism are all potential impacts.

6. Estimate the environmental impact if VHS were to establish (or is/was established) in SD.
   Rating: **MEDIUM,** Uncertainty: **REASONABLY CERTAIN**
   Rationale: VHS infections could result in die-offs of several valuable fish species in SD (Cordes 2006). Fish die-offs could potentially disrupt trophic status of a waterbody through removal of top predators and alter biogeochemical cycling through decomposition of large quantities of fish carcasses.

7. Estimate the impact from social and/or political influences if VHS were to establish (or is/was established) in SD.
   Rating: **HIGH,** Uncertainty: **VERY CERTAIN**
   Rationale: Although humans have not been infected from eating VHS-infected fish, the physical symptoms of infected fishes are often readily observable. Because outbreaks of VHS in the Great Lakes were well-publicized, social and political reactions to establishment in SD would likely be strongly negative.

APPENDIX G

Aquatic Nuisance Species (ANS) disinfection protocols for fieldworkers
South Dakota Game, Fish and Parks
Wildlife Division

Two disinfection levels for minimizing ANS risks.

Level 1: Used after every trip on all waters for boats, trailers, sampling gear and equipment.

Level 2*: Used **IN ADDITION TO LEVEL I** procedures every time a piece of equipment or a boat has been exposed to a waterbody that has a confirmed or suspected infestation of an ANS (e.g. zebra mussels, *Didymosphenia geminata*, Eurasian milfoil etc.) and is to be transferred out of the area of known contamination. If a boat is to be re-deployed into the same water it just came out of, level II decontamination is not necessary until the sampling trip is complete. For a current list of known or suspected ANS infested waterbodies in South Dakota; check the SDGFP website at: www.sdgfp.info/Wildlife/AquaticNuisance/AquaticNuisanceSpecies.aspx

Note: If possible, a complete set of equipment should be dedicated to work done within each area of known or suspected infestation. This equipment should be clearly labeled as "DIRTY" If it is not possible to dedicate sets of equipment to certain waters then Level 2 decontamination is required after all trips.

Level 1 disinfection

Before leaving any water access site

- Inspect boats, trailers and all sampling equipment.
- Clean and remove any visible plants, animals or sediment.
- Drain plugs should be removed and all water removed from interior spaces. Lower motors to completely drain the lower unit. Leave these areas open to the air until next launch.

After leaving water access site (see note below)

- Pressure wash boat hulls and bunks and all equipment with hot soapy water and rinse thoroughly (preferably car wash >100 F).

or

- Rinse boats and equipment with tap water and dry for at least 5 days prior to re-use.

Note: If a boat is to be re-deployed into the same water it just came out of, pressure washing or drying is not necessary until the sampling trip is complete.

LEVEL 2 disinfection* (for use IN ADDITION TO LEVEL I)

Boats

- All interior surfaces of the boat that may hold water including bilge areas and wet wells should be washed with hot (>100 F), soapy water and rinsed thoroughly (car wash).
- Areas that hold water should also be sprayed with the disinfectant** and rinsed after 1 hour.
- Leave all interior spaces open to the air for at least 5 days.
- After draining the lower unit of the motor, disengage the "dead man" switch, direct a constant flow of hot soapy water into the lower unit, and engage the starter to push the soapy water through the cooling system, rinse the system thoroughly in the same manner. DO NOT RUN THE MOTOR OUT OF THE WATER. After completion of the rinse, return the lower unit to the transom saver.
- Boat hulls should be washed using the brush or soap mop.
- Trailers should be carefully washed including bunks and all underneath surfaces and suspension systems.

Equipment

- Waders and wading shoes should be washed in normal laundry detergent using the manufacturer's guidelines. (Felt soled shoes and waders should not be used in any areas with known or suspected infestation).
- Sampling equipment should be washed in disinfectant solution; hard surfaces should be scrubbed with a brush.
- Leave all equipment in the open to dry for at least 5 days.

*The disinfectant recommended for use in level 2 is chlorine bleach. When applying bleach, workers should stay upwind of the spray and wear eye protection, rain gear and gloves. Bleach will breakdown in sunlight and when in contact with organic material. Bleach is corrosive to metal and rubber, consult appropriate Material Safety Data Sheet (MSDS) protocols for chlorine bleach use.

**Chlorine bleach at 200ppm is the recommended disinfectant. Household bleach (5.25% chlorine; sold at grocery stores) should be diluted to 200ppm (15ml household bleach to 1 gallon of water) and dispensed from a spray bottle (Other suitable disinfectants may be substituted).

Note: The task is not necessarily to directly kill the invasive species in question but to prevent their transfer to other uninfected waterbodies. When possible, if sampling both infested and uninfested waters, plan your trips to sample un-infested waters first, then suspected waters and conclude with the waters with confirmed infestations. These procedures are dependent on development of effective monitoring of ANS infestations and frequent updating and referencing of the SD infested waters list posted on the SDGFP website.