Asian clam sampling on five South Dakota Reservations.

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INTRODUCTION

Distribution

The Asian clam (*Corbicula fluminea*) is a non-native invasive freshwater bivalve that has spread rapidly in lakes, streams, rivers, and reservoirs throughout North America. Most of the major rivers in the United States have established populations of Asian clams (McMahon 1982). Asian clams have been documented downstream of Fort Randall and Gavins Point dams in South Dakota and Nebraska in 2005 and 2006 (Grohs 2008), and downstream of Gavins Point Dam in 2004 (Shearer et al. 2005), 2007 and 2008 (Stukel et al. 2008; Stukel et al. 2009). In 2009, an established Asian clam population was discovered in Lewis and Clark Lake by South Dakota Game Fish and Parks. Additionally, Asian clam shells were found in the summer rearing ponds at the Gavins Point National Fish Hatchery (NFH) in Yankton, South Dakota, whose fish production water is supplied by Lewis and Clark Lake (Schilling et al. 2010). Fish propagated at Gavins Point NFH have been stocked into the Missouri River and inland lakes throughout South Dakota since the 1960's.

Biology

Asian clams are generally found in lakes or streams with silt, sand, and gravel substrate. Asian clams can tolerate a wide variety of environmental conditions, however are intolerant of hypoxia, therefore they are generally found in well-aerated, lotic habitats or shallow, oxygenated lentic habitats (McMahon 1979; McMahon 1999). Asian clams tolerate water temperatures ranging from 2°C (36°F) to 34°C (93°F). They are filter feeders that can be found at the sediment surface or burrowed into the sediment (Wittmann et al. 2008). They have two tube-like siphons, one that draws water, food, and dissolved oxygen into the body and one that expels water and

wastes out of the body (IN DNR 2009). A strong muscular foot allows movement of Asian clams and they have the ability to secrete a mucous thread from within the gills; acting like a dragline that catches the current and pulls the clam off the bottom allowing downstream movement (IN DNR 2009). Asian clams are prolific hermaphrodites capable of both cross and self fertilization and can reach sexual maturity at 6 – 10 mm; consequently, one adult clam is capable of producing up to 400 larvae per day (IN DNR 2009). Reproduction generally occurs in the spring and fall when temperatures are above 16°C (61°F). The young are incubated in the adults shell and released within four to five days. Reproductive maturity is typically attained in three to 12 months and they may live up to four years (Hornbach 1992, McMahon 1999). This rapid reproduction allows the Asian clam to reach densities of over 10,000 clams per square meter in a very short period of time.

Impacts

The Asian clam out competes many native clam species for food and space. However, the Asian clam's greatest impact has been biofouling raw water systems, particularly power stations and water intake pipes, affecting power, water, and other industries. Fortunately, Asian clams cannot attach to hard surfaces like Zebra mussels, *Dreissena polymorpha*, instead Asian clams foul water systems by accumulating extremely high biomasses and by shells getting lodged in small components in water systems (IN DNR 2009).

The rapid spread of the Asian clam is mainly through human vectors such as fish stocking, bilge/live-well water of watercrafts, with fish bait, and dredging (McMahon 1982, McMahon 1999). Like zebra mussels, Asian clams have a planktonic veliger (larval) stage that can be transported via rearing pond water from stockable fish selected for augmentation in mid to late summer. Gavins Point NFH produces and stocks several species of cool, cold, and warm

water fishes throughout South Dakota, including the waters on the Cheyenne River Sioux, Lower Brule Sioux, Oglala Sioux, Rosebud Sioux, and Yankton Sioux Reservations. Presence of Asian clams at Gavins Point NFH is a concern because stocking these pond-reared fishes carries a risk of spreading this exotic species throughout the state. Recent stockings, within the last six years, of black crappies (*Pomoxis nigromaculatus*), bluegills (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), and walleye (*Sander vitreus*) have occurred at these five reservations since the discovery of Asian clams in the water supply to Gavins Point NFH (Table 1). Therefore, we sampled lakes at each reservation that have been stocked with fish from Gavins Point NFH to determine the presence or absence of established Asian clam populations.

METHODS

Gavins Point NFH has stocked fishes on the Cheyenne River Sioux (78 lakes), Lower Brule Sioux (32 lakes), Oglala Sioux (5 lakes), Rosebud Sioux (7 lakes), and Yankton Sioux Reservations (3 lakes) since 2000 (Schilling et al. 2009). Since Asian clams have been documented in the Missouri River since 2004, we selected lakes that have been stocked since 2004 to sample for Asian clams. This prioritization allowed us to sample the lakes on each reservation with the highest potential of having established Asian clam populations (Table 2).

Throughout July, August, and early September, Asian clams were sampled using two gears, a sieve bucket with a shovel and a “Berg Sampler”. The sieve bucket was a heavy-duty plastic bucket with 541 µm stainless steel wire cloth on the bottom, reinforced with hardware cloth and a heavy stainless steel ring (Figure 1A). Substrate was scooped into the sieve bucket with a shovel and rinsed to collect the sample. The Berg sampler was a 229 mm long piece of 102 mm diameter PVC pipe with 4 mm mesh material attached to the bottom and 2 m of lead

line consisting of 22.7 kg leadcore wrapped around the PVC pipe to allow the sampler to maintain contact with the bottom (Figure 1B). Additionally, the Berg sampler had 9 m of lead line (22.7 kg leadcore) attached to the top of the sampler for a throw rope. The Berg sampler was deployed by throwing it towards the center of the lake where it sank to the bottom and collected the sample as it dragged along the lake bottom when pulled in. Each lake was divided into two to three sample sites depending on the size of the lake and access to the water, both gears were deployed three to 10 times per site (Table 2). Additionally, visual examinations along the shoreline and shallow water areas were conducted for each lake at two to four sites. At each site, latitude, longitude, substrate, temperature (^{o}C), turbidity (Nephelometric Turbidity Units; NTU), and dissolved oxygen (mg/L) were collected. Presence or absence of Asian clams was documented at each site for all lakes sampled.

RESULTS

The Cheyenne River Sioux Reservation is located on the north bank of the Cheyenne River and the west bank of the Missouri River (Lake Oahe) in north central South Dakota. The reservation encompasses 1.4 million acres of mixed-grass prairie in Ziebach and Dewey counties. Ten lakes, 17.5% of the water bodies stocked since 2004, were sampled for Asian clams in August 2010 (Table 3). The lakes, primarily used as a water source for livestock, consist of soft clay and silt substrates, with an average temperature of 24°C, an average turbidity of 18 NTU, and an average dissolved oxygen of 8.6 mg/L at the time of sampling (Table 3). No Asian clams were collected. We did collect native clams (Sphaeriidae), freshwater mussels (Unionidae), and snails (Physidae, Lymnaeidae, and Planorbidae). At Buffalo Lake, we observed several large beds of freshwater mussels (Unionidae), with multiple size classes ranging from 50 mm to 152 mm, indicating successful reproduction and recruitment in this lake.

The Lower Brule Sioux Reservation is located along the west bank of the Missouri River (Lake Sharpe and Lake Francis Case) in central South Dakota. The reservation encompasses over 220,000 acres of rolling hills of mixed-grass prairie and steep drainages along the Missouri River in Lyman and Stanley counties. Twenty-two lakes, 84.6% of the water bodies stocked since 2004, were sampled for Asian clams in July and September 2010 (Table 4). The lakes, primarily used as a water source for livestock, consist of clay and silt substrates, with an average temperature of 21°C, an average turbidity of 72 NTU, and an average dissolved oxygen of 8.0 mg/L at the time of sampling (Table 4). No Asian clams were collected. We did collect native clams (Sphaeriidae), and snails (Physidae, Lymnaeidae, and Planorbidae).

The Oglala Sioux Reservation is located in southwestern South Dakota in Shannon, Jackson, and Bennett counties, and Sheridan county Nebraska. The reservation encompasses 1.7 million acres of rolling grassland prairie and deep canyons formed by streams and consist of the Badlands in the northern half of the reservation. Five lakes, 100% of the water bodies stocked since 2004, were sampled for Asian clams in August 2010 (Table 5). The lakes, primarily used for fishing and recreation, consist mostly of fine silt and organic matter, with some areas of scattered gravel. However, White Clay Dam is mostly sand and clay with scattered rock outcrops. The water temperatures averaged 24°C, turbidity averaged 19 NTU, and dissolved oxygen averaged 8.0 mg/L at the time of sampling (Table 5). No Asian clams were collected. We did collect native clams (Sphaeriidae) and snails (Physidae and Planorbidae).

The Rosebud Sioux Reservation is located in south central South Dakota in Todd County. The reservation encompasses 882,416 acres of grasslands with large scattered areas of Ponderosa Pine (*Pinus ponderosa*) forests and deep valleys defined by steep hills and ravines. Three lakes, 100% of the water bodies stocked since 2004, were sampled for Asian clams in August 2010

(Table 6). The lakes, primarily used for fishing and recreation, consist mostly of sand and silt substrates with some clay and scattered gravel. The water temperature averaged 24°C, turbidity averaged 27 NTU, and dissolved oxygen averaged 8.2 mg/L at the time of sampling (Table 6). No Asian clams were collected. We did collect snails (Physidae and Lymnaeidae).

The Yankton Sioux Reservation is located in southeastern South Dakota in Charles Mix County along the bank of the Missouri River. The reservation encompasses approximately 40,000 acres (without boundaries) of rolling grassland prairie. Three lakes, 100% of the water bodies stocked since 2004, were sampled for Asian clams in August 2010 (Table 7). The lakes, used primarily for fishing and recreation, consist of clay and silt substrates with scattered areas of sand and gravel. The water temperature averaged 29°C, turbidity averaged 16 NTU, and dissolved oxygen averaged 6.3 mg/L at the time of sampling (Table 7). No Asian clams were collected. We did collect native clams (Sphaeriidae) and snails (Physidae, Lymnaeidae, and Planorbidae).

DISCUSSION

There are a couple factors that may be beneficial in preventing the spread of Asian clams throughout the lakes on these five South Dakota Reservations. One factor is a lack of suitable habitat for Asian clams at most of the lakes sampled. Asian clams prefer sand and gravel substrate (McMahon 1999, IN DNR 2009), all of the lakes sampled on the Cheyenne River Sioux and Lower Brule Sioux Reservations consisted of clay and silt substrates. The only lakes that had suitable substrates for Asian clams were Kyle Dam, Oglala Reservoir, and White Clay Dam on the Oglala Sioux Reservation, Beads Dam and Eagle Feather on the Rosebud Sioux Reservation, and Dante and Songhawk lakes on the Yankton Sioux Reservation and yet no Asian

clams were collected at these lakes. Additionally, several large beds of freshwater mussels (Unionidae) were observed at Buffalo Lake on the Cheyenne River Sioux Reservation, the only lake out of all the lakes sampled where mussels were observed. Another benefit is that Asian clams cannot tolerate temperatures below 2°C and most of these lakes are small and shallow; therefore, most would freeze during the winter, eliminating the majority if not all of the Asian clams (McMahon 1982, Hornbach 1992, McMahon 1999, IN DNR 2009).

No Asian clams were collected at the 43 lakes sampled on the Cheyenne River Sioux, Lower Brule Sioux, Oglala Sioux, Rosebud Sioux, and Yankton Sioux Reservations. Therefore, future stocking of any fishes should be temporarily postponed until a decontamination protocol can be implemented to reduce the risk of spreading Asian clams. The Gavins Point NFH in Yankton, South Dakota is taking every precaution necessary to prevent the spread of invasive species and is currently working on a decontamination protocol with the U. S. Geological Survey (USGS) to prevent the spread of Asian clams through stocking efforts.

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Figure 1: Sieve bucket with a shovel (A) and the Berg sampler (B) used to collected samples for Asian clams on five reservations in South Dakota in July, August, and September 2010.

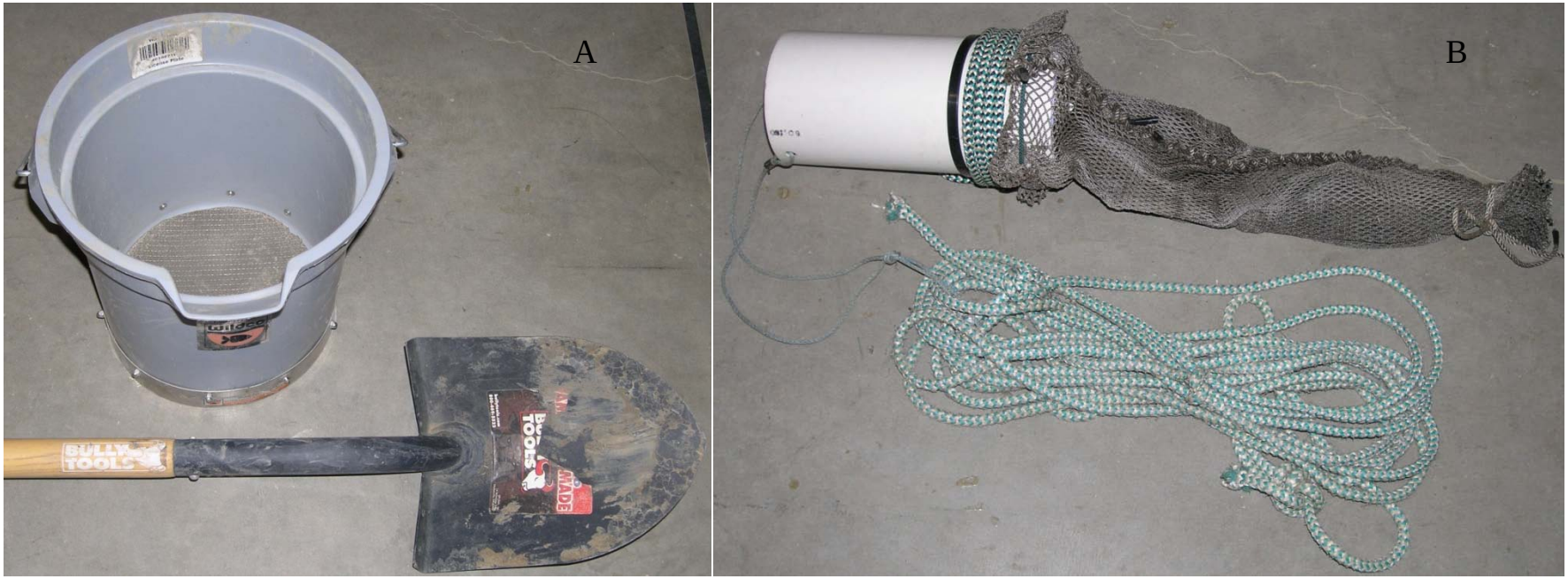

Table 1: Stocking history (2004 – Present) of lakes from five reservations in South Dakota sampled for Asian clams in July, August, and September 2010. Stocking records from Gavins Point NFH (Schilling et al. 2010).

Lake	Species	Number Stocked	Year stocked
	Cheyenne River Sioux Tribe		
Buffalo Lake	Walleye	25250	2005
Buffalo Lake	Largemouth bass	25250	2005
Buffalo Lake	Walleye	25250	2006
Buffalo Lake	Largemouth bass	25250	2006
Buffalo Lake	Bluegill	22640	2006
Buffalo Lake	Walleye	25217	2007
Buffalo Lake	Yellow perch	29072	2007
Buffalo Lake	Largemouth bass	25917	2007
Buffalo Lake	Black crappie	1756	2007
Buffalo Lake	Largemouth bass	21738	2008
Charging Eagle Dam	Largemouth bass	3750	2005
Charging Eagle Dam	Largemouth bass	3750	2006
Cherry Creek	Largemouth bass	2900	2005
Cherry Creek	Black crappie	2840	2005
Cherry Creek	Largemouth bass	2900	2006
Cherry Creek	Largemouth bass	2022	2008
Clarks Dam	Largemouth bass	4000	2005
Clarks Dam	Largemouth bass	4000	2006
Clarks Dam	Bluegill	2480	2008
Honey Webb Dam	Black crappie	2812	2006
Laurenz Dam	Largemouth bass	2000	2005
Laurenz Dam	Largemouth bass	2000	2006
Laurenz Dam	Bluegill	2000	2006
Lone Eagle Dam	Walleye	8000	2005
Lone Eagle Dam	Largemouth bass	8000	2005
Lone Eagle Dam	Black crappie	7866	2005
Lone Eagle Dam	Largemouth bass	8000	2006
Red Scaffold Dam	Walleye	3750	2005
Red Scaffold Dam	Walleye	3750	2006
Sharon Anderson	Largemouth bass	2250	2006
Swiftbird School	Largemouth bass	2500	2005
Swiftbird School	Largemouth bass	1348	2008
	Lower Brule Sioux Tribe		
B. Thompson	Bluegill	3000	2008
Bad Horse Dam	Yellow perch	23000	2008
Bad Horse Dam	Yellow perch	3000	2010
BLT	Bluegill	2500	2008
BLT	Yellow perch	6000	2010
Borrow Pit Dam N	Yellow perch	5056	2007
Borrow Pit Dam N	Largemouth bass	3250	2008

Table 1: Continued.

Lake	Species	Number Stocked	Year stocked
		Lower Brule Sioux Tribe	
Borrow Pit Dam N	Yellow perch	3000	2010
Borrow Pit Dam S	Largemouth bass	3140	2008
Borrow Pit Dam S	Yellow perch	3000	2010
C. Parker	Bluegill	2000	2008
D. Moore N	Bluegill	2000	2008
D. Moore S	Black crappie	2200	2010
D. Moore S	Yellow perch	8000	2010
Deadman	Bluegill	1500	2008
F. Jandreau	Bluegill	2000	2008
Hwy 1806 Dam	Bluegill	1500	2008
Karlen	Bluegill	2500	2008
Karlen	Yellow perch	4000	2010
Madson N	Bluegill	1500	2008
Madson S	Bluegill	1500	2008
Marty Jandreau	Bluegill	3000	2008
Reuers Dam	Largemouth bass	800	2004
Reuers Dam	Bluegill	3978	2004
Reuers Dam	Largemouth bass	800	2005
Reuers Dam	Bluegill	6000	2008
Right Tailrace Dam	Largemouth bass	800	2004
Right Tailrace Dam	Black crappie	3925	2004
Right Tailrace Dam	Largemouth bass	800	2005
Right Tailrace Dam	Yellow perch	23000	2008
Rubble Pond	Largemouth bass	1283	2007
Rubble Pond	Largemouth bass	5040	2008
Rubble Pond	Bluegill	6000	2008
Vicki Wheat	Bluegill	2000	2008
Wally's Dam	Bluegill	1500	2008
Williams Unit NE	Bluegill	3000	2008
Williams Unit SW	Bluegill	15000	2008
		Oglala Sioux Tribe	
Denby Dam	Largemouth bass	3661	2008
Denby Dam	Yellow perch	10000	2008
Kyle Dam	Largemouth bass	7660	2008
Kyle Dam	Black crappie	17063	2010
Oglala Reservoir	Walleye	70920	2008
Oglala Reservoir	Yellow perch	191090	2008
Oglala Reservoir	Walleye	71393	2009
Oglala Reservoir	Yellow perch	170899	2009
Oglala Reservoir	Walleye	70426	2010

Table 1: Continued.

Lake	Species	Number Stocked	Year stocked
	Oglala Sioux Tribe		
Oglala Reservoir	Yellow perch	60558	2010
White Clay Dam	Largemouth bass	10661	2008
White Clay Dam	Yellow perch	45000	2008
Yellow Bear	Largemouth bass	3633	2008
Yellow Bear	Yellow perch	7500	2008
	Rosebud Sioux Tribe		
Beads Dam	Walleye	4371	2009
Beads Dam	Yellow perch	42128	2010
Eagle Feather	Walleye	4371	2009
Eagle Feather	Walleye	10268	2010
Ghost Hawk	Yellow perch	5672	2009
Ghost Hawk	Yellow perch	42128	2010
	Yankton Sioux Tribe		
Dante Lake	Bluegill	3503	2008
Dante Lake	Largemouth bass	732	2008
Patterson Dam	Bluegill	3504	2008
Patterson Dam	Largemouth bass	732	2008
Songhawk	Bluegill	5005	2008
Songhawk	Largemouth bass	1098	2008

Table 2: Number of sites and total samples collected at Cheyenne River Sioux, Lower Brule Sioux, Oglala Sioux, Rosebud Sioux, and Yankton Sioux Reservations with each gear for lakes sampled for Asian clams.

Lake	Sites	Visual Exams	Sieve Bucket	Berg Sampler
Cheyenne River Sioux Tribe				
Buffalo Lake	3	12	12	12
Charging Eagle	2	4	8	8
Cherry Creek	2	4	8	8
Clarks Dam	2	4	8	8
Honey Webb	2	4	8	8
Laurenz Dam	2	4	8	8
Lone Eagle	2	4	8	8
Red Scaffold	2	4	8	8
Sharon Anderson	2	4	8	8
Swiftbird School	2	4	8	8
Lower Brule Sioux Tribe				
B. Thompson	2	4	8	8
Bad Horse Dam	2	4	8	0
BLT	2	4	8	8
Borrow Pit N	2	8	12	12
Borrow Pit S	2	8	12	12
C. Parker	2	4	8	8
D. Moore N	2	4	8	8
D. Moore S	2	4	8	8
Deadman	2	4	8	8
F. Jandreau	2	4	8	8
Hwy 1806 Dam	2	4	8	8
Karlen	2	4	8	8
Madson N	2	4	8	8
Madson S	2	4	8	8
M. Jandreau	2	4	8	8
Reuers Dam	2	4	8	8
Right Tailrace	2	8	12	12
Rubble Pond	1	2	4	4
Vicki Wheat	2	4	8	8
Wally's Dam	2	4	8	8
Williams Unit NE	2	4	6	6
Williams Unit SW	2	4	8	8
Oglala Sioux Tribe				
Denby Dam	2	5	9	15
Kyle Dam	3	6	12	12
Oglala Reservoir	3	12	16	16
White Clay Dam	2	8	12	12
Yellow Bear	3	6	12	12

Table 2: Continued

Lake	Sites	Visual Exams	Sieve Bucket	Berg Sampler
		Rosebud Sioux Tribe		
Beads Dam	2	8	13	12
Eagle Feather	2	8	10	12
Ghost Hawk	2	8	14	14
		Yankton Sioux Tribe		
Dante Lake	2	8	12	12
Patterson Dam	2	8	12	12
Songhawk	2	8	20	20

Table 3: Ten lakes sampled for Asian clams on the Cheyenne River Sioux Reservation, South Dakota on August 25-30, 2010.

Lake	Site	Date	Latitude	Longitude	Substrate	Temp (°C)	Turbidity (NTU)[a]	DO (mg/L)	Collection Comments
Buffalo Lake	1	8/25/2010	44.62066	-101.99402	Silt/Clay	22.9	9	8.3	Physidae, planorbidae, unionidae
Buffalo Lake	2	8/25/2010	44.62148	-101.99287	Silt/Clay	23.6	4	8.3	Physidae, planorbidae, unionidae
Buffalo Lake	3	8/25/2010	44.62182	-101.99200	Silt/Clay	23.5	2	8.4	Lymnaeidae, unionidae
Charging Eagle	1	8/25/2010	44.71759	-101.73328	Silt/Clay	23.3	17	7.6	Sphaeriidae, physidae, planorbidae
Charging Eagle	2	8/25/2010	44.71779	-101.73392	Silt/Clay	24.2	5	8.8	Physidae, planorbidae
Cherry Creek	1	8/25/2010	44.61483	-101.48137	Silt/Clay	24.4	3	8.4	No clams, snails, or mussels
Cherry Creek	2	8/25/2010	44.61667	-101.48119	Silt/Clay	24.6	6	10.1	Physidae
Clarks Dam	1	8/30/2010	44.96622	-100.71743	Silt/Clay	23.6	5	9.3	No clams, snails, or mussels
Clarks Dam	2	8/30/2010	44.96667	-100.71770	Silt/Clay	24.4	12	10.3	Physidae
Honey Webb	1	8/30/2010	44.86763	-100.57208	Silt/Clay	23.2	6	9.3	Sphaeriidae, physidae, lymnaeidae
Honey Webb	2	8/30/2010	44.86730	-100.57233	Silt/Clay	23.5	19	11.3	Sphaeriidae, physidae, lymnaeidae
Laurenz Dam	1	8/30/2010	44.86613	-101.06511	Silt/Clay	22.7	9	4.0	No clams, snails, or mussels
Laurenz Dam	2	8/30/2010	44.86617	-101.06432	Silt/Clay	22.6	16	4.0	No clams, snails, or mussels
Lone Eagle	1	8/25/2010	44.73894	-101.79625	Silt/Clay	24.5	16	12.4	Physidae
Lone Eagle	2	8/25/2010	44.73923	-101.79628	Silt/Clay	23.5	10	10.6	Physidae
Red Scaffold	1	8/25/2010	44.74464	-101.81920	Silt	23.5	7	8.4	Physidae
Red Scaffold	2	8/25/2010	44.74533	-101.81955	Silt	23.6	19	8.8	Physidae
Sharon Anderson	1	8/30/2010	44.96109	-100.93691	Silt/Clay	23.3	186	5.8	Sphaeriidae, physidae, lymnaeidae
Sharon Anderson	2	8/30/2010	44.96085	-100.93797	Silt/Clay	23.4	9	5.1	Sphaeriidae, lymnaeidae
Swiftbird School	1	8/30/2010	45.08955	-100.42697	Silt/Clay	23.4	6	10.4	Sphaeriidae, physidae, lymnaeidae, planorbidae
Swiftbird School	2	8/30/2010	45.08979	-100.42683	Silt/Clay	23.2	14	10.2	Sphaeriidae, physidae, lymnaeidae

[a]NTU = Nephelometric Turbidity Units.

Table 4: Twenty-two lakes sampled for Asian clams on the Lower Brule Sioux Reservation, South Dakota on July 27 and September 1-3, 2010.

Lake	Site	Date	Latitude	Longitude	Substrate	Temp (°C)	Turbidity (NTU)[a]	DO (mg/L)	Collection Comments
B. Thompson	1	9/3/2010	44.27728	-100.04925	Silt/Clay	21.1	11	12.7	Physidae
B. Thompson	2	9/3/2010	44.27750	-100.04952	Silt/Clay	20.4	31	7.7	Physidae
Bad Horse Dam	1	9/2/2010	44.06593	-99.85819	Silt/Clay	21.1	13	8.2	Sphaeriidae
Bad Horse Dam	2	9/2/2010	44.06596	-99.85693	Silt/Clay	20.0	25	8.2	Sphaeriidae, physidae
BLT	1	9/1/2010	44.03193	-99.64816	Clay	21.4	18	12.6	Physidae
BLT	2	9/1/2010	44.03131	-99.64706	Clay	21.6	9	12.1	Physidae
Borrow Pit N	1	7/27/2010	44.12926	-99.58267	Silt	29.0	89	5.7	No clams, snails, or mussels
Borrow Pit N	2	7/27/2010	44.12895	-99.58395	Silt	28.1	846	7.6	No clams, snails, or mussels
Borrow Pit S	1	7/27/2010	44.12654	-99.58444	Silt	27.0	25	3.7	Physidae
Borrow Pit S	2	7/27/2010	44.12577	-99.58458	Silt	27.0	46	7.6	No clams, snails, or mussels
C. Parker	1	9/3/2010	44.20121	-100.04420	Silt	17.0	13	3.4	Physidae
C. Parker	2	9/3/2010	44.20166	-100.04434	Silt	16.3	47	3.3	Physidae
D. Moore N	1	9/1/2010	44.02607	-99.60940	Silt/Clay	20.6	171	6.9	Sphaeriidae
D. Moore N	2	9/1/2010	44.02674	-99.60951	Silt/Clay	20.8	602	6.5	Sphaeriidae, physidae
D. Moore S	1	9/1/2010	44.01648	-99.60352	Clay	21.2	34	8.5	Physidae, planorbidae
D. Moore S	2	9/1/2010	44.01608	-99.60191	Clay	21.5	39	11.1	Physidae, planorbidae
Deadman	1	9/1/2010	44.04659	-99.67657	Clay	22.7	28	9.5	Sphaeriidae, lymnaeidae
Deadman	2	9/1/2010	44.04621	-99.67535	Clay	23.8	68	10.2	Sphaeriidae, lymnaeidae
F. Jandreau	1	9/2/2010	44.08439	-99.80267	Clay	18.8	19	8.6	Physidae, planorbidae
F. Jandreau	2	9/2/2010	44.08505	-99.80338	Silt/Clay	18.9	5	8.9	Physidae
Hwy 1806 Dam	1	9/2/2010	44.09867	-99.88609	Silt/Clay	18.9	3	7.8	Sphaeriidae, physidae
Hwy 1806 Dam	2	9/2/2010	44.09925	-99.88703	Silt/Clay	20.0	23	7.2	Sphaeriidae, physidae
Karlen	1	9/1/2010	44.02691	-99.58698	Silt/Clay	20.6	7	6.8	Physidae
Karlen	2	9/1/2010	44.02789	-99.58842	Silt/Clay	21.1	11	6.5	Physidae
Madson N	1	9/2/2010	44.08139	-100.01337	Clay	18.8	43	8.6	No clams, snails, or mussels
Madson N	2	9/2/2010	44.08203	-100.01292	Clay	18.5	34	8.2	No clams, snails, or mussels
Madson S	1	9/2/2010	44.06490	-100.01019	Hard Clay	19.4	22	9.5	Physidae
Madson S	2	9/2/2010	44.06445	-100.00959	Hard Clay	19.2	84	9.5	Physidae
M. Jandreau	1	9/2/2010	44.08625	-99.80902	Silt/Clay	19.7	5	7.2	Physidae

Table 4: Continued.

Lake	Site	Date	Latitude	Longitude	Substrate	Temp (°C)	Turbidity (NTU)[a]	DO (mg/L)	Collection Comments
M. Jandreau	2	9/2/2010	44.08580	-99.80878	Silt/Clay	20.0	6	9.5	Physidae
Reuers Dam	1	9/1/2010	44.05034	-99.65543	Clay	22.4	30	6.9	Physidae, lymnaeidae, planorbidae
Reuers Dam	2	9/1/2010	44.05084	-99.65660	Clay	24.1	43	12.2	Physidae, lymnaeidae
Right Tailrace	1	7/27/2010	44.03313	-99.44157	Silt	29.6	53	2.1	No clams, snails, or mussels
Right Tailrace	2	7/27/2010	44.03320	-99.44186	Silt	28.9	310	2.4	No clams, snails, or mussels
Rubble Pond	1	9/1/2010	44.07233	-99.59265	Silt/Clay	22.4	129	6.9	Planorbidae
Vicki Wheat	1	9/1/2010	44.03846	-99.66282	Clay	22.2	7	15.7	Physidae, lymnaeidae
Vicki Wheat	2	9/1/2010	44.03745	-99.66314	Clay	22.4	2	15.2	Physidae, lymnaeidae
Wally's Dam	1	9/2/2010	44.07481	-99.81417	Silt/Clay	19.3	16	6.9	Sphaeriidae
Wally's Dam	2	9/2/2010	44.07516	-99.81356	Clay	19.5	22	6.6	Sphaeriidae
Williams Unit NE	1	9/3/2010	44.20683	-100.14513	Silt/Clay	17.9	19	9.8	Sphaeriidae
Williams Unit NE	2	9/3/2010	44.20707	-100.14552	Silt/Clay	18.9	53	10.1	Sphaeriidae
Williams Unit SW	1	9/3/2010	44.19637	-100.15789	Silt	16.8	5	4.0	Physidae, planorbidae
Williams Unit SW	2	9/3/2010	44.19624	-100.15779	Silt	16.3	22	2.6	Physidae

[a]NTU = Nephelometric Turbidity Units.

Table 5: Five lakes sampled for Asian clams on the Oglala Sioux Reservation, South Dakota on August 17, 2010.

Lake	Site	Date	Latitude	Longitude	Substrate	Temp (°C)	Turbidity (NTU)[a]	DO (mg/L)	Collection Comments
Denby Dam	1	8/17/2010	43.05713	-102.31383	Silt/Sand	24.5	32	9.5	Sphaeriidae, physidae
Denby Dam	2	8/17/2010	43.05719	-102.31544	Silt	23.9	30	6.8	Sphaeriidae, physidae
Kyle Dam	1	8/17/2010	43.43475	-102.17771	Silt/Gravel	19.0	9	4.0	Physidae
Kyle Dam	2	8/17/2010	43.43206	-102.17921	Sand	22.9	10	4.6	Sphaeriidae, physidae
Kyle Dam	3	8/17/2010	43.43174	-102.17871	Silt/Sand	23.0	8	4.7	Sphaeriidae, physidae
Oglala Reservoir	1	8/17/2010	43.17907	-102.73864	Clay/Silt/Gravel	26.4	26	12.1	Physidae
Oglala Reservoir	2	8/17/2010	43.17865	-102.73899	Silt/Sand/Gravel	26.0	15	12.2	No clams, snails, or mussels
Oglala Reservoir	3	8/17/2010	43.17464	-102.74314	Clay/Silt	25.4	48	7.2	Physidae
White Clay Dam	1	8/17/2010	43.00472	-102.56351	Rocks/Silt	24.7	15	9.6	Sphaeriidae, physidae
White Clay Dam	2	8/17/2010	43.00393	-102.56261	Rocks/Silt	25.2	16	10.5	Sphaeriidae, physidae
Yellow Bear	1	8/17/2010	43.33403	-102.03912	Clay	23.7	7	6.5	Sphaeriidae, physidae, planorbidae
Yellow Bear	2	8/17/2010	43.33365	-102.03914	Clay	23.9	14	7.9	Sphaeriidae, physidae, planorbidae
Yellow Bear	3	8/17/2010	43.33305	-102.03839	Silt	24.2	16	8.8	Sphaeriidae, physidae, planorbidae

[a]NTU = Nephelometric Turbidity Units.

Table 6: Three lakes sampled for Asian clams on the Rosebud Sioux Reservation, South Dakota on August 16, 2010.

Lake	Site	Date	Latitude	Longitude	Substrate	Temp (^{o}C)	Turbidity (NTU)[a]	DO (mg/L)	Collection Comments
Beads Dam	1	8/16/2010	43.19606	-101.00677	Sand/Gravel	23.8	49	5.9	Physidae, lymnaeidae
Beads Dam	2	8/16/2010	43.19575	-101.00638	Sand	24.2	11	11.5	Physidae, lymnaeidae
Eagle Feather	1	8/16/2010	43.32169	-101.03419	Clay	23.1	23	5.1	Physidae, lymnaeidae
Eagle Feather	2	8/16/2010	43.32268	-101.03423	Sand/Gravel	24.0	21	8.4	Physidae, lymnaeidae
Ghost Hawk	1	8/16/2010	43.25584	-100.90839	Sand/Silt	24.1	20	8.2	Physidae, lymnaeidae
Ghost Hawk	2	8/16/2010	43.25824	-100.90708	Sand/Silt	22.3	37	10.1	Physidae, lymnaeidae

[a]NTU = Nephelometric Turbidity Units.

Table 7: Three lakes sampled for Asian clams on the Yankton Sioux Reservation, South Dakota on August 13, 2010.

Lake	Site	Date	Latitude	Longitude	Substrate	Temp (^{o}C)	Turbidity (NTU)[a]	DO (mg/L)	Collection Comments
Dante Lake	1	8/13/2010	43.06710	-98.17888	Clay/Silt/Gravel	30.0	21	4.8	Sphaeriidae, physidae, planorbidae
Dante Lake	2	8/13/2010	43.06699	-98.17675	Sand/Clay/Silt/Gravel	29.5	19	7.4	Sphaeriidae, physidae, planorbidae
Patterson Dam	1	8/13/2010	42.94110	-98.26048	Silt	28.4	16	6.7	Physidae
Patterson Dam	2	8/13/2010	42.94158	-98.26223	Silt	28.7	9	8.0	Physidae
Songhawk	1	8/13/2010	42.92639	-98.33828	Sand/Clay/Silt/Gravel	27.3	18	5.7	Physidae, lymnaeidae, planorbidae
Songhawk	2	8/13/2010	42.92771	-98.33965	Sand/Clay/Silt/Gravel	28.0	15	5.0	Physidae, lymnaeidae, planorbidae

[a]NTU = Nephelometric Turbidity Units.