SOUTH DAKOTA FISHERIES

ANGLER USE AND HARVEST SURVEYS ON FOUR MINNEHAHA COUNTY LAKES: SUMMERS OF 2004-2007 AND WINTER OF 2013-2014 (SCOTT AND TWIN LAKES)

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Angler Use and Harvest Surveys on Four Minnehaha County Lakes: Summers of 2004-2007 and Winter of 2013-2014 (Scott and Twin Lakes)

by

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Preface

Information in this report was collected between May 2004 and March 2014. Funding for this project was provided by Federal Aid in Sportfish Restoration, (D-J) Project F-21-R-47, Job Number 2109. Copies of this report and reference to the data are not for publication and can only be made with written permission from the authors, Director of the Division of Wildlife, or the Secretary of the South Dakota Department of Game, Fish and Parks, 523 E. Capitol, Pierre, South Dakota 57501-3182.

Executive Summary

Beaver, Diamond, Scott and Twin Lakes are located within 50 km of Sioux Falls which makes them important fisheries with high angler use. Natural reproduction of game fish in these lakes is sporadic so populations are maintained through aggressive stocking.

Diamond, Twin, and Beaver Lakes have a long history of problems with over-abundant bullheads impacting their fisheries. The Region III fisheries staff implemented several strategies designed to reduce bullhead populations and increase game fish production in these lakes. They included stocking large numbers of juvenile and adult walleyes to prey upon small bullheads and protecting them under a daily limit of one with a 61-cm minimum length limit (MLL). The MLL was removed from Beaver and Diamond lakes in 2009 after it failed to achieve the desired results and was modified on Twin Lake in 2010 to a daily limit of one with a 71-cm MLL to comply with the new set of walleye toolbox regulations.

The primary objective of this creel survey was to document angler use, catch and harvest rates, and catch and harvest of fish at these important fisheries. The creel survey was also designed to assess the effects of the MLL on the walleye, yellow perch and black bullhead fisheries. Additionally, the documentation of angler use and harvest may prove useful in justifying future intensive management strategies.

Beaver Lake

Most anglers fishing Beaver Lake were targeting black crappies (35%), walleyes (34%) or any species (generalists, 27%). Summer fishing pressure varied from 2,586 h (21 h/ha) in 2004 to 9,110 h (73 h/ha) in 2005. High catch rates for walleye and black crappie contributed to the high fishing pressure in 2005. Total fishing pressure per hectare over the 4-year period was higher at Beaver Lake (172 h/ha) than Diamond (142 h/ha) or Twin lakes (39 h/ha), but lower than Scott Lake (407 h/ha).

Monthly fishing pressure was highest in May and steadily declined through the summer. About 78% of fishing was done from shore with little variation by month.

Over the survey period, anglers caught an estimated 6,656 walleyes, but harvested only nine because nearly all were protected under the 61-cm MLL. Catch rates were over 0.3 fish/h in 3 of 4 years, similar to those for popular large lake walleye fisheries. Walleye catch rates declined in July of 2006. This decline coincided with a significant decline in gill-net CPUE during the 2006 lake survey on June 25-27. A moderate summer kill of small (10-15 cm) walleyes was reported on July 5, 2006 and it is possible some larger fish were lost during this period. Larger walleyes were absent in the 2007 survey as well.

The special walleye regulation was removed in 2009 and the lake has since been managed under statewide regulations. Several factors influenced the decision to remove the regulation. First, even though anglers did not harvest many walleyes, the larger fish common in 2004 and 2005 fish population survey net catches were absent from the 2006 and 2007 surveys. Moreover, walleye gill-net CPUE remained well below the objective of 15 fish per net in spite of aggressive stocking and protection of fish under the special regulation. Beaver Lake also suffered a severe fish kill during the winter of 2007-2008. Therefore, the regulation failed to achieve the intended objectives and was removed.

A large year class of black crappies naturally produced in 2001 supported a good fishery during the survey period. These fish fully recruited to the fishery at age-5 (2006) and angler catch and harvest rates rose to 1.06 fish/h and 0.74 fish/h, respectively. Anglers harvested an estimated 3,842 fish. Catch and harvest rates declined to 0.31 fish/h and 0.21 fish/h, respectively in 2007 with anglers harvesting fewer than 900 fish. Anglers were willing to harvest black crappies at about 18 cm long.

Yellow perch catch and harvest rates were low during the survey period. The highest catch rate (0.03 fish/h) was recorded in 2004, a year after 5,400 juvenile yellow perch were stocked. However, anglers harvested only a few perch in 2004 or 2005.

Black bullhead catch rates were high at Beaver Lake; however, anglers harvested only a small percentage of their catch. Catch rates varied from 0.96 fish/h in 2007 to 1.80 fish/h in 2004. The modest decline in catch rate over the 4-year period coincided with a decline in summer survey trap-net CPUE from 1,105 in 2004 to 190 in 2007. Most black bullheads harvested by anglers ranged in size from 15 to 20 cm. Anglers preferred to harvest larger black bullheads from popular area fisheries like Wall Lake and Lake Herman.

Diamond Lake

Most anglers were targeting walleyes (67%) or were generalists targeting any species (20%). The remainder were targeting yellow perch, northern pike and black bullheads.

Summer fishing pressure varied little in 3 of 4 years (4,077-4,536 h, 39-44 h/ha), but was substantially lower (1,753 h, 17 h/ha) in 2006. Total fishing pressure per hectare over the 4-year period was lower at Diamond (142 h/ha) than Scott Lake (407 h/ha) or Beaver Lake (172 h/ha), but higher than Twin Lake (39 h/ha). Monthly fishing pressure was highest in June and July and likely reflected good catch rates for walleyes during these months. About 63% of fishing was done from shore with little variation by month.

Anglers caught an estimated 6,076 walleyes at Diamond Lake, but harvested only 56 because nearly all were protected under the 61-cm MLL. The highest catch rate was recorded in 2007 when anglers were catching abundant yearling walleye. Summer fish population surveys showed a gradual decline in the abundance of larger walleyes from 2004 through 2007.

Despite considerable stocking effort and the protective harvest regulation, walleye abundance failed to achieve expectations. Additionally, growth of young walleyes slowed and condition declined. For these reasons, the special walleye regulation was removed in 2009 and the lake has since been managed under statewide regulations.

Diamond Lake supported a modest yellow perch fishery during the survey with anglers catching an estimated 1,133 yellow perch and harvesting 370. The highest catch rate was recorded in 2004 (0.18 fish/h) while harvest rate peaked in 2006. The 2006 harvest was most likely helped by the stocking of nearly 1,800 adult fish that year. Harvested perch were 18 to 34 cm long and came from multiple year classes.

Anglers caught an estimated 4,100 black bullheads and harvested about 700. The highest harvest (411) was recorded in 2004 when anglers kept 37% of the bullheads caught. Most bullheads in the 2004 summer survey trap nets exceeded 20 cm in length, and accordingly, anglers harvested fish from 20 cm to 33 cm long. Bullheads in 2007 survey nets also exceeded 20 cm, but few fish were longer than 25 cm, and anglers harvested a lower percentage of their catch.

Scott Lake

Most summer anglers were targeting walleyes (40%) or any species (29%). Summer angling parties also targeted yellow perch (15%) and black bullhead (10%). About 80% of winter angling parties were targeting yellow perch.

Summer fishing pressure varied little in 3 of 4 years (4,631-6,034 h, 39-44 h/ha), but was substantially lower (1,753 h, 17 h/ha) in 2006. Fishing pressure was also lower at Diamond Lake in 2006. Scott Lake (407 h/ha) had higher total fishing pressure per hectare than Beaver Lake (172 h/ha), Diamond Lake (142 h/ha) or Twin Lake (39 h/ha). However, fishing pressure per hectare was lower than for urban fisheries and Lake Alvin.

Winter 2013-14 fishing pressure was estimated at 4,124 hours or 96 h/ha. This pressure was likely created by the stocking of 3,516 adult yellow perch in fall 2013. Winter 2013-14 fishing pressure (96 h/ha) was similar to the average summer pressure

(102 h/ha) for the 2004-07 survey period and represents a much larger contribution to annual fishing pressure than reported elsewhere.

Monthly open-water fishing pressure on Scott Lake was highest in June and July. This was similar to Diamond and Twin lakes, and also reflected good mid-summer catch rates for walleyes. Monthly winter fishing pressure was highest in December and supported by high catch rates for yellow perch. Both winter fishing pressure and angler catch rates of yellow perch steadily declined from December through March.

About 88% of fishing was done from shore on Scott Lake. This was higher than at Beaver, Diamond or Twin lakes. The small size of Scott Lake and good access along the south shore may help explain the higher contribution of shore fishing to total pressure.

Scott Lake provided good walleye fishing in 2007 with a catch rate of 0.33 fish/h and harvest rate of 0.16 fish/h which met the SDGFP objective harvest rate of 0.15 walleyes/h. Anglers harvested about 900 walleyes in 2007 with most measuring between 29 cm and 38 cm long. These fish were likely produced by the 2003 and 2005 fingerling stockings. Only a few walleyes were caught during the winter of 2013-14.

Scott Lake supported a high catch rate for yellow perch in summer 2004 (0.77 fish/h) and winter 2013-14 (1.00 fish/h). In both cases, anglers only harvested a small percentage of their catch because the fish were small. Most perch harvested by summer anglers in 2004 measured less than 20 cm and fish down to 11 cm were witnessed by the clerk. Anglers harvested a greater percentage of their catch in 2007 with most fish measuring between 17 cm and 23 cm. Yellow perch harvested by winter anglers measured 17 to 24 cm long. Both the 2007 summer and 2013-14 winter fisheries were created by aggressive juvenile and adult fish stockings.

Anglers had good fishing for black crappies in 2004 and 2007. Most crappies harvested in 2007 were less than 20 cm long. A previous survey on Lake Alvin also showed that crappies under 20 cm were commonly harvested. Although the harvest of crappies under 20 cm is seldom recorded on large eastern South Dakota lakes, it has been significant at times.

The best fishing for black bullheads on Scott Lake occurred in 2004. The highest harvest (2,792) was recorded in 2004 when anglers kept 43% of the bullheads caught. Anglers also harvested about 700 fish in 2007. Most harvested bullheads in 2004 measured 20 cm to 25 cm long and many were longer than 25 cm in 2007. Harvested bullheads from Wall Lake and Lake Herman were similar in length to Scott Lake implying that 20 cm is the minimum size acceptable to anglers.

Twin Lake

Summer anglers primarily targeted walleye (80%) throughout the survey period while a few targeted yellow perch (11%) and black bullhead (3%). Winter anglers primarily targeted walleye (59%) and yellow perch (35%).

Summer fishing pressure was low (394-657 h, 3-6 h/ha) from 2004 through 2006, then increased in 2007 (2,909 h, 25 h/ha). This was produced by a dramatic increase in walleye catch rates starting in August 2006 and continuing through the summer of 2007. Winter 2013-14 fishing pressure was estimated at 4,507 h or 116 h/ha. The higher fishing pressure in winter relative to summer reflects the success of the trophy walleye regulation at producing a quality catch and release fishery for large fish. Winter fishing pressure per hectare at Twin Lake is higher than on most eastern South Dakota natural lakes and small impoundments and similar to some urban fisheries. A substantial amount of the ice fishing for walleyes is done at night so this survey undoubtedly underestimated fishing pressure and walleye catch.

Monthly summer fishing pressure was highest in June and July and reflected high walleye catch rates. Monthly winter fishing pressure remained relatively constant from December through February and then declined in March as ice conditions deteriorated. Only about 30% of fishing was done from shore, lower than at Scott, Beaver, or Diamond lakes. About 90% of the winter fishing was done from an ice shack.

Walleye catch rates were low through July 2006, dramatically increased in August (3.94 fish/h) and remained high throughout the summer of 2007. Anglers caught an estimated 4,135 walleyes in 2007, but harvested only 33 because nearly all were protected under the 61-cm MLL. Annual fingerling stockings from 2002 through 2006 were most likely responsible for the good walleye fishing.

Winter anglers caught an estimated 405 walleyes and did not harvest any. Winter walleye catch rates were intermediate when compared to large lakes in eastern South Dakota. Summer and winter catch rates of yellow perch were low. In general, winter anglers were satisfied with their fishing with just over half of parties interviewed satisfied and 35% neutral.

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Introduction

Beaver, Diamond, Scott and Twin Lakes are located within 50 km of Sioux Falls which makes them important fisheries with high angler use. Natural reproduction of game fish in these lakes is sporadic and populations are maintained through aggressive stocking.

Overabundant, slow-growing black bullhead *Ameiurus melas* populations have been a serious fisheries management problem in many southeastern South Dakota lakes, including Diamond, Twin, and Beaver Lakes. To address this problem, several measures designed to reduce bullhead populations and increase game fish production in these lakes were implemented. They included the stocking of juvenile and adult walleyes *Sander vitreus* and protecting them under a daily limit of one with a 61-cm minimum length limit (MLL). The restrictive regulation was needed to maintain a high density of large fish so they could prey on small bullheads. We also believed that the opportunity to harvest a large fish would create excitement where none had previously existed. The MLL was removed from Beaver and Diamond lakes in 2009 after it failed to achieve the desired results. It was modified on Twin Lake in 2010 to a daily limit of one with a 71-cm MLL to comply with walleye toolbox regulations (Lucchesi and Blackwell 2009).

The objective of this creel survey was to document angler use, catch and harvest rates, and catch and harvest of fish at these important fisheries. The creel survey was also designed to assess the effects of the MLL on the walleye, yellow perch *Perca flavescens* and black bullhead fisheries. Additionally, documenting high angler use and harvest on lakes close to Sioux Falls is needed to justify intensive management strategies.

Study Sites

Beaver Lake is a 124-ha natural lake located in west-central Minnehaha County (T.102N, R.52W, Sections 14-15) about 1 km southeast of the town of Humboldt, South Dakota. The lake is listed as meandered water in the State of South Dakota Listing of Meandered Lakes. It is shallow, hypereutrophic, and has a moderate coverage of aquatic vegetation. The southwest access area features a concrete boat ramp, boat dock, toilet and gravel parking area. Shore fishing access is limited to the southwest road right-of-way. Primary sport fishes include walleye, yellow perch, black crappie *Pomoxis nigromaculatus*, northern pike *Esox lucius*, and black bullhead. Other species present included common carp *Cyprinus carpio*, white sucker *Catostomus commersoni*, orange-spotted sunfish *Lepomis humilis*, and green sunfish *Lepomis cyanellus*.

Diamond Lake is a shallow, warmwater, semi-permanent, 104-ha natural lake located 21 km north and 3.2 km west of Humboldt in northwestern Minnehaha County (T.104N, R.52W, Section 5). The lake is listed as meandered water in the State of South Dakota Listing of Meandered Lakes. The Diamond Lake Access Area, upgraded in 2005,

consists of a concrete plank boat ramp, small gravel parking area, boat dock and toilet. Shore fishing can be done within the Access Area and along the county road grade on the south end of the lake. Walleye and yellow perch are the primary sport fish. Other species present include black bullhead, white sucker, common carp, black crappie, green sunfish, and orange-spotted sunfish.

Scott Lake is a shallow, warmwater, marginal 43-ha natural lake located 0.7 km north and 3.2 km west of Hartford in west-central Minnehaha County (T.102N, R.51W, Section 7-8). The lake is not listed as meandered public water in the State of South Dakota Listing of Meandered Lakes. Most of the lake lies within a Game Production Area (GPA) owned and managed by the South Dakota Department of Game, Fish, and Parks (GFP). The land under the very west end of the lake is privately owned. A fishing access improvement project, completed in 2012, added a boat ramp, dock, floating fishing pier, and parking on the south end of the lake. Walleye and yellow perch are the primary sport fish. Other species present include black bullhead, northern pike, black crappie, green sunfish, and orange-spotted sunfish.

Twin Lake is a warmwater, permanent, 116-ha natural lake located 9.7 km north and 1.6 km west of Humboldt in northwestern Minnehaha County (T.105N, R.52W, Section 16-17). The lake is not listed as meandered public water in the State of South Dakota Listing of Meandered Lakes; however, GFP manages the fishery. The lake has excellent water clarity and supports abundant beds of sago pondweed *Potamogen pectinatus*, clasping leaf pondweed *Potamogen richardsonii*, northern water milfoil *Myriophyllum exalbescens*, water buttercup *Ranunculus longirostris*, and coontail *Ceratophyllum demersum*. Common cattail *Typha spp.* and bulrush *Scirpus spp.* are common in shallow areas.

The Twin Lakes Fishing Access Area, located on the west side of the south lake, features a boat ramp, boat dock, concrete vault toilet and parking for about 15 vehicle-trailer rigs. There are also several areas to shore fish located east of the boat ramp. A navigation channel connecting the north and south lakes was constructed in the winter of 2010-11. Walleye and yellow perch are the primary sport fish. Other species present include black bullhead, common carp, bluegill, and green sunfish.

Methods

A stratified, access-point angler use and harvest survey was conducted from May 2004 through August 2007 and December 2013 through March 2014. An access-based survey design was selected due to the relatively small size of these waters and to maximize response rates and completed trip interviews while minimizing recall bias

(Malvestuto 1996; Greiner 2011) The close proximity of the study lakes permitted the surveying of four waters (2-h shift each) within an 8-h day for the open-water survey. Two lakes (3-h shift each) were surveyed within a 6-h day during the winter.

Within each 2-h shift during the open-water survey, three instantaneous counts of boat and shore anglers were made from various access points around the lake. Counts were made at the time of arrival, one hour into the shift, and just prior to leaving the location. Similar hourly counts of open-ice anglers and fishing shacks were made during the winter survey. To estimate total hours for anglers fishing in a boat or ice shack, these counts were expanded by the mean number of anglers per boat or shack estimated from angler interviews.

Survey days were stratified by weekend days and weekdays because fishing pressure is usually highest on weekend days. At least one weekend day was assigned each week. Eight- and six-hour shifts were divided between morning and evening periods to cover all daylight hours.

Interviews were conducted on a party basis. All lone anglers were interviewed and one representative from a party larger than one was interviewed. Catch-related information collected during interviews included the number of each species caught and whether they were released or harvested. Harvested fish were measured to the nearest mm. Angler trip information collected included time of interview, approximate time spent fishing, complete or incomplete trip, type of fishing (boat, shore, shack or open-ice), species targeted, party size, and zip code of residence. Anglers were also asked their opinions on various regulations, reasons for choosing to fish a lake and level of trip satisfaction. Angler use, catch and harvest estimates, and other statistics were computed using the Creel Application Software (CAS) designed by Craig Soupir (Soupir and Brown 2002).

Results and Discussion

Beaver Lake

Fishing Pressure

Most anglers were targeting black crappies (35%), walleyes (34%) or any species (27%, Table 1). The percentage of anglers targeting walleyes decreased from 59% in 2004 to 17% in 2007 (Table 1) while the percentage targeting black crappie increased (31-43%). The decline in walleye anglers coincided with a decline in gill-net CPUE for larger walleyes in 2006 and 2007. The percentage of crappie anglers increased as a large year class was recruited to the fishery. A small percentage of angling parties were targeting yellow perch and black bullheads.

Table 1. Percent of angling parties interviewed primarily targeting a species (or any species) totaled by month, over the summer and over the survey period on Beaver Lake, 2004-2007.

		Percent of anglers targeting				
Year	*Month*	*Walleye*	*Yellow perch*	*Black crappie*	*Black bullhead*	*Any species*
2004	May	31	6	38	13	12
	June	70	0	30	0	0
	July	71	10	19	0	0
	August	54	0	46	0	0
	Total	59	4	31	3	3
2005	May	52	0	16	3	29
	June	38	4	26	0	32
	July	40	2	23	0	35
	August	49	5	23	2	21
	Total	45	3	22	1	29
2006	May	20	0	54	5	21
	June	14	0	53	7	26
	July	8	0	50	0	42
	August	25	0	38	0	37
	Total	16	0	52	5	27
2007	May	10	0	52	0	38
	June	22	0	48	0	30
	July	5	0	18	6	71
	August	50	0	20	0	20
	Total	17	0	43	1	39
Overall	May	30	1	39	4	27
	June	32	2	38	2	26
	July	33	3	28	1	35
	August	47	3	29	1	19
	Total	34	2	35	2	27

Summer fishing pressure varied from 2,586 h (21 h/ha) in 2004 to 9,110 h (73 h/ha) in 2005 (Tables 2 and 3). High catch rates for walleye and black crappie (Table 4) were responsible for the high fishing pressure in 2005. Total fishing pressure per hectare over the 4-year period was higher at Beaver Lake (172 h/ha) than Diamond (142 h/ha) or Twin lakes (39 h/ha), but lower than Scott Lake (407 h/ha). Fishing pressure per hectare was also lower than those documented in urban fisheries (Lucchesi 2013a, 2013b) and other Sioux Falls area lakes (Alvin and Wall, Lucchesi et al. 2015) and similar to many popular large-lake fisheries (Lucchesi 2009).

Monthly fishing pressure was highest in May and steadily declined through the summer (Figure 1). About 78% of fishing was done from shore and varied little by month (Figure 1). Shore fishing as a percentage of total pressure was similar to Lake Alvin,

Table 2. Open-water totals for the number of interviews and estimates for fishing pressure and fishing pressure per surface hectare of water, angler days and percent of interviewed parties that were South Dakota (SD) residents from creel surveys conducted on Beaver Lake, May through August, 2004-2007 (80% confidence interval).

Year	*Number of interviews*	*Angler hours*	*Angler hours/ hectare*	*Angler days*	*% SD residents*
2004	70	2,586 (575)	21 (5)	1,469	100
2005	218	9,110 (1,670)	73 (13)	3,629	99
2006	139	5,187 (1,198)	42 (10)	2,981	100
2007	112	4,245 (974)	34 (8)	1,799	98

Table 3. Monthly and total (May through August) number of angler interviews (# Int), estimated fishing pressure (angler hours), estimated angler days, estimated trip length (hours), average party size, percent of interviewed parties that were South Dakota (SD) residents, percent of angling activity done by boat and percent of angling activity that occurred during weekends/holidays on Beaver Lake, South Dakota (80% confidence interval).

Year	*Month*	*# Int*	*Angler hours*	*Angler days*	*Trip Length (h)*	*Party size*	*% SD residents*	*% boat anglers*	*% weekends or holidays*
2004	May	16	700 (382)	398	1.76 (0.17)	2.30 (0.79)	100	60	77
	June	20	564 (262)	252	2.24 (0.29)	1.77 (0.18)	100	15	67
	July	21	679 (262)	635	1.07 (0.23)	2.53 (0.57)	100	19	76
	August	13	643 (217)	323	1.99 (--)	2.35 (--)	100	46	80
	Total	70	2,586 (575)	1,469	1.76 (0.10)	2.24 (0.25)	100	23	75
2005	May	67	2,816 (1,091)	1,482	1.90 (0.44)	2.15 (0.84)	99	13	74
	June	68	3,391 (1,094)	1,431	2.37 (0.13)	2.39 (2.04)	99	13	48
	July	44	1,647 (463)	580	2.84 (--)	1.79 (0.62)	100	39	51
	August	39	1,256 (433)	430	2.92 (0.57)	2.41 (1.10)	100	33	51
	Total	218	9,110 (1,670)	3,629	2.51 (0.18)	2.19 (0.67)	99	22	57
2006	May	62	2,240 (1,036)	1,806	1.24 (0.08)	2.16 (0.76)	100	5	34
	June	44	1,381 (398)	712	1.94 (0.26)	2.17 (0.74)	100	11	56
	July	25	1,245 (433)	556	2.24 (--)	2.36 (0.55)	100	8	31
	August	8	321 (127)	204	1.57 (--)	2.37 (--)	100	38	64
	Total	139	5,187 (1,198)	2,981	1.74 (0.07)	2.27 (0.30)	100	9	41
2007	May	47	1,978 (632)	673	2.94 (0.54)	2.00 (0.52)	96	27	59
	June	40	1,427 (672)	597	2.39 (0.44)	2.24 (1.16)	100	35	30
	July	17	678 (284)	346	1.96 (0.33)	2.17 (0.60)	100	63	33
	August	8	162 (129)	78	2.08 (--)	1.88 (--)	100	0	9
	Total	112	4,245 (974)	1,799	2.36 (0.21)	2.07 (0.35)	98	35	43

Table 4. Estimated open-water angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) by year for orange-spotted sunfish, black crappie, yellow perch and walleye at Beaver Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Orange-spotted sunfish		***Black crappie***		***Yellow perch***		***Walleye***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0.002 (--)	0	0.17 (0.07)	0.01 (0.01)	0.03 (0.03)	0.01 (0.01)	0.48 (0.34)	0.004 (0.01)
2005	0.02 (0.01)	0	0.39 (0.41)	0.08 (0.07)	0.003 (0.01)	0.003 (0.01)	0.31 (0.20)	0
2006	0	0	1.06 (1.16)	0.74 (0.86)	0.005 (0.01)	0.005 (0.01)	0.12 (0.10)	0
2007	0.005 (0.01)	0	0.31 (0.22)	0.21 (0.19)	0.005 (0.01)	0	0.46 (0.27)	0

higher than on urban lakes (Lucchesi et al. 2013a, Lucchesi et al. 2013b) and lower than on most large lakes (< 52%, Lucchesi 2012b).

Mean trip length at Beaver Lake was 2.09 hours, similar to that at Diamond Lake (2.56 h) and Wall Lake (2.39 h, Lucchesi et al. 2015), but longer than Scott Lake (1.74 h). Mean trip length was substantially shorter than on larger waters like the Madison lakes (Lucchesi 2011, 2012a, 2012b) and Lake Thompson (Lucchesi 2009).

Mean party size on Lake Alvin was 2.19 anglers and about 99% were residents of South Dakota. The percentage of local anglers was similar to urban fisheries (Lucchesi et al. 2013a, 2013b) and much higher than that on larger waters (Lucchesi 2009, 2011, 2012a, 2012b).

Angler Catch and Harvest

Walleye

Over the 4-year survey period, anglers caught an estimated 6,656 walleyes on Beaver Lake, but harvested only nine (Tables 4 and 5) because nearly all were protected under the 61-cm MLL. Catch rates exceeded 0.3 fish/h in 3 of 4 years, similar to those for popular large lake walleye fisheries (Lucchesi 2009). Walleye catch rates declined in July of 2006 which coincided with a significant decline in lake survey gill net catches that same year. A moderate summer kill of small (10-15 cm) walleyes was reported on July 5, 2006 so it is possible that larger fish were lost as well. Larger walleyes were absent in the 2007 survey, too.

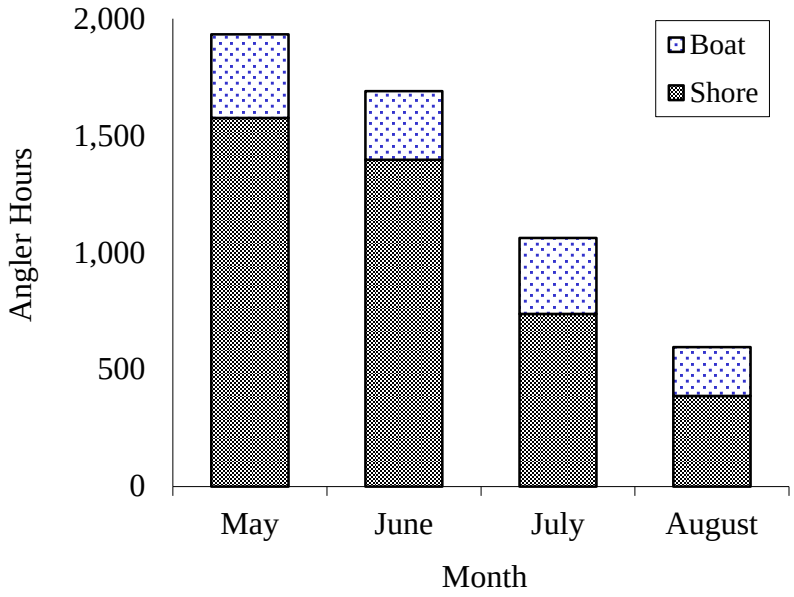

Figure 1. Mean monthly summer fishing pressure by boat and shore anglers on Beaver Lake, 2004-2007.

Table 5. Estimated open-water angler catch (C) and harvest (H) by year for orange-spotted sunfish, black crappie, yellow perch and walleye at Beaver Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Orange-spotted sunfish		***Black crappie***		***Yellow perch***		***Walleye***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	4 (--)	0	445 (138)	24 (25)	813 (68)	18 (35)	1,236 (561)	9 (18)
2005	138 (96)	0	3,531 (2,050)	683 (368)	29 (26)	29 (26)	2,824 (1,266)	0
2006	0	0	5,476 (4,147)	3,842 (3,387)	25 (19)	16 (13)	639 (365)	0
2007	21 (24)	0	1,319 (748)	876 (698)	2 (4)	0	1,957 (753)	0

The special walleye regulation was removed in 2009 and the lake has since been managed under statewide regulations. Several factors influenced the decision to remove the regulation. First, even though anglers did not harvest many walleyes, the larger fish common in 2004 and 2005 fish population survey net catches were absent from the 2006 and 2007 surveys. Moreover, walleye gill net CPUE remained well below the objective of

15 fish per net in spite of aggressive stocking (Table 6) and protection of fish under the special regulation. Beaver Lake also suffered a severe fish kill during the winter of 2007-2008. Therefore, since the regulation failed to achieve the intended objectives of increased large walleye abundance, reduced bullhead abundance and increased panfish production, it was removed.

Black Crappie

A large year class of black crappies, naturally produced in 2001, supported a good fishery during the survey period (Tables 4 and 5). This year class was fully recruited to the fishery at age-5 (2006). Catch and harvest rates rose to 1.06 fish/h and 0.74 fish/h, respectively, and harvest was an estimated 3,842 fish (Table 5). Catch and harvest rates declined to 0.31 fish/h and 0.21 fish/h, respectively in 2007, and fewer than 900 fish were harvested.

Most anglers appeared to be willing to harvest black crappies at 18 cm (Figures 2 and 3). They released a high percentage of their catch in 2004 and 2005 because the majority of fish were too small. The mean length of black crappies in survey trap nets and the angler harvest was 20 cm in 2006 indicating that anglers were harvesting what was available rather than selecting for larger fish. In 2007, mean lengths increased to 21 cm for fish captured in trap nets (Figure 3) and 21.5 cm for angler-harvested fish (Figure 2).

The size of harvested black crappies at Beaver Lake was similar to Lake Alvin (Lucchesi et al. 2015). The mean size of crappies harvested at Lake Alvin during years of no MLL was about 20 cm with anglers harvesting fish as small as 17 cm. At Wall Lake, although harvested crappies were often larger than 20 cm, in 2001 anglers kept 15 to 20 cm fish when larger fish were unavailable (Lucchesi et al. 2015). Similarly, anglers usually harvest larger crappies on large eastern South Dakota lakes, but at times, the harvest of fish under 20 cm has been significant (Lucchesi 2011, 2012).

Yellow Perch

Yellow perch catch and harvest rates on Beaver Lake were low during the survey period (Table 4). In 2004, a year after 5,400 juvenile yellow perch were stocked (Table 6), the highest catch rate (0.03 fish/h) was recorded. However, only a few perch were harvested in 2004 and 2005 (Table 5). Since the completion of this survey, the lake has provided good yellow perch fishing at times.

Black Bullhead

Although black bullhead catch rates were high at Beaver Lake (Table 7), anglers harvested few fish (Table 8). Catch rates varied from 0.96 fish/h in 2007 to 1.80 fish/h in

Table 6. Stocking record for Beaver Lake, Minnehaha County, 1998-2007.

Year	Number	Species	Size
1998	33,000	walleye	Fingerling
	133	walleye	Large Fingerling
	73	walleye	Adult
1999	30,000	walleye	Fingerling
2002	28,400	walleye	Fingerling
2003	300,000	walleye	Fry
	3,056	walleye	Large Fingerling
	5,412	yellow perch	Fingerling
2004	126	walleye	Juvenile
	1,730	Walleye	Adult
2005	20,460	fathead minnow	Adult
	10,240	walleye	Large Fingerling
2006	30,250	walleye	Fingerling
	6,666	walleye	Large Fingerling
	310	walleye	Juvenile
	24,700	fathead minnow	Adult
2007	825	walleye	Large Fingerling

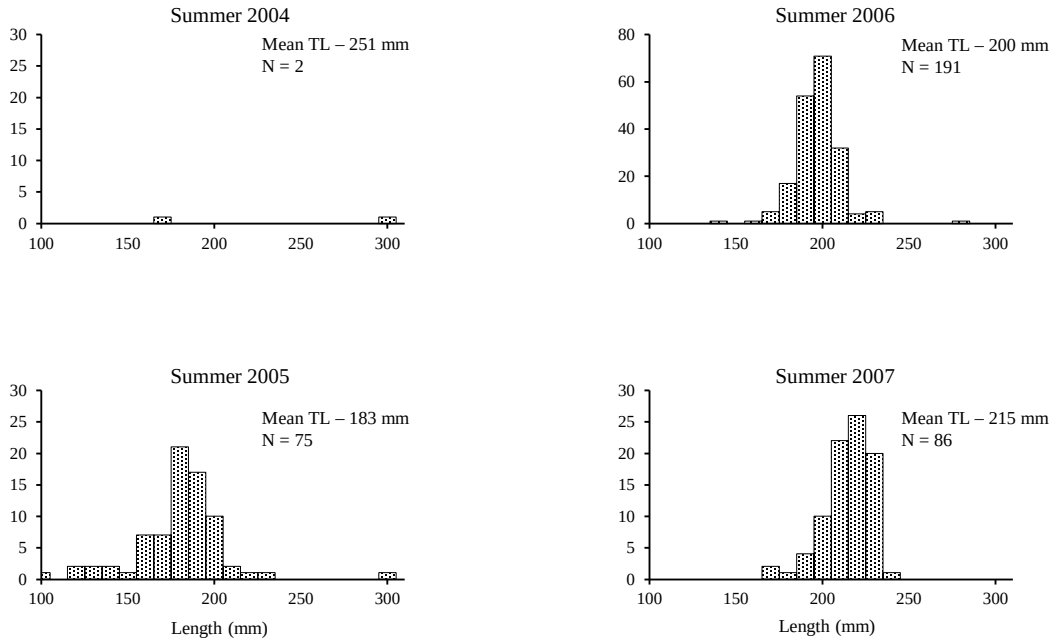

Figure 2. Length frequency of angler-harvested black crappie measured by the creel clerk during open-water creel surveys on Beaver Lake, 2004-2007.

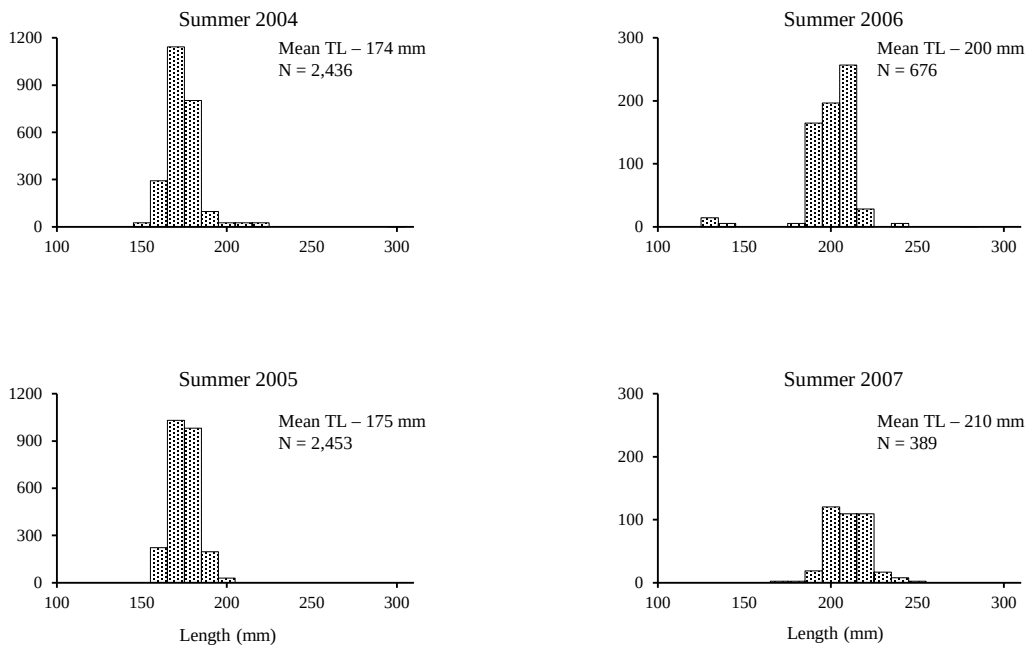

Figure 3. Length frequency of black crappie caught in trap nets during summer lake surveys on Beaver Lake, 2004-2007.

Table 7. Estimated open-water angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) by year for common carp, black bullhead, northern pike and green sunfish at Beaver Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Common carp		***Black bullhead***		***Northern pike***		***Green sunfish***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0.09 (0.06)	0.02 (0.03)	1.80 (0.86)	0.08 (0.12)	0	0	0	0
2005	0.01 (0.01)	0	1.26 (0.67)	0.02 (0.05)	0.004 (0.01)	0	0	0
2006	0.003 (0.01)	0.002 (0.01)	1.23 (0.72)	0.15 (0.13)	0.005 (0.01)	0.005 (0.01)	0.002 (0.01)	0
2007	0.01 (0.01)	0	0.96 (0.82)	0.02 (0.01)	0.002 (0.01)	0	0.01 (0.03)	0

Table 8. Estimated open-water angler catch (C) and harvest (H) by year for common carp, black bullhead, northern pike and green sunfish at Beaver Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Common carp		***Black bullhead***		***Northern pike***		***Green sunfish***	
Year	C	H	C	H	C	H	C	H
2004	233 (100)	58 (66)	4,650 (1,361)	216 (258)	0	0	0	0
2005	82 (43)	0	11,447 (2,085)	180 (146)	40 (38)	0	0	0
2006	15 (23)	8 (11)	6,360 (2,062)	770 (498)	24 (24)	13 (18)	81 (10)	0
2007	42 (214)	0	4,054 (1,360)	69 (57)	8 (8)	0	603 (133)	0

2004. This decline coincided with a decline in summer survey trap net CPUE from 1,105 in 2004 to 190 in 2007.

Most black bullheads harvested by anglers ranged in size from 15 to 20 cm (Figure 4). Length frequencies from summer survey trap net catches suggest that anglers kept only the largest bullheads in 2004 and 2005. In 2006 and 2007, the similar sizes of angler-harvested and trap-net caught bullheads indicated that anglers harvested what was available rather than selecting larger fish. Anglers harvested larger black bullheads from Wall Lake (Lucchesi et al. 2015) and Lake Herman (Lucchesi 2012b).

Diamond Lake

Fishing Pressure

On Diamond Lake during the survey period, most anglers were targeting walleyes (67%) or any species (20%, Table 9). The remainder were targeting yellow perch, northern pike and black bullheads.

Summer fishing pressure varied little in 3 of 4 years (4,077-4,536 h, 39-44 h/ha), but was substantially lower (1,753 h, 17 h/ha) in 2006 (Tables 10 and 11). Total fishing pressure per hectare over the 4-year period was lower at Diamond (142 h/ha) than Scott Lake (407 h/ha) or Beaver Lake (172 h/ha), but higher than Twin Lake (39 h/ha). Fishing pressure per hectare was lower than for urban fisheries (Lucchesi 2013a, 2013b) and other Sioux Falls area lakes (Alvin and Wall, Lucchesi et al. 2015) and similar to many popular large-lake fisheries (Lucchesi 2009).

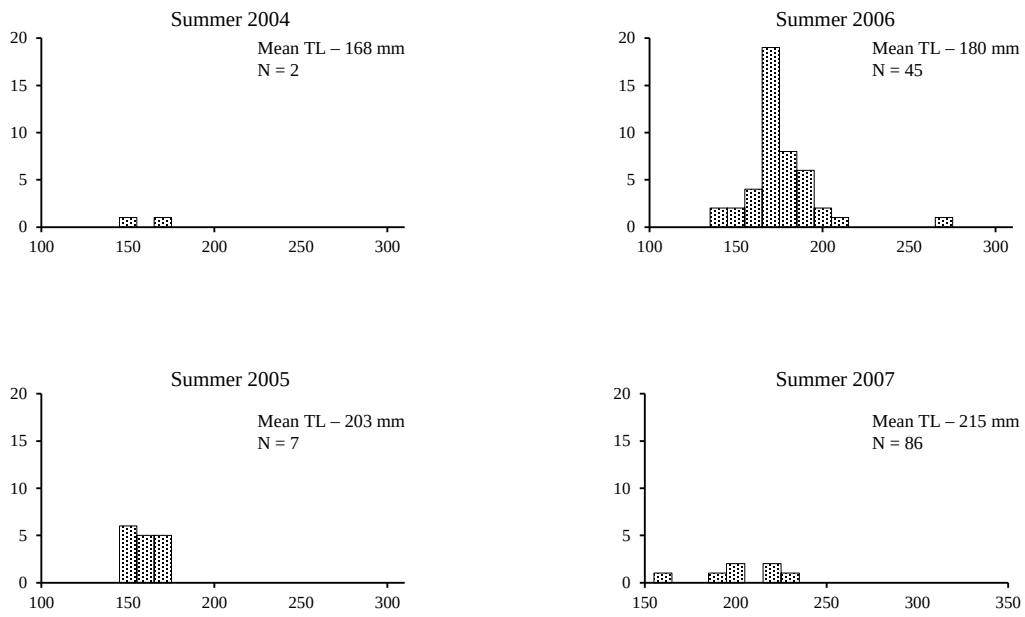

Figure 4. Length frequency of angler-harvested black bullhead measured by the creel clerk during open-water creel surveys on Beaver Lake, 2004-2007.

Although May is often the month of highest fishing pressure on many eastern South Dakota lakes including waters near Sioux Falls (Lucchesi et al. 2015) and Lake Herman (Lucchesi 2012b), it was highest in June and July on Diamond (Figure 5). Fishing pressure typically decreases by July as catch rates slow and interest declines. However, peak monthly fishing pressure occurred in June and July at Family Park Lake (Lucchesi 2013a) and Scott and Twin lakes (this report). Good mid-summer catch rates for walleye on Diamond and Scott lakes may help to explain their unique patterns of monthly pressure.

On Diamond Lake, about 63% of fishing was done from shore and this varied little by month (Figure 5). In comparison, shore fishing as a percentage of total pressure was higher on Lake Alvin and urban lakes (Lucchesi et al. 2013a, Lucchesi et al. 2013b) and lower on most large lakes (< 52%, Lucchesi 2012b). Mean trip length at Diamond Lake was 2.56 hours, similar to Beaver Lake (2.09 h) and Wall Lake (2.39 h, Lucchesi et al. 2015), but longer than Scott Lake (1.74 h). Mean trip length was substantially shorter than that on larger waters like the Madison lakes (Lucchesi 2011, 2012a, 2012b) and Lake Thompson (Lucchesi 2009).

Table 9. Percent of angling parties interviewed primarily targeting a species (or any species) totaled by month, over the summer and over the survey period on Diamond Lake, 2004-2007.

		Percent of anglers targeting				
Year	*Month*	*Walleye*	*Yellow perch*	*Northern pike*	*Black bullhead*	*Any species*
2004	May	71	0	0	14	15
	June	77	23	0	0	0
	July	91	9	0	0	0
	August	75	25	0	0	0
	Total	84	14	0	1	1
2005	May	53	6	24	0	17
	June	78	0	0	0	22
	July	72	4	0	0	24
	August	47	18	0	0	35
	Total	67	5	4	0	24
2006	May	22	11	0	11	56
	June	48	15	0	4	33
	July	40	20	0	0	40
	August	14	29	0	0	57
	Total	38	17	0	4	41
2007	May	55	0	0	0	45
	June	84	10	0	0	6
	July	74	6	0	0	20
	August	36	46	0	0	18
	Total	69	10	0	0	21
Overall	May	50	4	8	4	34
	June	72	10	0	1	18
	July	77	8	0	0	15
	August	51	28	0	0	22
	Total	67	11	1	1	20

Table 10. Open-water totals for the number of interviews and estimates for fishing pressure and fishing pressure per surface hectare of water, angler days and percent of interviewed parties that were South Dakota (SD) residents from creel surveys conducted on Diamond Lake, May through August, 2004-2007 (80% confidence interval).

Year	*Number of interviews*	*Angler hours*	*Angler hours/ hectare*	*Angler days*	*% SD residents*
2004	86	4,077 (710)	39 (7)	1,411	99
2005	98	4,354 (799)	42 (8)	1,601	99
2006	56	1,753 (438)	17 (4)	724	100
2007	96	4,536 (1,116)	44 (11)	2,034	99

Table 11. Monthly and total (May through August) number of angler interviews (# Int), estimated fishing pressure (angler hours), estimated angler days, estimated trip length (hours), average party size, percent of interviewed parties that were South Dakota (SD) residents, percent of angling activity done by boat and percent of angling activity that occurred during weekends/holidays on Diamond Lake, South Dakota (80% confidence interval).

Year	*Month*	*# Int*	*Angler hours*	*Angler days*	*Trip Length (h)*	*Party size*	*% SD residents*	*% boat anglers*	*% weekends or holidays*
2004	May	7	342 (231)	132	2.60 (--)	2.24 (1.17)	100	29	61
	June	13	831 (244)	222	3.74 (0.91)	2.09 (0.16)	100	23	26
	July	46	2,077 (556)	731	2.84 (0.71)	2.21 (1.68)	100	50	76
	August	20	828 (287)	345	2.40 (0.31)	1.79 (0.87)	99	45	65
	Total	86	4,077 (710)	1,411	2.89 (0.30)	2.08 (0.56)	99	43	62
2005	May	17	947 (421)	449	2.11 (0.10)	1.99 (0.54)	100	12	67
	June	35	1,956 (578)	677	2.89 (1.59)	2.26 (0.91)	97	31	59
	July	29	771 (206)	207	3.73 (0.67)	1.64 (1.12)	100	52	51
	August	17	680 (290)	316	2.15 (0.47)	2.42 (1.44)	100	41	61
	Total	98	4,354 (799)	1,601	2.72 (0.44)	2.08 (0.53)	99	36	60
2006	May	10	364 (229)	150	--	2.19 (--)	100	10	50
	June	28	622 (193)	252	2.47 (0.44)	1.60 (0.26)	100	39	48
	July	11	532 (292)	224	2.37 (--)	1.92 (--)	100	9	86
	August	7	235 (130)	97	--	1.43 (--)	100	0	31
	Total	56	1,753 (438)	724	2.42 (0.28)	1.81 (0.07)	100	23	57
2007	May	20	972 (592)	450	2.16 (--)	2.64 (0.62)	95	43	63
	June	31	1,708 (566)	1,029	1.66 (--)	2.23 (1.20)	100	40	50
	July	34	1,548 (742)	640	2.42 (--)	2.80 (1.94)	100	47	50
	August	11	308 (151)	103	3.00 (--)	1.85 (0.14)	100	42	36
	Total	96	4,536 (1,116)	2,034	2.23 (--)	2.38 (0.59)	99	43	52

Angler Catch and Harvest

Walleye

Over the 4-year survey period, anglers caught an estimated 6,076 walleyes at Diamond Lake, but harvested only 56 (Table 12) because nearly all were protected under a 61-cm MLL special regulation. The highest catch rate was recorded in 2007 when anglers were catching abundant yearling walleye (Table 13). Summer fish population surveys showed a gradual decline in the abundance of larger walleyes from 2004 through 2007.

The special walleye regulation was removed in 2009 and the lake has since been managed under statewide regulations. Despite considerable stocking effort and the protective harvest regulation, walleye abundance failed to achieve expectations. Additionally, growth of young walleyes slowed and condition declined providing additional reasons to remove the special regulation.

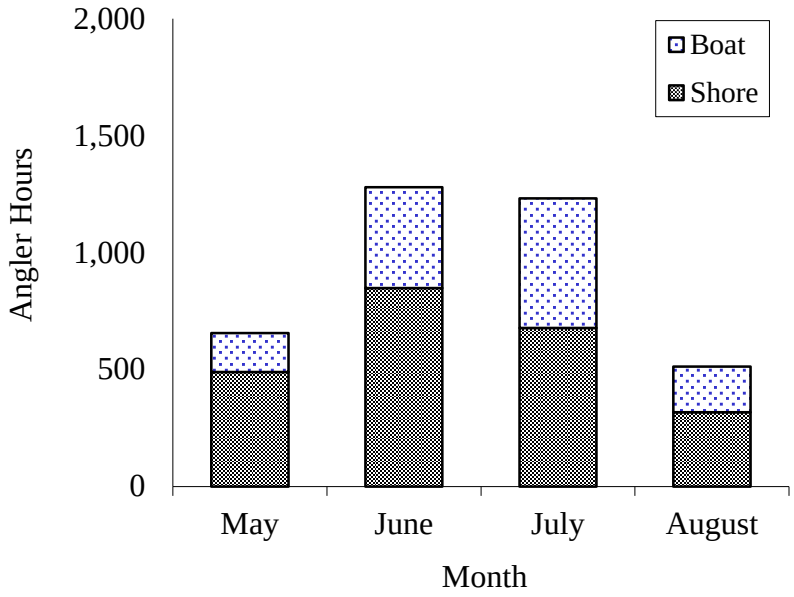

Figure 5. Mean monthly summer fishing pressure by boat and shore anglers on Diamond Lake, 2004-2007.

Table 12. Estimated open-water angler catch (C) and harvest (H) by year for orange-spotted sunfish, black crappie, yellow perch and walleye at Diamond Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Orange-spotted sunfish		***Black crappie***		***Yellow perch***		***Walleye***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0	0	0	0	714 (130)	95 (25)	1,436 (521)	56 (45)
2005	0	0	0	0	126 (58)	68 (38)	437 (495)	0
2006	0	0	12 (--)	0	184 (97)	132 (86)	71 (30)	0
2007	0	0	0	0	109 (64)	75 (63)	4,132 (1,548)	0

Table 13. Estimated open-water angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) by year for orange-spotted sunfish, black crappie, yellow perch and walleye at Diamond Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Orange-spotted sunfish		***Black crappie***		***Yellow perch***		***Walleye***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0	0	0	0	0.18 (0.09)	0.02 (0.01)	0.35 (0.22)	0.01 (0.01)
2005	0	0	0	0	0.03 (0.01)	0.02 (0.01)	0.10 (0.14)	0
2006	0	0	0.01 (--)	0	0.11 (0.10)	0.08 (0.10)	0.04 (0.02)	0
2007	0	0	0	0	0.02 (--)	0.02 (--)	0.91 (0.82)	0

Yellow Perch

Diamond Lake supported a modest yellow perch fishery during the survey with anglers catching an estimated 1,133 yellow perch and harvesting 370 (Table 12). The highest catch rate was recorded in 2004 (0.18 fish/h) while harvest rate peaked in 2006 (Table 13). The 2006 harvest was likely helped by the stocking of nearly 1,800 adult fish that year (Table 14). Harvested perch varied from 18 to 34 cm long representing multiple year classes.

Black Bullhead

Anglers caught an estimated 4,100 black bullheads and harvested about 700 (Tables 15 and 16). The highest harvest (411 fish) was recorded in 2004 when anglers kept 37% of the bullheads caught. Most bullheads in the 2004 summer survey trap nets exceeded 20 cm in length, and accordingly, anglers harvested fish from 20 cm to 33 cm. Bullheads sampled during the 2007 netting survey also exceeded 20 cm, but few fish were longer than 25 cm, and subsequently, anglers harvested a lower percentage of their catch (Table 15).

Scott Lake

Fishing Pressure

Most summer anglers at Scott Lake were targeting walleyes (40%) or any species (29%, Table 17). Yellow perch (15%) and black bullhead (10%) were also targeted. About 80% of winter angling parties targeted yellow perch.

Table 14. Stocking record for Diamond Lake, Minnehaha County, 1998-2007.

Year	Number	Species	Size
1998	27,700	Walleye	Fingerling
1999	25,600	Walleye	Fingerling
2000	27,000	Walleye	Fingerling
2001	25,600	Walleye	Fingerling
2002	263	Walleye	Adult
2003	149	Walleye	Adult
	51,200	Walleye	Fingerling
2005	24	Walleye	Adult
	8,320	Walleye	Fingerling
2006	25,680	Walleye	Fingerling
	1,771	Yellow perch	Adult
	1,107	Yellow perch	Juvenile
	6,645	Walleye	Large Fingerling
2007	2,232	Walleye	Large Fingerling
	476	Yellow perch	Adult

Table 15. Estimated open-water angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) by year for common carp, black bullhead, northern pike and green sunfish at Diamond Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Common carp		***Black bullhead***		***Northern pike***		***Green sunfish***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0.02 (0.04)	0	0.27 (0.14)	0.10 (0.10)	0.05 (0.04)	0.002 (0.01)	0	0
2005	0.02 (0.01)	0.02 (0.01)	0.16 (0.16)	0	0.02 (0.02)	0	0	0
2006	0.01 (0.01)	0.002 (0.01)	0.32 (0.24)	0.08 (0.06)	0	0	0	0
2007	0.02 (0.02)	0.005 (0.01)	0.39 (0.33)	0.03 (0.03)	0	0	0.003 (0.01)	0

Summer fishing pressure varied little (4,631-6,034 h, 39-44 h/ha), except for 2006 when it was substantially lower (1,753 h, 17 h/ha, Tables 18 and 19). Pressure was also lower at Diamond Lake in 2006 (Table 10). Scott Lake (407 h/ha) had higher fishing pressure per hectare over the survey period than Beaver Lake (172 h/ha), Diamond Lake (142 h/ha) or Twin Lake (39 h/ha). However, fishing pressure per hectare was lower than for urban fisheries (Lucchesi 2013a, 2013b) and Lake Alvin (Lucchesi et al. 2015).

Table 16. Estimated open-water angler catch (C) and harvest (H) by year for common carp, black bullhead, northern pike and green sunfish at Diamond Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Common carp		***Black bullhead***		***Northern pike***		***Green sunfish***	
Year	C	H	C	H	C	H	C	H
2004	71 (51)	0	1,085 (352)	411 (390)	195 (167)	68 (9)	0	0
2005	88 (60)	7 (7)	709 (363)	0	72 (45)	0	0	0
2006	21 (10)	4 (4)	553 (216)	134 (81)	0	0	0	0
2007	113 (48)	22 (0)	1,752 (510)	150 (164)	0	0	0	0

Table 17. Percent of angling parties interviewed primarily targeting a species (or any species) totaled by month, over the summer and over the survey period on Scott Lake, 2004-2007.

		Percent of anglers targeting					
Year	*Month*	*Walleye*	*Yellow Perch*	*Black Crappie*	*Sunfish*	*Black Bullhead*	*Any species*
2004	May	56	16	12	0	2	14
	June	55	7	30	0	4	4
	July	37	41	7	4	8	7
	August	11	83	6	0	0	0
	Total	47	26	17	1	3	6
2005	May	51	9	2	0	2	36
	June	50	15	12	0	3	20
	July	22	11	11	0	0	56
	August	29	14	0	0	0	57
	Total	47	11	5	0	2	34
2006	May	39	9	6	3	6	37
	June	0	11	33	33	0	22
	July	33	0	0	0	0	67
	August	25	0	0	0	25	50
	Total	31	8	10	8	6	37
2007	May	19	10	24	0	3	44
	June	36	10	10	0	3	41
	July	27	7	7	0	0	59
	August	42	17	0	0	0	41
	Total	27	10	15	0	2	46
Overall	May	42	11	11	0	3	33
	June	44	10	20	2	3	20
	July	32	23	7	2	4	32
	August	25	44	3	0	2	27
	Total	40	15	12	1	3	29

Table 18. Open-water totals for the number of interviews and estimates for fishing pressure and fishing pressure per surface hectare of water, angler days and percent of interviewed parties that were South Dakota (SD) residents from creel surveys conducted on Scott Lake, May through August, 2004-2007 (80% confidence interval).

Year	*Number of interviews*	*Angler hours*	*Angler hours/ hectare*	*Angler days*	*% SD residents*
2004	148	6,034 (1,001)	140 (23)	3,468	99
2005	131	4,631 (976)	108 (23)	2,616	96
2006	50	1,174 (300)	27 (7)	821	99
2007	125	5,660 (1,246)	132 (29)	2,775	100

Table 19. Monthly and total (May through August) number of angler interviews (# Int), estimated fishing pressure (angler hours), estimated angler days, estimated trip length (hours), average party size, percent of interviewed parties that were South Dakota (SD) residents, percent of angling activity done by boat and percent of angling activity that occurred during weekends/holidays on Scott Lake, South Dakota (80% confidence interval).

Year	*Month*	*# Int*	*Angler hours*	*Angler days*	*Trip Length (h)*	*Party size*	*% SD residents*	*% boat anglers*	*% weekends or holidays*
2004	May	50	2,487 (685)	2,163	1.15 (--)	1.99 (--)	98	0	67
	June	53	1,969 (540)	1,026	1.92 (0.21)	2.08 (0.37)	100	4	53
	July	27	869 (419)	494	1.76 (0.19)	2.25 (0.27)	96	7	31
	August	18	709 (255)	334	2.12 (0.67)	2.07 (0.21)	100	6	71
	Total	148	6,034 (1001)	3,468	1.74 (0.18)	2.10 (0.13)	99	3	58
2005	May	81	2,901 (860)	1,170	2.48 (0.73)	2.05 (0.31)	96	1	61
	June	34	941 (330)	653	1.44 (--)	1.78 (0.43)	94	9	47
	July	9	610 (296)	--	--	2.35 (--)	100	0	23
	August	7	179 (130)	130	1.38 (--)	2.00 (--)	100	29	100
	Total	131	4,631 (976)	2,616	1.77 (0.25)	2.05 (0.13)	96	5	55
2006	May	33	606 (184)	367	1.65 (0.46)	2.16 (0.64)	97	12	95
	June	10	200 (106)	308	0.65 (0.06)	1.72 (0.00)	100	10	39
	July	3	96 (83)	42	2.26 (--)	2.00 (--)	100	33	0
	August	4	272 (194)	190	--	2.09 (--)	100	0	74
	Total	50	1,174 (300)	821	1.43 (0.18)	1.99 (0.16)	99	12	72
2007	May	59	2,547 (990)	1,572	1.62 (0.27)	2.20 (0.33)	100	24	52
	June	39	1,803 (633)	538	3.35 (1.33)	2.16 (0.50)	100	2	42
	July	15	786 (346)	624	1.26 (--)	2.90 (0.55)	100	38	25
	August	12	524 (228)	267	1.96 (--)	2.00 (--)	100	22	36
	Total	125	5,660 (1,246)	2,775	2.04 (0.33)	2.35 (0.44)	100	19	44

Winter 2013-14 fishing pressure was estimated at 4,124 hours and 96 h/ha (Table 20). The high fishing pressure was created by the stocking of 3,516 adult yellow perch (Table 21). Winter 2013-14 fishing pressure (96 h/ha) was similar to the average summer pressure (102 h/ha) for the 2004-07 survey period and represents a much larger contribution to annual fishing pressure than reported elsewhere. For example, winter fishing pressure was only 10% of total pressure on Lake Alvin and about 36% on Wall Lake (Lucchesi et al. 2015). For comparison, winter fishing pressure is commonly about 20-30% of total pressure on larger lakes with good panfisheries (Lucchesi 2012a).

Monthly open-water fishing pressure on Scott Lake was highest in June and July (Figure 6) and similar to Diamond and Twin lakes. May is often the month of highest fishing pressure on many eastern South Dakota lakes such as waters near Sioux Falls (Lucchesi et al. 2015) and Lake Herman (Lucchesi 2012b). Fishing pressure typically decreases by July as catch rates slow and interest declines. However, peak monthly fishing pressure occurred in June and July at Family Park Lake (Lucchesi 2013a) and Diamond Lake (this report). High mid-summer catch rates for walleye on Diamond and Scott lakes may help explain their unique patterns of monthly pressure.

Monthly winter fishing pressure on Scott Lake was highest in December (Table 20) and supported by high catch rates for yellow perch. Winter fishing pressure and angler catch rates of yellow perch steadily declined from December through March (Tables 20 and 24).

About 88% of fishing at Scott Lake was done from shore (Figure 6). Shore fishing as a percentage of total pressure was higher than Beaver, Diamond or Twin lakes. The small size of Scott Lake and good shore fishing access along the south and east sides of the lake may help to explain the higher percentage of shore fishing to total pressure.

Table 20. Monthly and total (December 2013 through March 2014) number of angler interviews (# Int), estimated fishing pressure (angler hours), estimated angler days, estimated trip length (hours), average party size, percent of interviewed parties that were South Dakota (SD) residents, percent of angling activity done in a shack and percent of angling activity that occurred during weekends/holidays on Scott Lake, South Dakota (80% confidence interval).

Month	*# Int*	*Angler hours*	*Angler days*	*Trip Length (h)*	*Party size*	*% SD residents*	*% shack anglers*	*% weekends or holidays*
December	52	1,732 (757)	381	4.54 (2.00)	1.56 (0.83)	100	85	48
January	28	1,224 (693)	463	2.64 (--)	1.81 (0.87)	96	85	51
February	34	756 (392)	248	3.05 (--)	1.58 (0.36)	100	82	53
March	13	412 (240)	70	5.87 (0.36)	1.64 (0.69)	100	80	72
Total	127	4,124 (1,125)	970	4.25 (0.62)	1.65 (0.36)	99	84	52

Table 21. Stocking record for Scott Lake, Minnehaha County, 1998-2007 and 2013.

Year	Number	Species	Size
2000	600	yellow perch	Adult
2002	909	yellow perch	Adult
2003	10,360	walleye	Fingerling
2004	259	northern pike	Adult
2005	2,200	yellow perch	Adult
	4,384	walleye	Fingerling
2006	1,875	yellow perch	Juvenile
	480	yellow perch	Adult
2007	331	walleye	Juvenile
2013	3516	yellow perch	Adult

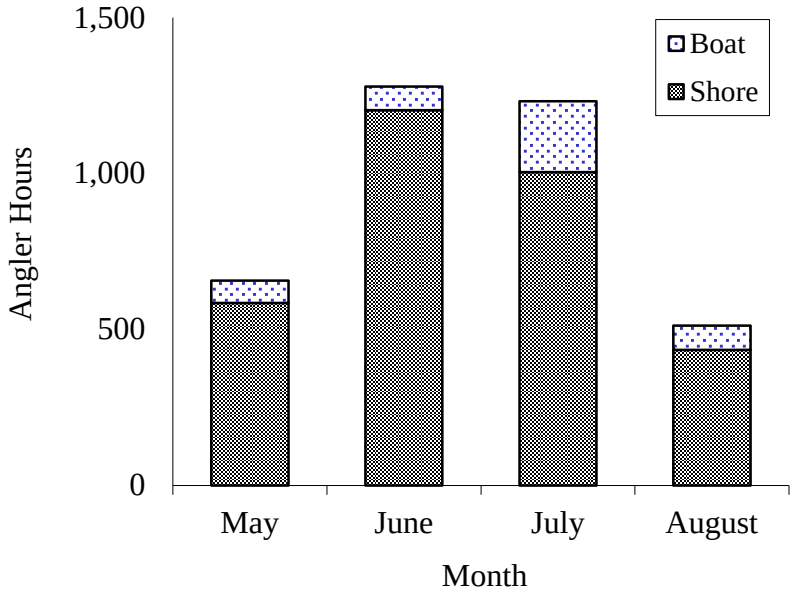

Figure 6. Mean monthly summer fishing pressure by boat and shore anglers on Scott Lake, 2004-2007.

Shore fishing as a percentage of total pressure was higher at Scott Lake than Lake Alvin and Wall Lake, but lower than on urban lakes (> 95%, Lucchesi et al. 2013a, Lucchesi et al. 2013b).

Mean trip length at Scott Lake was 1.74 hours and 4.25 hours for summer and winter, respectively. Open-water trips at Beaver Lake (2.09 h), Diamond Lake (2.56 h), Wall Lake and Lake Alvin (2.39 h, Lucchesi et al. 2015) were longer than at Scott. Mean trip length in the summer was similar to urban lakes (Lucchesi 2013a, 2012a, 2012b). Winter anglers at Scott Lake took longer trips than anglers fishing other Sioux Falls area waters (Lucchesi et al. 2015) and similar-length trips to anglers fishing large lakes (Lucchesi 2009, 2012a, 2012b).

Angler Catch and Harvest

Walleye

Scott Lake provided good walleye fishing in 2007 with a catch rate of 0.33 fish/h and harvest rate of 0.16 fish/h (Table 22). This exceeded the GFP objective harvest rate of 0.15 walleyes/h. In 2007, anglers harvested about 900 walleyes (Table 23) with most measuring between 29 cm and 38 cm long (Figure 7). These fish likely originated from the 2003 and 2005 fingerling stockings (Table 21). Winter 2013-14 anglers caught only a few walleyes (Tables 24 and 25).

Yellow Perch

Scott Lake supported high yellow perch catch rates in summer 2004 (0.77 fish/h, Table 22) and winter 2013-14 (Table 24). In both cases, the harvest percentage was low because the majority of fish caught were small. Most perch harvested by summer anglers measured less than 20 cm and fish as small as 11 cm were witnessed by the clerk (Figure 8). In 2007, anglers harvested a greater percentage of their catch with most fish measuring between 17 cm and 23 cm. Yellow perch harvested by winter anglers measured 17 to 24 cm long. The 2007 summer and 2013-14 winter fisheries were created by juvenile and adult stockings (Table 21).

Black Crappie

Scott Lake produced good fishing for black crappies in 2004 and 2007 (Tables 22 and 23). Anglers harvested a greater percentage of their catch in 2007 than 2004 (Table 23), however, larger crappies were kept in 2004 (Figure 9). Most fish harvested in 2007 were less than 20 cm long (Figure 9). Crappies less than 20 cm long were commonly harvested at Lake Alvin (Lucchesi et al. 2015). Although the harvest of crappies under 20 cm is seldom recorded on large eastern South Dakota lakes, it has been significant at times (Lucchesi 2011, 2012a).

Table 22. Estimated open-water angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) by year for bluegill, black crappie, yellow perch and walleye at Scott Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Bluegill		***Black crappie***		***Yellow perch***		***Walleye***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0.004 (0.01)	0	0.33 (0.15)	0.13 (0.08)	0.77 (0.36)	0.08 (0.08)	0.61 (0.27)	0.01 (0.01)
2005	0	0	0.002 (0.01)	0.002 (0.01)	0.01 (0.01)	0.01 (0.01)	0.04 (0.02)	0.03 (0.02)
2006	0.33 (0.27)	0	0	0	0	0	0.002 (0.01)	0
2007	0.01 (0.01)	0	0.36 (0.31)	0.25 (0.26)	0.23 (0.22)	0.08 (0.07)	0.33 (0.18)	0.16 (0.09)

Table 23. Estimated open-water angler catch (C) and harvest (H) by year for bluegill, black crappie, yellow perch and walleye at Scott Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Bluegill		***Black crappie***		***Yellow perch***		***Walleye***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	21 (3)	0	1,987 (653)	780 (331)	4,659 (1,311)	470 (340)	3,567 (1,168)	50 (36)
2005	0	0	7 (6)	7 (6)	66 (32)	66 (32)	163 (56)	156 (56)
2006	384 (296)	0	0	0	0	0	2 (3)	0
2007	51 (43)	0	2,030 (928)	1,426 (813)	1,324 (681)	445 (246)	1,880 (805)	908 (383)

Black Bullhead

The best black bullhead fishing occurred in 2004 (Table 26). The highest harvest (2,792 fish) was also recorded in 2004 when anglers kept 43% of the bullheads caught (Table 27). They also harvested about 700 fish in 2007. In 2004, harvested bullheads were 20-25 cm long and in 2007, many were longer than 25 cm (Figure 10). In 2006, harvest was a small percentage of catch because most bullheads were less than 20 cm long (2006 trap nets catches) and unacceptable to anglers. Bullheads harvested from Wall Lake

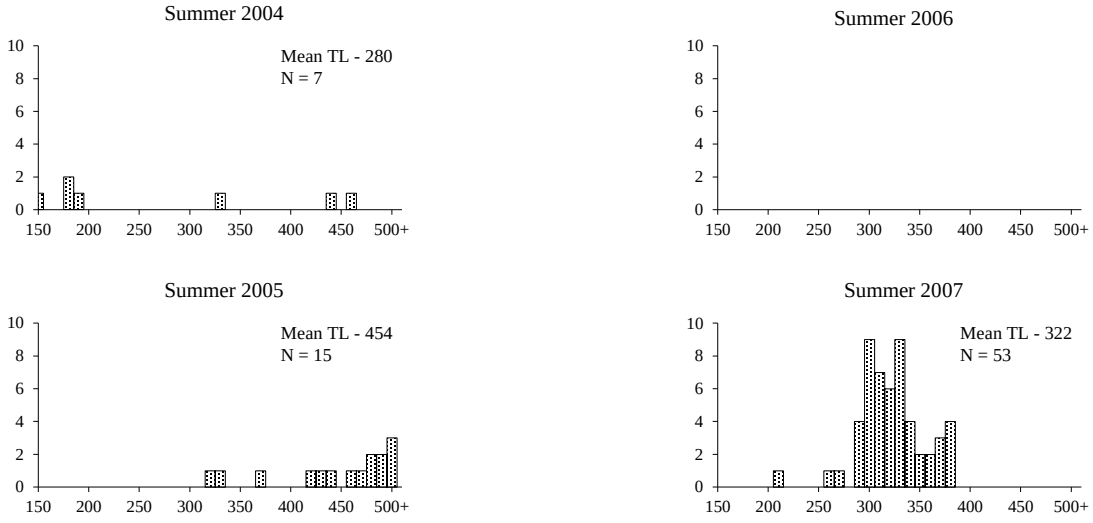

Figure 7. Length frequency of angler-harvested walleye measured by the creel clerk during open-water creel surveys on Scott Lake, 2004-2007.

Table 24. Estimated monthly and overall winter 2013-14 angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) for all anglers by species at Scott Lake, South Dakota. Standard errors of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: black bullhead (BLB), black crappie (BLC), yellow perch (YEP), and walleye (WAE).

	BLB		BLC		YEP		WAE	
Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
December	0	0	0	0	1.27 (1.10)	0.08 (0.09)	0.01 (0.02)	0
January	0	0	0	0	0.94 (1.47)	0.09 (0.25)	0	0
February	0.01 (0.02)	0	0.02 (--)	0	0.68 (1.63)	0.05 (0.12)	0	0
March	0.08 (0.07)	0	0	0	0.60 (0.57)	0.09 (0.05)	0.01 (0.01)	0
Total	0.01 (0.007)	0	0.003 (0.002)	0	1.00 0.71)	0.08 (0.09)	0.007 (0.008)	0

Table 25. Estimated monthly and overall winter 2013-2014 angler catch (C) and harvest (H) for all anglers by species at Scott Lake, South Dakota. Standard errors of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: black bullhead (BLB), black crappie (BLC), yellow perch (YEP), and walleye (WAE).

	BLB		BLC		YEP		WAE	
Month	C	H	C	H	C	H	C	H
December	0	0	0	0	2,202 (892)	145 (36)	24 (32)	0
January	0	0	0	0	1,157 (1,158)	115 (244)	0	0
February	7 (13)	0	12 (10)	0	512 (470)	35 (39)	0	0
March	34 (25)	0	0	0	248 (104)	35 (--)	4 (5)	0
Total	41 (28)	0	12 (10)	0	4,119 (1,539)	331 (250)	28 (32)	0

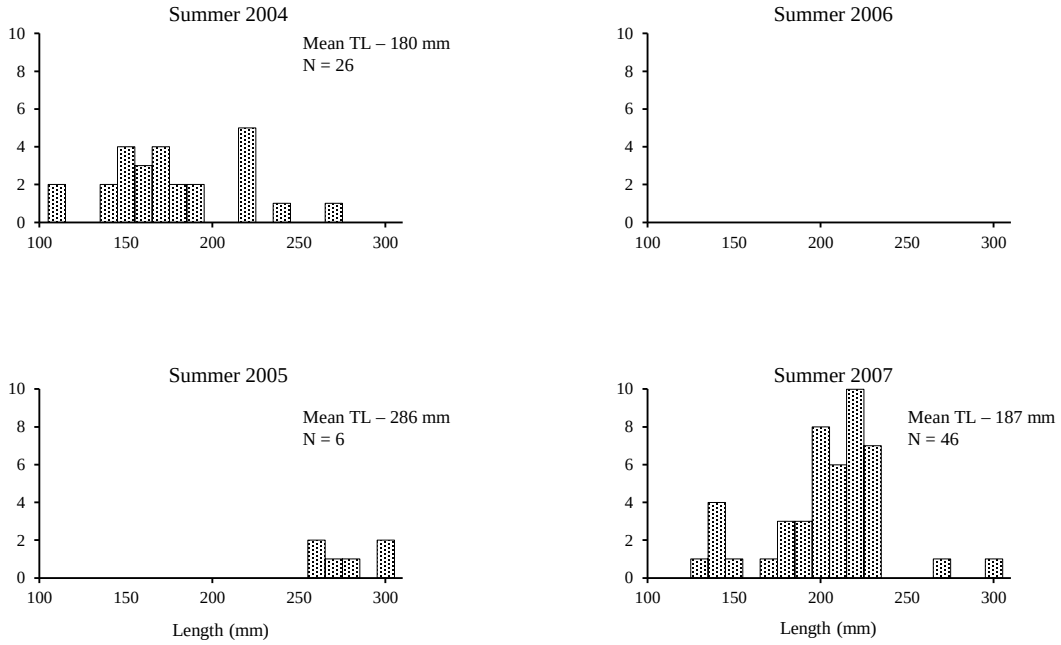

Figure 8. Length frequency of angler-harvested yellow perch measured by the creel clerk during open-water creel surveys on Scott Lake, 2004-2007.

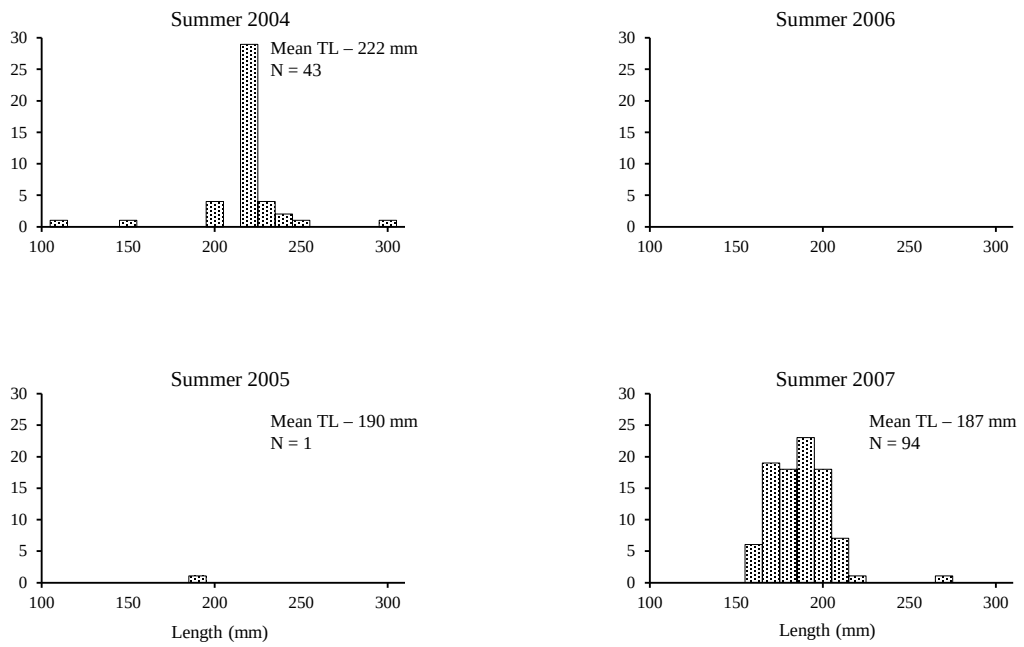

Figure 9. Length frequency of angler-harvested black crappie measured by the creel clerk during open-water creel surveys on Scott Lake, 2004-2007.

Table 26. Estimated open-water angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) by year for common carp, black bullhead, northern pike and green sunfish at Scott Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Common Carp		***Black Bullhead***		***Northern Pike***		***Green Sunfish***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0	0	1.07 (1.32)	0.46 (0.85)	0.01 (0.01)	0	0.06 (0.02)	0
2005	0	0	0.11 (0.09)	0.04 (0.05)	0.04 (0.02)	0.02 (0.02)	0	0
2006	0	0	1.05 (0.96)	0.13 (0.13)	0	0	0.22 (0.18)	0.04 (0.01)
2007	0	0	1.27 (1.14)	0.12 (0.12)	0.005 (0.01)	0.005 (0.01)	0.22 (0.14)	0.04 (0.03)

Table 27. Estimated open-water angler catch (C) and harvest (H) by year for common carp, black bullhead, northern pike and green sunfish at Scott Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Common Carp		***Black Bullhead***		***Northern Pike***		***Green Sunfish***	
Year	C	H	C	H	C	H	C	H
2004	0	0	6,454 (3,957)	2,792 (3,151)	47 (33)	0	377 (159)	0
2005	0	0	496 (284)	206 (196)	163 (73)	85 (47)	0	0
2006	0	0	1,235 (1,057)	156 (67)	0	0	255 (201)	51 (3)
2007	0	0	7,207 (2,855)	703 (629)	29 (35)	29 (35)	1,234 (852)	238 (114)

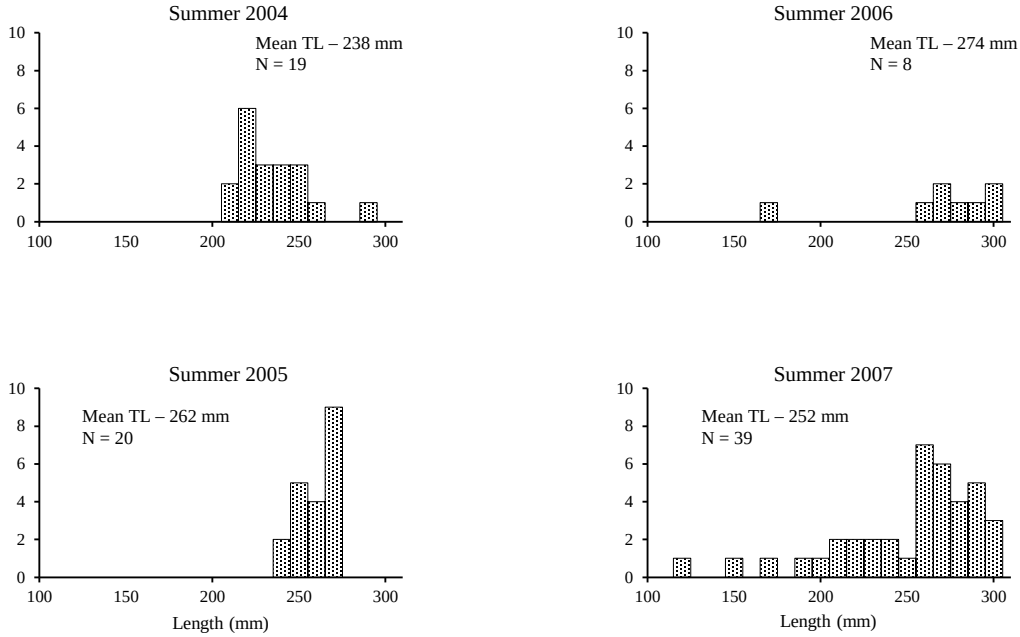

Figure 10. Length frequency of angler-harvested black bullhead measured by the creel clerk during open-water creel surveys on Scott Lake, 2004-2007.

(Lucchesi et al. 2015) and Lake Herman (Lucchesi 2012b) were similar in length to Scott Lake implying that 20 cm is the minimum size acceptable to anglers.

Twin Lake

Fishing Pressure

Summer anglers at Twin Lake primarily targeted walleye (80%) during the survey period (Table 28). A few also targeted yellow perch (11%) and black bullhead (3%). Winter anglers primarily targeted walleye (59%) and yellow perch (35%).

Summer fishing pressure on Twin Lake was low (394-657 h, 3-6 h/ha) from 2004 through 2006, then increased in 2007 (2,909 h, 25 h/ha, Tables 29 and 30). The pressure increase in 2007 was produced by a dramatic increase in walleye catch rates starting in August 2006 and continuing throughout the summer of 2007 (Appendix 7 and Table 31). Over the 4-year survey period, Twin Lake (39 h/ha) had lower summer fishing pressure per hectare than Beaver Lake (172 h/ha), Diamond Lake (142 h/ha) or Scott Lake (407 h/ha). Fishing pressure per hectare on Twin was also lower than on urban fisheries (Lucchesi 2013a, 2013b), Lake Alvin (Lucchesi et al. 2015) and many larger eastern South Dakota lakes (Lucchesi 2009).

Winter fishing pressure in 2013-14 was estimated at 4,507 h and 116 h/ha (Table 32). Higher fishing pressure in winter compared to summer reflects the effectiveness of the special walleye regulation at producing a quality catch and release fishery for large fish. Over 30% of angling parties interviewed stated that catching lots of fish or larger fish was the primary reason they chose to fish Twin Lake. Typically, less than 5% of anglers select “a chance to catch larger fish” as the reason for fishing a lake (Lucchesi 2011, 2012a, 2012b). Winter fishing pressure per hectare at Twin Lake is higher than on most eastern South Dakota natural lakes and small impoundments (Lucchesi 2009, Lucchesi et al. 2015) and similar to some urban fisheries (Lucchesi 2013b). A substantial amount of the ice fishing for walleyes is done at night so this survey undoubtedly underestimated fishing pressure and walleye catch.

Monthly summer fishing pressure was highest in June and July (Figure 11) which was similar to Scott and Diamond lakes. Good mid-summer catch rates for walleye on Twin may help explain this pattern. Monthly winter fishing pressure remained relatively constant from December through February and then declined in March as ice conditions deteriorated (Table 32). Only about 30% of fishing was done from shore at Twin Lake (Figure 11). In comparison, shore fishing as a percentage of total pressure was higher at Scott, Beaver, or Diamond. The contribution of shore fishing to total fishing pressure at Twin Lake was similar to some larger eastern South Dakota waters (Lucchesi 2011, 2012a). About 90% of the winter fishing was done from an ice shack (Table 32).

Table 28. Percent of angling parties interviewed primarily targeting a species (or any species) totaled by month, over the summer and over the survey period on Twin Lake, 2004-2007.

		Percent of anglers targeting				
Year	*Month*	*Walleye*	*Yellow perch*	*Northern pike*	*Black bullhead*	*Any species*
2004	May	100	0	0	0	0
	June	100	0	0	0	0
	July	100	0	0	0	0
	August	0	100	0	0	0
	Total	89	9	0	0	0
2005	May	50	0	0	0	50
	June	71	15	0	0	14
	July	33	0	0	0	67
	August	50	0	0	0	50
	Total	57	29	0	7	7
2006	May	100	0	0	0	0
	June	0	0	0	0	100
	July	0	0	0	0	0
	August	100	0	0	0	0
	Total	80	0	0	0	20
2007	May	88	0	0	12	0
	June	100	0	0	0	0
	July	93	0	0	0	7
	August	0	100	0	0	0
	Total	88	6	0	3	3
Overall	May	84	0	0	8	8
	June	80	5	0	0	15
	July	87	0	0	0	13
	August	50	38	0	0	13
	Total	80	11	0	3	5

Table 29. Open-water totals for the number of interviews and estimates for fishing pressure and fishing pressure per surface hectare of water, angler days and percent of interviewed parties that were South Dakota (SD) residents from creel surveys conducted on Twin Lake, May through August, 2004-2007 (80% confidence interval).

Year	*Number of interviews*	*Angler hours*	*Angler hours/ hectare*	*Angler days*	*% SD residents*
2004	9	394 (194)	3 (2)	137	100
2005	14	657 (203)	6 (2)	310	93
2006	6	588 (254)	5 (2)	309	100
2007	34	2,909 (620)	25 (5)	892	99

Table 30. Monthly and total (May through August) number of angler interviews (# Int), estimated fishing pressure (angler hours), estimated angler days, estimated trip length (hours), average party size, percent of interviewed parties that were South Dakota (SD) residents, percent of angling activity done by boat and percent of angling activity that occurred during weekends/holidays on Twin Lake, South Dakota (80% confidence interval).

Year	*Month*	*# Int*	*Angler hours*	*Angler days*	*Trip Length (h)*	*Party size*	*% SD residents*	*% boat anglers*	*% weekends or holidays*
2004	May	1	49 (63)	13	3.75 (--)	2.00 (--)	100	100	0
	June	2	151 (162)	79	1.92 (--)	3.47 (--)	100	50	19
	July	5	161 (74)	63	2.54 (--)	1.80 (--)	100	60	100
	August	1	33 (42)	15	2.17 (--)	2.00 (--)	100	100	100
	Total	9	394 (194)	137	2.88 (--)	2.62 (--)	100	67	56
2005	May	2	108 (98)	--	--	3.00 (--)	50	0	100
	June	7	282 (119)	112	2.51 (--)	2.27 (--)	100	57	49
	July	3	231 (125)	112	2.07 (--)	2.00 (--)	100	67	43
	August	2	36 (46)	22	1.67 (--)	2.00 (--)	100	100	100
	Total	14	657 (203)	310	2.12 (--)	2.20 (--)	93	57	58
2006	May	1	98 (93)	84	1.17 (--)	2.00 (--)	100	0	34
	June	2	41 (53)	29	1.42 (--)	2.00 (--)	100	0	100
	July	0	199 (167)	--	--	--	--	--	9
	August	3	250 (159)	57	4.41 (--)	2.00 (--)	100	100	74
	Total	6	588 (254)	309	1.90 (--)	2.00 (--)	100	50	47
2007	May	8	572 (290)	150	3.81 (0.89)	1.69 (0.27)	87	62	43
	June	9	924(328)	266	3.48 (--)	2.48 (--)	100	81	47
	July	15	1,075 (416)	372	2.89 (--)	2.81 (12)	100	84	63
	August	2	338 (139)	104	-- (--)	3.50(--)	100	100	18
	Total	34	2,909 (620)	892	3.26 (0.11)	2.43 (0.08)	99	80	49

Mean trip length at Twin Lake was 2.73 hours for summer anglers and 4.18 hours for winter anglers. Summer trip lengths at Twin Lake were longer than Beaver Lake (2.09 h), Diamond Lake (2.56 h), Wall Lake (2.39) and Lake Alvin (2.34 h). Mean trip length for anglers on larger eastern South Dakota lakes was typically over 3 h (Lucchesi 2013a, 2012a, 2012b).). Winter trip lengths at Twin Lake were similar to those at Scott Lake and large lakes (Lucchesi 2009, 2012a, 2012b).

Angler Catch and Harvest

Walleye

Walleye catch rates were low through July 2006, dramatically increased in August (3.94 fish/h) and remained high through the summer of 2007 (Appendix 7 and Table 31). Anglers caught an estimated 4,135 walleyes in 2007, but harvested only 33 because nearly all were protected under the 61-cm MLL (Table 33). Annual fingerling stockings

Table 31. Estimated open-water angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) by year for northern pike, black bullhead, yellow perch and walleye at Twin Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Northern pike		***Black bullhead***		***Yellow perch***		***Walleye***	
Year	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	0	0	0	0	0	0	0.10 (0.11)	0
2005	0	0	0	0	0	0	0.04 (0.04)	0.02 (0.04)
2006	0	0	0	0	0.02 (0.04)	0	1.67 (2.89)	0
2007	0	0	0.34 (0.08)	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)	1.42 (0.85)	0.01 (0.01)

Table 32. Monthly and total (December 2013 through March 2014) number of angler interviews (# Int), estimated fishing pressure (angler hours), estimated angler days, estimated trip length (hours), average party size, percent of interviewed parties that were South Dakota (SD) residents, percent of angling activity done in a shack and percent of angling activity that occurred during weekends/holidays on Twin Lake, South Dakota (80% confidence interval).

Month	*# Int*	*Angler hours*	*Angler days*	*Trip Length (h)*	*Party size*	*% SD residents*	*% shack anglers*	*% weekends or holidays*
December	24	1,368 (419)	294	4.65 (0.99)	1.86 (0.44)	91	89	58
January	42	1,057 (254)	307	3.44 (0.85)	1.73 (0.33)	92	94	68
February	17	1,535 (705)	345	4.45 (0.24)	1.93 (1.87)	98	87	72
March	32	548 (404)	130	4.22 (--)	1.88 (0.75)	88	89	97
Total	115	4,507 (949)	1,078	4.18 (0.48)	1.84 (0.56)	93	90	70

from 2002 through 2006 were most likely responsible for the good walleye fishing (Table 34).

Winter anglers on Twin Lake caught an estimated 405 walleyes but harvested none (Table 35). Winter walleye catch rates were intermediate when compared to eastern South Dakota large lakes (Lucchesi 2009). Walleye fishing was fastest (0.17 fish/h) in December and gradually slowed into February and March (Table 35). In general, anglers were satisfied with the walleye and perch fishing with just over half of parties interviewed satisfied and 35% neutral.

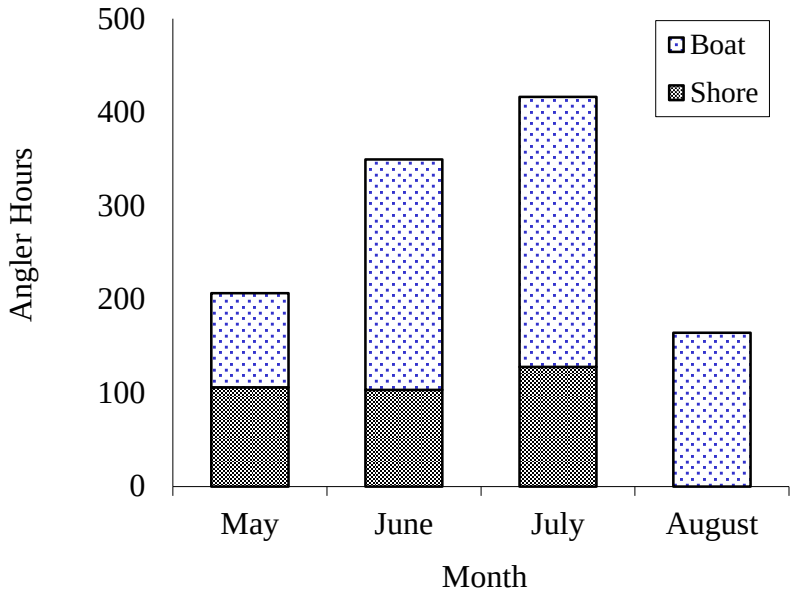

Figure 11. Mean monthly summer fishing pressure by boat and shore anglers on Twin Lake, 2004-2007.

Table 33. Estimated open-water angler catch (C) and harvest (H) by year for northern pike, black bullhead, yellow perch and walleye at Twin Lake, South Dakota, from May 2004 through August 2007 (80% confidence interval).

	Northern pike		***Black bullhead***		***Yellow perch***		***Walleye***	
Year	C	H	C	H	C	H	C	H
2004	0	0	0	0	0	0	37 (35)	0
2005	0	0	0	0	0	0	25 (25)	14 (23)
2006	0	0	0	0	14 (24)	0	983 (924)	0
2007	0	0	1,000 (115)	54 (0)	28 (19)	8 (12)	4,135 (918)	33 (31)

Table 34. Stocking record for Twin Lake, Minnehaha County, 1998-2007.

Year	Number	Species	Size
2000	1,920	yellow perch	Adult
2002	109	walleye	Adult
2003	58,784	walleye	Fingerling
2004	5,606	walleye	Large Fingerling
	25	walleye	Juvenile
2005	19,616	walleye	Large Fingerling
2006	31,030	walleye	Fingerling
	5,372	yellow perch	Adult
2007	1,493	yellow perch	Adult

Table 35. Estimated monthly and overall winter 2013-2014 angler catch rate per hour (C/h), catch (C), harvest rate per hour (H/h) and harvest (H) for all anglers by species at Twin Lake, South Dakota. Standard errors of estimates are provided in parentheses where they could be calculated. Abbreviations for species are walleye (WAE) and yellow perch (YEP).

	WAE		WAE		YEP		YEP	
Month	C/h	H/h	C	H	C/h	H/h	C	H
December	0.17	0	226	0	0.007	0	10	0
	(0.10)		(127)		(0.006)		(11)	
January	0.11	0	112	0	0.07	0.03	77	31
	(0.06)		(63)		(0.03)	(0.02)	(26)	(20)
February	0.03	0	40	0	0.04	0	56	0
	(0.02)		(--)		(0.04)		(41)	
March	0.05	0	27	0	0.01	0.01	6	6
	(0.07)		(30)		(0.02)	(0.02)	(10)	(10)
Total	0.09	0	405	0	0.03	0.008	150	37
	(0.04)		(145)		(0.02)	(0.005)	(51)	(22)

Other

Very few yellow perch were caught during the summer survey (Table 33). Winter anglers caught an estimated 150 yellow perch and harvested 37 (Table 35). Catch rates remained low throughout the winter. Summer anglers caught an estimated 1,000 black bullheads in 2007 and harvested 54 (Table 33).

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Appendix 1. Estimated monthly (May – August) and overall summer angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) for all anglers by species at Beaver Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC), black bullhead (BLB), northern pike (NOP), green sunfish (GSF), orange-spotted sunfish (OSF), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		OSF		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	May	0.04 (0.03)	0.02 (0.07)	2.32 (2.58)	0.31 (0.59)	0	0	0	0	0	0	0.07 (0.06)	0.02 (0.02)	0	0	1.05 (0.88)	0
	June	0.08 (0.05)	0	1.43 (1.14)	0	0	0	0	0	0	0	0.22 (0.24)	0	0.18 (0.29)	0.07 (0.12)	0.94 (2.51)	0.03 (0.18)
	July	0.21 (0.31)	0.07 (0.06)	2.43 (1.59)	0	0	0	0	0	0	0	0.14 (0.13)	0.02 (0.02)	0.05 (0.08)	0	0.30 (0.33)	0
	August	0.02 (0.03)	0	0.88 (1.26)	0	0	0	0	0	0.007 (--)	0	0.27 (0.12)	0	0	0	0.07 (0.22)	0
	Total	0.09 (0.06)	0.02 (0.03)	1.80 (0.86)	0.08 (0.12)	0	0	0	0	0.002 (--)	0	0.17 (0.07)	0.01 (0.01)	0.03 (0.03)	0.01 (0.01)	0.48 (0.34)	0.004 (0.01)
2005	May	0	0	0.18 (0.12)	0.005 (0.01)	0.005 (0.01)	0	0	0	0	0	0.22 (0.30)	0.05 (0.07)	0.01 (0.02)	0.01 (0.02)	0.56 (0.56)	0
	June	0.004 (0.01)	0	2.02 (1.68)	0.03 (0.05)	0.008 (0.01)	0	0	0	0.04 (0.03)	0	0.60 (1.04)	0.06 (0.16)	0	0	0.33 (0.33)	0
	July	0.006 (0.01)	0	1.54 (2.37)	0	0	0	0	0	0	0	0.22 (0.84)	0.03 (0.04)	0	0	0.06 (0.14)	0
	August	0.05 (0.04)	0	1.23 (1.26)	0.04 (0.05)	0	0	0	0	0	0	0.41 (0.22)	0.22 (--)	0	0	0.02 (0.02)	0
	Total	0.01 (0.01)	0	1.26 (0.67)	0.02 (0.05)	0.004 (0.01)	0	0	0	0.02 (0.01)	0	0.39 (0.41)	0.08 (0.07)	0.003 (0.01)	0.003 (0.01)	0.31 (0.20)	0
2006	May	0	0	1.38 (1.50)	0.06 (0.12)	0.005 (0.01)	0	0	0	0	0	1.78 (2.60)	1.18 (1.70)	0	0	0.09 (0.13)	0
	June	0.01 (0.01)	0.005 (0.01)	1.50 (1.10)	0.35 (0.36)	0	0	0	0	0	0	0.50 (2.22)	0.47 (2.20)	0	0	0.26 (0.41)	0
	July	0	0	0.61 (0.66)	0.11 (0.15)	0.01 (0.02)	0.01 (0.02)	0.01 (0.01)	0.01 (0.01)	0	0	0.59 (0.79)	0.41 (0.57)	0.02 (0.02)	0.02 (0.02)	0.05 (0.05)	0
	August	0	0	1.39 (1.99)	0.04 (0.31)	0	0	0	0	0	0	0.19 (--)	0.13 (0.05)	0	0	0	0
	Total	0.003 (0.01)	0.002 (0.01)	1.23 (0.72)	0.15 (0.13)	0.005 (0.01)	0.005 (0.01)	0.002 (0.01)	0	0	0	1.06 (1.16)	0.74 (0.86)	0.005 (0.01)	0.005 (0.01)	0.12 (0.10)	0

Appendix 1. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2007	May	0.008	0	0.40	0.02	0.004	0	0.005	0	0	0	0.50	0.37	0	0	0.50	0
		(0.01)		(0.22)	(0.03)	(0.01)		(0.01)				(0.39)	(0.41)			(0.39)	
	June	0.003	0	1.05	0.01	0	0	0	0	0.02	0	0.14	0.04	0	0	0.63	0
		(0.01)		(1.81)	(0.01)					(0.02)		(0.11)	(0.07)			(0.71)	
	July	0.02	0	2.26	0.01	0	0	0.07	0	0	0	0.17	0.12	0	0	0.09	0
		(0.01)		(4.64)	(0.01)			(0.20)				(0.45)	(0.21)			(--)	
	August	0.06	0	1.54	0	0	0	0	0	0	0	0.07	0	0.01	0	0.06	0
		(0.12)		(7.55)								(0.42)		(0.03)		(0.19)	
	Total	0.01	0	0.96	0.02	0.002	0	0.01	0	0.005	0	0.31	0.21	0.005	0	0.46	0
		(0.01)		(0.82)	(0.01)	(0.01)		(0.03)		(0.01)		(0.22)	(0.19)	(0.01)		(0.27)	

Appendix 2. Estimated monthly (May – August) and overall summer angler catch (C) and harvest (H) for all anglers by species at Beaver Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC), black bullhead (BLB), northern pike (NOP), green sunfish (GSF), orange-spotted sunfish (OSF), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		OSF		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2004	May	27 (21)	13 (15)	1,624 (1,088)	216 (258)	0	0	0	0	0	0	49 (42)	13 (19)	0	0	732 (498)	0
	June	47 (26)	0	809 (479)	0	0	0	0	0	0	0	127 (85)	0	47 (60)	18 (35)	253 (175)	9 (18)
	July	143 (92)	46 (64)	1,652 (215)	0	0	0	0	0	0	0	94 (79)	11 (16)	34 (32)	0	204 (187)	0
	August	16 (21)	0	565 (628)	0	0	0	0	0	4 (--)	0	176 (61)	0	0	0	47 (38)	0
	Total	233 (100)	58 (66)	4,650 (1,361)	216 (258)	0	0	0	0	4 (--)	0	445 (138)	24 (25)	81 (68)	18 (35)	1,236 (561)	9 (18)
2005	May	0	0	515 (272)	15 (18)	15 (17)	0	0	0	0	0	632 (296)	145 (94)	29 (26)	29 (26)	1,577 (1,022)	0
	June	13 (19)	0	6,862 (1,305)	116 (133)	26 (34)	0	0	0	138 (96)	0	2,022 (1,945)	202 (232)	0	0	1,119 (744)	0
	July	9 (10)	0	2,531 (1,159)	0	0	0	0	0	0	0	360 (412)	55 (60)	0	0	103 (65)	0
	August	60 (38)	0	1,540 (1,107)	49 (57)	0	0	0	0	0	0	517 (406)	282 (263)	0	0	25 (20)	0
	Total	82 (43)	0	11,447 (2,085)	180 (146)	40 (38)	0	0	0	138 (96)	0	3,531 (2,050)	683 (368)	29 (26)	29 (26)	2,824 (1,266)	0
2006	May	0	0	3,083 (1,906)	129 (173)	12 (16)	0	0	0	0	0	3,990 (3,086)	2,638 (1,967)	0	0	211 (273)	0
	June	15 (23)	8 (11)	2,071 (562)	860 (335)	0	0	0	0	0	0	6912 (2,722)	650 (2,721)	0	0	364 (236)	0
	July	0	0	759 (467)	140 (176)	13 (18)	13 (18)	8 (10)	8 (10)	0	0	733 (509)	514 (447)	25 (19)	16 (13)	64 (55)	0
	August	0	0	447 (289)	12 (43)	0	0	0	0	0	0	62 (23)	41 (19)	0	0	0	0
	Total	15 (23)	8 (11)	6,360 (2,062)	770 (498)	24 (24)	13 (18)	8 (10)	8 (10)	0	0	5,476 (4,147)	3,842 (3,387)	25 (19)	16 (13)	639 (365)	0

Appendix 2. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2007	May	15 (15)	0	782 (439)	46 (54)	8 (8)	0	10 (13)	0	0	0	986 (721)	733 (690)	0	0	993 (536)	0
	June	4 (3)	0	1,492 (859)	17 (20)	0	0	0	0	21 (24)	0	205 (156)	64 (42)	0	0	893 (526)	0
	July	14 (8)	0	1,530 (885)	7 (7)	0	0	50 (133)	0	0	0	117 (119)	79 (97)	0	0	61 (55)	0
	August	10 (17)	0	251 (369)	0	0	0	0	0	0	0	12 (17)	0	2 (4)	0	10 (17)	0
	Total	42 (214)	0	4054 (1,360)	69 (57)	8 (8)	0	60 (133)	0	21 (24)	0	1,319 (748)	876 (698)	2 (4)	0	1,957 (753)	0

Appendix 3. Estimated monthly (May – August) and overall summer angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) for all anglers by species at Diamond Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC), black bullhead (BLB), northern pike (NOP), green sunfish (GSF), orange-spotted sunfish (OSF), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		OSF		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	May	0.02 (0.04)	0	0.29 (0.84)	0.24 (0.72)	0.12 (0.39)	0	0	0	0	0	0	0	0	0	0.09 (0.42)	0
	June	0.08 (0.14)	0	0.61 (0.77)	0.36 (0.56)	0.06 (0.11)	0	0	0	0	0	0	0	0.11 (0.10)	0.02 (0.02)	0.57 (1.15)	0
	July	0.004 (0.01)	0	0.21 (0.08)	0	0.05 (0.03)	0	0	0	0	0	0	0	0.26 (0.21)	0.007 (0.01)	0.36 (0.15)	0.03 (0.02)
	August	0	0	0.05 (0.06)	0.03 (0.05)	0.008 (0.01)	0.008 (0.01)	0	0	0	0	0	0	0.11 (--)	0.07 (--)	0.22 (0.14)	0
	Total	0.02 (0.02)	0	0.27 (0.14)	0.10 (0.10)	0.05 (0.04)	0.002 (0.01)	0	0	0	0	0	0	0.18 (0.09)	0.02 (0.01)	0.35 (0.22)	0.01 (0.01)
2005	May	0.05 (0.06)	0	0.10 (0.14)	0	0.04 (--)	0	0	0	0	0	0	0	0	0	0.07 (0.06)	0
	June	0.004 (0.01)	0.004 (0.01)	0.25 (0.39)	0	0.01 (0.03)	0	0	0	0	0	0	0	0	0	0.18 (0.34)	0
	July	0.04 (0.04)	0	0.08 (0.11)	0	0.01 (0.01)	0	0	0	0	0	0	0	0.12 (0.18)	0.08 (0.14)	0.02 (0.01)	0
	August	0.01 (0.01)	0	0.11 (0.14)	0	0	0	0	0	0	0	0	0	0.05 (--)	0.007 (0.01)	0	0
	Total	0.02 (0.01)	0.02 (0.01)	0.16 (0.16)	0	0.02 (0.02)	0	0	0	0	0	0	0	0.03 (0.01)	0.02 (0.01)	0.10 (0.14)	0
2006	May	0.02 (--)	0.01 (--)	0.12 (--)	0.09 (--)	0	0	0	0	0	0	0	0	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)	0
	June	0	0	0.44 (0.59)	0.15 (0.14)	0	0	0	0	0	0	0.02 (--)	0	0.06 (--)	0.06 (--)	0.08 (0.04)	0
	July	0	0	0.40 (0.41)	0.02 (0.03)	0	0	0	0	0	0	0	0	0.08 (0.29)	0.05 (0.25)	0.02 (0.04)	0
	August	0.06 (0.06)	0	0.12 (0.22)	0	0	0	0	0	0	0	0	0	0.41 (0.61)	0.27 (0.49)	0	0
	Total	0.01 (0.01)	0.002 (0.01)	0.32 (0.24)	0.08 (0.06)	0	0	0	0	0	0	0.01 (--)	0	0.11 (0.10)	0.08 (0.10)	0.04 (0.02)	0

Appendix 3. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2007	May	0.01 (0.03)	0	0.43 (0.88)	0.05 (0.06)	0	0	0	0	0	0	0	0	0.04 (--)	0.01 (--)	0.67 (1.31)	0
	June	0.04 (0.03)	0	0.55 (0.85)	0	0	0	0	0	0	0	0	0	0	0	1.38 (1.07)	0
	July	0.01 (--)	0.01 (--)	0.11 (0.06)	0.06 (0.07)	0	0	0	0	0	0	0	0	0.01 (0.03)	0.01 (0.03)	0.54 (1.23)	0
	August	0.04 (0.05)	0	0.72 (0.31)	0	0	0	0.04 (0.05)	0	0	0	0	0	0.17 (--)	0.15 (--)	0.93 (5.53)	0
	Total	0.02 (0.02)	0.005 (0.01)	0.39 (0.33)	0.03 (0.03)	0	0	0.003 (0.01)	0	0	0	0	0	0.02 (--)	0.02 (--)	0.91 (0.82)	0

Appendix 4. Estimated monthly (May – August) and overall summer angler catch (C) and harvest (H) for all anglers by species at Diamond Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC) black bullhead (BLB), northern pike (NOP), green sunfish (GSF), orange-spotted sunfish (OSF), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		OSF		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2004	May	5	0	100	84	40	0	0	0	0	0	0	0	0	0	32	0
		(15)		(240)	(240)	(132)										(21)	
	June	59	0	508	299	53	0	0	0	0	0	0	0	92	20	475	0
		(48)		(252)	(304)	(88)								(47)	(18)	(467)	
	July	7	0	436	0	96	0	0	0	0	0	0	0	535	15	749	56
		(11)		(26)		(49)								(122)	(17)	(207)	(45)
	August	0	0	40	28	6	6	0	0	0	0	0	0	87	61	181	0
				(44)	(42)	(9)	(9)							(--)	(--)	(102)	
	Total	71	0	1,085	411	195	6	0	0	0	0	0	0	714	95	1,436	56
		(51)		(352)	(390)	(167)	(9)							(130)	(25)	(521)	(45)
2005	May	44	0	92	0	42	0	0	0	0	0	0	0	0	0	65	0
		(49)		(73)		(36)										(49)	
	June	7	7	481	0	24	0	0	0	0	0	0	0	0	0	359	0
		(7)	(7)	(343)		(26)										(492)	
	July	30	0	61	0	7	0	0	0	0	0	0	0	92	33	13	0
		(33)		(36)		(4)								(54)	(37)	(10)	
	August	7	0	75	0	0	0	0	0	0	0	0	0	34	5	0	0
		(--)		(87)										(21)	(7)		
	Total	88	7	709	0	72	0	0	0	0	0	0	0	126	68	437	0
		(60)	(7)	(363)		(45)								(58)	(38)	(495)	
2006	May	7	4	45	33	0	0	0	0	0	0	0	0	7	7	7	0
		(--)	(--)	(--)	(--)									(8)	(8)	(8)	
	June	0	0	271	92	0	0	0	0	0	0	12	0	35	35	50	0
				(167)	(80)							(--)		(22)	(22)	(22)	
	July	0	0	210	90	0	0	0	0	0	0	0	0	45	26	13	0
				(136)	(13)									(41)	(35)	(18)	
	August	14	0	28	0	0	0	0	0	0	0	0	0	97	62	0	0
		(10)		(19)										(85)	(76)		
	Total	21	4	553	134	0	0	0	0	0	0	12	0	184	132	71	0
		(10)	(4)	(216)	(81)							(--)		(97)	(86)	(30)	

Appendix 4. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2007	May	11 (13)	0	415 (297)	50 (68)	0	0	0	0	0	0	0	0	36 (18)	11 (18)	654 (450)	0
	June	69 (44)	0	943 (373)	0	0	0	0	0	0	0	0	0	0	0	2,349 (1,305)	0
	July	22 (--)	21 (--)	171 (180)	100 (149)	0	0	0	0	0	0	0	0	22 (27)	17 (25)	843 (392)	0
	August	12 (13)	0	223 (26)	0	0	0	121 (13)	0	0	0	0	0	51 (56)	46 (55)	285 (579)	0
	Total	113 (48)	22 (0)	1,752 (510)	150 (164)	0	0	12 (13)	0	0	0	0	0	109 (64)	75 (63)	4,132 (1,548)	0

Appendix 5. Estimated monthly (May – August) and overall summer angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) for all anglers by species at Scott Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC), black bullhead (BLB), northern pike (NOP), green sunfish (GSF), bluegill (BLG), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	May	0	0	1.27 (0.75)	0.43 (0.47)	0.01 (0.01)	0	0.14 (0.02)	0	0	0	0.33 (0.25)	0.11 (0.14)	1.32 (0.84)	0.11 (0.08)	1.00 (0.71)	0.01 (0.01)
	June	0	0	0.80 (0.52)	0.23 (0.32)	0.01 (--)	0	0.006 (0.01)	0	0	0	0.54 (0.36)	0.24 (0.18)	0.33 (0.18)	0.03 (0.02)	0.40 (0.23)	0
	July	0	0	1.94 (11.31)	1.45 (8.79)	0.003 (0.01)	0	0	0	0.02 (0.01)	0	0.09 (0.14)	0.02 (0.10)	0.31 (0.83)	0.16 (0.63)	0.37 (0.29)	0.02 (0.02)
	August	0	0	0.03 (0.04)	0	0	0	0.01 (0.01)	0	0	0	0.03 (0.09)	0	0.66 (0.29)	0	0.09 (0.08)	0
	Total	0	0	1.07 (1.32)	0.46 (0.85)	0.01 (0.01)	0	0.06 (0.02)	0	0.004 (0.01)	0	0.33 (0.15)	0.13 (0.08)	0.77 (0.36)	0.08 (0.08)	0.61 (0.27)	0.01 (0.01)
2005	May	0	0	0.13 (0.13)	0.07 (0.08)	0.06 (0.05)	0.03 (0.03)	0	0	0	0	0.003 (0.01)	0.003 (0.01)	0.02 (0.02)	0.02 (0.02)	0.05 (0.03)	0.05 (0.03)
	June	0	0	0.11 (0.17)	0	0	0	0	0	0	0	0	0	0	0	0.01 (0.02)	0.01 (0.02)
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0.11 (0.09)	0.04 (0.05)	0.04 (0.02)	0.02 (0.02)	0	0	0	0	0.002 (0.01)	0.002 (0.01)	0.01 (0.01)	0.01 (0.01)	0.04 (0.02)	0.03 (0.02)
2006	May	0	0	0.19 (0.22)	0.09 (0.21)	0	0	0.28 (0.22)	0.03 (0.01)	0.37 (0.49)	0	0	0	0	0	0.004 (0.01)	0
	June	0	0	0.14 (0.43)	0	0	0	0.27 (0.85)	0	0.07 (0.10)	0	0	0	0	0	0	0
	July	0	0	1.03 (--)	0	0	0	0	0	0.06 (--)	0	0	0	0	0	0	0
	August	0	0	3.65 (4.66)	0.38 (0.27)	0	0	0.12 (--)	0.12 (--)	0.51 (--)	0	0	0	0	0	0	0
	Total	0	0	1.05 (0.96)	0.13 (0.13)	0	0	0.22 (0.18)	0.04 (0.01)	0.33 (0.27)	0	0	0	0	0	0.002 (0.01)	0

Appendix 5. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2007	May	0	0	1.76	0.27	0.01	0.01	0.12	0.01	0.007	0	0.47	0.38	030	0.14	0.21	0.15
				(1.76)	(0.29)	(0.01)	(0.01)	(--)	(0.01)	(--)		(0.69)	(0.62)	(0.45)	(0.19)	(0.21)	(0.15)
	June	0	0	1.03	0.007	0	0	0.26	0.09	0	0	0.39	0.23	0.14	0.04	0.14	0.09
				(0.78)	(0.01)			(0.14)	(0.10)			(0.52)	(0.33)	(0.08)	(0.06)	(0.09)	(0.09)
	July	0	0	0.78	0	0	0	0.11	0.04	0	0	0.15	0.08	0.09	0	1.07	0.37
				(4.87)				(0.13)	(0.04)			(--)	(0.07)	(0.08)		(1.10)	(0.37)
	August	0	0	0.48	0	0	0	0.69	0	0.06	0	0	0	0.46	0	0.48	0.13
				(0.54)				(1.73)		(0.08)				(1.79)		(0.21)	(0.06)
	Total	0	0	1.27	0.12	0.005	0.005	0.22	0.04	0.01	0	0.36	0.25	0.23	0.08	0.33	0.16
				(1.14)	(0.12)	(0.01)	(0.01)	(0.14)	(0.03)	(0.01)		(0.31)	(0.26)	(0.22)	(0.07)	(0.18)	(0.09)

Appendix 6. Estimated monthly (May – August) and overall summer angler catch (C) and harvest (H) for all anglers by species at Scott Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC), black bullhead (BLB), northern pike (NOP), green sunfish (GSF), bluegill (BLG), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2004	May	0	0	3,167	1,072	28	0	360	0	0	0	833	279	3,282	264	2,488	36
				(1,481)	(1,148)	(33)		(158)				(504)	(263)	(1,250)	(174)	(1,137)	(30)
	June	0	0	1,573	459	17	0	12	0	0	0	1,058	480	645	63	784	0
				(664)	(532)	(--)		(16)				(409)	(195)	(210)	(30)	(248)	
	July	0	0	1,690	1,262	3	0	0	0	21	0	77	21	266	143	323	14
				(3,609)	(2,886)	(4)				(3)		(53)	(48)	(319)	(290)	(78)	(19)
	August	0	0	24	0	0	0	5	0	0	0	19	0	466	0	63	0
				(24)				(7)				(30)		(98)		(59)	
	Total	0	0	6,454	2,792	47	0	377	0	21	0	1,987	780	4,659	470	3,657	50
				(3,957)	(3,151)	(33)		(159)		(3)		(653)	(331)	(1,311)	(340)	(1,168)	(36)
2005	May	0	0	389	206	163	85	0	0	0	0	7	7	66	66	150	143
				(269)	(196)	(73)	(47)					(6)	(6)	(32)	(32)	(54)	(54)
	June	0	0	107	0	0	0	0	0	0	0	0	0	0	0	13	13
				(90)												(15)	(15)
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	496	206	163	85	0	0	0	0	7	7	66	66	163	156
				(284)	(196)	(73)	(47)					(6)	(6)	(32)	(32)	(56)	(56)
2006	May	0	0	118	52	0	0	169	20	225	0	0	0	0	0	2	0
				(94)	(67)			(110)	(3)	(295)						(3)	
	June	0	0	27	0	0	0	54	0	14	0	0	0	0	0	0	0
				(84)				(168)		(19)							
	July	0	0	99	0	0	0	0	0	6	0	0	0	0	0	0	0
				(--)						(--)							
	August	0	0	991	105	0	0	31	31	139	0	0	0	0	0	0	0
				(1,050)	(0)			(--)	(--)	(--)							
	Total	0	0	1,235	156	0	0	255	51	384	0	0	0	0	0	2	0
				(1,057)	(67)			(201)	(3)	(296)						(3)	

Appendix 6. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2007	May	0	0	4,479	691	29	29	310	35	18	0	1,202	955	769	367	538	389
				(2,519)	(628)	(35)	(35)	(202)	(40)	(20)		(787)	(756)	(587)	(242)	(322)	(245)
	June	0	0	1,863	12	0	0	474	171	0	0	707	408	248	78	249	159
				(857)	(19)			(409)	(104)			(480)	(295)	(137)	(48)	(197)	(130)
	July	0	0	612	0	0	0	90	31	0	0	121	63	69	0	843	294
				(1,003)				(59)	(24)			(110)	(49)	(51)		(711)	(264)
	August	0	0	253	0	0	0	360	0	33	0	0	0	239	0	249	66
				(262)				(717)		(39)				(314)		(0)	(0)
	Total	0	0	7,207	703	29	29	1,234	238	51	0	2,030	1,426	1,324	445	1,880	908
				(2,855)	(629)	(35)	(35)	(852)	(114)	(43)		(928)	(813)	(681)	(246)	(805)	(383)

Appendix 7. Estimated monthly (May – August) and overall summer angler catch rate per hour fished (C/h) and harvest rate per hour fished (H/h) for all anglers by species at Twin Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC), black bullhead (BLB), northern pike (NOP), green sunfish (GSF), bluegill (BLG), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2004	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.23 (0.24)	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.10 (0.11)	0
2005	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09 (0.10)	0.05 (0.09)
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04 (0.04)	0.02 (0.04)
2006	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0.06 (0.10)	0	3.94 (9.51)	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0.02 (0.04)	0	1.67 (2.89)	0

Appendix 7. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h	C/h	H/h
2007	May	0	0	0.12 (0.07)	0.09 (0.05)	0	0	0	0	0	0	0	0	0.01 (0.02)	0	1.29 (1.37)	0.04 (--)
	June	0	0	0.07 (0.12)	0	0	0	0	0	0	0	0	0	0	0	2.54 (3.05)	0
	July	0.01 (0.01)	0	0.80 (0.31)	0	0	0	0	0	0	0	0	0	0.02 (0.02)	0.01 (0.01)	0.97 (0.84)	0.01 (0.02)
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0.003 (0.01)	0	0.34 (0.08)	0.02 (0.01)	0	0	0	0	0	0	0	0	0.01 (0.01)	0.01 (0.01)	1.42 (0.85)	0.01 (0.01)

Appendix 8. Estimated monthly (May – August) and overall summer angler catch (C) and harvest (H) for all anglers by species at Twin Lake, South Dakota. 80% confidence intervals of estimates are provided in parentheses where they could be calculated. Abbreviations for species are as follows: common carp (COC), black bullhead (BLB), northern pike (NOP), green sunfish (GSF), bluegill (BLG), black crappie (BLC), yellow perch (YEP) and walleye (WAE).

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2004	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37 (35)	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37 (35)	0
2005	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25 (25)	14 (23)
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25 (25)	14 (23)
2006	May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	14 (24)	0	983 (924)	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	14 (24)	0	983 (924)	0

Appendix 8. Continued

		COC		BLB		NOP		GSF		BLG		BLC		YEP		WAE	
Year	Month	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H
2007	May	0	0	70 (21)	54 (0)	0	0	0	0	0	0	0	0	8 (9)	0	740 (684)	25 (29)
	June	0	0	68 (104)	0	0	0	0	0	0	0	0	0	0	0	2,352 (300)	0
	July	8 (12)	0	862 (44)	0	0	0	0	0	0	0	0	0	20 (16)	8 (12)	1,044 (532)	8 (12)
	August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	8 (12)	0	1,000 (115)	54 (0)	0	0	0	0	0	0	0	0	28 (19)	8 (12)	4,135 (918)	33 (31)