

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-47

Name: Angostura Reservoir

County: Fall River

Legal description: Sec. 1-12, 17, 19, 20,21,28-33; T 8S, R 5,6 E

Location from nearest town: 7 miles southeast of Hot Springs, SD.

Dates of present survey: May 14-16, August 7, 11-13, 2014

Date last surveyed: May 20-23, August 1, 5-7, 2013

Management classification: Warmwater permanent

Primary Species: (game and forage)

1. Walleye
2. Channel catfish
3. Smallmouth bass
4. Gizzard shad
5. Largemouth bass
6. Black crappie
7. Spottail shiner
8. Emerald shiner
9. _____

Secondary and other species:

1. Bluegill
2. Common carp
3. Green sunfish
4. Northern pike
5. Northern redhorse
6. River carpsucker
7. White sucker
8. Yellow perch
9. Freshwater drum

PHYSICAL CHARACTERISTICS

Surface Area: 4,612 acres

Watershed: 5,824,000 acres

Maximum depth: 70 feet

Mean depth: 29.3 feet

Lake elevation at survey (from known benchmark): unknown

Ownership of lake and adjacent lakeshore property:

The U.S. Bureau of Reclamation performs the maintenance of Angostura Reservoir and Dam. The South Dakota Department of Game, Fish and Parks manages much of the adjacent land as recreation/campground area and as a Game Production Area. The local irrigation district controls the water level and irrigation releases.

Fishing Access

Angostura Reservoir has excellent access for boat and shore anglers. Seven boat ramps are located around the reservoir and a marina with store is located at the northeast corner of the lake. Shore anglers can access around the reservoir by paved roads and on the southern portion through two track trails. A state park sticker is required for all public access to the reservoir.

Observations of Water Quality and Aquatic Vegetation

Department personnel identified no pollution problems during the 2014 survey. Submergent vegetation, curlyleaf pondweed and sago pondweed were observed in the bays and shallow water areas of Angostura. Emergent vegetation consisted of cattail and smartweed.

Observations on conditions of structures (i.e. spillway, boat ramps and docks, roads, etc)

No apparent problems were identified on either the dam or spillway. The boat ramps and other facilities were in excellent condition.

MANAGEMENT OBJECTIVES

Objective 1. To maintain a walleye fishery with a minimum gill net catch for stock-length (10 in) and longer of 20 per net, a PSD range of 30-60, PSD-P 10 or greater, and maintain a mean growth rate of no less than 35.5 cm (14 in) by age-3.

Objective 2. Maintain the gizzard shad population.

Objective 3. Maintain an angler satisfaction rate of 64.5% or greater.

BIOLOGICAL DATA

Sampling Effort and Catch

Age-0 Fish Survey

Daytime boat electrofishing was used on August 7, 2014 to index gizzard shad reproduction. Electrofishing was done using a boat mounted Smith-Root unit with pulsed-DC. Sampling consisted of ten stations totaling 1.0 hours of electrofishing. No other age-0 fish were collected during this survey so all further discussion is included with the gizzard shad section of this report.

Adult Fish survey

Trap nets were used on May 14-16 and experimental gill nets on August 11-13, 2014 to sample adult fish populations in the reservoir (Figure 1). The net sampling consisted of eight trap net nights and four gill net nights and catch data is displayed in Tables 1 and 2. Discussion on selected fish species follows and completes this report.

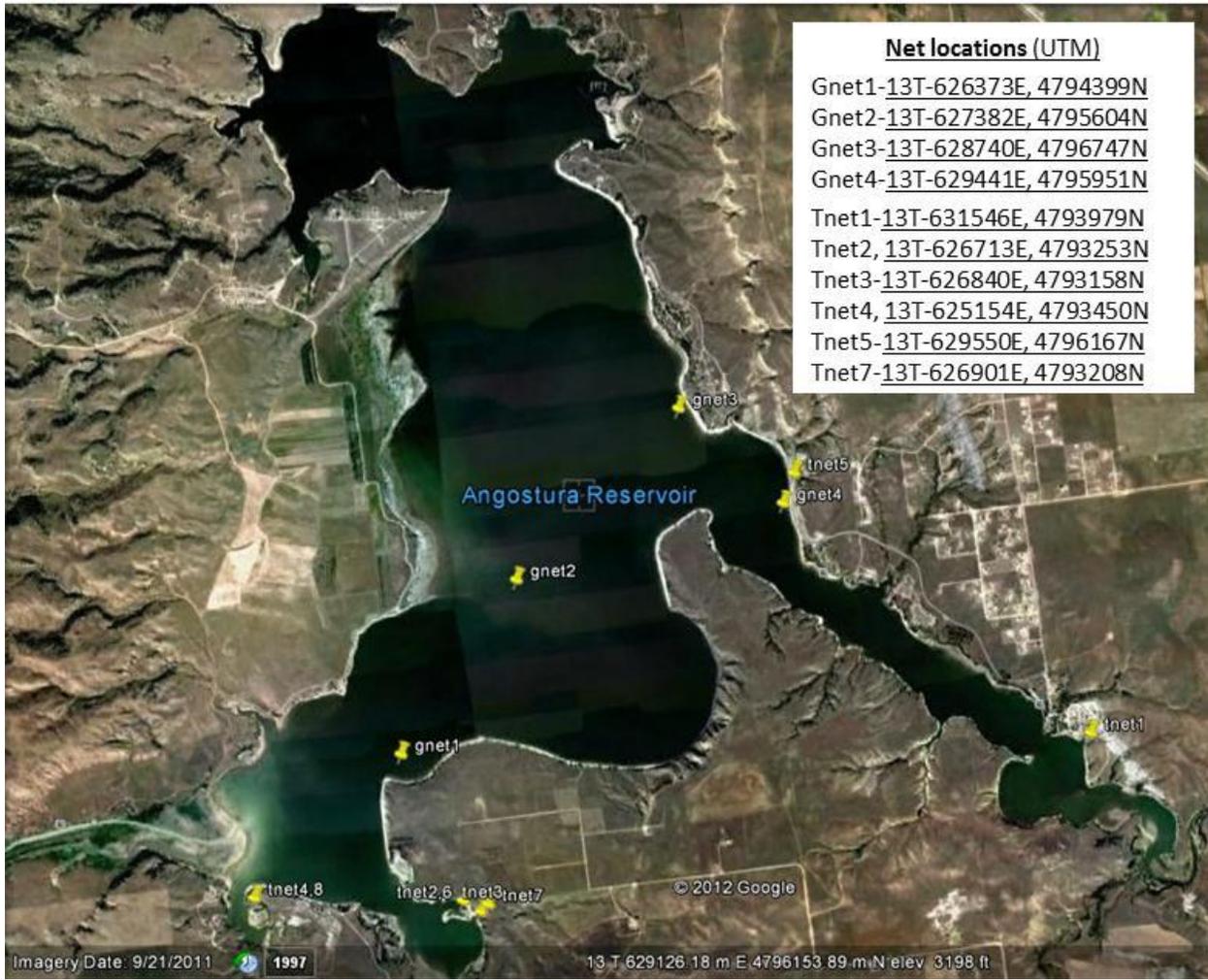


Figure 1. Locations, including GPS coordinates, of experimental gill (gnet) and trap (tnet) nets during the fisheries survey of Angostura Reservoir, Fall River County, 2014.

Table 1. Catch data from all species collected in eight trap nets in Angostura Reservoir, Fall River County, May 14-16, 2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	<i>Wr</i> >S
Black bullhead	17	2.1 (3.0)	1.1 (1.6)	0	0	91.5 (2.8)
Black crappie	56	7.0 (2.3)	7.0 (2.3)	95 (5)	68 (10)	98.3 (0.7)
Bluegill	16	2.0 (1.6)	2.0 (1.6)	88 (15)	6 (11)	92.3 (2.5)
Channel catfish	31	3.9 (1.7)	1.3 (0.6)	10 (18)	0	84.9 (2.0)
Common carp	21	2.6 (1.2)	2.6 (1.2)	62 (19)	5 (8)	81.5 (1.5)
Northern pike	1	0.1 (0.2)	0.1 (0.2)	--	--	83.3 (--)
River carpsucker	4	0.5 (0.3)	0.5 (0.3)	--	--	91.3 (4.0)
Rock bass	1	0.1 (0.2)	0.1 (0.2)	--	--	93.8 (--)
Shorthead redhorse	1	0.1 (0.2)	0.1 (0.2)	--	--	74.3 (--)
Smallmouth bass	11	1.4 (1.4)	1.4 (1.4)	91 (17)	18 (22)	94.8 (4.3)
Walleye	10	1.3 (1.0)	1.3 (1.0)	100	20 (24)	85.1 (2.5)
White sucker	3	0.4 (0.3)	0.4 (0.3)	--	--	81.1 (15.1)

Table 2. Catch data from all species collected in four gill nets in Angostura Reservoir, Fall River County, August 11-13, 2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	<i>Wr</i> >S
Black crappie	20	5.0 (3.3)	3.3 (2.2)	54 (26)	54 (26)	106.8 (4.2)
Channel catfish	124	31.0 (8.0)	16.8 (6.0)	27 (9)	1 (3)	81.6 (8.1)
Common carp	12	3.0 (1.8)	3.0 (1.8)	67 (26)	0	82.8 (0.7)
Freshwater drum	20	5.0 (1.2)	4.3 (1.0)	6 (10)	0	88.4 (1.3)
Gizzard shad	10	2.5 (2.0)	2.5 (2.0)	100	0	90.2 (3.4)
Largemouth bass	2	0.5 (0.5)	0.3 (0.4)	--	--	118.9 (--)
River carpsucker	8	2.0 (2.8)	2.0 (2.8)	--	--	91.0 (2.0)
Shorthead redhorse	34	8.5 (3.2)	8.5 (3.2)	--	--	85.7 (1.2)
Smallmouth bass	19	4.8 (3.2)	4.3 (2.9)	82 (17)	24 (19)	95.1 (3.1)
Walleye	136	34.0 (4.3)	29.5 (5.1)	59 (8)	6 (4)	84.6 (0.6)
White sucker	1	0.3 (0.4)	0.3 (0.4)	--	--	83.0 (--)
Yellow perch	31	7.8 (3.7)	3.8 (1.6)	60 (23)	13 (16)	91.7 (2.3)

Black crappie

Trap net catch per unit effort (CPUE) was 7.0 per net (Tables 1 and 3), compared to 11.6 last year. Size structure showed a population dominated by large fish (Figure 2) with a proportional stock density (PSD) of 95 and of preferred-length stock density (PSD-P) of 68. This year size structure was similar to last year's PSD of 73 and a PSD-P of 26. Fish condition was good with a mean relative weight for stock length and larger fish (*Wr*>S) of 98.3 (Table 1). Growth was excellent well above the state and regional average (Table 4)

Table 3. Composite listing of data for black crappie collected by trap nets in Angostura Reservoir 2011-2014. CPUE's with 80% confidence intervals in parentheses. PSD and PSD-P with 90% confidence intervals in parentheses.

Year	N	CPUE	PSD	PSD-P
2011	211	26.4 (15.4)	100 (1)	50 (6)
2012	32	4.0 (2.0)	94 (8)	31 (14)
2013	93	11.6 (5.9)	73 (8)	26 (8)
2014	56	7.0 (2.3)	95 (5)	68 (10)

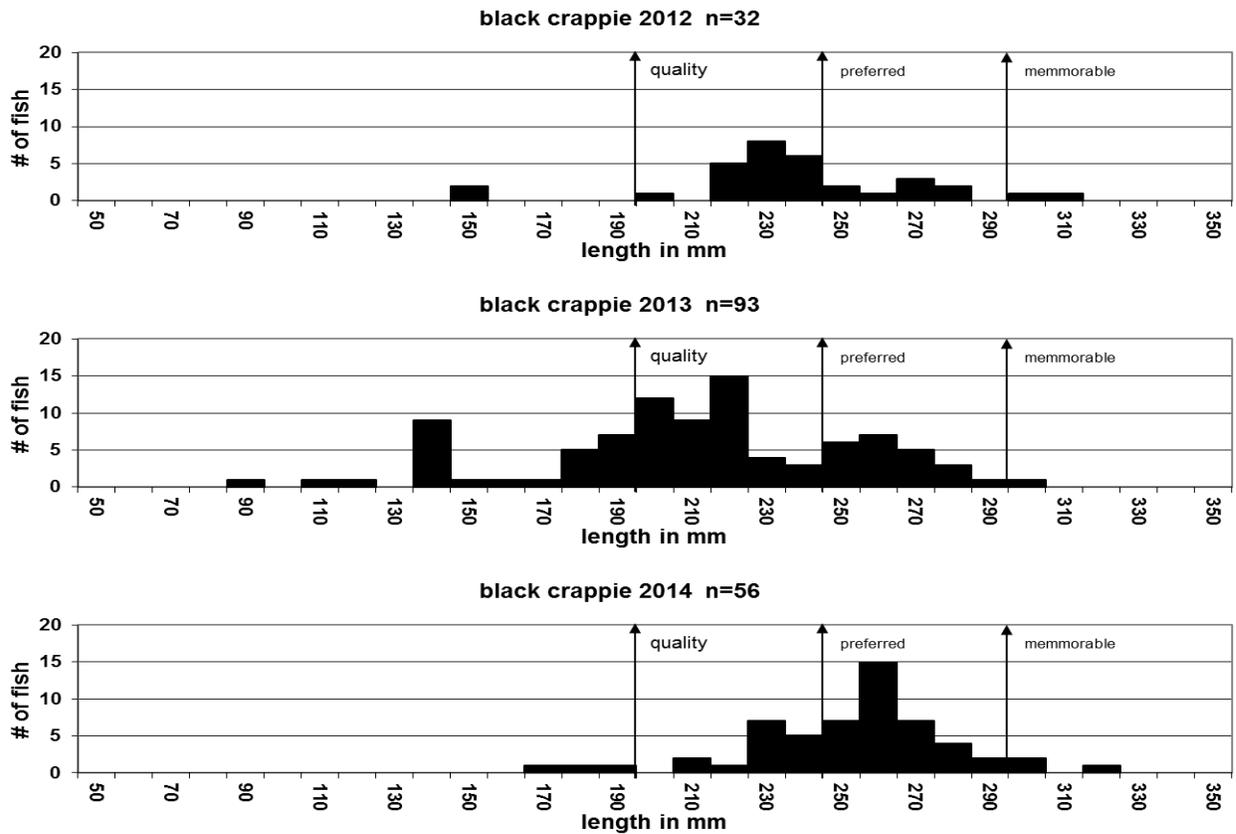


Figure 2. Length frequency histograms of black crappies collected by trap nets from Angostura Reservoir, Fall River County, 2012-2014.

Table 4. Angostura Lake black crappie year class, age in 2014, sample size (N), mean back-calculated total length-at-age, the Region 1 mean length-at-age, and the South Dakota state-wide black crappie mean length-at-age (Willis et al 2001). Standard errors are in parentheses.

Year Class	Age	N	1	2	3	4	5	6	7
2012	2	7	95	202					
2011	3	10	89	152	237				
2010	4	30	83	152	215	263			
2009	5	2	106	186	269	285	308		
2008	6	5	70	119	166	185	219	267	
2007	7	1	102	202	257	281	301	310	320
2014 Pop. mean (SE)		55	91 (5)	169 (14)	229 (18)	254 (23)	276 (29)	288 (21)	320
Region 1			74 (3)	122 (7)	158 (9)	197 (13)	217 (16)		
South Dakota			83 (2)	147 (4)	195 (5)	229 (6)	249 (6)		

Bluegill

Bluegill catch was lower this year with a CPUE of 2.0, versus CPUE in 2013 at 8.1 (Tables 1 and 5). Stock density indices yielded a size structure dominated by larger fish with a PSD of 88 and a PSD-P of 6. The length frequency histogram indicates low recruitment by showing few fish under quality length (Figure 3).

Table 5. Composite listing of data for bluegill collected by trap nets in Angostura Reservoir 2011-2014. CPUE's with 80% confidence intervals in parentheses. PSD and PSD-P with 90% confidence intervals in parentheses.

Year	N	CPUE	PSD	PSD-P
2011	6	0.8 (0.7)	67 (43)	0
2012	36	4.5 (1.7)	83 (11)	0
2013	65	8.1 (9.3)	52 (11)	2 (2)
2014	16	2.0 (1.6)	88 (15)	6 (11)

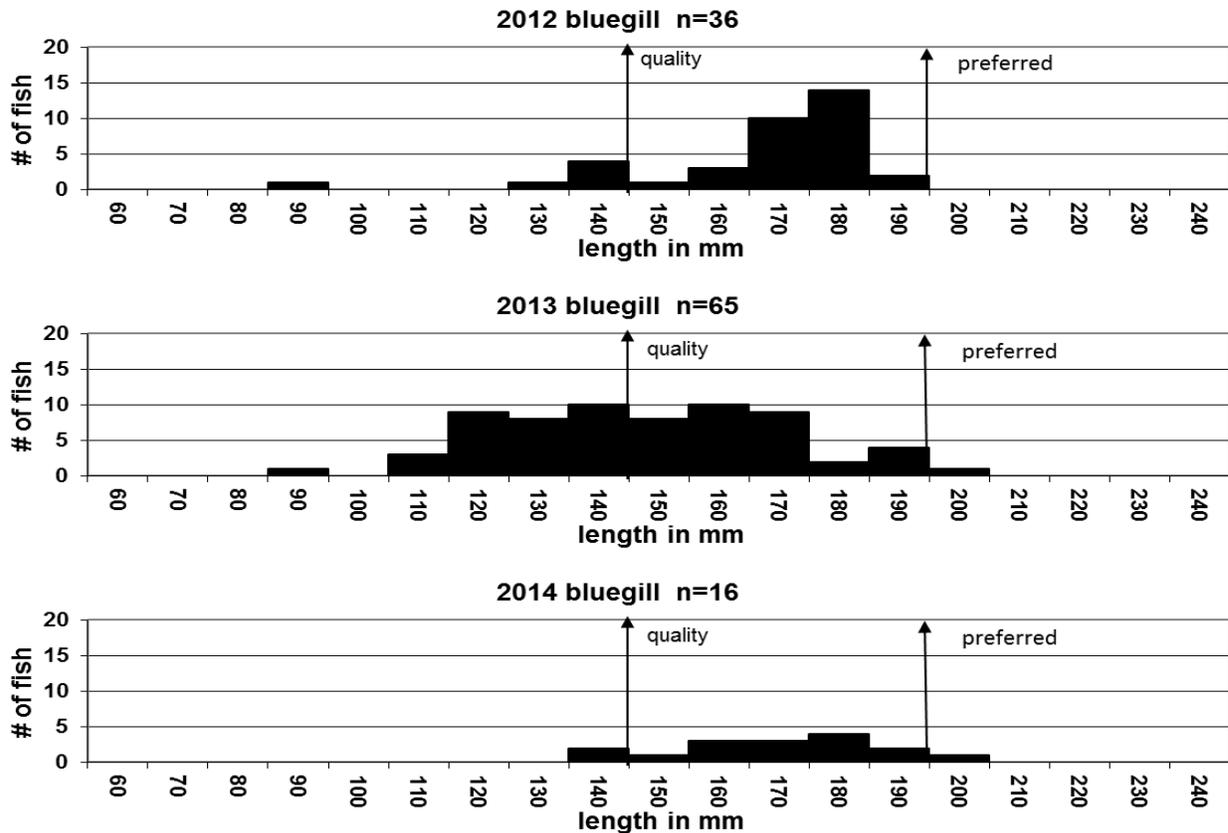


Figure 3. Length frequency histograms of bluegill collected from Angostura Reservoir, Fall River County, 2012-2014.

Channel catfish

Channel catfish were the second most abundant fish collected in gill nets (Table 2). Mean gill net CPUE for channel catfish was 31.0, and for fish stock length and greater catch (CPUE-S) was 16.8 (Table 6). Stock density indices remain low; PSD=27, PSD-P=1, but these numbers are the highest recorded in recent years. Mean channel catfish $Wr>S$ was 81.6. The length frequency histogram (Figure 4) shows a few larger fish compared to last year.

Table 6. Composite listing of data for channel catfish collected by gill nets in Angostura Reservoir 2009-2014. CPUE's with 80% confidence intervals in parentheses. PSD and PSD-P with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P
2009	137	34.3 (16.7)	26.5 (11.4)	2 (2)	0
2010	60	15.0 (5.3)	13.8 (5.1)	11 (7)	0
2011	120	30.0 (4.6)	24.0 (2.9)	21 (7)	0
2012	65	16.3 (8.0)	9.8 (5.4)	13 (9)	0
2013	114	28.5 (23.4)	13.5 (9.1)	15 (8)	0
2014	124	31.0 (8.0)	16.8 (6.0)	27 (9)	1 (3)

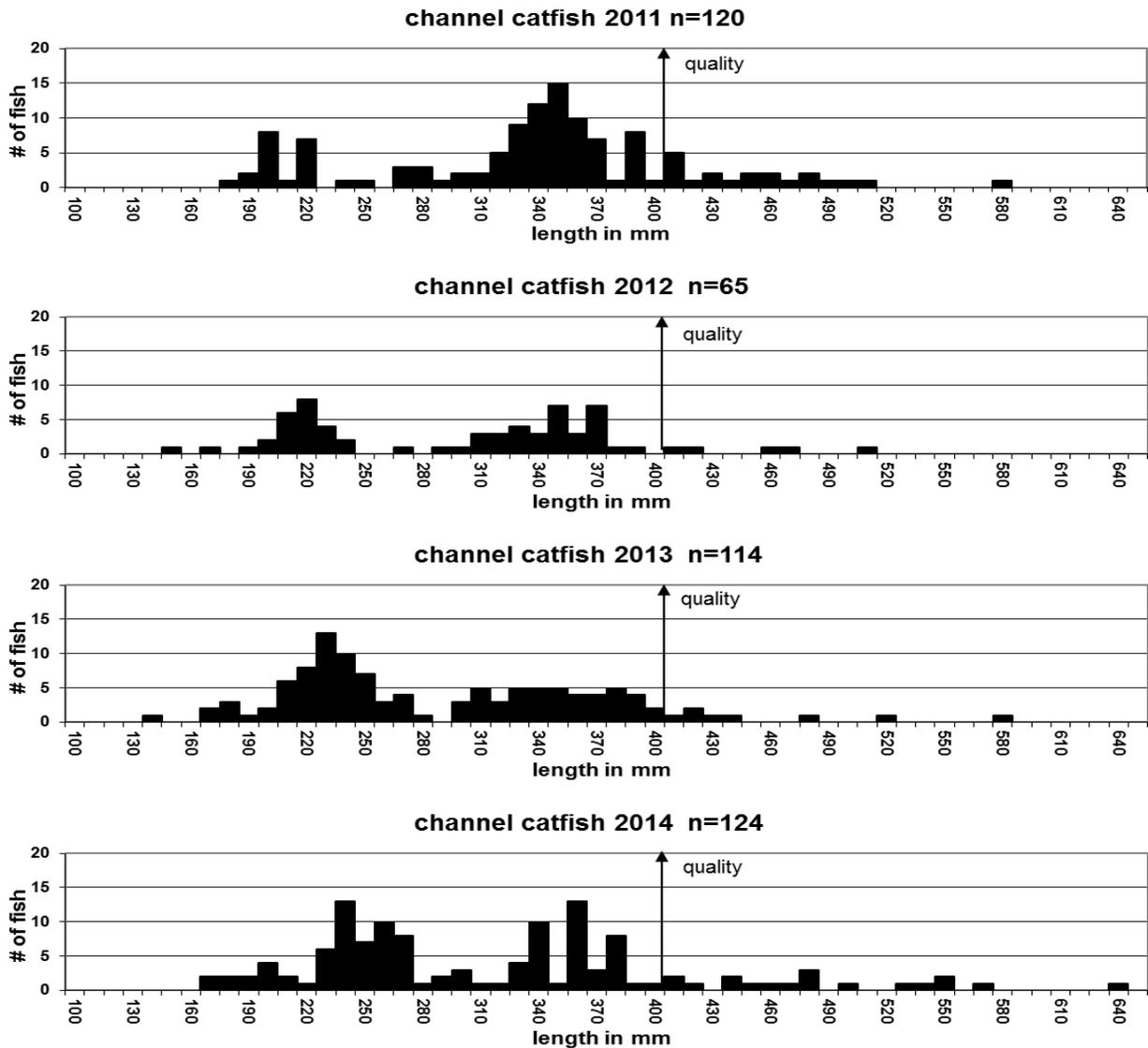


Figure 4. Length frequency histograms of channel catfish collected in experimental gill nets from Angostura Reservoir, Fall River County, 2011-2014.

Gizzard shad

Gizzard shad were introduced to Angostura Reservoir in 1990 to provide additional forage for game fish, particularly walleye which were experiencing slow growth and low relative weights. The first age-0 gizzard shad were collected in 1994 during a ¼ arc seine survey, showing successful natural reproduction. No adult gizzard shad have been stocked in Angostura Reservoir since 1994.

Daytime boat electrofishing was completed during August 7, 2014 and a total of 1,003 age-0 gizzard shad were captured in 1.0 hours of electrofishing. Catch per hour was 1,003.0 per hour compared to 788.0 last year, with nine of the ten sites sampled containing gizzard shad (Figure 5).

The northern latitude of South Dakota and subsequent cold winter water temperatures likely causes some over-winter mortality of gizzard shad on an annual basis. Limited winter mortality of gizzard shad is desirable to keep densities of adults low, while maintaining high reproductive potential due to the high fecundity of the species. The continued presence of age-0 gizzard shad, indicate that adult survival is occurring, and often results in years of large reproduction.

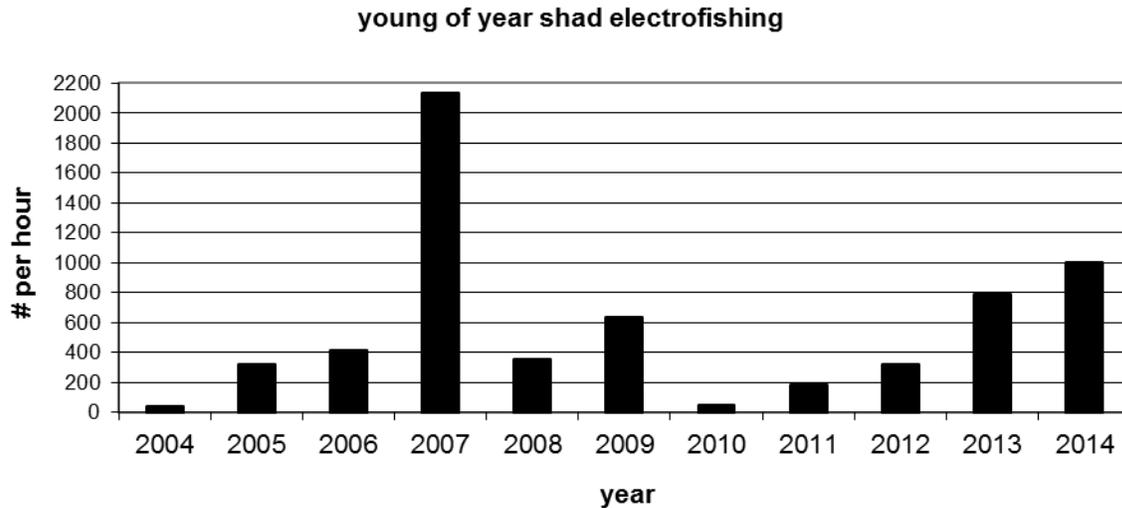


Figure 5. Daytime electrofishing results for age-0 (young of year) gizzard shad from Angostura Reservoir, 2004-2014.

Smallmouth bass

Gill net CPUE for smallmouth bass was 4.8 (Table 2). Stock indices indicate a population dominated by larger fish with a PSD of 82 and a PSD-P of 24. Fish condition for stock length and larger fish was 95.1. Growth was excellent with fish reaching 350 mm at age four (Table 6). Length frequency and age data indicate good recruitment (Figure 6, Table 7).

Table 7. Estimated age, minimum, maximum and weighted mean length (mm) at capture for smallmouth bass by otoliths from the Angostura Reservoir gill net sample, August 11-13, 2014

Age	Minimum length range @ capture	Weighted mean length @ capture	Maximum length range @ capture	N
2	253	266	273	3
3	286	312	340	9
4	345	363	375	4
5	374	374	374	1

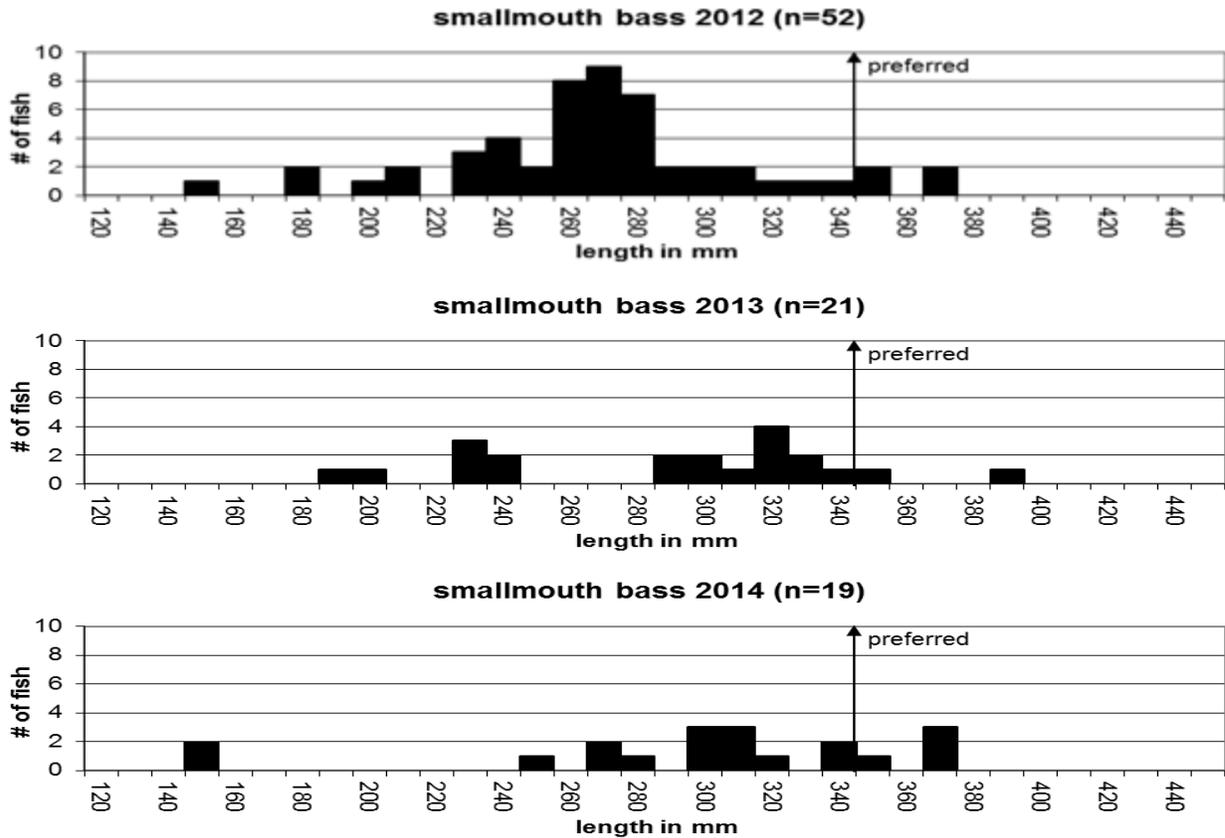


Figure 6. Length frequency histograms of smallmouth bass collected in experimental gill nets from Angostura Reservoir, Fall River County, 2012-2013.

Walleye

Angostura Reservoir remains a popular walleye fishery in western South Dakota. Despite high fishing pressure, walleye abundance remains good with a gill net CPUE of 34.0 (Tables 2 and 8). In 2013, CPUE was a little lower at 26.3. CPUE for stock length and larger fish (CPUE-S) was 29.5, compared to 25.3 last year. The 2005 lake management plan sets the target CPUE for stock length and longer walleye to be at least 20 per gill net, which is where it is at most years.

Sizes of fish and condition have also remained stable over the past few years with only small changes. Stock density indices indicate a slightly higher proportion of quality size walleye this year with a PSD of 59 versus 55 last year (Table 8). Both years fall within the current management objective of PSD between 30 and 60. Fish over 20 inches decreased slightly this year yielding a PSD-P of 6, compared to 9 last year. Walleye condition was nearly identical with a 2014 mean W/S of 84.6 and a 2013 mean of 84.5 (Table 8). Growth continues to look excellent with fish surpassing 15 inches between age-2 and age-3 (Table 9). The length frequency histogram resembles a balanced population with several strong year classes present (Figure 7). It also shows excellent recruitment. Even with no fingerling stockings in 2013, a strong year class of age1 fish is present.

Table 8. Composite listing of data for walleye collected by gill nets in Angostura Reservoir 2006-2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and $W \geq S$ with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P	$W \geq S$
2006	98	24.5 (6.8)	23.3 (6.0)	27 (8)	3 (3)	82.8 (0.1)
2007	82	20.5 (4.0)	20.5 (4.0)	23 (8)	5 (4)	83.3 (0.7)
2008	123	41.0 (10.9)	39.0 (10.9)	65 (7)	2 (2)	84.7 (0.1)
2009	88	22.0 (2.3)	21.8 (2.4)	53 (9)	8 (5)	86.0 (0.7)
2010	94	23.5 (6.1)	21.5 (4.8)	53 (9)	6 (4)	83.3 (0.4)
2011	71	17.8 (7.0)	16.5 (6.4)	70 (10)	9 (6)	84.8 (0.2)
2012	86	21.5 (9.1)	20.0 (8.1)	48 (10)	6 (5)	87.7 (0.8)
2013	105	26.3 (9.5)	25.3 (8.8)	55 (9)	9 (5)	84.5 (0.5)
2014	136	34.0 (4.3)	29.5 (5.1)	59 (8)	6 (4)	84.6 (0.6)

Table 9. Estimated age, minimum, maximum and weighted mean length (mm) at capture for walleye by otoliths from the Angostura Reservoir gill net sample, August 11-13, 2014.

Age	Minimum length range @ capture	Weighted mean length @ capture	Maximum length range @ capture	N
1	251	290	332	30
2	356	380	409	31
3	387	427	476	42
4	440	463	535	8
5	516	526	535	2
6	558	599	640	2
7	617	617	617	1
9	576	576	576	1
10	485	485	485	1

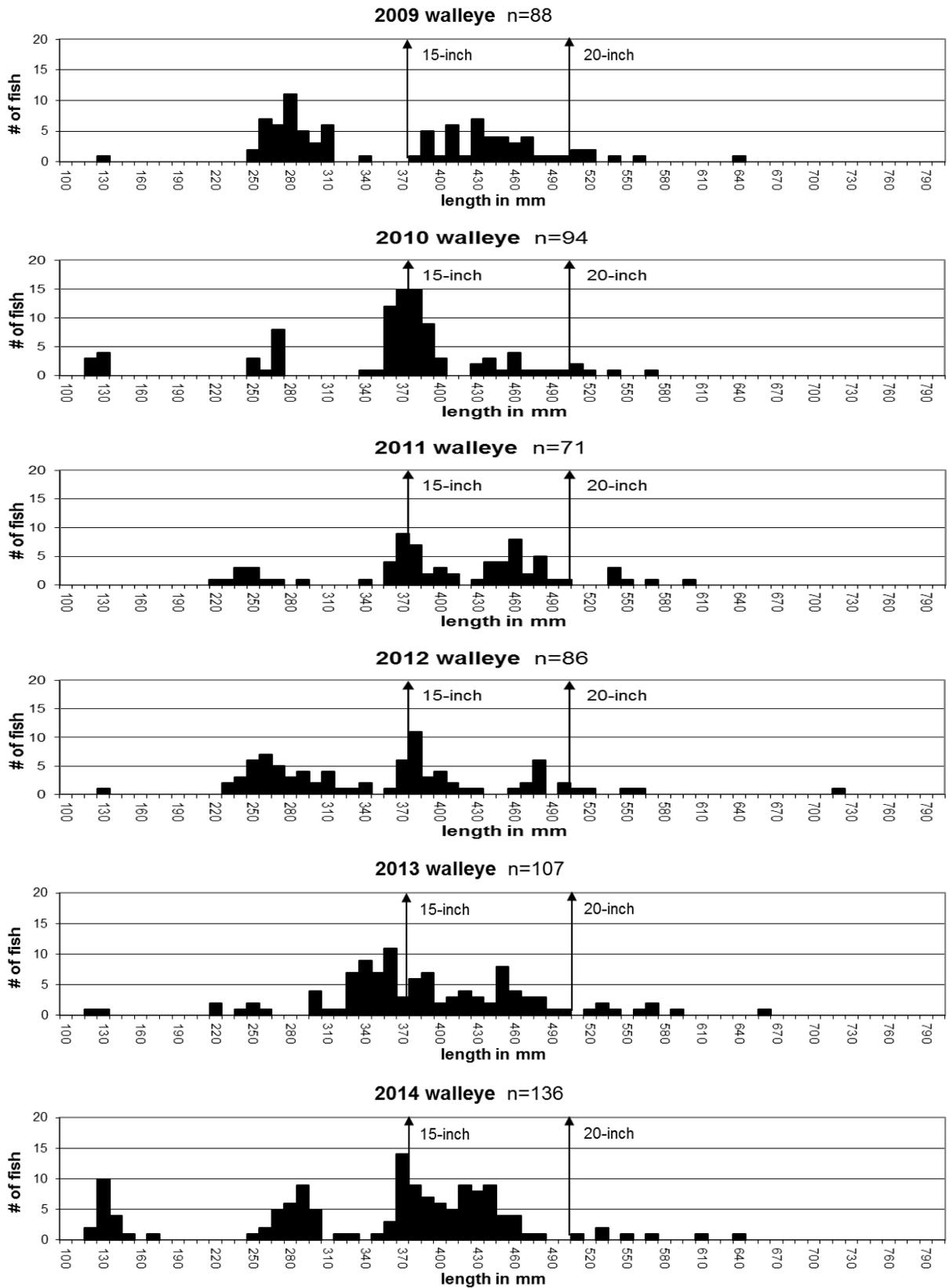


Figure 7. Length frequency histogram of walleye collected in experimental gill nets from Angostura Reservoir, Fall River County, South Dakota, 2009-2014.

RECOMMENDATIONS

1. Continue conducting annual lake surveys to evaluate fish populations and regulation success.

APPENDIX

Appendix A. Stocking history, including year a stocking occurred, number stocked, species and size of fish for Angostura Reservoir, Fall River County, South Dakota, 2000-2014.

Year	Number	Species	Size
2000	97,133	Rainbow trout	Fingerling
	207,779	Walleye	Fingerling
2001	12,638	Largemouth bass	Fingerling
	37,000	Rainbow trout	Fingerling
2002	50,100	Walleye	Fingerling
	30,000	Smallmouth bass	Fingerling
2003	218,791	Walleye	Fingerling
	80,000	Rainbow trout	Fingerling
2005	381,045	Walleye	Fingerling
2008	479,900	Walleye	Fingerling
2010	289,340	Walleye	Fingerling
2011	310,199	Walleye	Fingerling
2012	476,423	Walleye	Fingerling
2014	549,725	Walleye	Fingerling