SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

Diamond Lake, Minnehaha County
2102-F-21-R-46
2013

Legal Description: T104N-R52W-Sec. 5
Location from nearest town: 13 miles north and 2 miles west of Humboldt, SD

Dates of present survey: July 10-11, 2013
Date last surveyed: July 11-12, 2011

Game Species	Other Species
Walleye	White Sucker
Yellow Perch	Common Carp
Black Crappie	
Black Bullhead	
Green Sunfish	
Orange-spotted Sunfish	

PHYSICAL DATA

Surface Area: 256 acres
Maximum depth: 12 feet
Volume: No data available
Contour map available: No
Watershed area: No data available
Mean depth: 6 feet
Shoreline length: No data
Date mapped: 2002 (shoreline)
Lake elevation observed during the survey: Full
Beneficial use classifications: (5) warmwater semi-permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering.

Ownership of Lake and Adjacent Lakeshore Properties

Diamond Lake is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes. Game, Fish, and Parks (GFP) owns the majority of the lake basin as a Game Production Area and manages the fishery. The remainder of the shoreline is privately owned.

Fishing Access

The Diamond Lake Access Area was upgraded in 2005. It consists of a concrete plank boat ramp, gravel parking area, a boat dock and a toilet. Shore fishing access is available in the access area and along the county road grade on the south end of the lake.

Field Observations of Water Quality and Aquatic Vegetation

The water was fairly turbid during the survey with a Secchi depth measurement of 66 cm (26.0 in). Some common cattail (*Typha spp.*) and bulrush (*Scirpus spp.*) exist in shallow bays.

BIOLOGICAL DATA

Winterkill:

Diamond Lake suffered a severe winterkill in 2010-11. Low oxygen levels were detected prior to ice-out. After ice-out, a large number of fish, mostly common carp, were found floating in the lake. Subsequent test netting and the lake survey found that some black bullheads, black crappies, yellow perch and common carp had survived the winterkill.

Methods:

Diamond Lake was sampled on July 10-11, 2013 with three overnight gill net sets and five overnight trap net sets. The trap nets are constructed with 19-mm-bar-mesh (¾ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh (½, ¾, 1, 1¼, 1½, and 2 in) monofilament netting.

Results and Discussion:

Gill Net Catch

Black bullhead and common carp comprised the majority of the 2013 gill net sample (Table 1). About 7% of the bullhead CPUE consisted of fish smaller than stock length (15 cm, 6 in). Yellow perch was the only other species caught.

Table 1. Total catch from three overnight gill net sets at Diamond Lake, Minnehaha County, July 10-11, 2013.

Species	#	%	CPUE[1]	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	302	83.7	100.7	±15.2	54.2	0	0	90
Common Carp	41	11.4	13.7	±1.3	14.8	2	0	90
Yellow Perch	18	5.0	6.0	±10.3	20.5	0	0	103

*6 years (2000, 2002, 2004, 2006, 2007, 2009)

[1] See Appendix A for definitions of CPUE, PSD, and mean Wr.

Table 2. Catch per unit effort by length category for various fish species captured with gill nets in Diamond Lake, July 10-11, 2013.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Black Bullhead	7.7	93.0	93.0	--	--	100.7	±15.2
Common Carp	--	13.7	13.4	0.3	--	13.7	±1.3
Yellow Perch	--	6.0	6.0	--	--	6.0	±10.3

Length categories can be found in Appendix A.

Trap Net Catch

Black bullheads were the most abundant species in the trap net catch (Table 3). Other species caught included yellow perch, black crappie, common carp, hybrid sunfish, orange-spotted sunfish and green sunfish.

Table 3. Total catch from five overnight trap net sets at Diamond Lake, Minnehaha County, July 10-11, 2013.

Species	#	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	484	81.5	96.8	±40.1	347.0	17	3	79
Yellow Perch	54	9.1	10.8	±5.5	4.2	2	0	97
Black Crappie	19	3.2	3.8	±2.4	0.7	0	0	103
Common Carp	13	2.2	2.6	±1.2	10.1	0	0	87
Hybrid Sunfish	13	2.2	2.6	±2.7	0.3	--	--	--
O. S. Sunfish	7	1.2	1.4	±0.5	0.0	--	--	--
Green Sunfish	4	0.7	0.8	±0.7	0.4	--	--	--

*6 years (2000, 2002, 2004, 2006, 2007, 2009)

Table 4. Catch per unit effort by length category for various fish species captured with trap nets in Diamond Lake, July 10-11, 2013.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Black Bullhead	6.0	90.8	75.2	12.8	2.8	96.8	±40.1
Yellow Perch	--	10.8	10.6	0.2	--	10.8	±5.5
Black Crappie	--	3.8	3.8	--	--	3.8	±2.4
Common Carp	--	2.6	2.6	--	--	2.6	±1.2
Hybrid Sunfish*	--	--	--	--	--	2.6	±2.7
O. S. Sunfish*	--	--	--	--	--	1.4	±0.5
Green Sunfish	--	0.8	0.8	--	--	0.8	±0.7

*No length categories established. Length categories can be found in Appendix A.

Walleye

Management objective: Maintain a walleye population with a gill-net CPUE of at least 15.

No walleyes were sampled by gill nets or trap nets during the 2013 lake survey (Tables 1, 3). It is likely the small fingerling stockings made in 2011 and 2012 failed (Table 8). The 2013 small fingerling stocking could not be evaluated since they would not have been large enough to be caught at the time of this survey.

Table 5. Walleye gill-net CPUE, PSD, RSD-P, and mean Wr for Diamond Lake, Minnehaha County, 2004-2013.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CPUE	2.3		10.0	6.7		6.7		0.5		0.0
PSD	100		49	--		6		--		--
RSD-P	17		11	--		6		--		--
Mean Wr	92		85	82		81		--		--

*6 years (2002, 2004, 2006, 2007, 2009, 2011)

Yellow Perch

Management objective: Maintain a yellow perch population with a gill-net CPUE of at least 50.

Yellow perch gill net CPUE declined in 2013 and remains well below the management objective (Table 6) despite fingerling stockings in 2011-2013 (Table 8). All of the perch sampled were 14-18 cm (5.5-7.1 in) long and were probably 2 years old (2011 year class) (Figure 2).

Table 6. Yellow perch gill-net CPUE, PSD, RSD-P, and mean Wr for Diamond Lake, Minnehaha County, 2004-2013.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CPUE	9.3		15.0	1.7		11.0		13.0		6.0
PSD	93		87	--		85		38		0
RSD-P	0		16	--		12		0		0
Mean Wr	97		81	--		101		109		103

*6 years (2002, 2004, 2006, 2007, 2009, 2011)

Other Species

Common carp and black bullhead abundance has increased since 2011 while game species abundance remains low (Table 7). White sucker, northern pike, and bluegill have not been sampled for several years.

Table 7. Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Diamond Lake, Minnehaha County, 2004-2013.

Species	2004	2005	2006	2007	2009	2010	2011	2012	2013
COC (GN)	4.3		50.0	4.0	8.0		1.0		13.7
COC (TN)	9.5		19.8	11.7	3.3		8.0		2.6
WHS (GN)	--		--	--	--		--		--
WHS (TN)	0.3		0.5	0.1	0.3		--		--
BLB (GN)	108.0		33.3	12.0	6.0		59.0		100.7
BLB (TN)	104.7		289.4	256.6	17.1		184.6		96.8
CCF (GN)	--		--	--	--		--		--
CCF (TN)	0.1		--	--	--		--		--
NOP (GN)	0.3		--	--	--		--		--
NOP (TN)	0.5		0.3	0.2	--		--		--
GSF (GN)	--		--	--	--		--		--
GSF (TN)	0.7		0.7	--	0.4		0.6		0.8
OSF (GN)	--		--	--	--		--		--
OSF (TN)	0.2		--	--	--		--		1.4
HYB (GN)	--		--	--	--		--		--
HYB (TN)	0.1		--	--	0.5		1.4		2.6
BLG (GN)	--		--	--	--		--		--
BLG (TN)	0.1		0.1	--	--		--		--
BLC (GN)	--		--	--	0.3		1.0		--
BLC (TN)	0.1		0.1	0.1	2.7		1.0		3.8
YEP (GN)	9.3		14.7	1.7	11.0		13.0		6.0
YEP (TN)	0.7		1.9	0.6	2.6		3.6		10.8
WAE (GN)	2.3		10.0	6.7	6.7		0.5		--
WAE (TN)	0.8		5.3	4.0	6.5		0.2		--

COC (Common Carp), WHS (White Sucker), BLB (Black Bullhead), CCF (Channel Catfish), NOP (Northern Pike), GSF (Green Sunfish), OSF (Orangespotted Sunfish), HYB (Hybrid Sunfish), BLG (Bluegill), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye)

MANAGEMENT RECOMMENDATIONS

1. Stock walleyes and yellow perch as needed to accomplish management objectives.

2. Investigate the potential of several shallow lake management techniques that could be used to improve water quality, increase submerged aquatic vegetation and improve game fish populations. These may include but are not limited to undesirable fish control, top-down predator management, aeration/circulation, and total chemical renovation.

Table 8. Stocking record for Diamond Lake, Minnehaha County, 1997-2013.

Year	Number	Species	Size
1997	2,640	Yellow Perch	Adult
	19,485	Yellow Perch	Fingerling
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
2008	4,325	Walleye	Large Fingerling
2009	100,700	Yellow Perch	Fingerling
2011	27,040	Walleye	Fingerling
	104,960	Yellow Perch	Fingerling
2012	40,350	Walleye	Fingerling
	81,210	Yellow Perch	Fingerling
2013	26,220	Walleye	Fingerling
	104,030	Yellow Perch	Fingerling

Table 9. History of known fish kills for Diamond Lake, Minnehaha County.

Year	Type of Kill	Severity*
2001	Winterkill	Light
2011	Winterkill	Heavy

*Total – no live fish found
Heavy – large numbers of dead fish, some kill-resistant fish alive
Moderate – moderate numbers of dead fish, some kill-resistant and kill-prone fish alive
Light – just a few kill-prone fish found dead

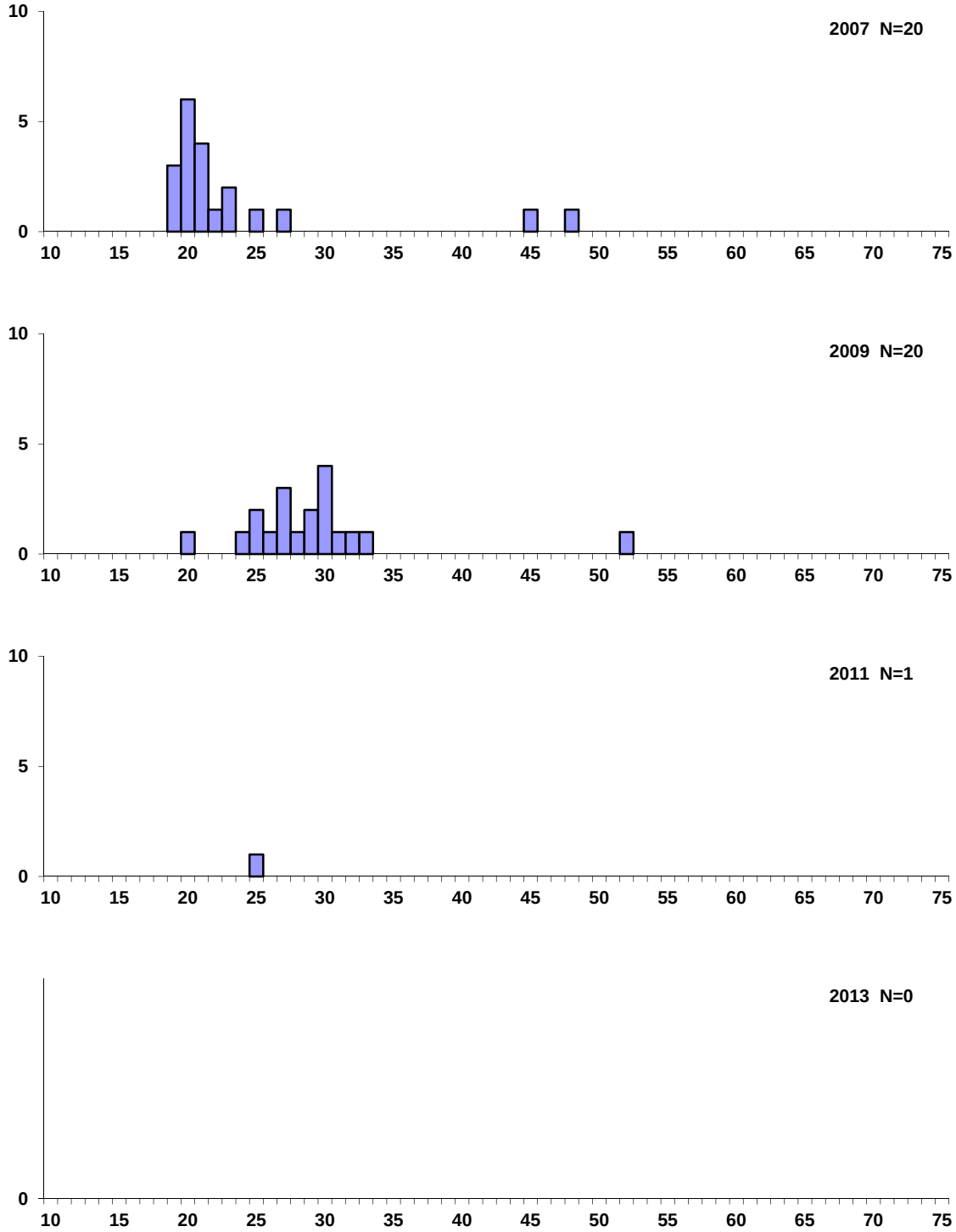

Figure 1. Length frequency histogram for walleye sampled with gill nets in Diamond Lake, Minnehaha County, 2007, 2009, 2011 and 2013.

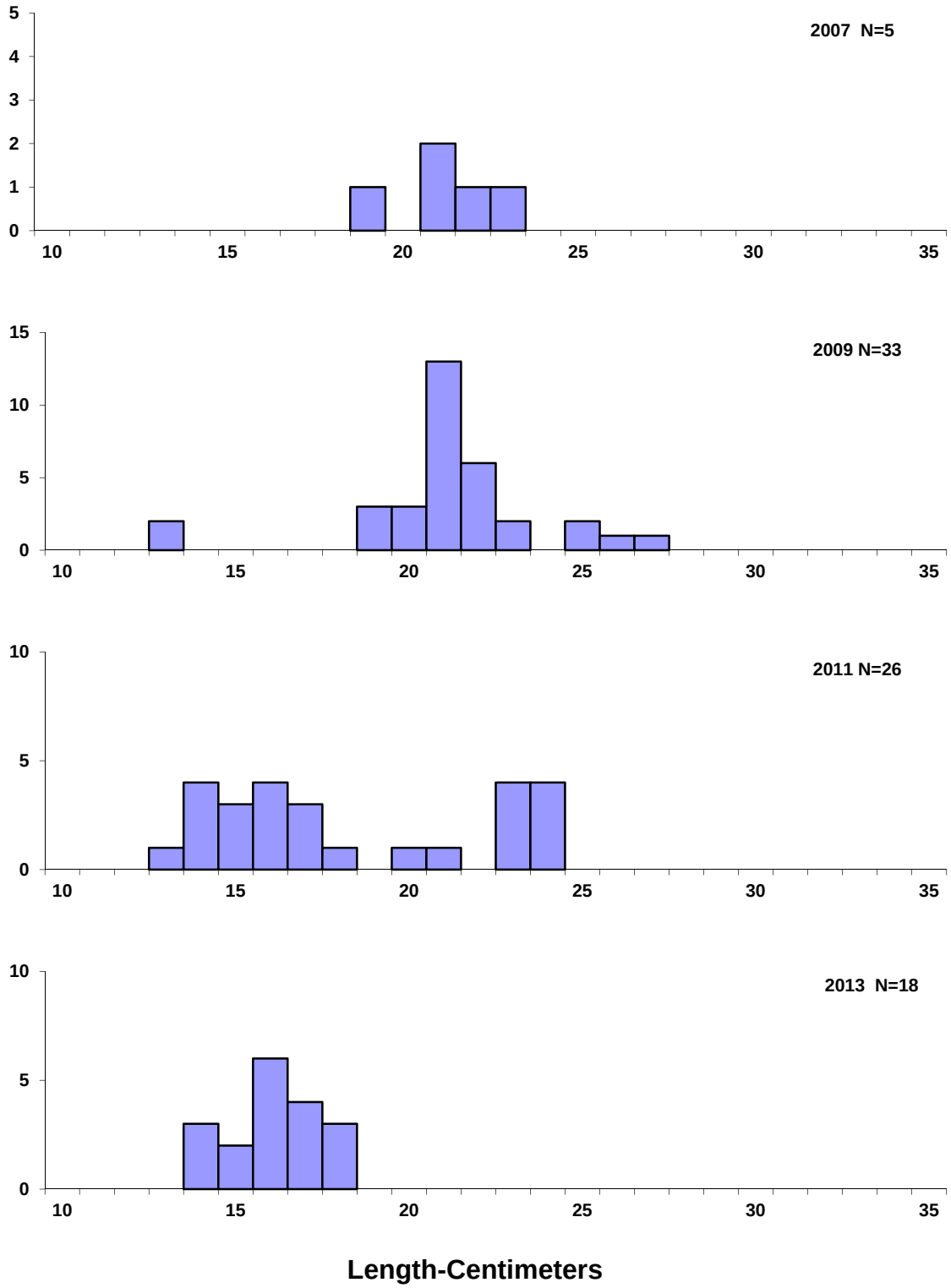

Figure 2. Length frequency histograms for yellow perch sampled with gill nets in Diamond Lake, Minnehaha County, 2007, 2009, 2011 and 2013.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch Per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$RSD\text{-}P = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters (Inches in parenthesis).

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25 (10)	38 (15)	51 (20)	63 (25)	76 (30)
Yellow perch	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
Black crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
White crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
Bluegill	8 (3)	15 (6)	20 (8)	25 (10)	30 (12)
Largemouth bass	20 (8)	30 (12)	38 (15)	51 (20)	63 (25)
Smallmouth bass	18 (7)	28 (11)	35(14)	43 (17)	51 (20)
Northern pike	35 (14)	53 (21)	71 (28)	86 (34)	112 (44)
Channel catfish	28 (11)	41 (16)	61 (24)	71 (28)	91 (36)
Black bullhead	15 (6)	23 (9)	30 (12)	38 (15)	46 (18)
Common carp	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)
Bigmouth buffalo	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.