Fall Walleye Index Netting at Battle Lake, Alberta, 2012

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Abstract

A total of 244 fish representing six species were caught during the Fall Walleye Index Netting (FWIN) survey. Walleye were the most abundant species in the FWIN nets accounting for 61% of the catch. Individual net catches were variable ranging from 10 to 42 Walleye. The catch-per-unit effort (CPUE) for Walleye was 22.7 fish·100m^{-2}·24hrs^{-1} (95% C.I. 14.2–30.9), which is 22% more than the Alberta mean of 18.6 fish·100m^{-2}·24hrs^{-1}. Walleye total lengths (TL) (n=149) ranged from 178 to 687 mm and fish over 500 mm TL represented 46% of the catch. The majority of fish were in the 430 to 570 mm TL size category. There were 10 age-classes present (ages 0 to 5, 7, 9, 13 and 14) and 70% of the Walleye sampled were mature. Average age-at-maturity was 5.6 years for females and 3.0 years for males, and female and male Walleye started maturing by age 3 and 4, respectively. Walleye from Battle Lake reached a mean TL of 500 mm by age 4 and the growth curve suggests that the asymptotic average maximum body size (L_{inf}) was 679.6 mm TL.

Lake Whitefish only accounted for 5% of the catch. The CPUE for Lake Whitefish was 1.7 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.7–2.7). Lake Whitefish TLs (n=11) ranged from 110 to 647 mm and fish over 500 mm TL represented 73% of the catch. There were 7 age-classes present (ages 0, 1, 11, 13, 14, 18 and 19) and 73% of Lake Whitefish sampled were mature.

The CPUE for Yellow Perch was 2.9 fish·100m^{-2}·24hrs^{-1} (95% C.I. 1.9–3.8). Yellow Perch TLs (n=20) ranged from 110 to 192 mm.

Northern Pike were the second most abundant species in the FWIN nets accounting for 20% of the catch. The CPUE for Northern Pike was 7.1 fish·100m^{-2}·24hrs^{-1} (95% C.I. 5.0–9.4). Northern Pike TLs (n=49) ranged from 374 to 766 mm, and fish greater than 630 mm TL represented 45% of the catch.

Introduction

Alberta Environment and Sustainable Resource Development develops and implements strategies to sustainably manage fish populations and provide opportunities for harvest, when suitable. Monitoring is required to evaluate the effectiveness of these strategies and to develop alternate strategies where evidence supports change. During Fall Walleye Index Netting (FWIN) our objective is to estimate relative abundance, population structure and growth of Walleye (*Sander vitreus*), and also collect data on other species. Although FWIN is not designed specifically for managing and estimating abundance of other sport fish species, FWIN surveys have been useful as a tool in assessing and monitoring those populations as well. These data are essential to provide sustainable harvest allocations for sport fish, and provides insight into the current management strategies by comparing the results from previous FWIN surveys. This FWIN survey was conducted in September 2012 to determine abundance, structure, and reproduction (recruitment) of the Walleye population in Battle Lake. The data collected on Walleye was also used in determining licence allocations for harvest under the Special Fish Harvest Licence.

Methods

This FWIN survey was conducted from September 19 to 21, 2012. A comprehensive description of equipment and methodology can be found in the Manual of Instructions Fall Walleye Index Netting (FWIN) (Morgan 2002). The FWIN nets consisted of eight panels, 7.62 m in length and 1.83 m in height with stretched mesh sizes of 25, 38, 51, 64, 76, 102, 127, and 152 mm. Nets were set at 6 sites randomly selected and weighted by depth stratum. Nets were set for 24 hrs (± 3 hours) before being cleared of fish and reset at new locations. Set and pull times were recorded. Nets were set perpendicular to depth contours, and minimum and maximum depths were recorded. Net location were recorded in Universal Transverse Mercator (UTM) projection coordinates using the North American Datum 1983 (NAD 83) on handheld GPS units. Surface water temperature was also recorded at all net locations, and ranged between 13.7 and 14.9°C.

All fish species were kept for biological sampling. Catches were recorded by net location and mesh size. Net identification, date, mesh size, and count of each species of fish caught were recorded for each panel for catch-per-unit-effort (CPUE) calculations. All fish were measured for fork length (FL), and total length (TL) to the nearest millimetre, and weighed in grams, with individual data recorded on a sample envelope for each fish. Walleye, Lake Whitefish (*coregonus clupeaformis*), Northern Pike (*Esox lucius*) and Yellow Perch (*Perca flavescens*) were examined for gender and maturity, and a bony structure was removed for ageing. Otoliths were collected from Walleye, Lake Whitefish and Yellow Perch and aged following criteria in Watkins and Spencer (2009). Cleithra were collected from Northern Pike and aged following the criteria in Mackay et al. (1990). Growth was described using the von Bertalanffy growth model in FAST 2.1 (Auburn University 2000-2001).

Relative abundance expressed as CPUE was calculated as number of fish caught·100m^{-2}·24hrs^{-1} with 95% confidence intervals empirically determined by bootstrapping catches to 50,000 replications (Haddon 2001).

Interpretations of the Walleye population status are based on criteria contained in the *Alberta's Walleye Management Recovery Plan* (Berry 1995, Sullivan 2003) modified for FWIN (Watters and Davis 2004).

The raw data is stored digitally in the Fish and Wildlife Management Information System (FWMIS), project # 16539.

Results

A total of 244 fish representing six species were caught during the 2012 FWIN survey (Table 1). Walleye were the most abundant species in the FWIN nets accounting for 61% of the catch. Individual net catches were variable ranging from 10 to 42 Walleye. The CPUE for Walleye was 22.7 fish·100m^{-2}·24hrs^{-1} (95% C.I. 14.2–30.9), which is 22% more than the Alberta mean of 18.6 fish·100m^{-2}·24hrs^{-}1, but has declined by 29% from 32.1 fish·100m^{-2}·24hrs^{-1} (95% C.I. 26.8–36.8) since the last FWIN survey in 2008 (Figure 1, Table 2). In 2012, Walleye total lengths (TL) (n=149) ranged from 178 to 687 mm and fish over 500 mm TL represented 46% of the catch. During the most recent survey, the majority of Walleye were in the 430 to 570 mm TL size category. Walleye in the 240 to 300 and 580 to 640 mm TL size ranges declined substantially since 2008 (Figure 2). In 2012, there were 10 age-classes present (ages 0 to 5, 7, 9, 13 and 14), but majority of the ages were poorly represented. Only three age-classes had a stable CPUE (>3 fish·100m^{-2}·24hrs^{-1}); the 1, 4 and 5-year-olds (Figure 3). This is similar to the 2008 survey where 13 age-classes were represented, three of these being stable (1, 9 and 10-year-olds). The most abundant age-classes were the 5-year-olds in 2012 and the 1-year-olds in 2008, which represented 41% and 46% of the sample, respectively. In 2012, the mean Walleye age was 4.1 years and 70% of Walleye sampled were mature. Average age-at-maturity was 5.6 years for females and 3.0 years for males, and female and male Walleye started maturing by age 3 and 4, respectively (Figure 4). Walleye reached a mean TL of 500 mm by age 4 and the growth curve suggests that the asymptotic average maximum body size (L_{inf}) was 679.6 mm TL, which is an underestimate because 2% of the sample had TL greater than the model predicted (Figure 5).

Lake Whitefish only accounted for 5% of the catch, in 2012. The CPUE for Lake Whitefish was 1.7 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.7–2.7), which declined considerably from 6.4 fish·100m^{-2}·24hrs^{-1} (95% C.I. 4.0–8.9) caught in 2008 (Table 2). In 2012, Lake Whitefish TLs (n=11) ranged from 110 to 647 mm and fish over 500 mm TL represented 73% of the catch. Lake Whitefish length frequency distribution between years cannot be compared due to the low sample size in 2012 (n=11) (Figure 6). During the most recent survey, there were 7 age-classes present (ages 0, 1, 11, 13, 14, 18 and 19), but none had a CPUE >3 fish·100m^{-2}·24hrs^{-1} (Figure 7). In 2008, 13 age-classes were represented in the sample and many of these exhibited a much higher CPUE then what was encountered in 2012. The most abundant age-class was difficult to determine in 2012 due to the low abundance of fish in the sample (n=10). In 2012, the mean Lake Whitefish age was 11.4 years and 73% of the Lake Whitefish sampled were mature.

The CPUE for Yellow Perch was 2.9 fish·100m^{-2}·24hrs^{-1} (95% C.I. 1.9–3.8), which increased by 42% from 1.2 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.4–1.9) caught in 2008 (Table 2). Yellow Perch TLs (n=20) ranged from 110 to 192 mm. Yellow Perch length frequency distribution between years cannot be compared due to the low sample size in 2008 (n=8) (Figure 8).

Northern Pike were the second most abundant species in the FWIN nets accounting for 20% of the catch. The CPUE for Northern Pike was 7.1 fish·100m^{-2}·24hrs^{-1} (95% C.I. 5.0–9.4), which decreased by 34% from 10.6 fish·100m^{-2}·24hrs^{-1} (95% C.I. 6.9–14.2) caught in 2008 (Table 2). Northern Pike TLs (n=49) ranged from 374 to 766 mm, and fish greater than 630 mm TL represented 45% of the catch. In 2012, there were a greater abundance of larger individuals in the 640 to 740 mm TL size range when compared to the 2008 data where smaller individuals (480 to 580 mm TL) were more abundant (Figure 9).

Interpretation

As of 2012, Battle Lake is slightly above the provincial average of reported FWIN Walleye catch rates annually from across Alberta, but was found to have declined considerably since 2008. The population status classification for the Battle Lake Walleye fishery indicates a vulnerable population, according to the criteria outlined in *Alberta's Walleye Management Recovery Plan* (Berry 1995). Of the 5 biological population metrics used as the criteria for classifying status of Walleye fisheries, modified for FWIN analysis (from Sullivan, 2003), 3 population metrics relating to catch rate, age-class distribution and age-class stability indicate a vulnerable population, and the 2 metrics of age at maturity and length at age indicate a collapsed population (Table 3). This is consistent with the 2008 vulnerable population status classification of the Walleye fishery in Battle Lake (Dick 2013), yet the catch rate has dropped by 29% indicating a declining trend from a vulnerable status closer to a collapsed population status.

The catch rate of Lake Whitefish has declined significantly since 2008 indicating a trend towards a collapsed population status. The age-class distribution has narrowed since the last sampling event, and none of the mature age-classes appear strong enough to indicate or support a stable population. Although annual recruitment appears to be occurring over the past two years,, the lack of consistent recruitment and low abundance of fish are indications of a collapsed population and are known to limit the ability of the population to recover.

The catch rate of Yellow Perch has shown signs of improvement and has increased by over doubling since 2008. Although the low abundance of Yellow Perch likely suggests that the population is in a vulnerable-collapsed state, there is evidence and signs of recovery occurring.

The catch rate of Northern Pike has declined since the last sampling event, but is still relatively high in comparison to other Central Alberta lakes. The moderate abundance and increase in size distribution of Northern Pike suggests that the population is and remains at a vulnerable status.

Table 1. Species catch summary by site, Battle Lake, September 2012

Set Number	Lift Date (2012)	Stratum	UTM Easting	UTM Northing	Meridian	Soak Time (h)	Fish Count per Species						
							LKWH	NRPK	SPSH	WALL	WHSC	YLPR	Set Total
10D	21-Sep	Deep	690201	5871748	-117 (Zone 11)	22.00	4	10	1	34		4	52
14D	20-Sep	Shallow	691692	5871161	-117 (Zone 11)	26.00	3	14		42	8	5	70
3C	21-Sep	Deep	686563	5873884	-117 (Zone 11)	23.50	2	6		11		4	22
5A	20-Sep	Deep	687250	5873250	-117 (Zone 11)	26.17	1	8		10		4	21
5C	20-Sep	Deep	687927	5872870	-117 (Zone 11)	25.00		4		34		1	39
9A	20-Sep	Deep	689231	5872288	-117 (Zone 11)	26.50	1	7		24		2	34
Species Total							11	49	1	149	8	20	244

Table 2. Species catch rates from the 2008 and 2012 Battle Lake FWIN surveys.

Species	Year	CPUE	95% CI
LKWH	2008	6.4	(4.0 - 8.9)
	2012	1.7	(0.7 - 2.7)
NRPK	2008	10.6	(6.9 - 14.2)
	2012	7.1	(5.0 - 9.4)
SPSH	2008	N/A	N/A
	2012	0.2	(0.0 - 0.5)
WALL	2008	32.1	(26.8 - 36.8)
	2012	22.7	(14.2 - 30.9)
WHSC	2008	3.3	(1.9 - 4.8)
	2012	1.1	(0.0 - 3.3)
YLPR	2008	1.2	(0.4 - 1.9)
	2012	2.9	(1.9 - 3.8)

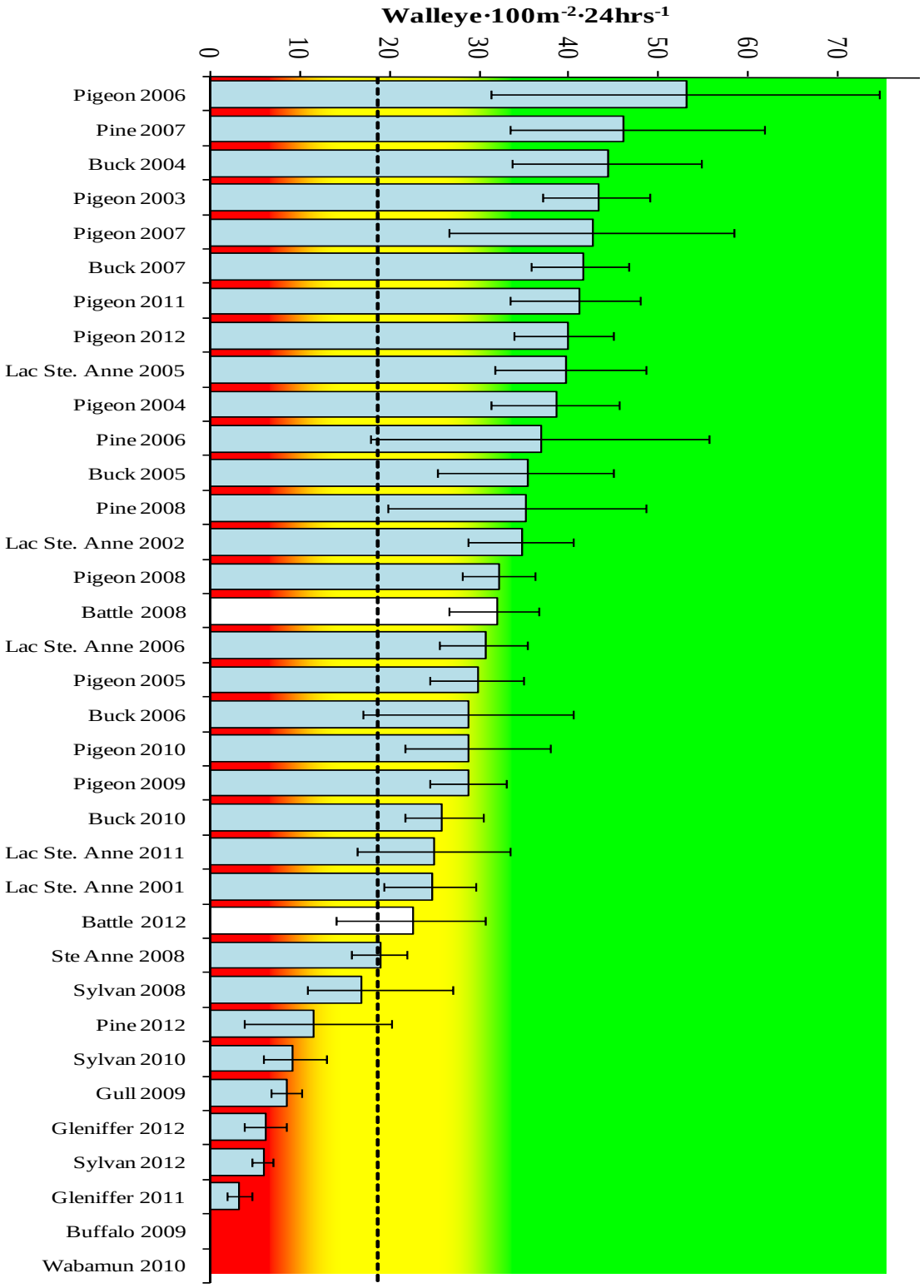

Figure 1. Mean Walleye catch rates with 95% CI from a representative sample of FWIN surveys from Across Central Alberta. The dashed line represents the mean provincial catch rate of 18.6 fish·100m^{-2}·24hrs^{-1}. Collapsed, vulnerable, and stable catch rate ranges are indicated by red, yellow and green backgrounds. The Walleye catch rates from the 2008 and 2012 Battle Lake FWIN surveys are highlighted.

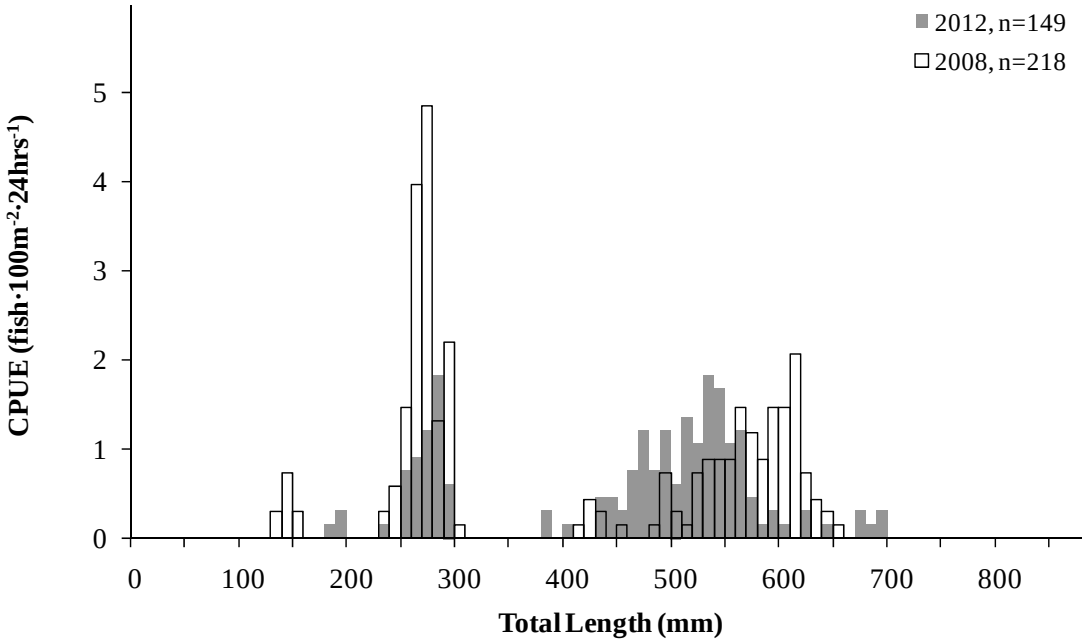

Figure 2. Walleye total length frequency distributions from the 2008 and 2012 FWIN surveys on Battle Lake.

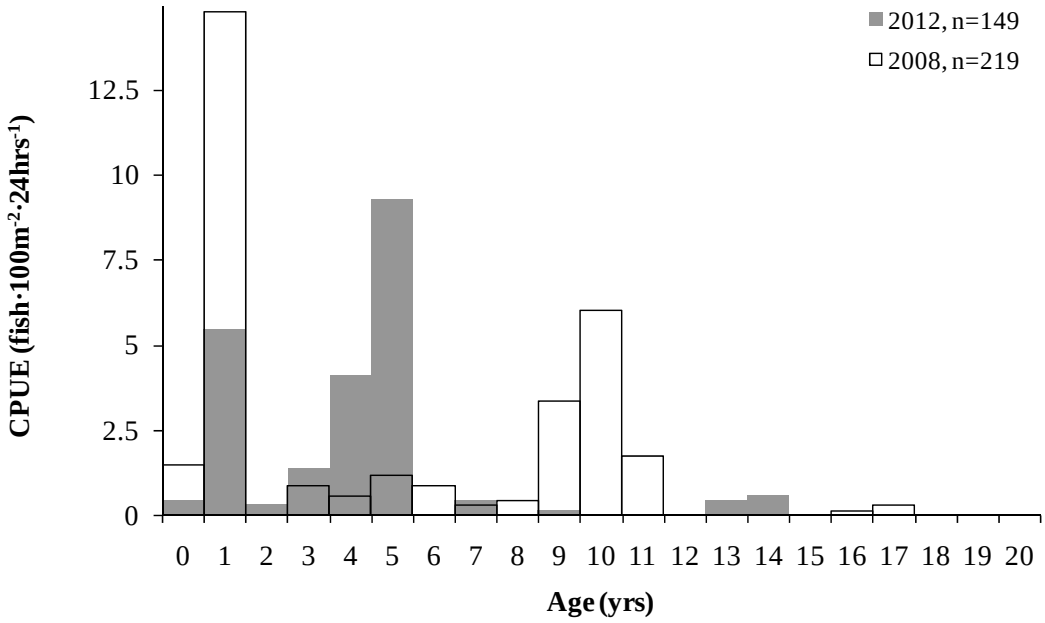

Figure 3. Walleye age frequency distributions from the 2008 and 2012 FWIN surveys on Battle Lake. Mean ages were 4.8 and 4.1 years, respectively.

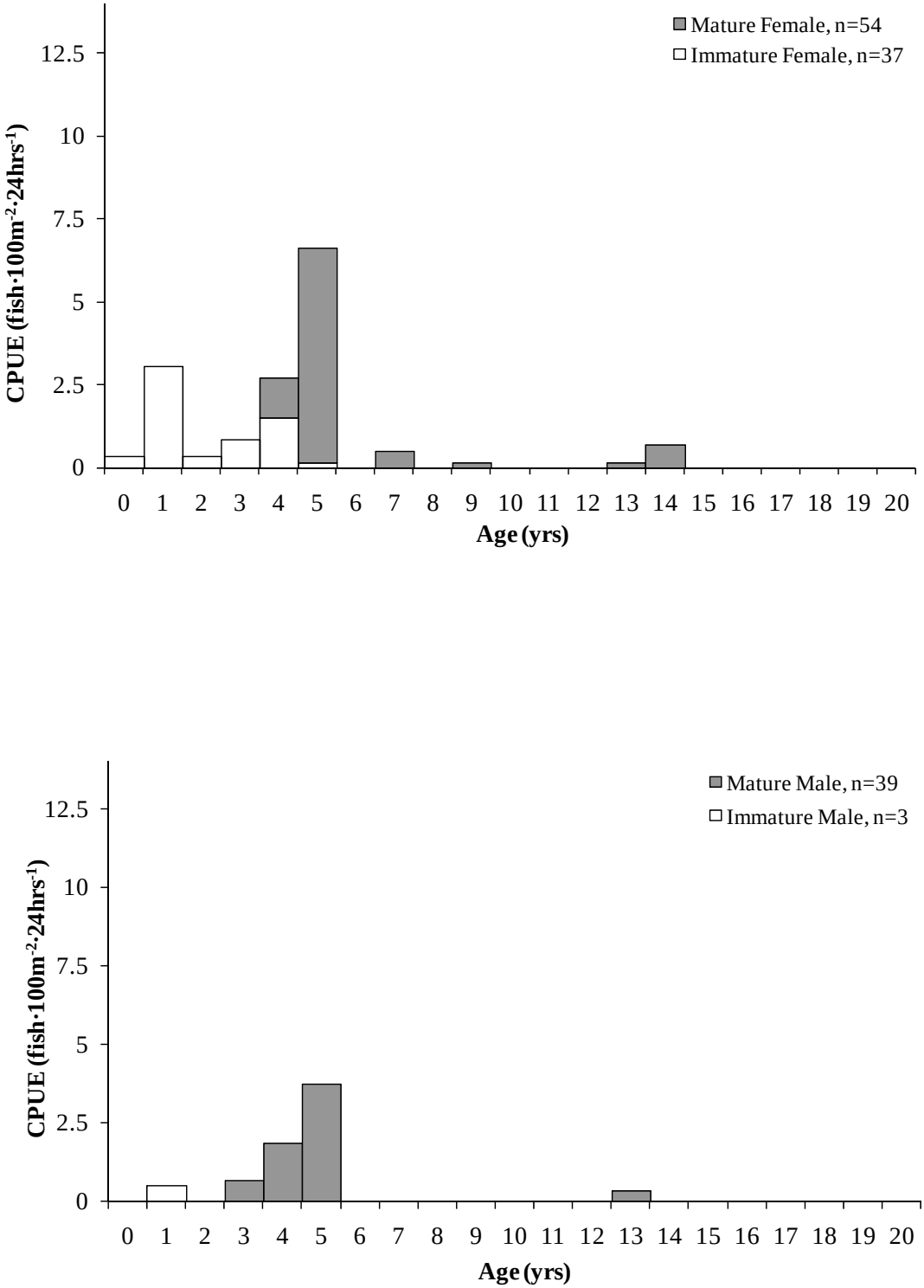

Figure 4. Age-at-maturity distributions for female and male Walleye from the 2012 FWIN survey on Battle Lake.

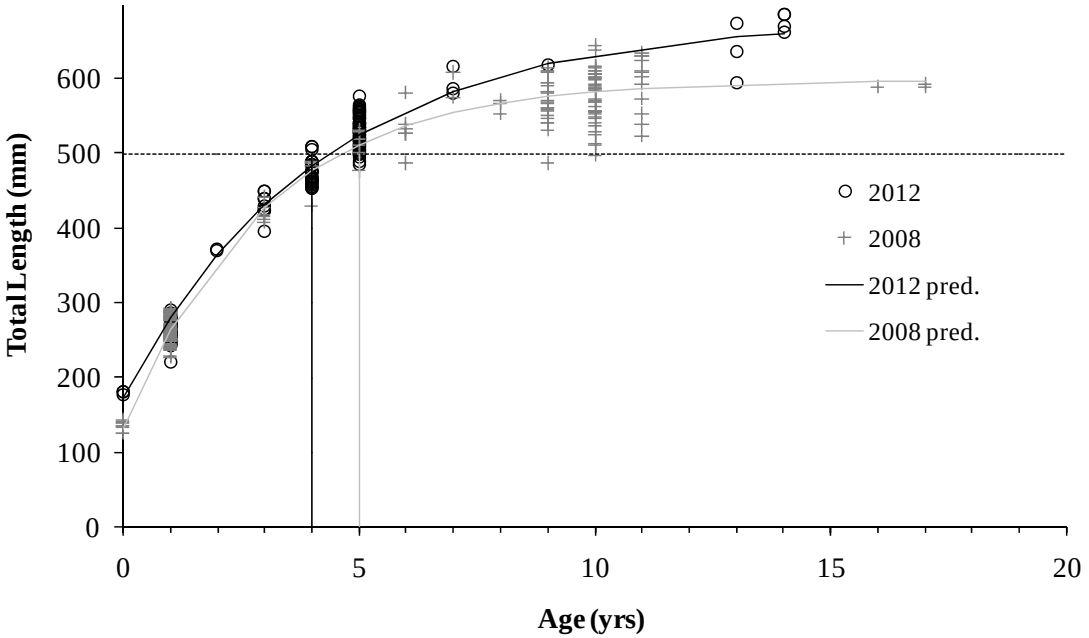

Figure 5. Total length-at-age for Battle Lake Walleye from the 2008 (L_{inf} = 599.0, K = 0.337, t_o = -0.741, R^2 = 0.99, Prob > 0.0001), and 2012 (L_{inf} = 679.6, K = 0.238, t_o = -1.234, R^2 = 1.00, Prob > 0.0001) FWIN surveys.

Table 3. Walleye stock classification for Battle Lake based on the 2012 FWIN survey results.

POPULATION METRIC	POPULATION STATUS CLASSIFICATION			
	TROPHY	STABLE	VULNERABLE	COLLAPSED
CATCH RATE (FWIN)	High - >30 walleye•100m^{-2}•24h^{-1}	High - >30 walleye•100m^{-2}•24h^{-1}	Moderate: 15-30 walleye•100m^{-2}•24h^{-1}	Low: <15 walleye•100m^{-2}•24h^{-1}
			CPUE =22.7	
AGE CLASS DISTRIBUTION	Wide: 8 or more age classes (n=200); mean age >9 years.	Wide: 8 or more age classes (n=200); mean age 6 to 9 years.	Narrow: 1 to 3 age classes; mean age 4 to 6 years; few old (>10 years).	Can be wide or narrow; mean age 6 to 10 years.
			Wide age class distribution - 10 age-classes (n=149); mean age = 4.1 years; few old fish.	
AGE CLASS STABILITY	Very stable: 1 to 2 "measureable" (> 3 walleye•100m^{-2}•24h^{-1}) age classes out of a smooth catch curve.	Relatively stable: 2 to 3 "measureable" age classes out of a smooth catch curve.	Unstable: 1 to 3 "measureable" age classes, with gaps in age classes.	Stable or unstable: 1 or fewer "measurable" age classes.
			3 measurable age classes (> 3 walleye•100m-2•24h-1)of 1, 4 and 5 -year old fish; gaps in age classes.	
AGE AT MATURITY	Females: 10-20 years Males: 10-16 years	Females: 8-10 years Males: 7-9 years	Females: 7-8 years Males: 5-7 years	Females: 4-7 years Males:3-6 years
				Females: 5.6 years Males: 3.0 years
LENGTH AT AGE	Very Slow 50 cm in 12-15 years	Slow 50 cm in 9-12 years	Moderate 50 cm in 7-9 years	Fast 50 cm in 4-7 years
				500mm TL reached at 4 years

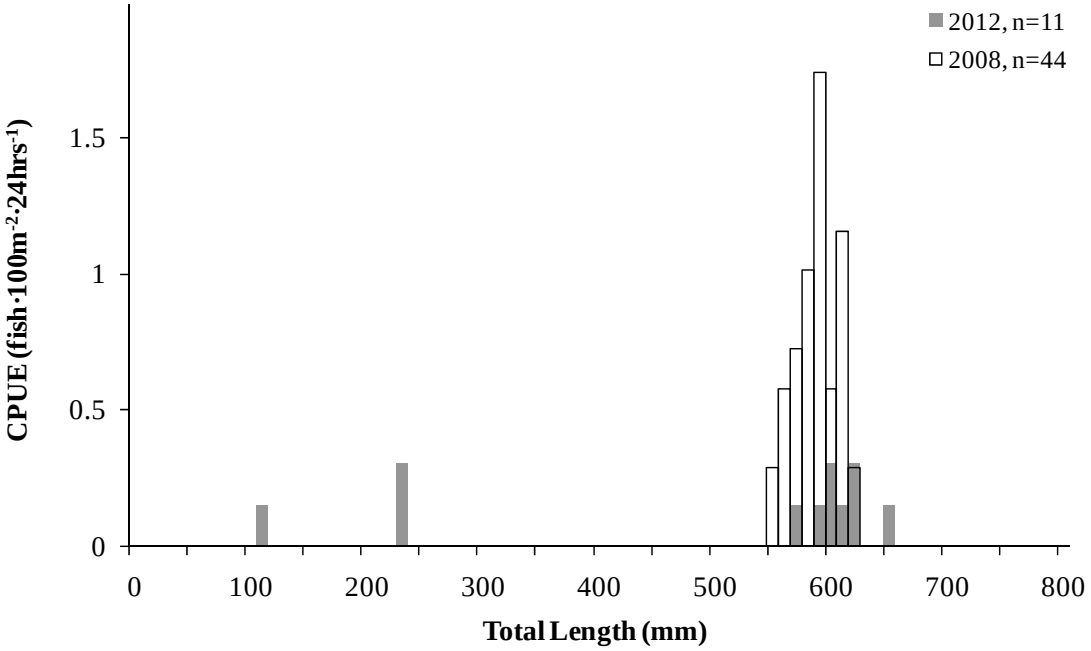

Figure 6. Lake Whitefish total length frequency distributions from the 2008 and 2012 FWIN surveys on Battle Lake.

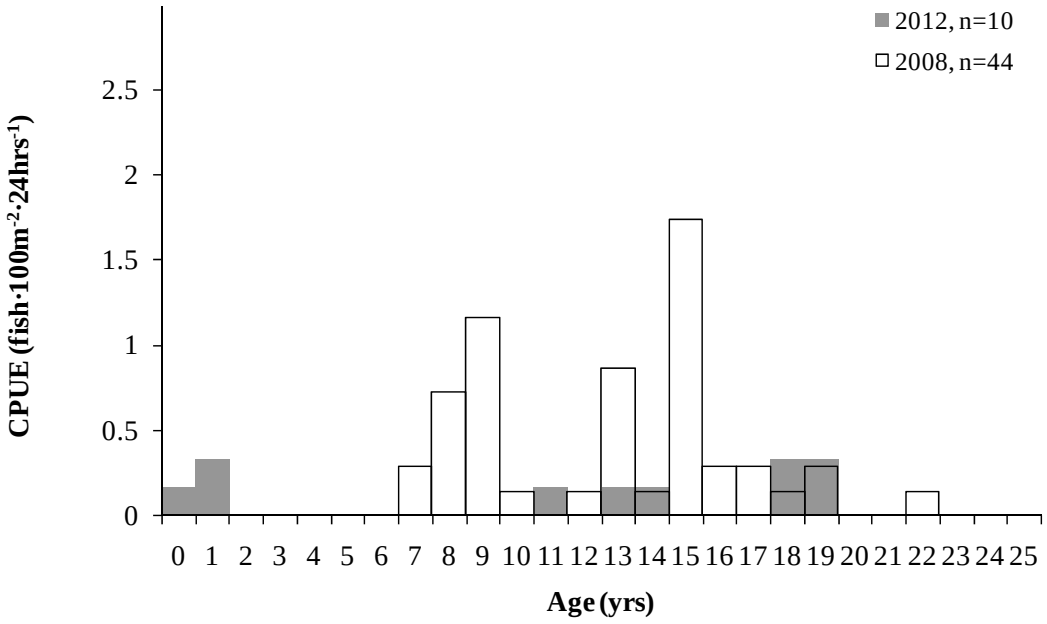

Figure 7. Lake Whitefish age frequency distributions from the 2008 and 2012 FWIN surveys on Battle Lake. Mean ages were 12.8 and 11.4 years, respectively.

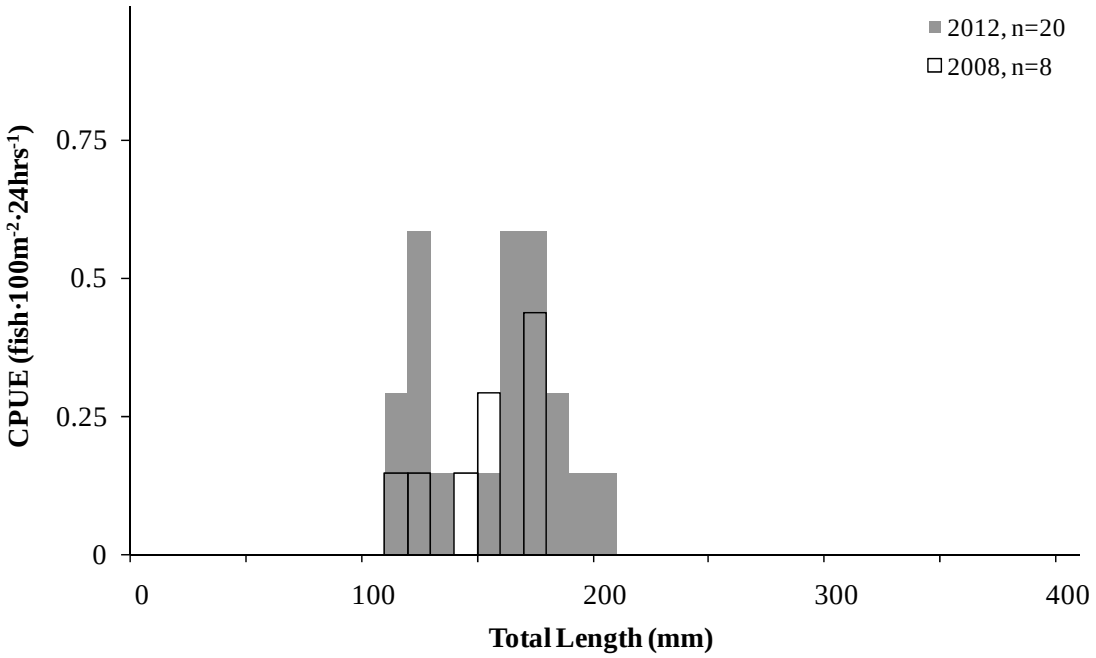

Figure 8. Yellow Perch total length-frequency distributions from the 2008 and 2012 FWIN surveys on Battle Lake.

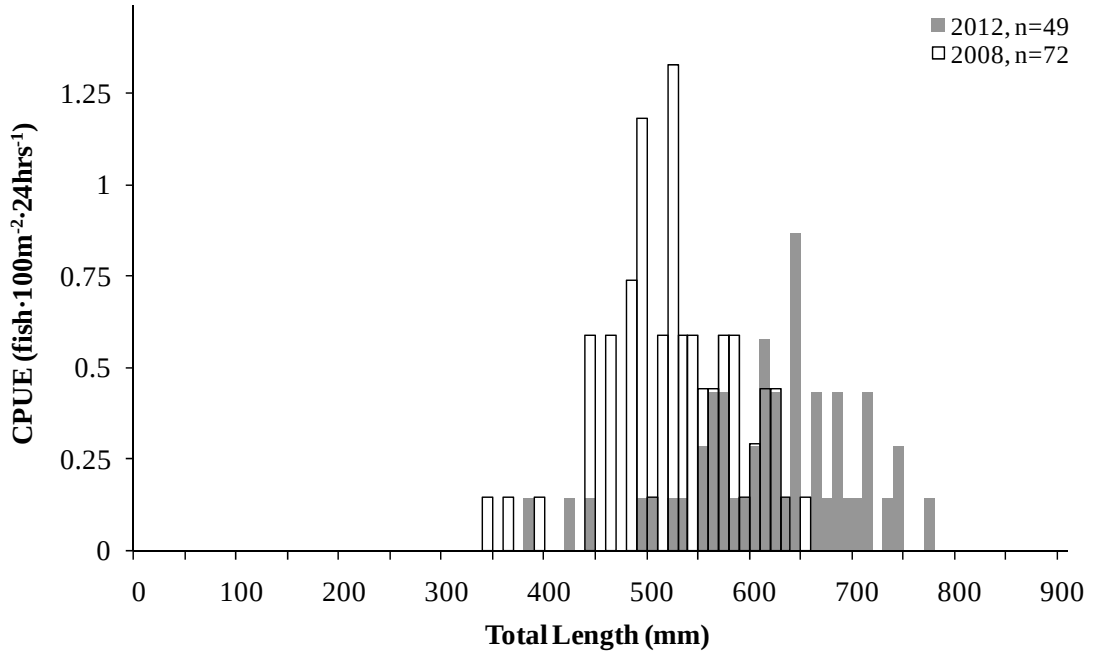

Figure 9. Northern Pike total length-frequency distributions from the 2008 and 2012 FWIN surveys on Battle Lake.

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