Fall Walleye Index Netting at Sylvan Lake, Alberta, 2010

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Abstract

A total of 539 fish representing five species were caught during the Fall Walleye Index Netting (FWIN) survey. Walleye were the second most abundant species in the FWIN nets accounting for 26% of the catch. Individual net catches were variable ranging from 4 to 34 Walleye. The catch-per-unit effort (CPUE) for Walleye was 9.2 fish·100m^{-2}·24hrs^{-1} (95% C.I. 6.2–13.3), which is well below the Alberta mean of 18.6 Walleye·100m^{-2}·24hrs^{-1}. Walleye total lengths (TL) (n=143) ranged from 200 to 654 mm and fish over 500 mm TL represented 9% of the catch. The majority of fish were in the 260 to 360 mm and 410 to 470 mm TL size categories. There were 10 age-classes present (ages 2 to 5, 9 to 12, 16 and 19) and 35% of the Walleye sampled were mature. Mean age-at-maturity is difficult to determine due to age-class gaps and low sample sizes in some year classes, but females and males first matured by ages 10 and 4, respectively. Walleye reached a mean TL of 500 mm by age 8 and the asymptotic average maximum body size (L_{inf}) was 1108.9 mm TL.

Lake Whitefish were the most abundant species caught in the FWIN nets and accounted for 63% of the catch. The CPUE for Lake Whitefish was 21.9 fish·100m^{-2}·24hrs^{-1} (95% C.I. 17.2–28.1). Lake Whitefish TLs (n=335) ranged from 297 to 512 mm and fish over 500 mm TL represented 0.3% of the catch. The majority of fish were in the 340 to 440 mm TL size category. There were 17 age-classes present (ages 3 to 6, 8 to 19 and 21), with age-class 14 being the most abundant.

The CPUE for Yellow Perch was 0.1 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.0–0.3). Yellow Perch TLs (n=2) ranged from 199 to 272 mm.

The CPUE for Northern Pike was 1.8 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.5–3.4). Northern Pike TLs (n=28) ranged from 477 to 1135 mm.

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 2010 to determine abundance, structure, and reproduction (recruitment), and monitor stocking success of the Walleye population in Sylvan Lake.

Methods

This FWIN survey was conducted from September 20 to 23, 2010. 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 14 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 12.1 and 12.4 °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 1996, 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 # 14627.

Results

A total of 539 fish representing five species were caught during the 2010 FWIN survey (Table 1). Walleye were the second most abundant species in the FWIN nets accounting for 26% of the catch. Individual net catches were variable ranging from 4 to 34 Walleye. The CPUE for Walleye was 9.2 fish·100m^{-2}·24hrs^{-1} (95% C.I. 6.2–13.3), which has decreased by 46% from the 2008 CPUE of 16.9 fish·100m^{-2}·24hrs^{-1} (95% C.I. 10.9–27.2) (Table 2). The CPUE for Walleye on Sylvan Lake is well below the Alberta average of 18.6 Walleye·100m^{-2}·24hrs^{-1}, but similar to other lakes with collapsed populations in Alberta, and on the decline since Sylvan was sampled in 2008 (Figure 1, Table 2). In 2010, Walleye TLs (n=143) ranged from 200 to 654 mm, and fish over 500 mm TL represented only 9% of the catch (Figure 2). The majority of fish captured were in the 260 to 360 and 410 to 470 mm TL size categories, and the abundance of larger individuals in the 420 to 520 mm TL size ranges has declined considerably since 2008. In the most recent survey there were 10 age-classes present (ages 2 to 5, 9 to 12, 16 and 19), with only 2 stable age-classes (> 3 fish·100m^{-2}·24hrs^{-1}) of 4 and 10 year-olds (Figure 3). This is comparable to the 2008 data where 9 age-classes were represented, but few were stable (2 and 8-year-olds). In 2010, the most abundant age-classes were the 4 and 10-year-olds, which represented 50% and 38% of the sample, respectively. The most abundant age-class in 2008 was the 8-year-olds, which represented 60% of the catch. The catch rate of Walleye from stockings in 2006, 2007 and 2008 (age 2, 3, 4) year-classes was 4.8 fish·100m^{-2}·24hrs^{-1} and still account for 52% of the catch, which is a slight increase from 4.4 fish·100m^{-2}·24hrs^{-1} from the 2008 sampling event. In 2010, the mean Walleye age was 6.9 years and 35% of Walleye sampled were mature. Mean age-at-maturity is difficult to determine due to age-class gaps and low sample sizes in some year-classes, however based on the data collected females first matured at age 10 and males first matured at age 4 and were fully recruited by age 10 (Figure 4). Walleye from Sylvan Lake 2010 FWIN survey reached a mean TL of 500 mm by age 11. The

growth curve suggests that the asymptotic average maximum body size (L_{inf}) was 1108.9 mm TL, which is unlikely since the largest individual encountered was only 654 mm (Figure 5).

Lake Whitefish were the most abundant species caught in the FWIN nets and accounted for 63% of the catch. The CPUE for Lake Whitefish was 21.9 fish·100m^{-2}·24hrs^{-1} (95% C.I. 17.2–28.1), which decreased by 29% from the 28.2 fish·100m^{-2}·24hrs^{-1} (95% C.I. 19.3–37.0) caught in 2008 (Table 2). Lake Whitefish TLs (n=335) ranged from 297 to 512 mm and fish over 500 mm TL represented 0.3% of the catch. The majority of fish were in the 340 to 440 mm TL size category, which is consistent with the 2008 data (Figure 6). In the most recent survey 17 age-classes were present (ages 3 to 6, 8 to 19 and 21), with age-class 14 being the most abundant. The rest of the age-classes had a CPUE of less than three fish·100m^{-2}·24hrs^{-1}. This is similar to the 2011 data where 17 age-classes were also present (Figure 7).

The CPUE for Yellow Perch was 0.1 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.0–0.3), which decreased from 0.6 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.1–1.1) caught in 2008 (Table 2). In 2010, Yellow Perch TLs (n=2) ranged from 199 to 272 mm. Yellow Perch length frequency distribution between years cannot be compared due to the low sample sizes in 2008 and 2010 (n=4 and n=2, respectively) (Figure 8).

The CPUE for Northern Pike was 1.8 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.5–3.4), which decreased by 56% from 2.8 fish·100m^{-2}·24hrs^{-1} (95% C.I. 0.8–5.3) caught in 2008 (Table 2). In 2010, Northern Pike TLs (n=28) ranged from 477 to 1135 mm. Northern Pike length frequency distribution between years cannot be compared due to the low sample size in 2008 and 2010 (n=19 and n=28, respectively) and low frequency of fish in each size category (Figure 9).

Interpretation

Stocking of Walleye in Sylvan Lake occurred most recently from 2006 to 2008 in order to re-establish a naturally reproducing population. Most of the Walleye being caught continue to be from the 2006 and 2007 stocking years, and the proportion of the population that has been naturally recruited within Sylvan Lake is very low, as is evident by age-class gaps (indicative of year-class failures) and the low abundance of younger fish since the last stocking event. This is compounded by the lack of reproductively mature fish to support the population. Sylvan Lake has remained within the bottom third of reported FWIN Walleye catch rates annually from across Alberta and has declined since 2008. The considerable decline in abundance of larger Walleye since 2008 is concerning in spite of restrictive angling regulations and perhaps might be indicative of both increased angling effort (catch and release mortality) or decrease in angling compliance (poaching). The 2010 population status classification for the Sylvan Lake Walleye fishery suggests a collapsed 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), 4 population metrics (catch rate, age-class distribution, age-class stability and age-at-maturity for male fish) indicate a collapsed population, 2 (age-at-maturity for female fish and length at age) falls into the stable population status (Table 3). This is consistent with the 2008 collapsed population status classification of the Walleye fishery in Sylvan Lake (Winkle 2010).

The catch rate of Lake Whitefish has declined since 2008 but has remained relatively high. Annual recruitment appears to be occurring regardless of the absence of 1, 2 and 3 year-olds in both sample years. The high CPUE, wide range of age-classes, high percentage of reproductively mature individuals and evidence of annual recruitment indicates a stable population.

The catch rate of Yellow Perch has declined since 2008 and the low abundance of Yellow Perch likely suggests that the population is in a collapsed state.

The catch rate of Northern Pike has declined since 2008 and the low abundance of Northern Pike suggests that this population is in a collapsed state, although there appears to be a wide size class distribution of pike with fish greater than 1 meter present in the population.

Table 1. Species catch summary by site, Sylvan Lake, September 2010.

Set Number	Lift Date (2010)	Stratum	UTM Easting	UTM Northing	Meridian	Soak Time (h)	Fish Count per Species					
							LKWH	NRPK	WALL	WHSC	YLPR	Set Total
11A	21-Sep	Shallow	690434	5807892	-117 (Zone 11)	24.50	32	9	34	1		76
15D	21-Sep	Deep	688260	5806255	-117 (Zone 11)	23.83	27		6			33
19D	22-Sep	Deep	692214	5806273	-117 (Zone 11)	22.50	12		9			21
22B	21-Sep	Shallow	688746	5805812	-117 (Zone 11)	24.58	62	5	20	6		93
27C	22-Sep	Deep	693716	5805269	-117 (Zone 11)	22.58	17		6	1	1	25
28D	22-Sep	Deep	694268	5805277	-117 (Zone 11)	22.75	12		7			19
36C	23-Sep	Deep	694817	5804250	-117 (Zone 11)	23.50	20		7		1	28
45A	22-Sep	Deep	696822	5803821	-117 (Zone 11)	22.50	27	2	4	5		38
46D	23-Sep	Deep	697746	5803240	-117 (Zone 11)	23.40	32	1	6	5		44
52A	23-Sep	Deep	697234	5802726	-117 (Zone 11)	23.75	19		14			33
56B	23-Sep	Deep	695800	5801778	-117 (Zone 11)	24.08	15		14	5		34
59D	23-Sep	Deep	698244	5801259	-117 (Zone 11)	23.75	21	1	6	5		33
5A	21-Sep	Deep	688803	5808734	-117 (Zone 11)	24.25	22	1	5			28
66A	23-Sep	Shallow	697737	5799884	-117 (Zone 11)	23.00	20	9	5			34
Species Total							338	28	143	28	2	539

Table 2. Species catch rates from the 2008 and 2010 Sylvan Lake FWIN surveys.

Species	Year	CPUE	95% CI
LKWH	2008	28.19	(19.3 - 37.1)
	2010	21.94	(17.2 - 28.1)
NRPK	2008	2.75	(0.8 - 5.3)
	2010	1.81	(0.5 - 3.4)
WALL	2008	16.87	(10.9 - 27.2)
	2010	9.23	(6.2 - 13.3)
WHSC	2008	1.23	(0.0 - 3.1)
	2010	1.82	(0.5 - 3.4)
YLPR	2008	0.58	(0.1 - 1.1)
	2010	0.13	(0.0 - 0.3)

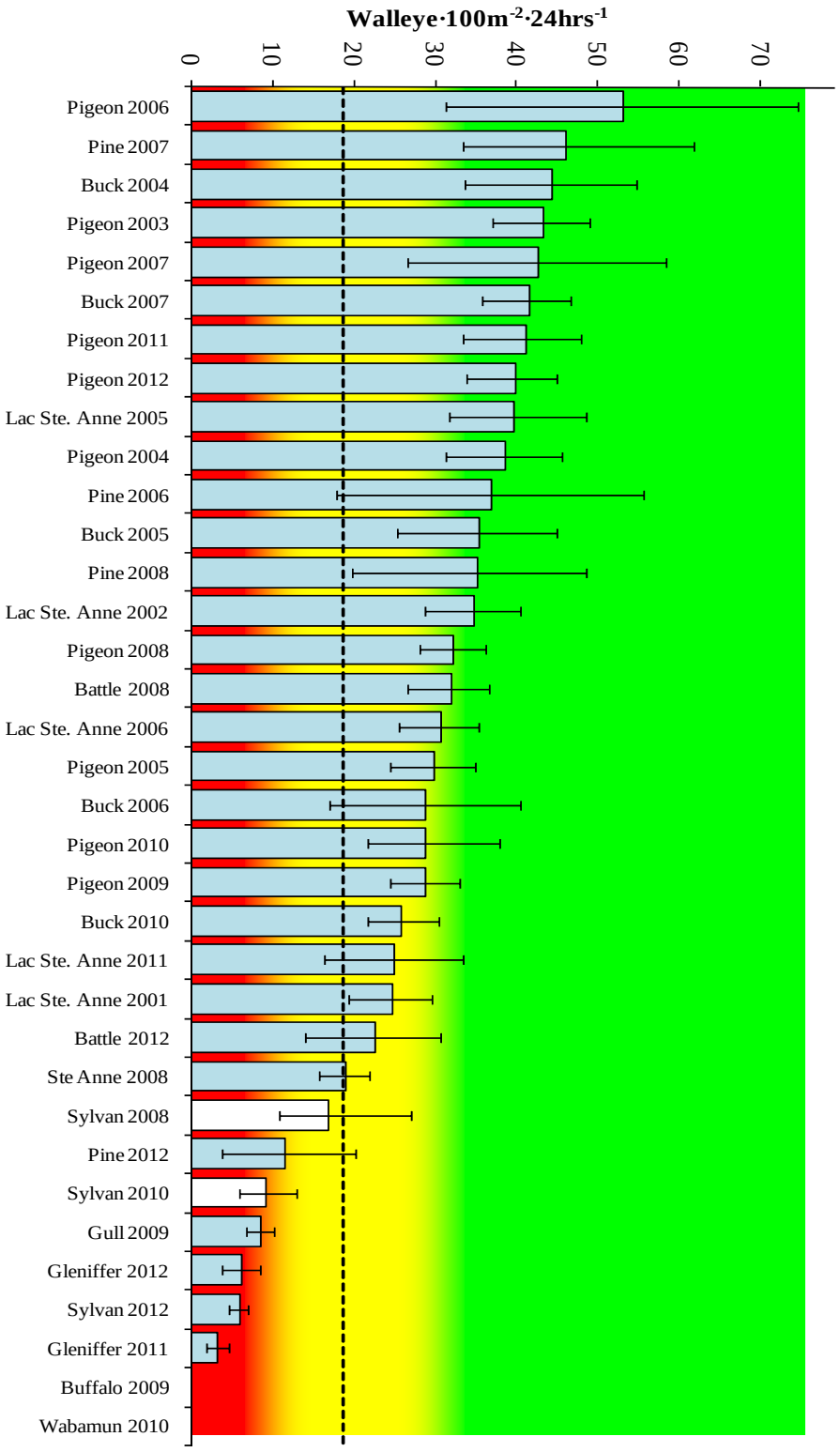

Figure 1. Mean Walleye catch rates with 95% CI from a representative sample of FWIN surveys from Across Central Alberta. The dashed line represents the mean provincial catch rate of 18.6 fish·100m^{-2}·24hrs^{-1}. Collapsed, vulnerable, and stable catch rate ranges are indicated by red, yellow and green backgrounds. The Walleye catch rates from the 2008 and 2010 Sylvan Lake FWIN surveys are highlighted.

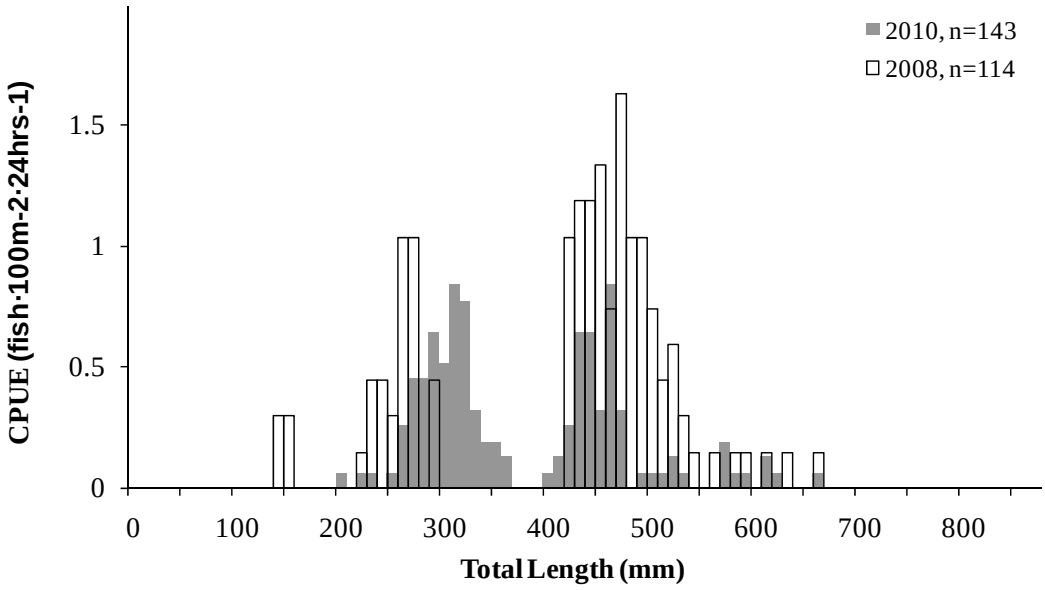

Figure 2. Walleye total length frequency distributions from the 2008 and 2010 FWIN surveys on Sylvan Lake.

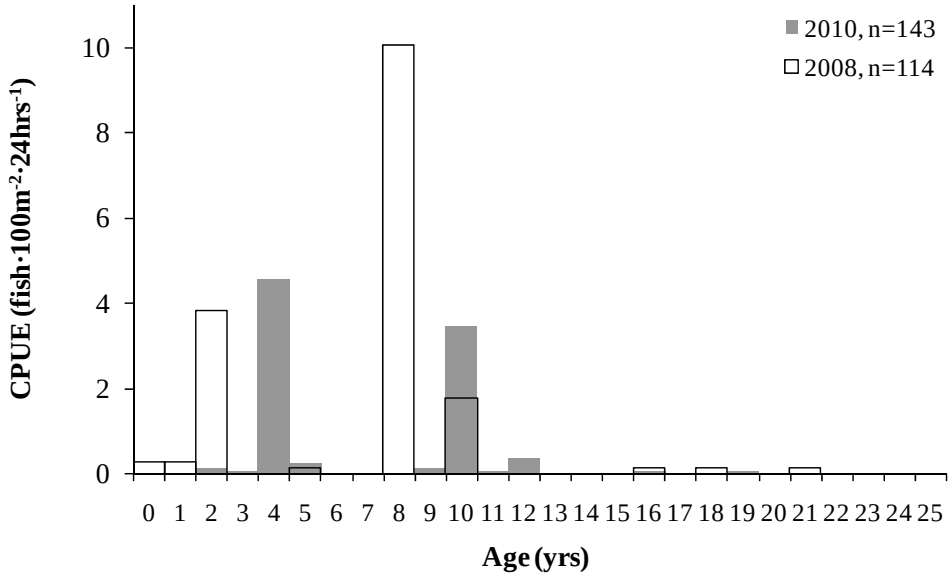

Figure 3. Walleye age frequency distributions from the 2008 and 2010 FWIN surveys on Sylvan Lake. Mean ages were 6.8 and 6.9 years, respectively.

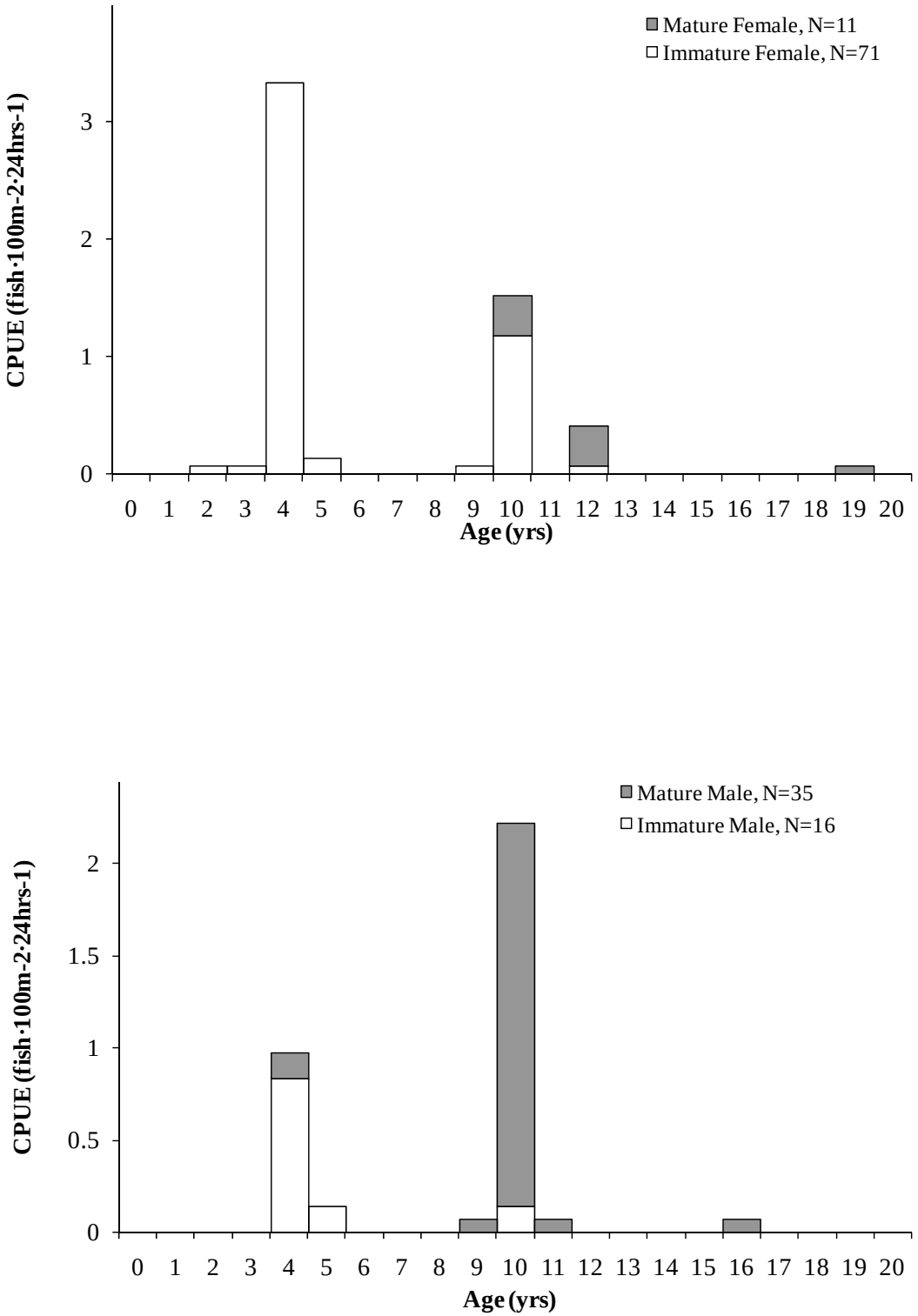

Figure 4. Age-at-maturity distributions for female and male Walleye from the 2010 FWIN survey on Sylvan Lake.

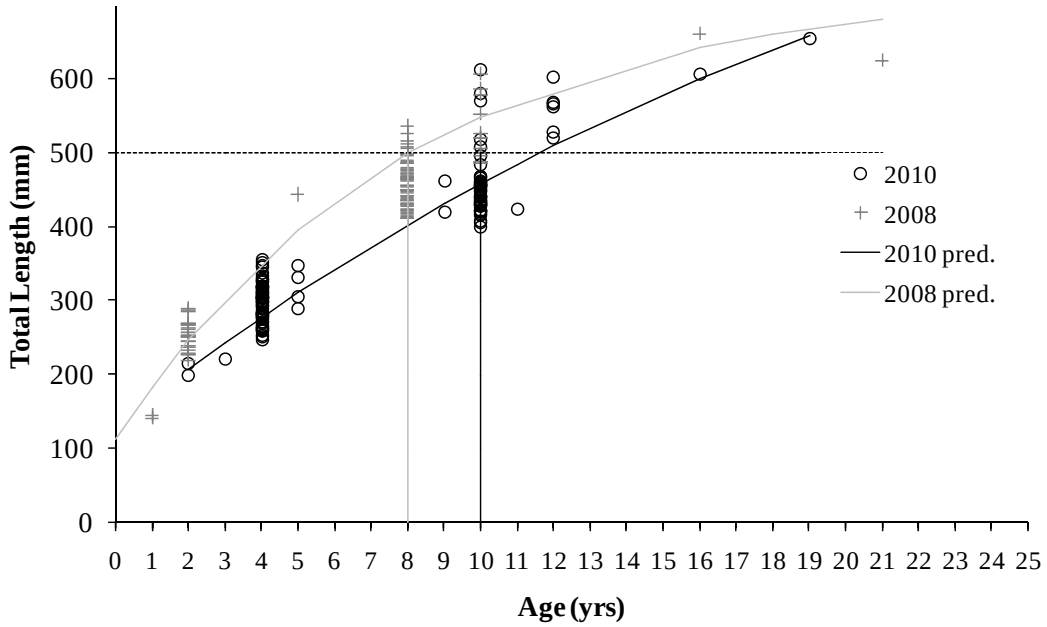

Figure 5. Total length-at-age for Sylvan Lake Walleye from the 2008 (L_{inf} = 725.5, K = 0.124, t_o = -1.352, R^2 = 0.96, Prob > 0.0001) and 2010 (L_{inf} = 1108.9, K = 0.041, t_o = -3.049, R^2 = 0.97, Prob > 0.0001) FWIN survey data.

Table 3. Walleye stock classification for Sylvan Lake based on the 2010 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 = 9.229.**
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 (n=143); mean age = 6.9 years.**
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. **2 measurable age class of 4 and 10-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 at age 10.**	Females: 7-8 years Males: 5-7 years	Females: 4-7 years Males:3-6 years **Males at age 4.**
LENGTH AT AGE	Very Slow 50 cm in 12-15 years	Slow 50 cm in 9-12 years **500mm TL reached at 8 years**	Moderate 50 cm in 7-9 years	Fast 50 cm in 4-7 years

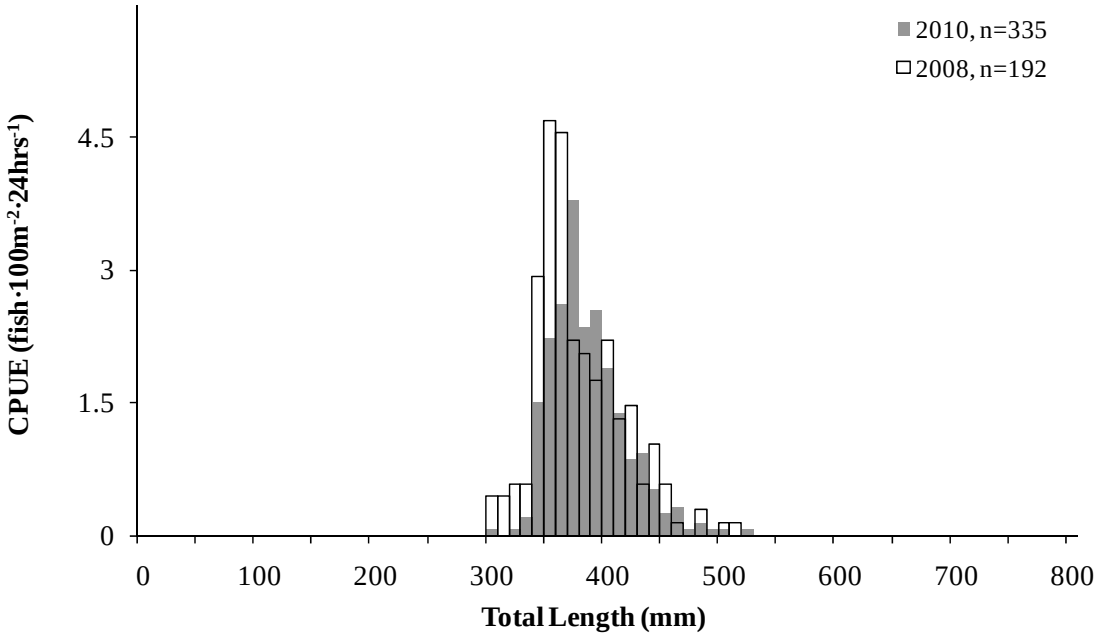

Figure 6. Lake Whitefish total length frequency distributions from the 2008 and 2010 FWIN surveys on Sylvan Lake.

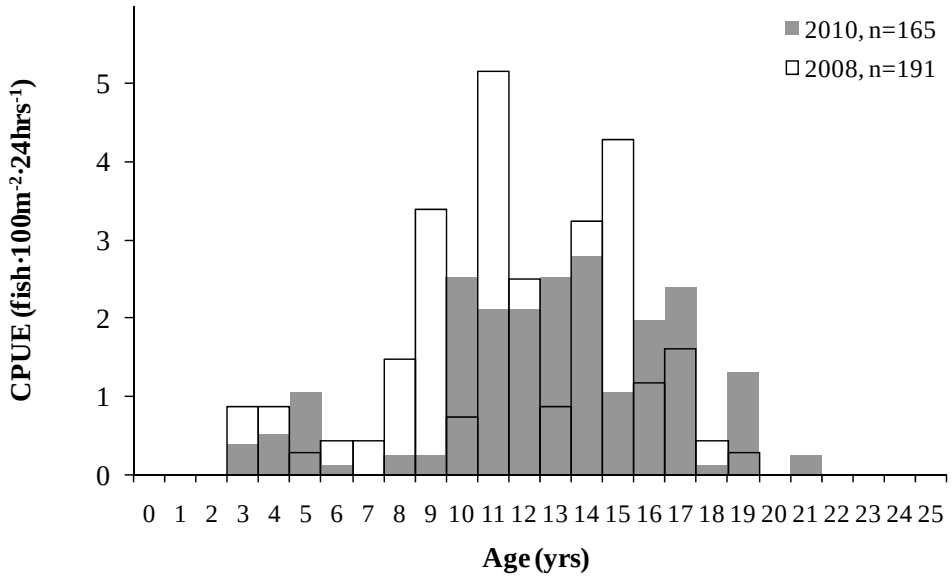

Figure 7. Lake Whitefish age frequency distributions from the 2008 and 2010 FWIN surveys on Sylvan Lake. Mean ages were 11.8 and 12.8 years, respectively.

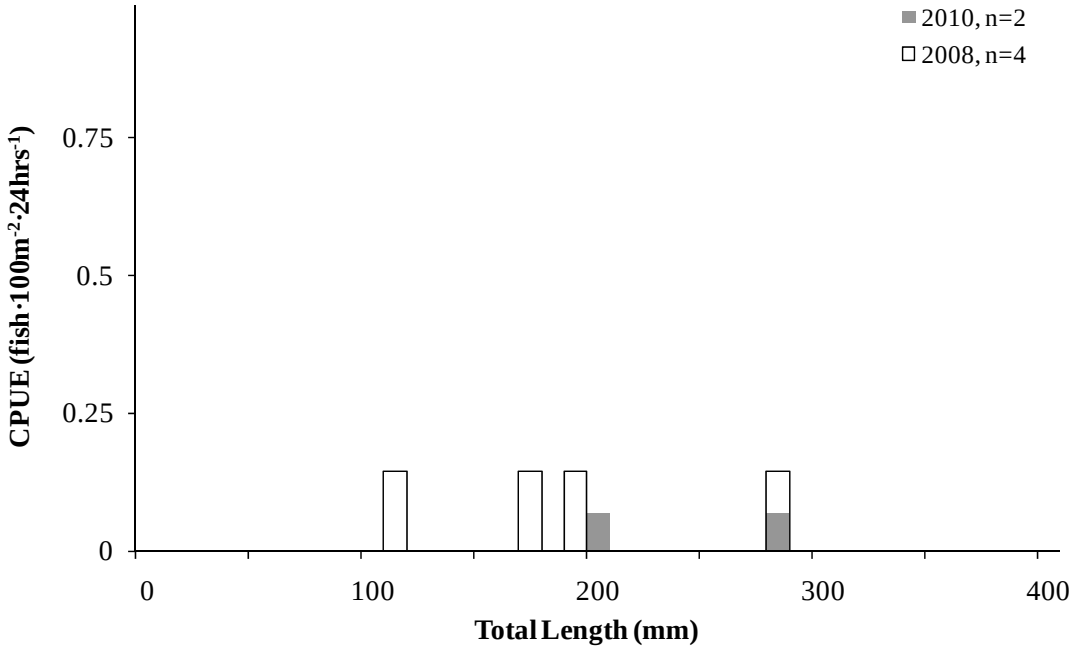

Figure 8. Yellow Perch total length-frequency distributions from the 2008 and 2010 FWIN surveys on Sylvan Lake.

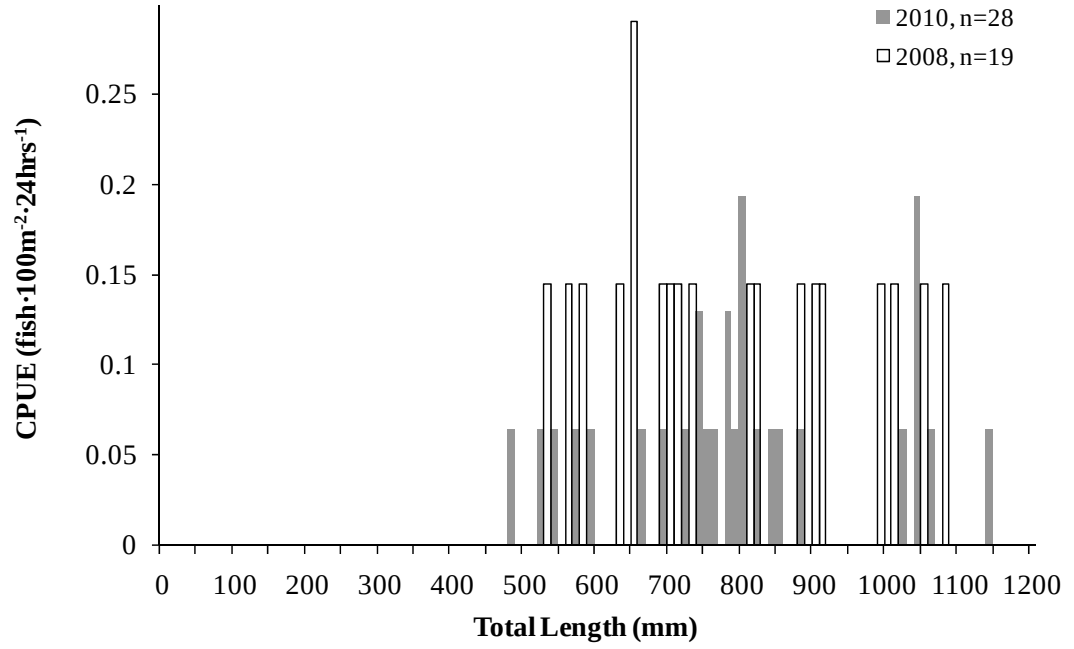

Figure 9. Northern Pike total length-frequency distributions from the 2008 and 2010 FWIN surveys on Sylvan Lake.

Literature Cited

Auburn University. 2000-2001. Fishery Analyses and Simulation Tools (FAST 2.1).

Berry, D.K. 1996. Alberta's Walleye management and recovery plan. Alberta Environmental Protection, Natural Resources Service. Number T/310. 32 pp.

Haddon, M. 2001. Modelling and quantitative methods in fisheries. Chapman & Hall/CRC, Boca Raton, London, New York, Washington D.C., 406 pp.

Mackay, W.C., G.R. Ash, and H.J. Norris (eds.). 1990. Fish ageing methods for Alberta. R.L.& L. Environmental Services Ltd. in assoc. with Alberta Fish and Wildlife Division and University of Alberta, Edmonton. 113 p.

Morgan, G.E. 2002. Manual of instructions – fall Walleye index netting (FWIN). Percid Community Synthesis, Diagnostics and Sampling Standards Working Group. Ontario Ministry of Natural Resources. 34 p.

Sullivan, M. G. 2003. Active Management of Walleye Fisheries in Alberta: Dilemmas of Managing Recovering Fisheries. North American Journal of Fisheries Management 23:1343–1358, 2003.

Watkins, O.B. and S.C. Spencer. 2009. Collection, preparation and ageing of Walleye otoliths. Fish and Wildlife Division Technical Report. Alberta Sustainable Resource Development. 40 pp.

Watters, D. and C. Davis. 2004. Calling Lake Walleye Status Assessment and Comparison of Fall Walleye Index Netting Surveys in 2001 and 2002. Fisheries Management Division Technical Report. Alberta Sustainable Resource Development. 36 pp.

Winkel, L. 2010.Sylvan Lake Fall Walleye (*Sander vitreus*) Index Netting Survey, 2008. Fisheries Management Division Technical Report. Alberta Sustainable Resource Development. 26 pp.