Fall Walleye Index Netting at Jackson Lake, Alberta, 2010

Fisheries Management
Lac La Biche

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Abstract

In September 2010, a Fall Walleye Index Netting (FWIN) protocol was used to assess the walleye (*Sander vitreus*) population at Jackson Lake. The mean catch-per-unit-effort for walleye was 21.1 walleye·100m^{-2}·24h^{-1} (95% CI = 17.8 – 24.6 walleye·100m^{-2}·24h^{-1}). Total length for walleye ranged from 126 mm to 660 mm, with a mean of 483 mm. 94% of walleye sampled were between 320 mm and 580 mm in total length, and 51% of the total sample exceeded 500 mm total length (legally harvestable). Walleye ages ranged from young of year to 18 years with a mean age of 9.2 years. The two most heavily-represented age class ranges were 4 to 5 years, 26% of walleye sampled, and 10 to 13 years, 63% of walleye sampled. There is evidence of significant recruitment failures in 2001, 2002, 2003, and 2004. For both male and female walleye, maturity was reached at age 5 and growth rates were slow with males reaching 500 mm total length at 11 years of age and females at 7. Jackson Lake's walleye population meets the criteria for vulnerable classification.

Introduction

Alberta's lentic walleye (*Sander vitreus*) populations are assessed using a Fall Walleye Index Netting (FWIN) protocol developed by the Ontario Ministry of Natural Resources. This protocol also provides population data for other game and non-game fishes in the target system.

In September 2010, a FWIN assessment was completed at Jackson Lake in order to assess the status of the walleye population and determine if adjustment to the regulations or management practices was necessary. Current regulations allow harvest of one walleye, over 500 mm total length, collectively for Jackson Lake, Kinnaird Lake, and Blackett Lake. This collective regulation is made necessary by unrestricted movement between these lakes and the associated enforcement issues. Jackson Lake was last assessed in 2005, at which time it was classified as a vulnerable walleye population.

The specific objectives for this survey were:

1. Determine a FWIN catch rate for walleye to compare to the 2005 catch rate as well as correlate with known density estimates.
2. Assess walleye stock parameters (length distribution, age distribution and stability, growth rate, age-at-maturity)
3. Determine a FWIN catch rate for northern pike (*Esox lucius*), yellow perch (*Perca flavescens*), and any other species represented in the survey. These catch rates will be correlated with known density estimates if available.
4. Assess stock parameters for species other than walleye.

Methods

Sampling Design

The Fall Walleye Index Netting protocol uses multi-panel gillnets to assess relative abundance of fish stocks and provide other biological indicators of stock status (Morgan 2002).

Based on the total surface area of the study site, 12 nets were set. Set locations were randomly selected using ArcGIS 9.0 and were depth stratified to reflect the proportion of the lake's surface area that fell within each strata [Shallow (2-5m) = 67% (8 nets), Deep (5+m) = 33% (4 nets)]. All nets were set between 09:00 and 11:00 and were pulled 24 h ±3 h later.

The standard monofilament gillnets used for FWIN assessments are 1.8 m deep, 61 m long and consist of 8 equal length panels arranged in decreasing stretched mesh sizes of 152 mm, 127 mm , 101 mm, 76 mm, 63 mm, 50 mm, 38 mm, and 25 mm. For this assessment there were two notable departures from the standard FWIN gear. The nets used were 38.1 m in length and included an additional 19 mm, and 12 mm panel. Fish captured in these additional meshes were excluded from the analysis found in this report.

All fish caught were field processed to determine fork length, total length, weight, sex, and maturity stage. For age determination, cleithra were collected from all northern pike; otoliths were collected from all walleye as well as yellow perch over 140 mm total length. Ages were interpreted as described by MacKay et al. (1990). Sub-sampling based on total length and batch weight was used for meshes containing high numbers of small size class fish. Sub-sampled fish were included in subsequent analyses via randomly selected known total lengths of fish from the same size class. Individual fish measurements and associated catch data, including the 12 and 19 mm that were excluded from this analysis, were uploaded to the FWMIS database and referenced as Project ID #15756.

Statistical Analyses

Catch-per-unit-effort (CUE) was calculated for walleye, northern pike, and yellow perch and expressed as fish·100m^{-2}·24h^{-1}. The calculated CUE values were bootstrapped to 10,000 repetitions and the resulting frequency distribution used to estimate 95% confidence intervals (Haddon 2001). Relative standard error (RSE) was calculated by dividing the standard deviation of bootstrapped means by the overall mean. Size, age, and maturity frequencies were calculated using Microsoft Excel 2003, and von Bertalanffy growth curves plotted with FAST 2.0 (Slipke and Maceina, 2001).

Results & Interpretation

Nets were set on September 13, 2010 and the FWIN survey was completed on September 15, 2010. The surface temperature at all net locations fell between 13.5°C and 14.0°C and the mean net soak time was 24.3 h. A total of 366 fish were captured: 142 walleyes (39%), 71 northern pike (19%), 41 yellow perch (11%), 6 white suckers (*Catostomus commersonii*) (2%), and 106 cisco (*Coregonus artedi*) (29%) (Table 1). Calculated catch rates (CUE) for sportfish were 21.1 walleye·100m^{-2}·24h^{-1}(95% C.I = 17.8 – 24.6), 10.5 northern pike·100m^{-2}·24h^{-1}(95% C.I = 8.2 – 13.2), and 6.1 yellow perch·100m^{-2} (95% C.I = 3.2 – 9.5) (Table 2).

The calculated CUE for walleye was 21.1 walleye·100m^{-2}·24h^{-1}(95% C.I = 17.8 – 24.6) with a relative standard error of 0.08. This is consistent with the 2005 FWIN catch rate of 21.4 walleye·100m^{-2}·24h^{-1} (Table 2). The CUE meets the criteria for a moderate catch rate, indicates a vulnerable population, and is consistent with catch rates from other lakes in the province with the same classification.

Total length for walleye ranged from 126 mm to 660 mm, with a mean of 483 mm. The distribution is unimodal with 91% of recorded total lengths between 320 mm and 580 mm (Figure 1). A comparison of length distributions between the 2005 and 2010 FWIN surveys shows an increase in the proportion of walleye that exceed the 500mm minimum total length harvest regulation: 51% in 2010 compared to only 29% in 2005.

Walleye ages ranged from young-of-year (age 0) to 18 with a mean age of 9.2 for both sexes (Figure 2). Of the sampled walleye, 26% were 4 to 5 years of age and 62% were 10 to 13 years of age. In 2005, three measureable year classes were present (6, 7, and 8) and accounted for 75% of fish sampled (Figure 2). Consistency of age interpretation between the two FWIN events is supported by representation of 6, 7, and 8 year old fish from the 2005 sample as 11, 12, and 13 year old fish in the 2010 sample. There is a notable lack of fish aged 6-9 years in the 2010 sample, providing evidence of recruitment failures in 2001, 2002, 2003, and 2004. When a CUE threshold value of 3.0 walleye·100m^{-2}·24h^{-1} is applied, only one year class (11) is considered measureable. Four additional year classes (4, 5, 10, and 13) exceed 2.0 walleye·100m^{-2}·24h^{-1}. In 2005, three measureable year classes were present (6, 7, and 8) and accounted for 75% of fish sampled (Figure 2). Consistency of age interpretation between the two FWIN events is supported by representation of 6, 7, and 8 year old fish from the 2005 sample as 11, 12, and 13 year old fish in the 2010 sample.

Male walleye sampled during the 2010 FWIN survey began maturing at age 4, and all male walleye 5 years or older were mature (Figure 3). Female walleye also began maturing at age 4; 99% of all female walleye 5 years or older were mature (Figure 4).

The von Bertalanffy growth equation for all walleye indicates fish reach 500 mm total length at age 9. Growth curves indicate male walleye reach 500 mm total length at age 11 and females at age 7 (Figure 5). L_{inf} for male walleye was 534.16 mm, and L_{inf} for female walleye was 562.67 mm. This is consistent with growth rates calculated for the 2005 FWIN effort. These statistics are influenced by incomplete total length distributions associated with predicted recruitment failures in 2001, 2002, 2003, and 2004.

Discussion

The 2005 FWIN catch rate was strongly influenced by the 6, 7, and 8 year old walleye (1997, 1998, and 1999 year classes). The same year classes were strongly represented in 2010 as 10 to 13 year olds but with reduced catch rates. This is likely due to natural mortality and harvest. Both FWINs provide strong evidence of recruitment failures in 2001, 2002, 2003, and 2004 and it is reasonable to expect future effects on age class structure and stability. These failures likely correlate with environmental conditions affecting growth rates and early survival. The presence of only two measureable year classes meets the criteria for a vulnerable stock classification (Table 3).

Based on the maturation of both sexes at age 5, the current minimum size limit (500 mm TL) should allow females to spawn at least twice and males a minimum of six times before being susceptible to legal harvest. There were few immature walleye captured.

Table 1. Total catch for Jackson Lake 2010 FWIN.

Set ID	Number Caught										
	WALL	NRPK	YLPR	LKWH	WHSC	CISC	LNSC	SPSH	NNST	BURB	Total
10	12	4	9	0	0	9	0	0	0	0	0
11	18	7	5	0	0	1	0	0	0	0	0
13	8	5	2	0	0	13	0	0	0	0	0
14	13	3	1	0	1	7	0	0	0	0	0
15	15	9	1	0	2	5	0	0	0	0	0
16	10	7	4	0	0	9	0	0	0	0	0
19	15	5	9	0	0	6	0	0	0	0	0
2	10	5	0	0	0	8	0	0	0	0	0
3	6	5	5	0	0	8	0	0	0	0	0
5	12	4	0	0	0	30	0	0	0	0	0
6	11	4	1	0	0	9	0	0	0	0	0
8	12	13	4	0	3	1	0	0	0	0	0
	142	71	41	0	6	106	0	0	0	0	0

Table 2. CUE (fish·100m^{-2}·24h^{-1}) and 95% confidence intervals for 2005 and 2010 Jackson Lake FWINs.

Species	Year	CUE	(95% CI)
WALL	2005	19.1	(14.7 - 23.7)
	2010	21.1	(17.8 - 24.6)
NRPK	2005	11.5	(8.7 - 14.3)
	2010	10.5	(8.2 - 13.2)
YLPR	2005	7.8	(5.4 - 10.4)
	2010	6.2	(3.2 - 9.5)

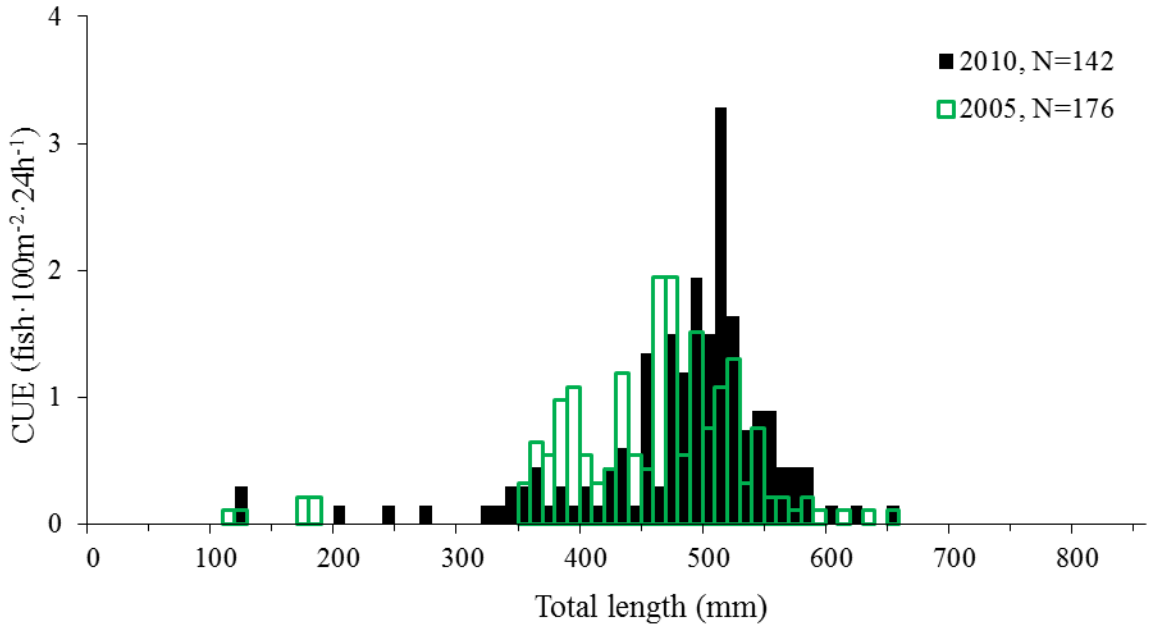

Figure 1. Comparison of walleye total-length frequency distributions for Jackson Lake 2005 and 2010 FWIN. Data are displayed as CUE (walleye·100m^{-2}·24h^{-1}) for 10 mm total-length increments.

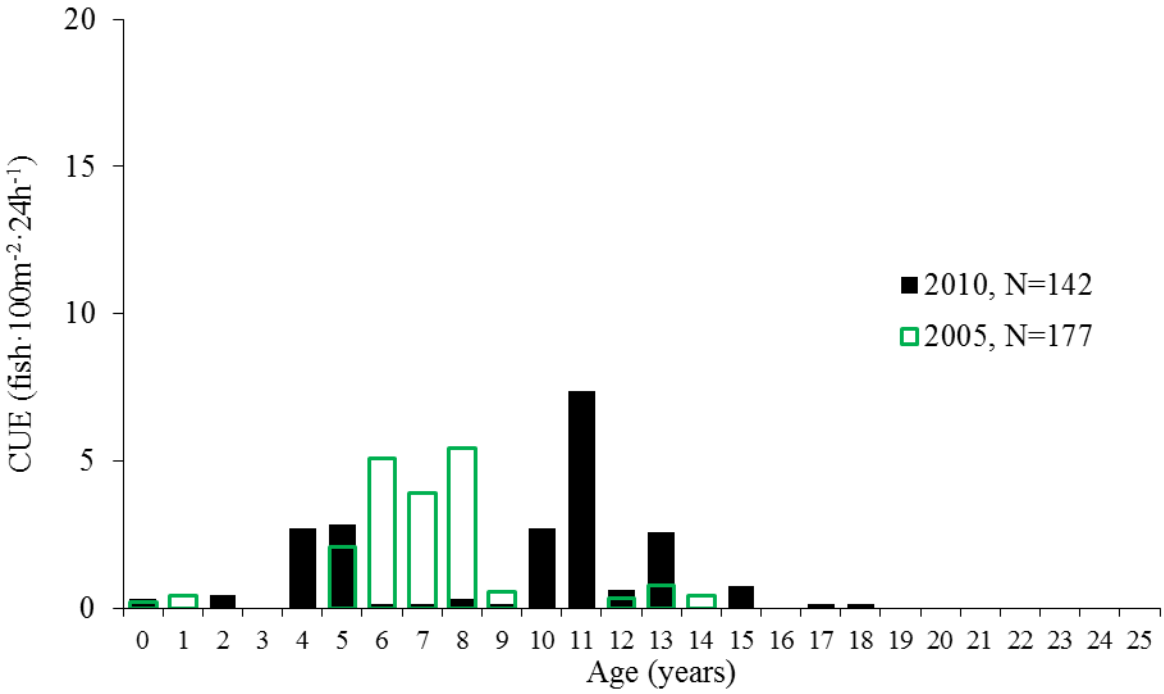

Figure 2. Comparison of walleye age frequency distributions for Jackson Lake 2005 and 2010 FWIN. Data are displayed as CUE (walleye·100m^{-2}·24h^{-1}) for individual year classes.

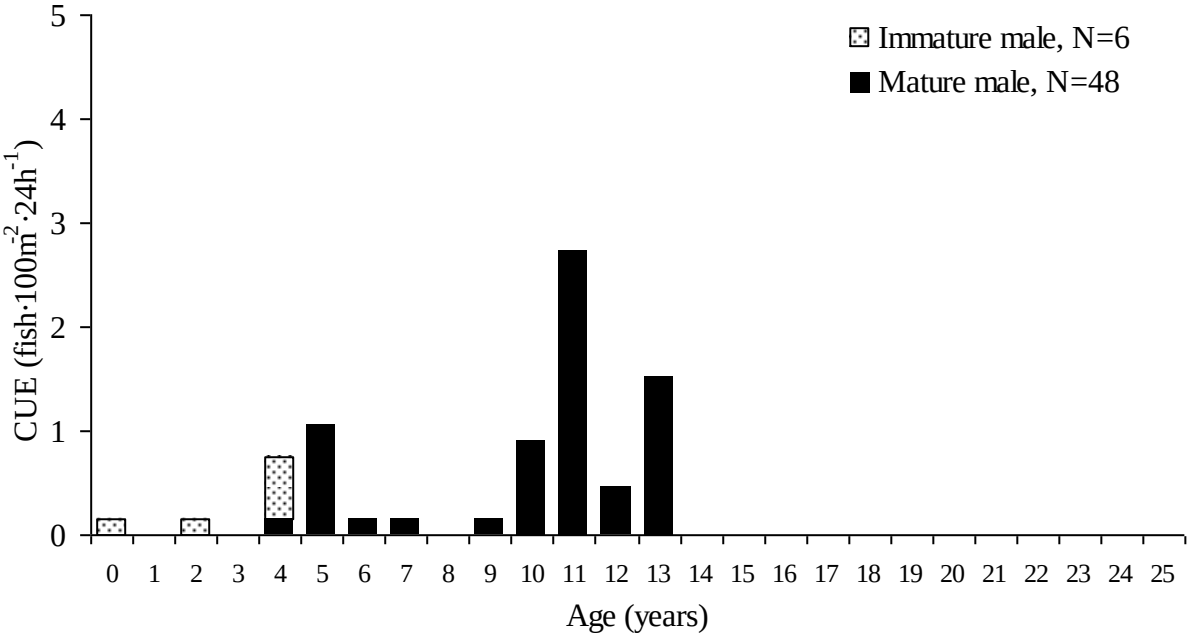

Figure 3. Age-at-Maturity frequency distribution for male walleye for Jackson Lake 2010. Data are displayed as CUE for individual year classes by maturity.

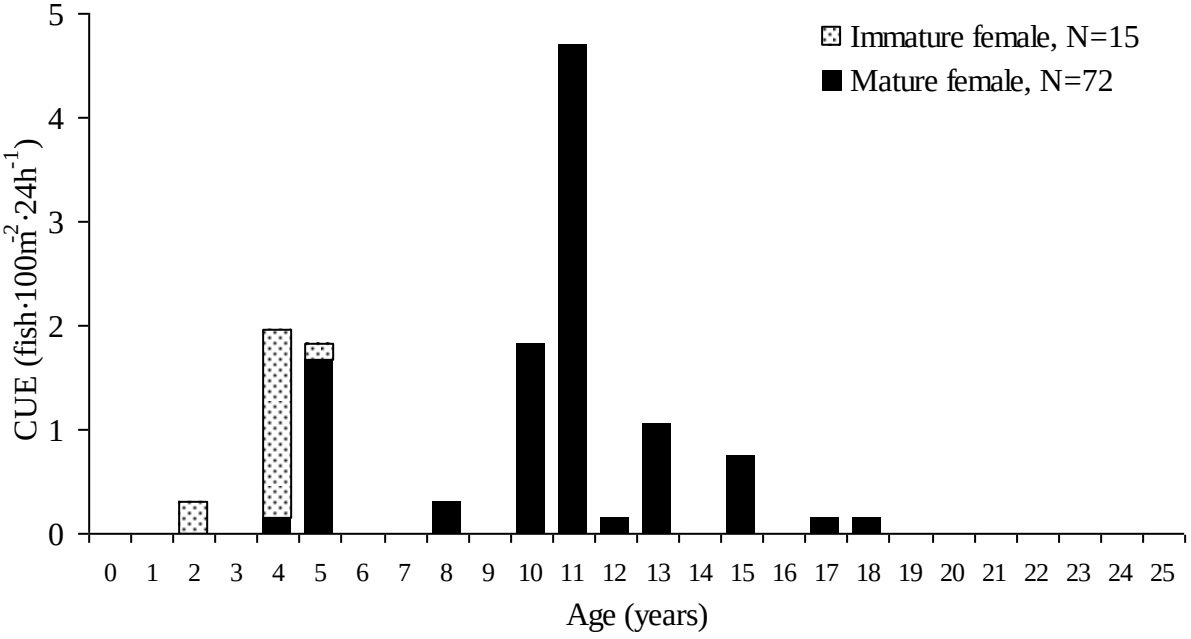

Figure 4. Age-at-Maturity frequency distribution for female walleye for Jackson Lake 2010. Data are displayed as CUE for individual year classes by maturity.

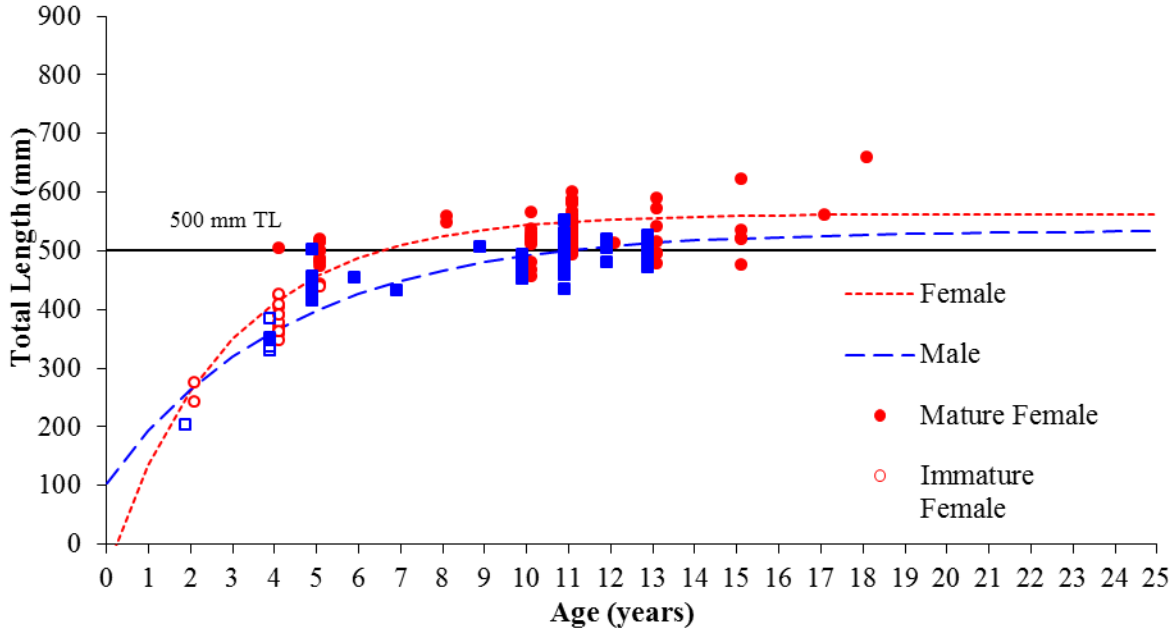

Figure 5. Length-at-Age function and Von Bertalanffy growth curve for male and female walleye for Jackson Lake 2010 FWIN. Data are displayed as total length for individual year classes by sex. Female walleye total length-at-age (Linf = 562.67, K = 0.348, t0 = 0.212), male walleye total length-at-age (Linf = 534.16 , K = 0.231 , t0 = -0.929).

Table 3. Walleye Stock Classification for Jackson Lake based on the results of the 2010 FWIN survey.

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}
			CUE= 21.4	
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.
				2 age classes mean age = 9.2
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 measureable age classes; 4 and 11-year-olds	
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: approx. 5 years **Males: approx. 5**
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
		All: by age 9 Males: by age 11	**Females: by age 7**	

References

FAST 2.0 Fishery Analyses and Simulation Tools. Copyright © 2000-2001. Auburn University.

Fisheries and Wildlife Management Information System. Provincial database. (Date accessed: December 2011).

Haddon, M. 2001. Modelling and quantitative methods in fisheries. Chapman & Hall/CRC Press. Boca Raton, Florida.

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 Wildl. Div. and Univ. 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.

Slipke, J.W. and M.J. Maceina. 2001. Fishery Analyses and Simulation Tools (FAST 2.0). Department of Fisheries and Allied Aquacultures. Auburn University, Alabama.

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.