



**Bourque Lake 2011 Fall Walleye Index
Netting**

January 2012

BOURQUE LAKE 2011 FALL WALLEYE INDEX NETTING

Caitlin January and Jordan Walker

Fisheries Management

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PERMISSION TO QUOTE

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Author contact information: 5013-51st Street
Cold Lake, AB
T9M 1P3
office (780) 594-7874
fax (780) 594-3340

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ABSTRACT

In 2011, the Fisheries Management staff in Cold Lake completed a Fall Walleye Index Netting (FWIN) project on Bourque Lake, Alberta. A total of 372 fish were caught, consisting of 6 different species. Walleye made up 24.7% of the catch and northern pike 4.3%. The majority of the catch was comprised of cisco at 40.3%. The catch per unit effort for walleye was 13.0 fish·100m⁻²·24hrs⁻¹ (95% C.I. 8.3-17.7). The walleye catch was well distributed from 300-650 mm. The age-class distribution was widely distributed, with a higher catch per unit effort than the 2001 FWIN.

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INTRODUCTION

During the fall of 2011 the Cold Lake fisheries management team conducted a Fall Walleye Index Netting (FWIN) (Morgan 2000) survey from September 26-29 on Bourque Lake. The purpose of this study was to assess the relative abundance and population structure of the fisheries, while focusing primarily on walleye.

The FWIN survey is a standardized method for indexing walleye (*Sander vitreus*) populations that has been adapted as a fisheries management standard by the Fisheries Management Branch of Alberta Sustainable Resource Development (ASRD). The FWIN protocol allows fisheries managers to compare population trends over time or between populations in order to monitor the effects of management strategies. Individual populations are assessed and classified as stable, vulnerable, or collapsed as per Alberta's Walleye Management and Recovery Plan (Berry 1995). Management strategies are implemented with the goal of recovering and/or maintaining stable, self-sustaining walleye fisheries.

Bourque Lake is home to endemic populations of walleye, northern pike (*Esox lucius*), burbot (*Lota lota*), yellow perch (*Perca flavescens*), cisco (*Coregonus artedi*), lake whitefish (*Coregonus clupeaformis*) and white sucker (*Catostomus commersoni*) as well as other small-bodied fish species. Current fishing pressure on the lake is largely in the form of recreational angler harvest. The pressure on Bourque by Indian Domestic fishing would be classed as light. Between 1987 and 2011, the lake has issued, on average, less than 1 domestic license per year and very little domestic activity has been observed.

For anglers, from 1997 to 2003 the daily catch limit for walleye was 3 over 50cm. From the FWIN survey in 2001, regulations were changed to 1 over 50 cm, however the population continued to decline. In 2006 the walleye population was assessed and was best described as collapsed. Since 2008, a bag limit of zero for walleye has been applied. The 2011 FWIN survey allow us to re-examine the status of the population and the current regulation choice. The FWIN method allows fisheries managers to compare the same population between years and across many populations. Specific survey objectives included:

1. Determine the walleye catch rate (catch per unit effort) as an index of abundance.
2. Estimate other walleye population metrics including age-class distribution and stability, age-at-maturity, and growth rate.
3. Compare results to the previous FWIN surveys.

4. Utilize FWIN survey to determine relative abundance and other population metrics for northern pike.

STUDY SITE

Bourque Lake (54° 40' 29 N, 110° 33' 28 W) is small mesotrophic lake (Watters, 1980), located approximately 43 km north and 13 km east of Bonnyville, AB (Twp 65 & 66, Rge 7, W4M; FWMIS water body ID 4112) in the Boreal-Forest zone of east-central Alberta (figure 1). Access is limited by well site roads and unimproved trails on both the south and west side of the lake. Several small streams on the north end feed into the lake and is drained by Jackfish Creek. The lake has a surface area of 497 hectares and includes two basins, which lie on the north-south axis (English, 2005). Bourque Lake's maximum depth has been reported at two different depths; 27.7 m (Watters 1980, Mills 1988) and 15 m in the FWMIS data base. The mean depth remains consistent at 8.4 m.

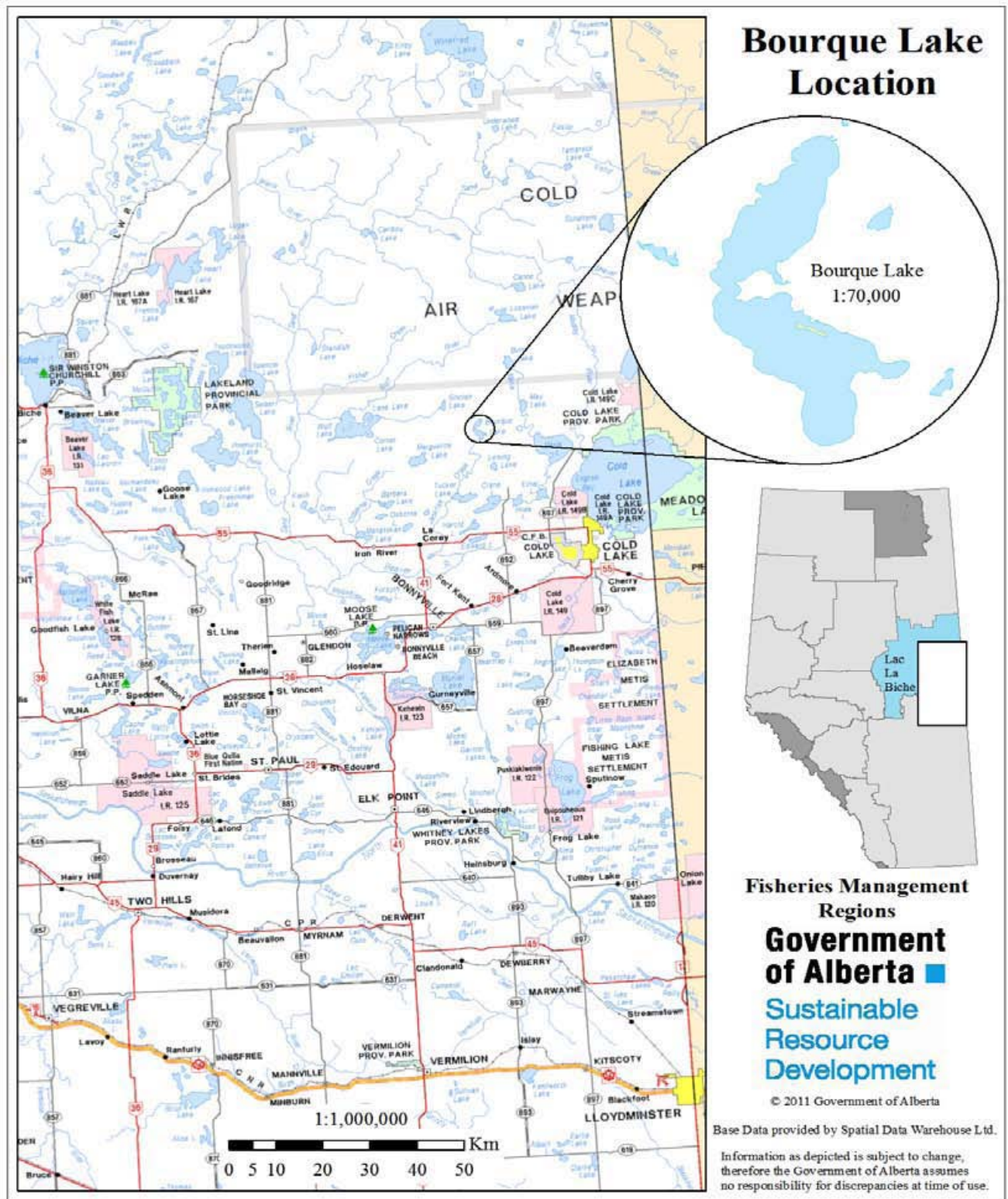


Figure 1. Bourque Lake is located in the northeast region, approximately 43 km north and 13 km east of Bonnyville, AB.

METHODS

Sampling Design

The lake was sampled according to the sample design and methodology outlined in Morgan 2000, however for this survey half sized gill nets were used. The lake was stratified by two different depths. Areas between 2-5m were considered “shallow” and 5-15m were considered “deep”. Nets were placed perpendicular to the shoreline. The nets were set out for duration of 24 hrs (+/- 3 hrs).

A total of 14 sample sites were set on Bourque Lake, 11 fell into the deep stratum and 3 into the deep stratum (figure 1). The nets used were half the length of regular sized FWIN nets, each consisting of 8 panels of different mesh sizes (25, 38, 51, 64, 76, 102, 127, and 152 mm stretched mesh) sewn together from smallest to largest. Each panel of mesh was 1.83 meters tall x 3.81 meters long with a total length of 30.5m and an area 109.8 m². Using half-length nets had been validated as having a near 1:1 capture ratio per unit area for walleye when compared to full length FWIN nets (Pruden and Davis 2006) and this also helps reduce mortality.

The nets included additional small mesh panels of 12 and 19 mm separated from the standard gang by ten meter leads to collect data on juveniles and small fish species. For the purposes of this report, only fish caught in the eight half-length panels are reported. Appendix 2-6 has the species caught for the smaller mesh panels.

Biological Data

All species caught, were bagged and labelled according to mesh size. Biological data were collected for walleye, northern pike, yellow perch, lake whitefish, and cisco. This included fork-length (mm), total-length (mm), weight (g), gonad weight (g), sex, maturity, stomach contents and aging structures. The aging structures included otoliths, cleithrums, operculums, pelvic fin-rays, and scales.

Data Analysis

Walleye catch per unit effort (CUE) was reported as fish·100m²·24hrs⁻¹ and calculated for each sample site:

$$CUE = (No. \text{ of fish} \times (100 \text{ m}^2 / (109.8 \text{ m}^2 / 2)) \times (24 \text{ hrs} / \text{ set time hrs})) \times 2$$

The CUEs were bootstrapped (10,000 replications) to determine upper and lower confidence intervals to 95% (Haddon 2001). The overall catch rate was calculated as a maximum likelihood estimate (MLE). The CUEs were multiplied by 2 because half-size gill nets were used.

Walleye total length and age distributions, age-at-maturity and length-at-age (growth rate) were determined to assess the stock status according to modified guidelines of the Walleye Management and Recovery Plan (Berry 1995, Sullivan 2003). Growth rate for walleye was estimated using the Von Bertalanffy growth equation and parameters were calculated using FAST 2.1 software (Slipke and Maceina 2001).

Northern Pike was analysed for CUE and total length distributions. Due to the small number of fish caught we did not calculate age distribution, age-at-maturity and length-at-age (growth rate).

All data were analysed and reported on Microsoft Office 2000 or 2007. The data set for this study is stored in the ASRD Fisheries and Wildlife Management Information System (FWMIS) provincial database under project number 15579 and waterbody ID # 4112.

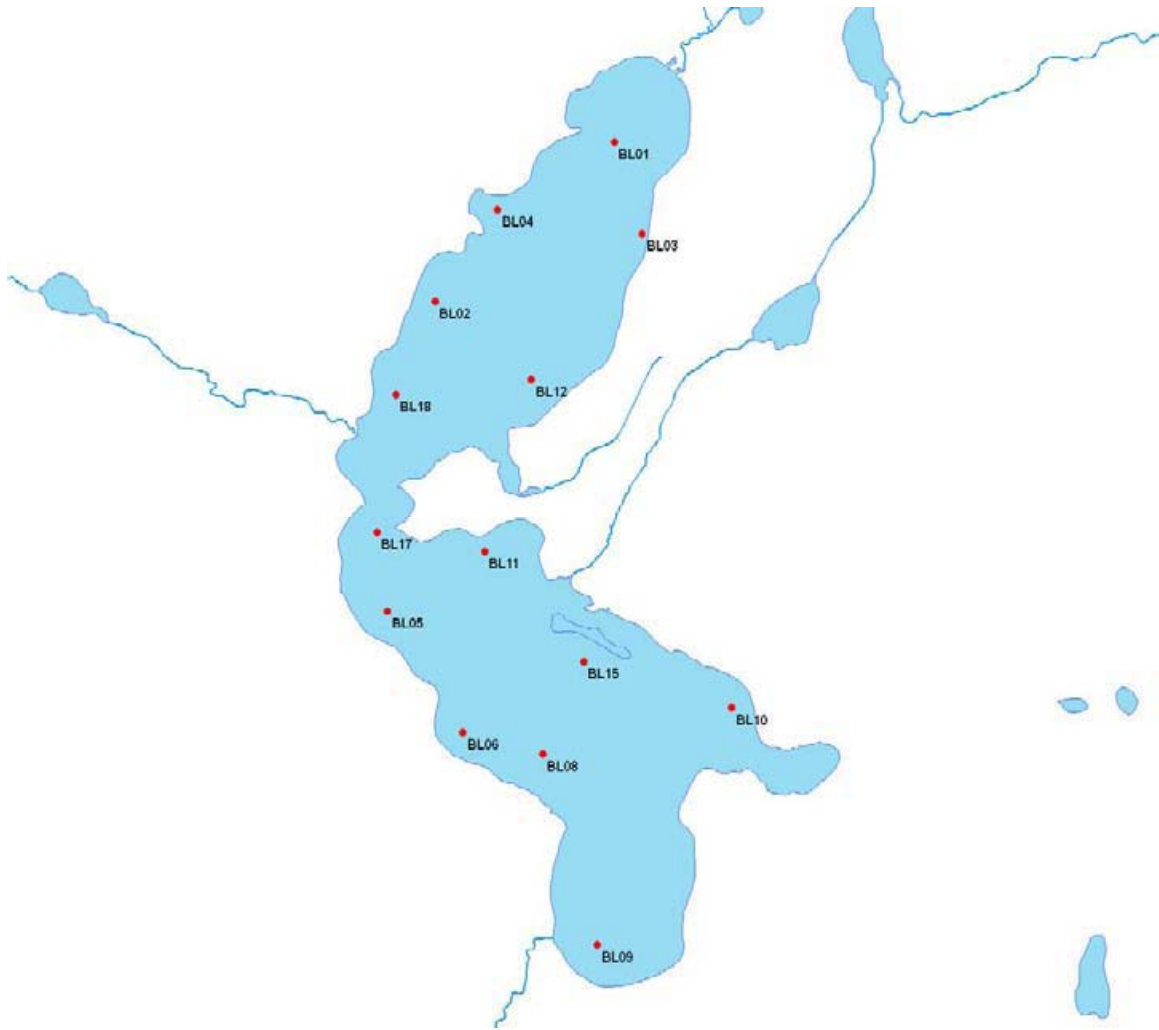


Figure 2. Map of Bourque Lake, Alberta showing sample locations for walleye FWIN in 2011

RESULTS

Overall Catch

A total of 372 fish representing six species were caught with walleye representing 24.7% of the catch (n=92) and northern pike 4.3% (n=16). The remainder of the catch was comprised of 40.3% cisco (n=150), 13.7% yellow perch (n=51), 15.3% lake whitefish (n=57), and 1.6% white sucker (n=6) (Appendix 2-6).

An additional 257 fish were captured in the non-FWIN small mesh nets. Spottail shiners at 60.3% (n=155) and yellow perch at 26.8% (n=69) made up the majority of the small mesh catch. The remainder fish included walleye at 10.1% (n=26), cisco at 1.9 (n=5) and northern pike at 0.77% (n=2). The fish captured in the small mesh nets are excluded from analysis but are reported in appendix 2-6.

Walleye Catch Rate

The catch per unit effort for walleye was 13.0 fish·100m⁻²·24hrs⁻¹ (95% C.I. 8.3-17.7) (figure 4, table 1). This catch rate has steadily increased from the previous 2006 FWIN survey at 9.2 fish·100m⁻²·24hrs⁻¹ and is slightly lower than the 2001 FWIN survey at 16.16 fish·100m⁻²·24hrs (figure 4).

The Bourque Lake 2011 FWIN catch rate ranked below the provincial average of 18.6 walleyes 100m⁻²·24hrs⁻¹ (figure 3). Catch rates and 95% C.I for all other species can be found in Table 1. A comparison of walleye population indices for previous Bourque Lake FWINs can be found in Appendix 7.

Table 1. Species catch rates from 2011, 2006, 2001 Bourque Lake FWIN surveys calculated assuming full sized gill nets were used.

Species	Year	CPUE	95% CI
CISC	2011	21.1	(11.9 - 32.6)
	2006	1.1	(0.3 - 1.9)
	2001	1.9	(0.6 - 3.5)
NRPK	2011	2.2	(0.7 - 4.0)
	2006	3.8	(2.1 - 5.8)
	2001	6.2	(4.4 - 7.9)
WALL	2011	13	(8.3 - 17.7)
	2006	9.2	(4.8 - 13.8)
	2001	16.16	(10.0 - 23.2)
WHSC	2011	0.8	(0.2 - 1.5)
	2006	1.0	(0.3 - 1.7)
	2001	1.1	(0.3 - 2.0)
YLPR	2011	7.2	(2.6 - 13.3)
	2006	6.8	(2.1 - 14.2)
	2001	13.3	(8.0 - 19)

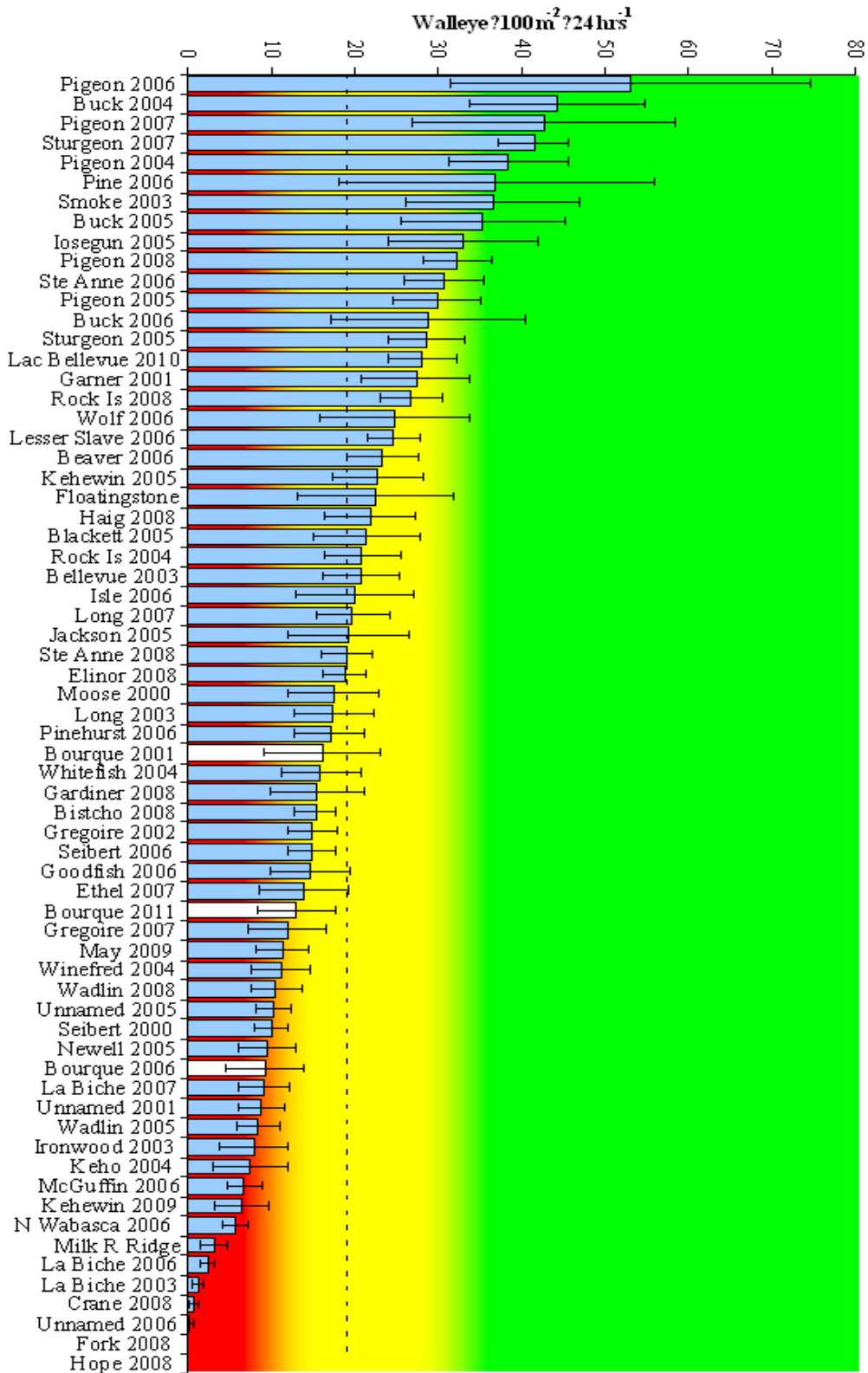


Figure 3. FWIN catches of walleye from Bourque Lake 2001, 2006 and 2011 surveys and other Alberta FWIN surveys (with 95% CI). The dashed line represents the mean provincial catch rate of 18.9 fish·100m⁻²·24hrs⁻¹. Collapsed, vulnerable, and stable catch rate ranges are indicated by red, yellow, and green backgrounds.

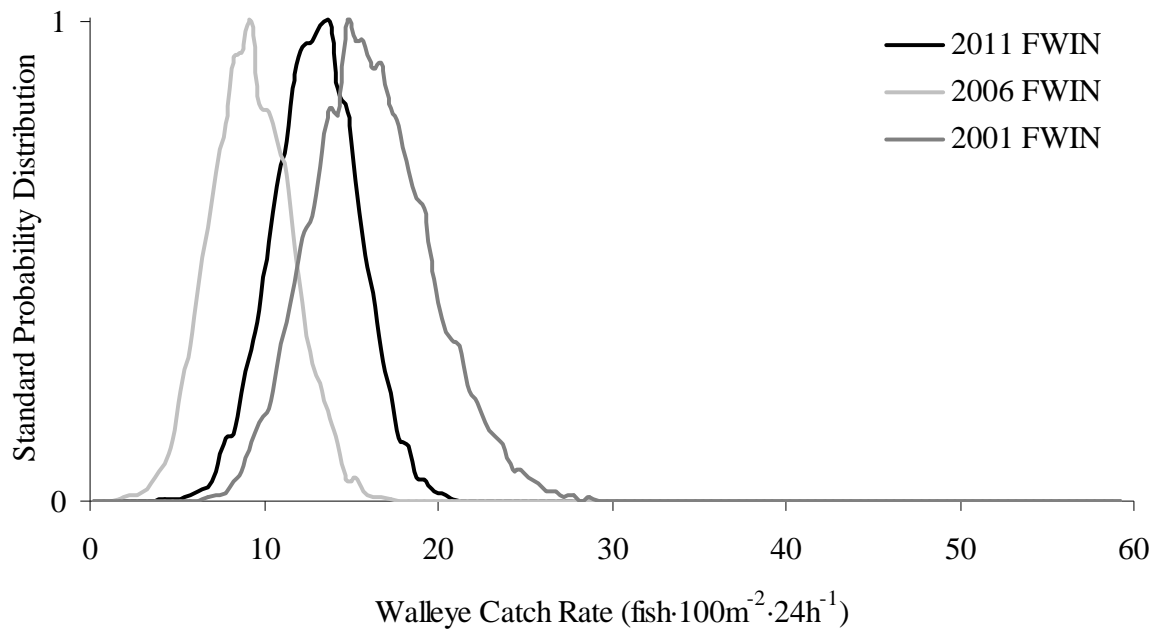


Figure 4. Walleye catch rates for Bourque Lake 2011, 2006, 2001 FWIN surveys. The 2011 catch rate = 13.0 fish·100m⁻²·24hrs⁻¹ (95% C.I. 8.3-17.7, n=92), 2006 catch rate = 9.2 fish·100m⁻²·24hrs⁻¹ (95% C.I. 4.8-13.8, n=98), and 2001 catch rate = 16.16 fish·100m⁻²·24hrs⁻¹ (95% C.I. 10-23.2, n= 212)..

Walleye Total-Length Distribution

Walleye total lengths (n=92) ranged from 125 – 675 mm TL with a mean of 442 mm (figure 5). The total length distribution was poorly developed with the greatest catch rates between the 350 and 550 mm range. Walleye greater than 500 mm (used to be harvestable before regulation change) made up about a quarter of the sample (26% n=26). For 2006 walleye greater than 500mm made up 12% (n=12) of the sample and in 2001 13% of walleye made up the sample (n=29).

Walleye Age-Class Distribution and Stability

Walleye ages in the 2011 FWIN ranged from one to twenty years old with a mean age of 8.12 (n=90). The age classes were poorly represented with no single age group meeting the criteria of 3 measureable fish·100m⁻²·24hrs⁻¹ for all three years (figure 6). Only three age classes, the 5, 8, and 10 year olds had a catch rate over 1 fish·100m⁻²·24hrs⁻¹ and one age class, the 7 year olds reached a catch rate over 2 fish·100m⁻²·24hrs⁻¹.

Both 2006 and 2001 FWINs also had a low age-class distribution. Walleye ages from 2006 ranged from zero to twenty years old with a mean age of 4.94 (n=98) and from 2001 walleye ranged from one to fourteen years old with a mean age of 5.41 (n=212). Less than 1-2 age classes fell over the catch rate of 1 fish·100m⁻²·24hrs⁻¹. Northern pike age-class distributions were not calculated due to extremely low catch rates and inefficient data.

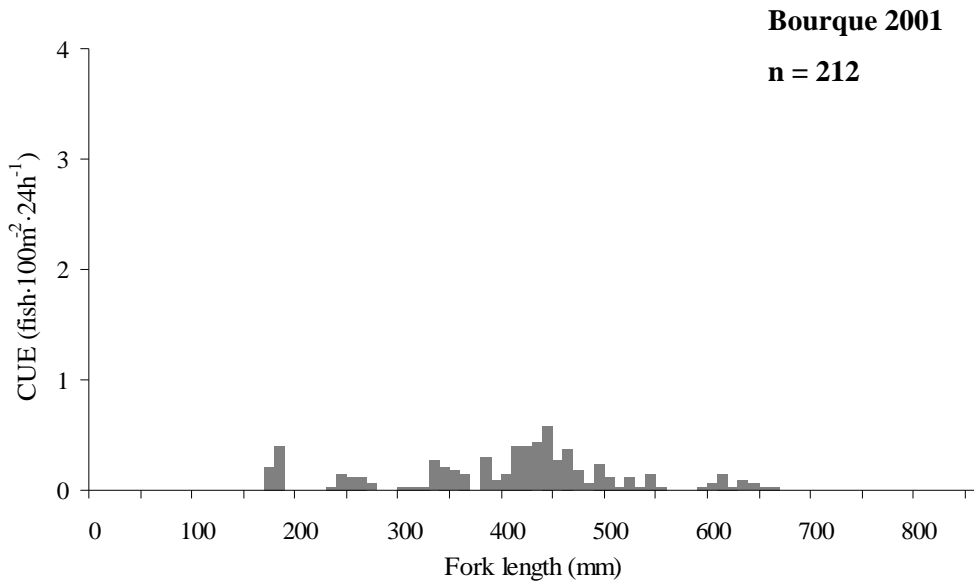
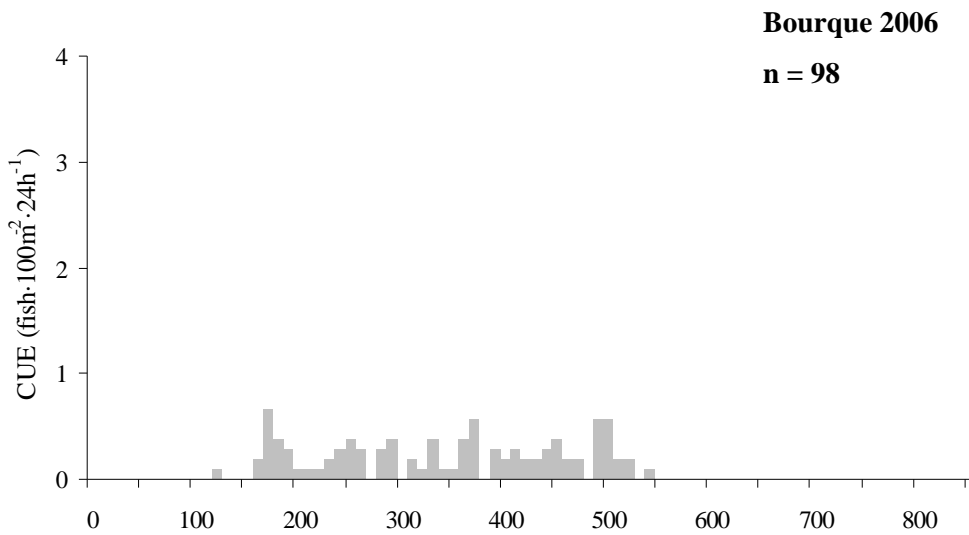
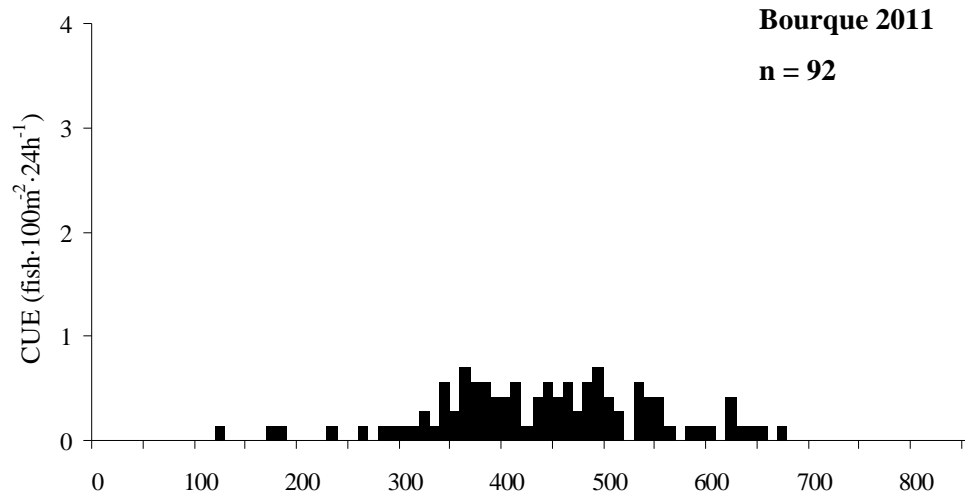


Figure 5. Walleye total length frequency distributions for Bourque Lake 2011, 2006, and 2001 FWIN surveys

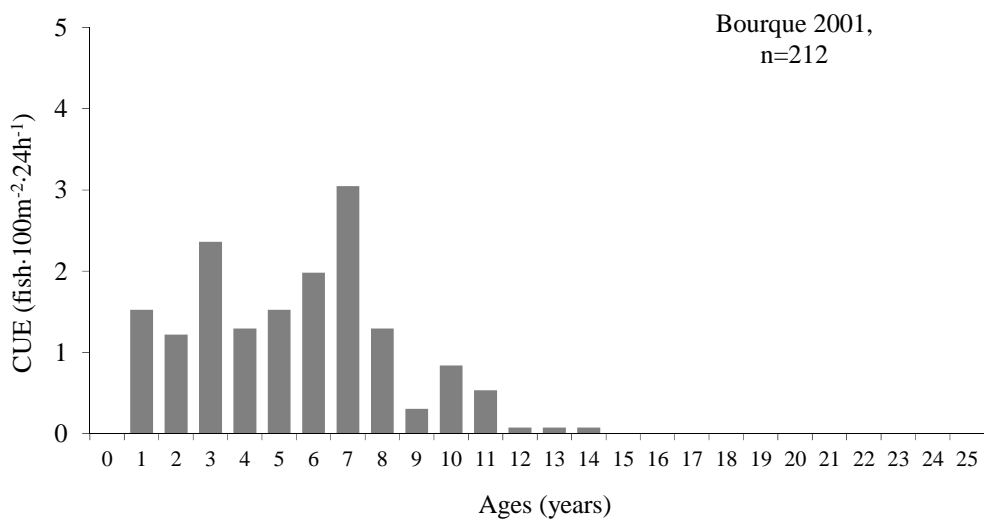
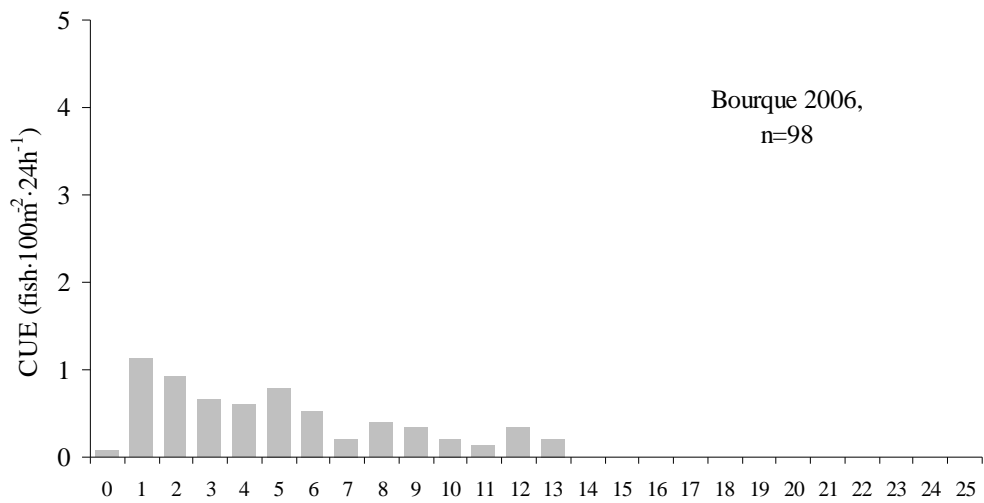
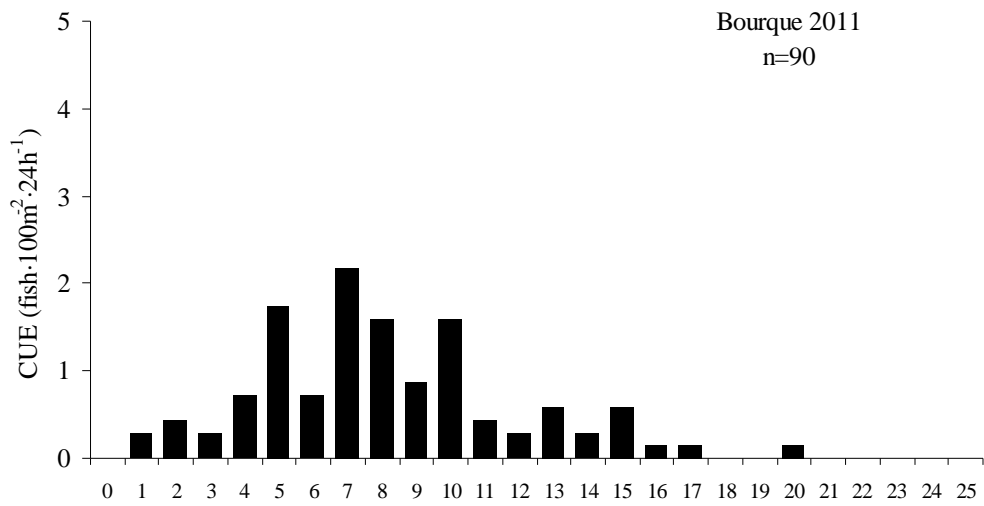


Figure 6. Walleye age-frequency distribution, Bourque Lake 2011, 2006, 2001 FWIN surveys.

Walleye Age-at-Maturity

Seventy percent of walleye sampled were categorized as mature. Of the 98 walleye that were identified to sex, 48 were male and 41 females. Males began to mature at age four and by age eight 72% were mature. All male walleye were mature by age 8. Females began to mature at age six and by age seven 40% were mature. All female walleye were mature by age 10 (figure 7, appendix 7). Age-at-maturity were not analysed for northern pike due to insufficient sample size.

Walleye Length-at-Age

Overall, the walleye growth rates have been similar for the past FWIN surveys. Walleye from the 2011 and 2006 FWIN reached a mean total length of 500 mm by age 8. For 2001 walleye reached a total length of 500 mm between the ages of 10 and 11. Length-at age could not be analysed for northern pike due to insufficient sample size.

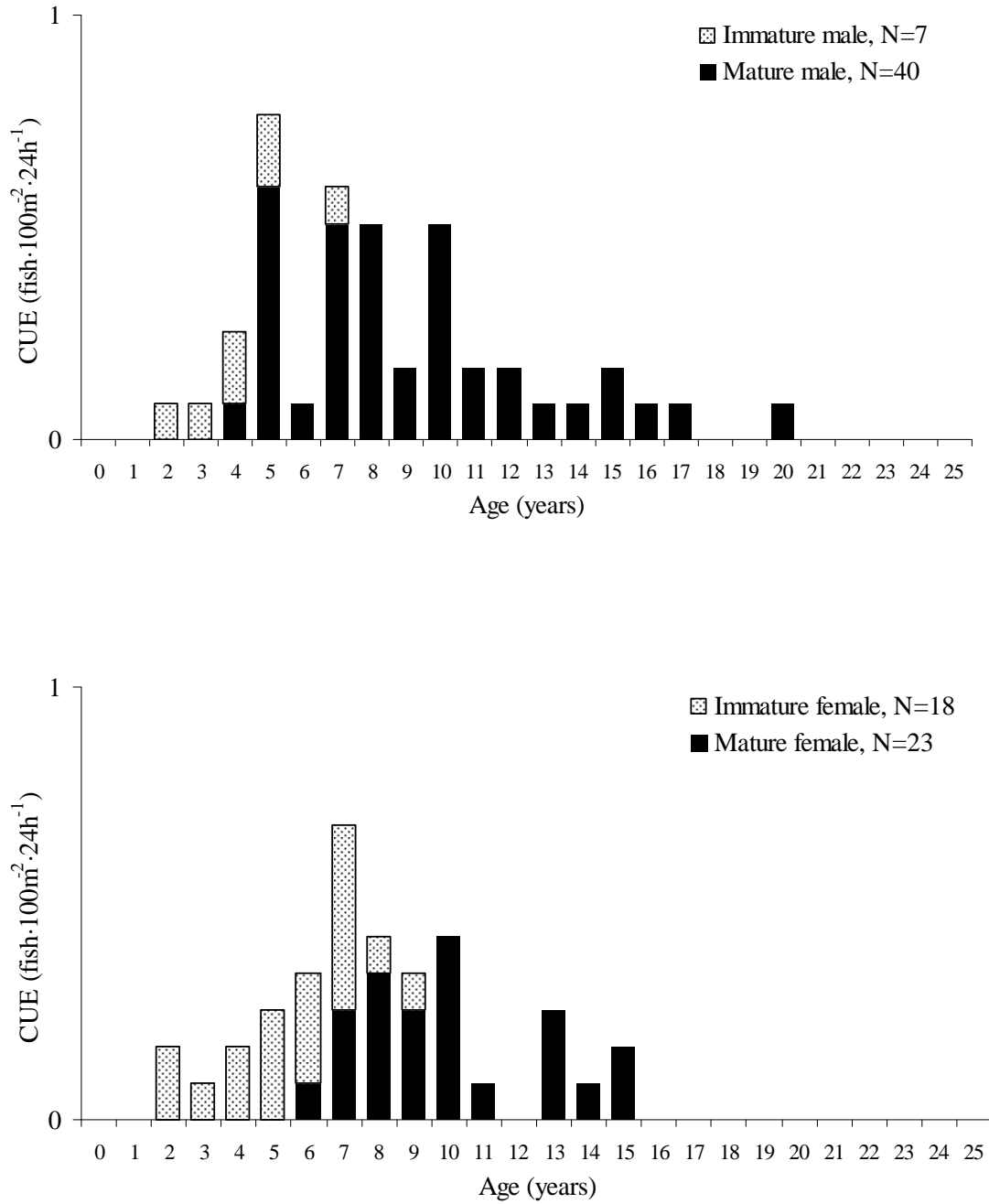


Figure 7. Age-at-maturity distribution for male and female walleye from Bourque Lake 2011 FWIN survey

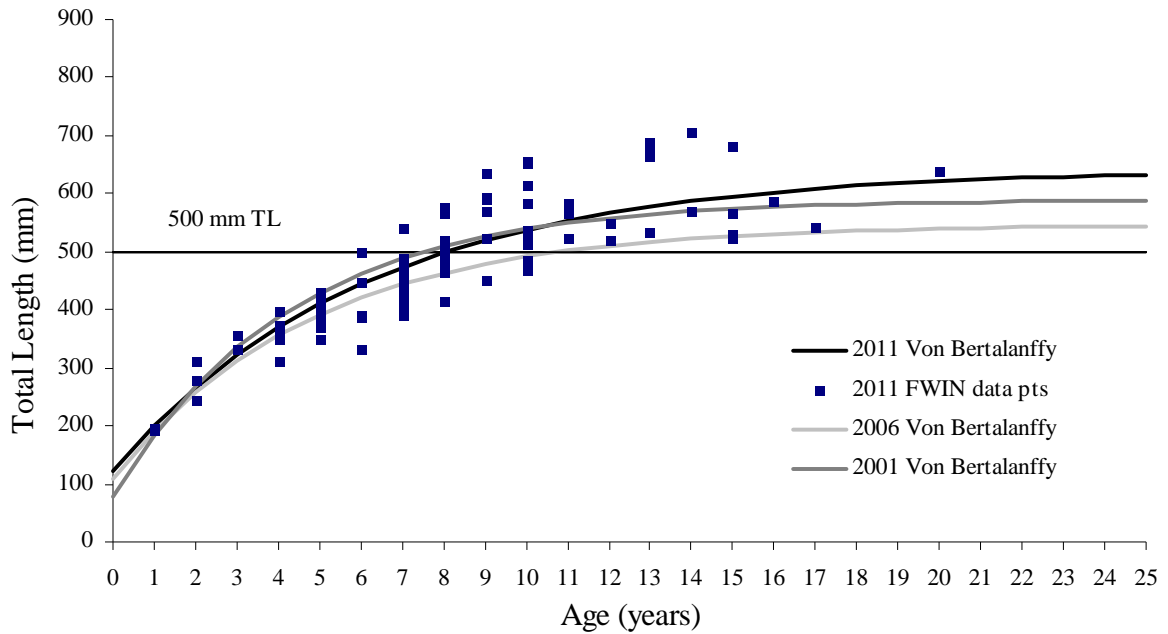


Figure 8. Walleye length-at-age from Bourque Lake 2011 FWIN survey ($L_{inf} = 642$, $K = 0.16$, $t_0 = -1.32$, $P < 0.001$, $n = 90$) compared with results from 2006 FWIN survey ($L_{inf} = 546$, $K = 0.21$, $t_0 = -1.087$, $P < 0.001$, $n = 98$) and from the 2001 FWIN survey ($L_{inf} = 589$, $K = 0.23$, $t_0 = -0.618$, $P < 0.001$, $n = 212$)

Table 2. A comparison of the criteria for classifying status's of walleye fisheries in 2011, 2006, and 2001 modified for FWIN analysis

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
Bourque lake 2011				13.0 walleye/net
Bourque lake 2006				9.2 walleye/net
Bourque lake 2001			16.16 walleye/net	
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.
Bourque lake 2011			age classes 18, wide distribution/low density, mean =8.12	
Bourque lake 2006			age classes 14, narrow distribution/older densities are low mean=4.94	
Bourque lake 2001			age classes 14, narrow distribution/low older density, higher younger density mean=5.41	
AGE CLASS STABILITY	Very stable: 1 to 2 "measurable" (> 3 walleye•100m ⁻² •24h ⁻¹) age classes out of a smooth catch curve.	Relatively stable: 2 to 3 "measurable" age classes out of a smooth catch curve.	Unstable: 1 to 3 "measurable" age classes, with gaps in age classes.	Stable or unstable: 1 or fewer "measurable" age classes.
Bourque lake 2011				0 measurable age class. Greatest age class >2.
Bourque lake 2006				0 measurable age class. Greatest age class >2.
Bourque lake 2001				0 measurable age class. Greatest age class >2.
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
Bourque lake 2011			Males 75% mature at age 5 and fully mature at age 8; females start maturing at age 6, 50% between 7 and 8, fully mature at age 10	
Bourque lake 2006			Males fully mature at age 5; females fully mature at age 7	
Bourque lake 2001				Males 50% mature at age 3 and fully mature at age 6; most females fully mature between ages 6 and 7 and fully by age 9
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
Bourque lake 2011			Females and males reach 50cm at age 8	
Bourque lake 2006		Females and males reach 50cm at age 11		
Bourque lake 2001			Females and males reach 50cm at age 7-8	

DISCUSSION

The 2011 walleye catch rate was 13.0 fish·100m⁻²·24hrs⁻¹. This catch rate is considered low, and would be best characterised as vulnerable – collapsed and is an improvement from the 2006 density of 9.2 fish·100m⁻²·24hrs⁻¹. The 2011 catch included a greater proportion of older age classes than the previous surveys which is a positive trend. However the age-class distribution, stability, age-at-maturity, were still best categorized as vulnerable. Overall, the population remains low to moderate density with females maturing early.

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APPENDICES

Appendix 1. Bourque Lake 2011 FWIN net locations and site data.

Site	Lift Date	Stratum	UTM Easting	UTM Northing	Soak Time (h)	Max depth (m)	Min depth (m)	Temp. (°C)
BL11	27-Sept-11	Shallow	529075	6058413	24.33	4.6	2.0	14.8
BL05	27-Sept-11	Deep	528517	6058096	24.90	12.3	10.2	14.9
BL01	27-Sept-11	Deep	529819	6060622	23.70	9.7	6.3	14.7
BL12	27-Sept-11	Deep	529343	6059343	24.25	13.7	12.9	14.8
BL18	28-Sept-11	Deep	528565	6059264	23.82	11.7	5.0	14.0
BL10	28-Sept-11	Shallow	530495	6057575	23.43	5.0	2.6	14.3
BL03	28-Sept-11	Deep	529980	6060129	23.67	8.9	5.0	14.0
BL08	28-Sept-11	Deep	529410	6057326	24.05	13.5	13.0	15.1
BL15	29-Sept-11	Deep	529643	6057823	23.85	8.2	6.2	13.7
BL17	29-Sept-11	Deep	258458	6058517	24.08	8.4	8.2	14.0
BL04	29-Sept-11	Deep	529149	6060261	24.03	8.4	5.0	14.0
BL02	29-Sept-11	Deep	528791	6059764	23.82	8.4	5.0	14.0
BL09	29-Sept-11	Shallow	529722	6056305	24.15	3.6	2.0	14.3
BL06	29-Sept-11	Deep	258952	6057445	23.02	9.5	6.2	14.7

Appendix 2. Walleye catch summary for Bourque Lake FWIN, 2011

Set ID	FWIN Nets, Mesh Size ¹								Totals	Non-FWIN Nets, Mesh size (mm) ²		
	25	38	51	63	76	102	127	152		12	19	Totals
BL01			2	1	3	2	1		9	1	1	2
BL02					2	3	1		6	2	3	5
BL03		2		1	4	1			8		2	2
BL04	1		1	1	3	1			7		2	2
BL05			1	4	1	1	1		8			0
BL06		1	1	4	1	2			9		1	1
BL08					1				1			0
BL09					1	1	1		3		1	1
BL10			1	3	4	3		3	14	1	1	2
BL11									0	1		1
BL12									0		5	5
BL15		1	3	2	3	2	2		13	1	4	5
BL17		1	6	2	5				14			0
BL18									0			0
Totals	1	5	15	18	28	16	6	3	92	6	20	26

Appendix 3. Northern Pike catch summary for Bourque Lake FWIN, 2011

Set ID	FWIN Nets, Mesh Size ¹	Non-FWIN
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									Nets, Mesh size (mm) ²			
	25	38	51	63	76	102	127	152	Totals	12	19	Totals
BL01	1		1						2			0
BL02									0			0
BL03									0			0
BL04									0			0
BL05									0			0
BL06									0			0
BL08					1				1			0
BL09			1	3	1				5			0
BL10				2		1			3			0
BL11		1	3						4			0
BL12									0		2	2
BL15			1						1			0
BL17									0			0
BL18									0			0
Totals	1	1	6	5	2	1	0	0	16	0	2	2

Appendix 4. Yellow Perch catch summary for Bourque Lake FWIN, 2011

Set ID	FWIN Nets, Mesh Size ¹								Non-FWIN Nets, Mesh size (mm) ²			
	25	38	51	63	76	102	127	152	Totals	12	19	Totals
BL01	3								3	4	1	5
BL02	1								1			0
BL03			1						1	5		5
BL04	8	1							9	1		1
BL05									0			0
BL06	5	2							7	1	1	2
BL08									0			0
BL09	2	1	2	1					6	15		15
BL10	13	6	1						20		1	1
BL11	1								1	39		39
BL12									0			0
BL15	1								1	1		1
BL17	2								2			0
BL18									0			0
Totals	36	10	4	1	0	0	0	0	51	66	3	69

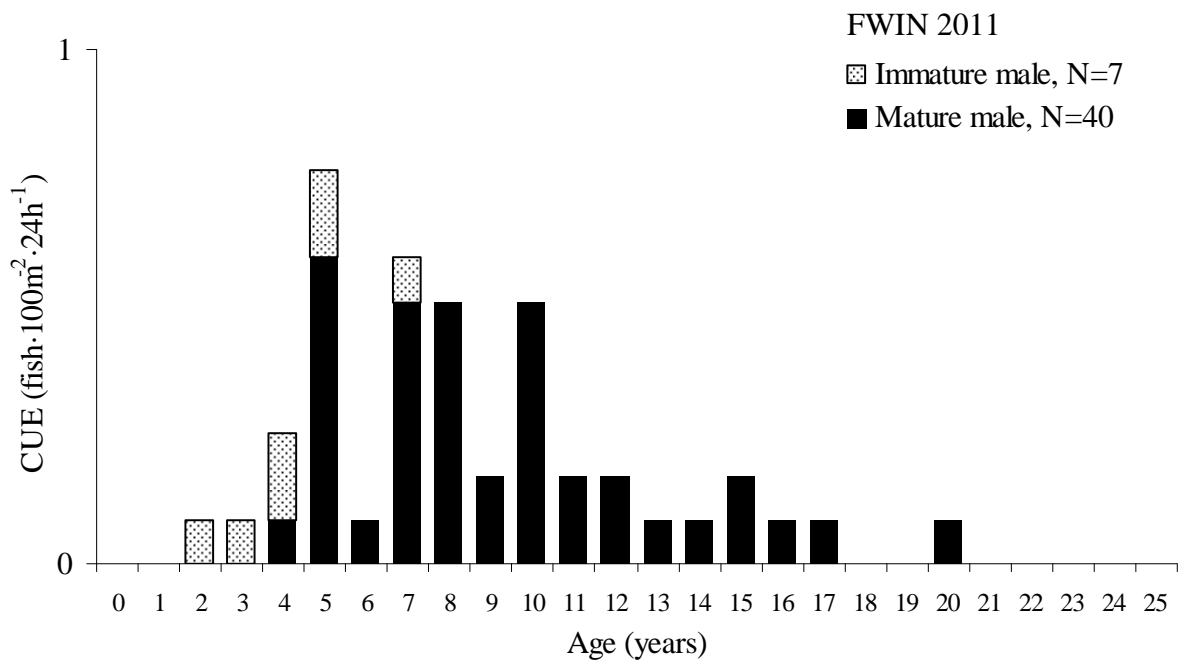
Appendix 5. Cisco catch summary for Bourque Lake FWIN, 2011

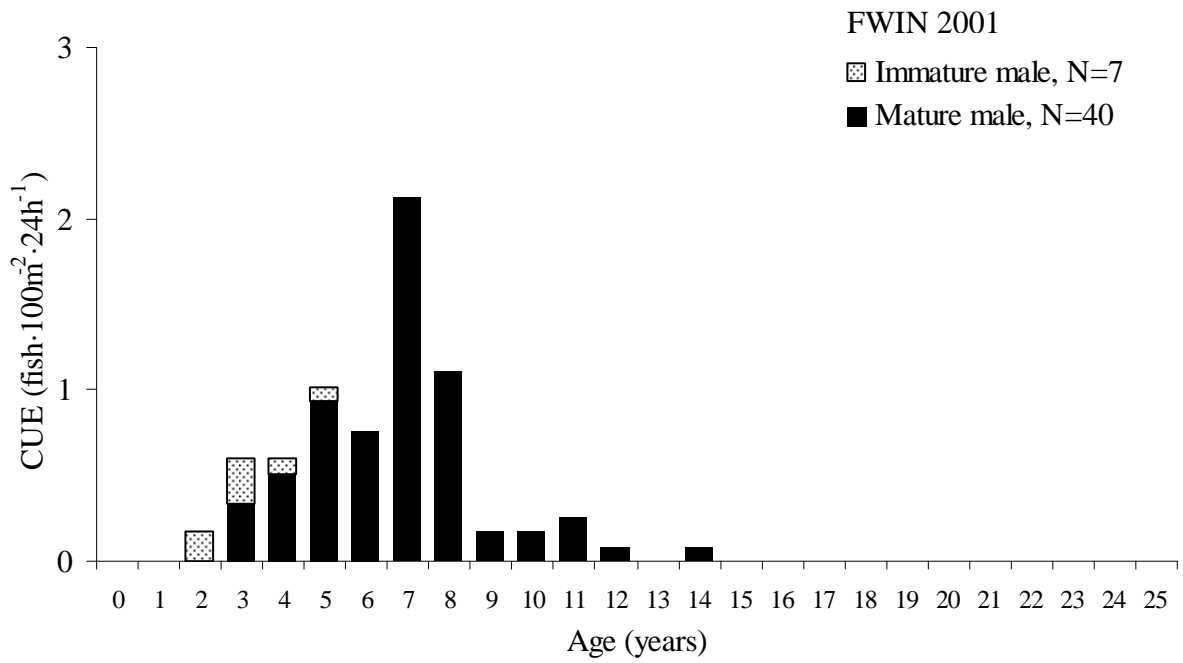
Set ID	FWIN Nets, Mesh Size ¹								Non-FWIN Nets, Mesh size (mm) ²			
	25	38	51	63	76	102	127	152	Totals	12	19	Totals
BL01	5	4	1	2	2				14			0
BL02	5	1	2	2	1				11			0
BL03	11	6	13	7	3				40		2	2
BL04	13		1	1	1				16		2	2
BL05	13	6	3						22		1	1
BL06	2	1	1						4			0
BL08		4	7	2	3				16			0
BL09									0			0
BL10		2	5	5					12			0
BL11									0			0
BL12									0			0
BL15	1		1						2			0
BL17		2	1						3			0
BL18	3		7						10			0
Totals	53	26	42	19	10	0	0	0	150	0	5	5

Appendix 6. White sucker catch summary for Bourque Lake FWIN, 2011

Set ID	FWIN Nets ¹	Non-FWIN nets ²
BL01	1	0
BL02	0	0
BL03	1	0
BL04	0	0
BL05	0	0
BL06	1	0
BL08	0	0
BL09	0	0
BL10	1	0
BL11	0	0
BL12	0	0
BL15	0	0
BL17	2	0
BL18	0	0
Totals	6	0

Appendix 7. Age-at-maturity distribution for male walleye from Bourque Lake 2011, 2001 FWIN survey





Appendix 8. Age-at-maturity distribution for female walleye from Bourque Lake 2011, 2001 FWIN survey

