Heart Lake Fall Walleye Index Netting Surveys, 2005 and 2011

Fisheries Management
Lower Athabasca Region
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Abstract

Heart Lake is a regionally important recreational fishery in Northern Alberta. As part of a monitoring program to manage the fishery, Fall Walleye Index Netting was performed in 2005 and 2011 to evaluate the abundance and structure of the walleye population.

During the 2005 survey, a total of 1,920 fish of 7 species were caught including 35 walleye *(Sander vitreus)*, 251 northern pike *(Esox lucius)*, 1,247 yellow perch *(Perca flavescens)*, 5 lake whitefish *(Coregonus clupeaformis)*, and 361 cisco *(Coregonus artedi)*. The catch rate for walleye was 1.9 fish/100m^2/24 hours (95% confidence interval 0.9-2.1). Walleye total lengths ranged from 271 to 725 mm (n = 35), and walleye over 500 mm made up 51% of the sample. Females began maturing at age 2 and males at age 8. Female walleye reached a total length of 500 mm by approximately age 6 and males reached a total length of 500 mm at age 7.

During the 2011 survey, a total of 532 fish of 7 species were caught including 105 walleye, 92 northern pike, 108 yellow perch, 7 lake whitefish, and 218 cisco. The catch rate for walleye was 11.3 fish/100m^2/24 hours (95% confidence interval 5.7-17.7). Walleye total lengths ranged from 240 to 700 mm (n = 105), and walleye over 500 mm made up 60% of the sample. Females began maturing at age 4 and males at age 8. Female walleye reached a total length of 500 mm by approximately age 4, and males reached a total length of 500 mm at age 6.

Introduction

Heart Lake is an important recreational and subsistence fishery located in Northern Alberta. A fall walleye index netting (FWIN) assessment conducted in 2000 classified the walleye *(Sander vitreus)* population as 'collapsed', with a catch rate among the lowest in the province (2.5 fish·100m^{-2}·24hrs^{-1}) (Walker 2006). Ongoing monitoring of the population is part of the Alberta Environment and Sustainable Resource Development Department's management strategy for this fishery. The Lac La Biche area Fisheries Management team conducted FWIN surveys on Heart Lake to assess the abundance and population structure of the Heart Lake walleye population in 2005 and 2011. The results from these two surveys can be used to assess management strategies by comparing the results to those of previous FWIN surveys.

Methods

FWIN surveys were conducted from September 12-16 in 2005. Twenty five sampling locations were used for this survey; locations were selected randomly and weighted by depth stratum (Appendix 1). FWIN surveys were conducted in 2011 from October 4-5. Sixteen sampling locations, selected randomly and weighted by depth stratum, were used for the 2011 survey.

A detailed description of the methods and equipment used can be found in the Manual of Instructions Fall Walleye Index Netting (FWIN) (Morgan 2002). The FWIN nets used in both surveys consisted of 8 panels. Nets had stretched mesh sizes of 25, 38, 51, 64, 76, 102, 127, and 152 mm. Two additional panels of 12 and 19 mm stretched mesh were attached but separated from the standard gang by ten meter leads to collect data for an ongoing regional forage study. Of the 25 nets set in 2005, 15 were the standard FWIN net size of 7.62m long and 1.83m high. The remaining 10 nets were half the size of standard FWIN nets, 3.81m long and 1.83m high. In 2011, all nets were half the size of standard nets. Nets were set for approximately 24 hours before being cleared of fish and reset at a new location. 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.

All fish species caught in the FWIN nets were kept for analysis. Catches were recorded by net location and mesh size. A net ID, date, mesh size, and count of each species of fish caught were recorded for each panel for catch-per-unit-effort (CUE) calculations. Biological data collected from all fish include weight (g) and fork and total length (mm). Sex and reproductive maturity data was collected from all sportfish, as well as bony structures for aging. Otoliths were collected from yellow perch (*Perca flavescens*) and walleye and aged as described by Watkins and Spencer (2009).Cleithra were collected from northern pike (*Esox lucius*) and aged according to methods described by Mckay et al. (1990).

Only data from fish caught in the standard eight-panel FWIN nets were included in analyses. . The supplemental 12 and 19 mm mesh panels are not relevant to this FWIN survey. Relative abundance expressed as CUE was calculated as number of fish caught/100 m^2/24 hours with 95% confidence intervals empirically determined by bootstrapping catches to 50,000 replications. Growth was described using the von Bertalanffy growth model in FAMS 1.0 (Slipke 2010).

The raw data from these FWIN surveys, including the supplemental 12 and 19 mm panels, are stored digitally in the Fish and Wildlife Management Information System (FWMIS). The 2005 survey data can be found under Project ID # 6586 and the 2011 data can be found under Project ID# 15857.

Results

2005 FWIN

A total of 1,920 fish belonging to 7 species were caught in 2005 (Appendix 1). The walleye catch rate was 1.9 fish/100m^2/24 hours (95% confidence interval, 0.9-2.1) (Table 1), consistent with that of a collapsed population. The catch rate for northern pike was 12.1 fish/100m^2/24 hours (95% C.I.9.7– 11.2) and the catch rate for yellow perch was 60.5 fish/100m^2/24 hours (95% C.I. 40.0 – 65.1). Other species caught included 5 lake whitefish (*Coregonus clupeaformis*), 364 cisco (*Coregonus artedi*), 16 white suckers (*Catostomus commersoni*), and one spottail shiner (*Notropus hudsonius*) (Appendix 1).

Walleye caught during the 2005 FWIN survey had total lengths ranging from 271 mm to 725 mm (n = 35) (Figure 1). Fifty-one percent of walleye sampled were over 500 mm total length, the standard provincial minimum harvestable size limit for walleye.

Walleye ranged from 2 to 16 years of age. The average age was 6.7 years. There were no measurable age classes (i.e. a CUE over 3.0 fish/100m^2/24 hours) sampled (Figure 2). The largest age class was the 2-year-old class, representing 34% of the sample. This class can be tracked in the 2011 age-class distribution as the 8-year-old class. The 2005 age distribution is not continuous and shows gaps between ages 5-8 and between ages 10-14. This discontinuous age distribution could explain the gaps in ages in the 2011 age distributions.

Fifty-seven percent of captured walleye in 2005 were mature (20 of 35). Females began maturing at age 2, and all female walleye were mature by age 5 (Figure 3). All males were mature by age 8 (Figure 3). All males were mature by age 8. Females reached 500mm total length at age 6, and males reached 500mm at age 7 (Figure 5).

Two hundred fifty one northern pike were sampled ranging from 347 to 853mm in total length with an average length of 618.7mm. Ages ranged from 2 to 15 years with an average age of 6.5years.

2011 FWIN

A total of 532 fish belonging to 7 species were caught in 2011 (Appendix 2). The walleye catch rate was 11.3 fish/100m^2/24 hours (95% C.I. 5.7-17.7) (Table 1), consistent with that of a collapsed population. The catch rate for northern pike was 10.3 fish/100m^2/24 hours (95% C.I. 7.3-13.4) and the catch rate for yellow perch was 12.1 fish/100m^2/24 hours (95% C.I. 9.4 – 14.6). Other species caught included 7 lake whitefish , 218 cisco , 5 white suckers , and 2 spottail shiners (Appendix 2).

Walleye caught during the 2011 FWIN survey had total lengths ranging from 240 mm to 700 mm (n = 105) (Figure 1). Eighty-six percent of walleye sampled were over 500 mm total length.

Walleye ranged from 1 to 20 years of age, with an average of 7.3 years of age. The 8-year old age class was the only measurable age class (i.e. a CUE over 3.0 fish/100m^2/24 hours) sampled (Figure 2). It was the largest age class, and represented 60% of the sample. The 2011 age distribution is not continuous and shows gaps between ages 10 and 15 and between ages 15 and 20.

Eighty-six percent of walleye captured in 2011 were mature (90 of 105). Females began maturing at age 4, and all female walleye were mature by age 5 (Figure 4). All males were mature by age 8 (Figure 4). All males were mature by age 3. Females reached 500mm total length at age 4, and males reached 500mm at age 6 (Figure 6).

Ninety-two northern pike were sampled ranging from 463 to 920mm in total length with an average length of 659.3mm. Ages ranged from 4 to 14 years with an average age of 7.2 years.

Interpretation

The Heart Lake walleye population status remains largely unchanged between 2000, 2005 and 2011. The length-at-age distributions show that walleye reached 500 mm at approximately age 7 for both the 2005 and 2011 surveys. Only one measurable age-class (8 year-olds) was detected in the 2011 survey, and there were no age-classes with a CUE greater than 3 fish/100m^2/24hours in the 2005 survey. The average age of sampled walleye changed from 8.8 years in 2005 to 7.3 years in 2011. The walleye population improved in 2011, with an increased catch rate of 11.3 fish/100m^2/24 hours and more age classes with greater recruitment in the 0-5 year age range. Despite the improvement in CUE, the Heart Lake walleye population is still classified as 'collapsed'.

Table 1. Species catch rates from the 2005 and 2011 Fall Walleye Index Netting Survey on Heart Lake.

Species	Year	CUE (fish/100m^2/24 hours)	95% C.I.
WALL	2005	1.9	(0.9 – 2.1)
	2011	11.3	(5.7 – 17.7)
NRPK	2005	12.1	(9.7 – 11.2)
	2011	10.3	(7.3 – 13.4)
YLPR	2005	60.5	(40.0– 65.1)
	2011	12.1	(9.4 – 14.6)
CISC	2005	13.4	(8.0 – 22.5)
	2011	24.4	(17.1 – 32.7)

Table 1. Walleye Stock Classification Chart for the 2005 and 2011 Heart Lake FWIN surveys.

POPULATION METRIC	POPULATION STATUS CLASSIFICATION			
	TROPHY	STABLE	VULNERABLE	COLLAPSED
CATCH RATE (FWIN)	High - >30 Walleye/100m^2/24hr	High - >30 Walleye/100m^2/24hr	Moderate: 15-30 Walleye/100m^2/24hr	Low: <15 Walleye/100m^2/24hr
				2005: 1.9 fish/100m^2/24 hours
				2011: 11.3 fish/100m^2/24 hours
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.
				2005: 8 age classes (n=35); mean age = 8.8
				2011: 10 age classes (n=105); mean age = 7.3
AGE-CLASS STABILITY	Very stable: 1 to 2 "measureable" (> 3 Walleye/100m^2/24hr) 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.
				2005: 0 measurable age classes.
				2011: 1 measurable age class.
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
				2005: females at 2-5 years. Males at 8 years (no males younger than 8 caught).
				2011: Females at 4-5 years. Males at 3-8.
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
				2005: 7 years
				2011: 6 years

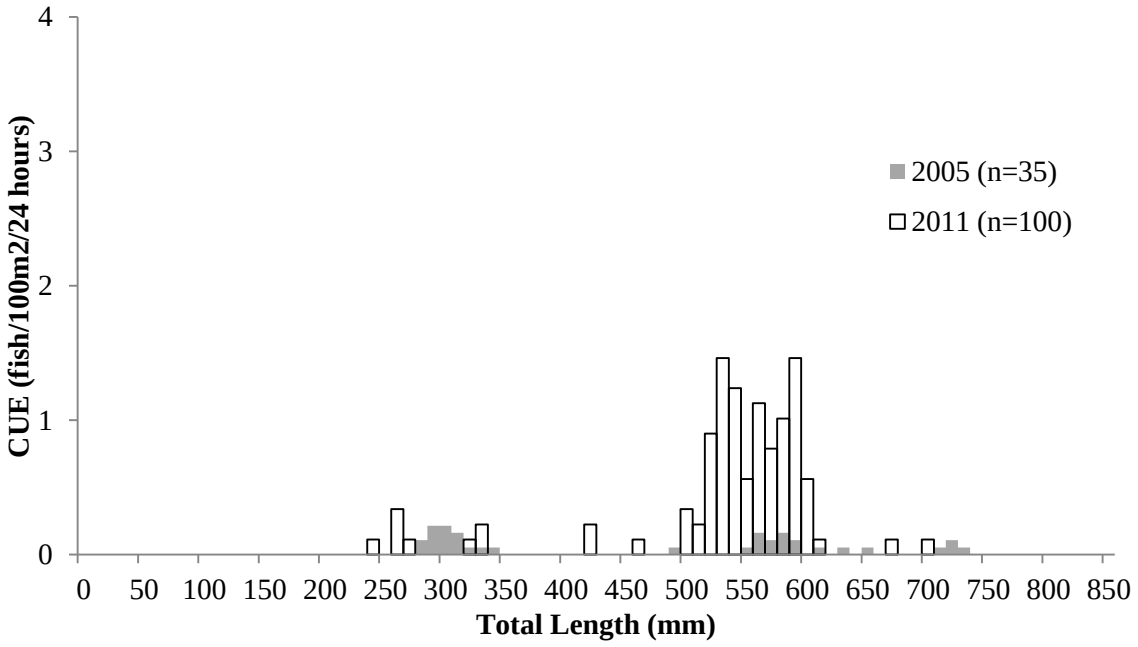

Figure 1. Total length distribution of walleye sampled during the 2005 and 2011 Heart Lake FWIN surveys (n=35 and 100, respectively).

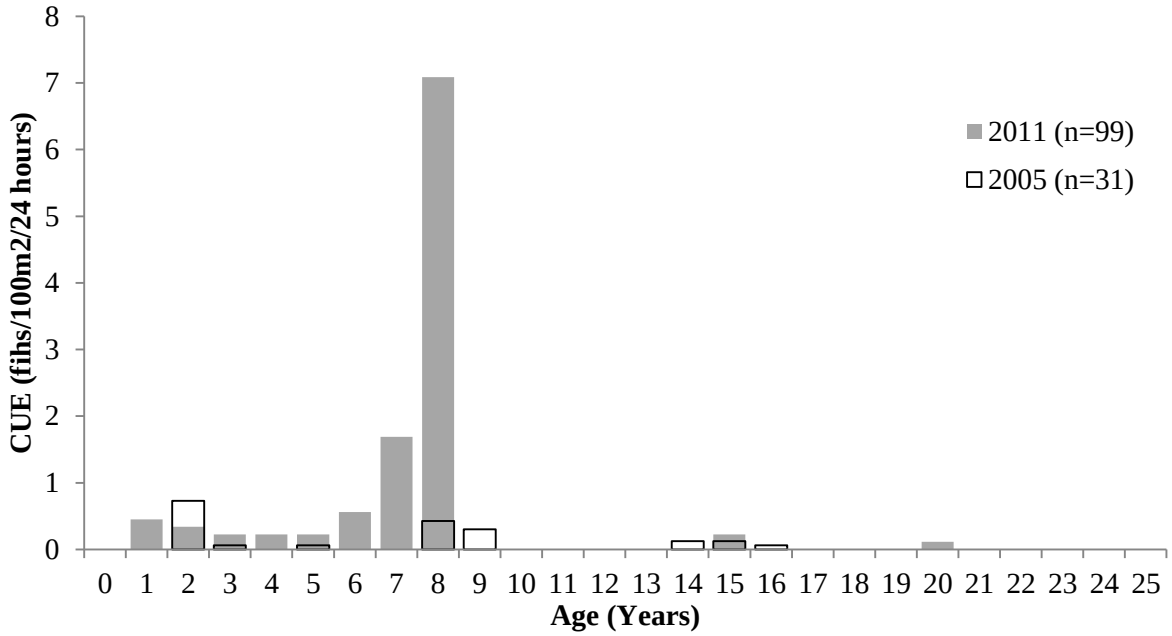

Figure 2. Age distribution of walleye sampled during the 2005 and 2011 Heart Lake FWIN survey (n=31 and 99, respectively).

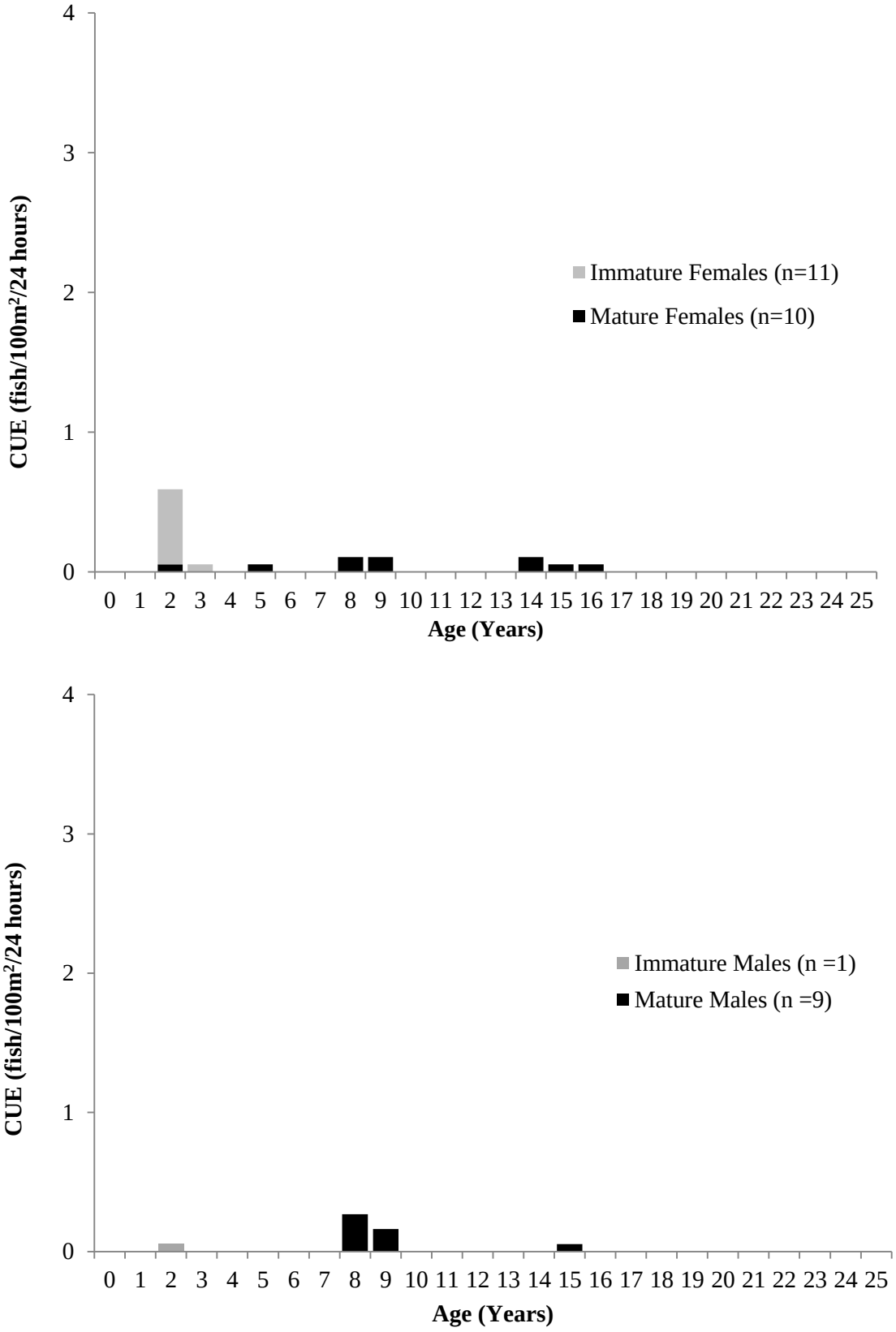

Figure 3. Age-at-maturity distributions for female and male walleye, respectively, caught during the 2005 Heart Lake FWIN survey.

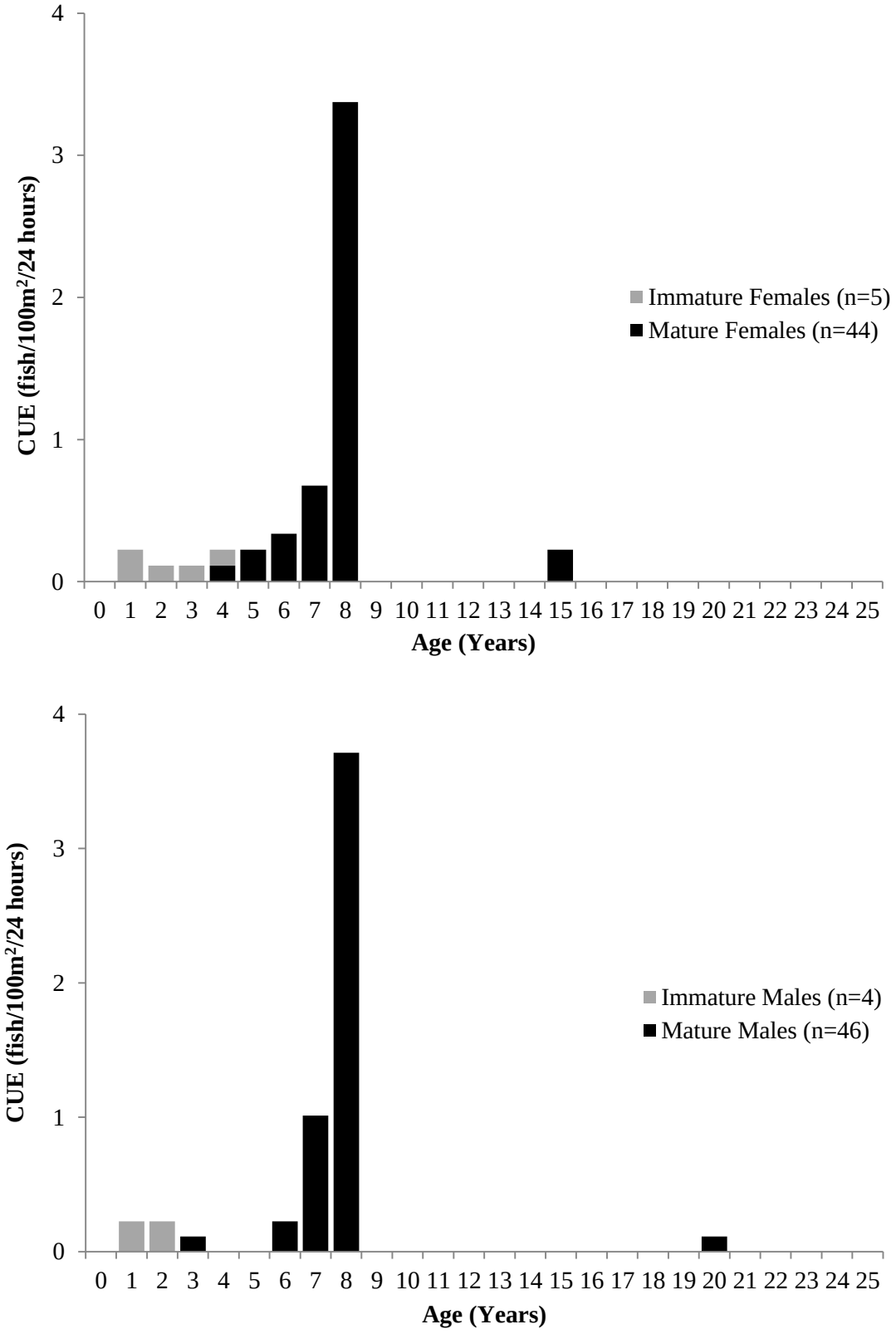

Figure 4. Age-at-maturity distributions for female and male walleye, respectively, caught during the 2011 Heart Lake FWIN survey.

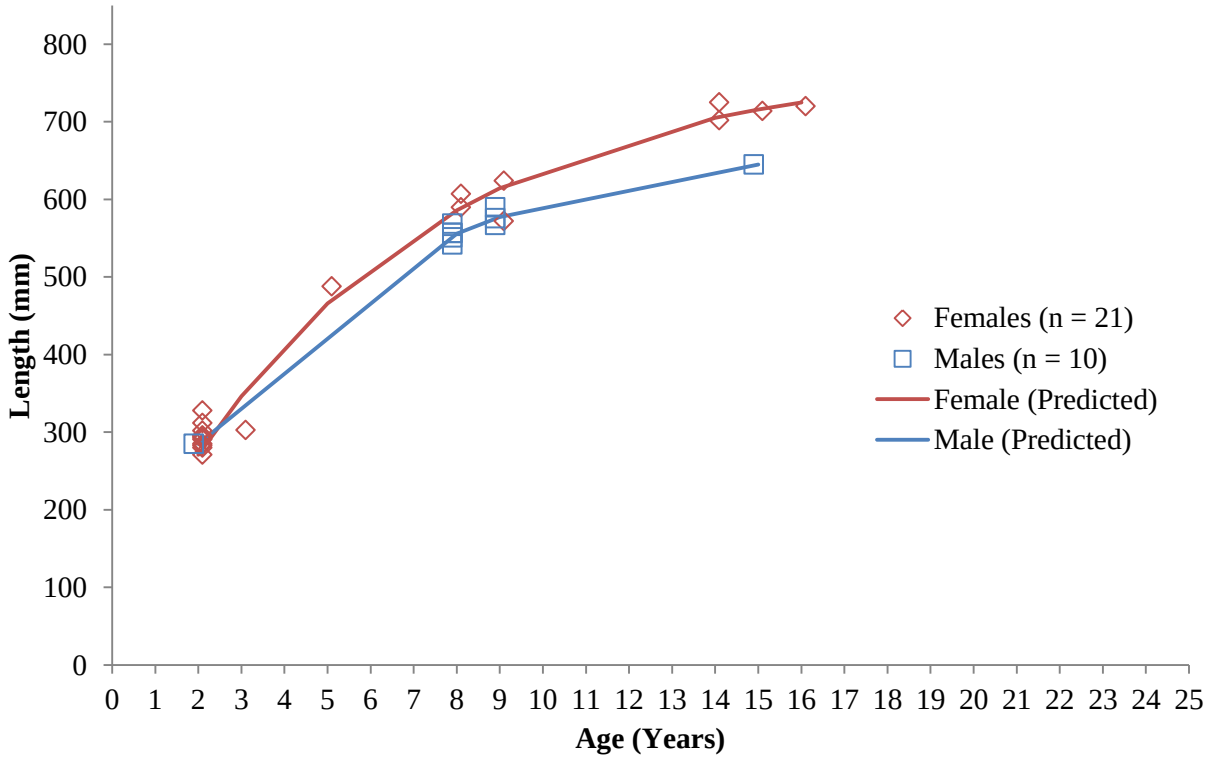

Figure 5. Total length-at-age for walleye caught during the 2005 Heart Lake FWIN survey (Females: L_{inf} = 777.3, K = 0.2, t_o = -0.7, R^2 = 0.98, Prob > F= 0.0001; Males: L_{inf} = 675.1, K = 0.2, t_o = -0.8, R^2 = 1.0, Prob > F= 0.0001).

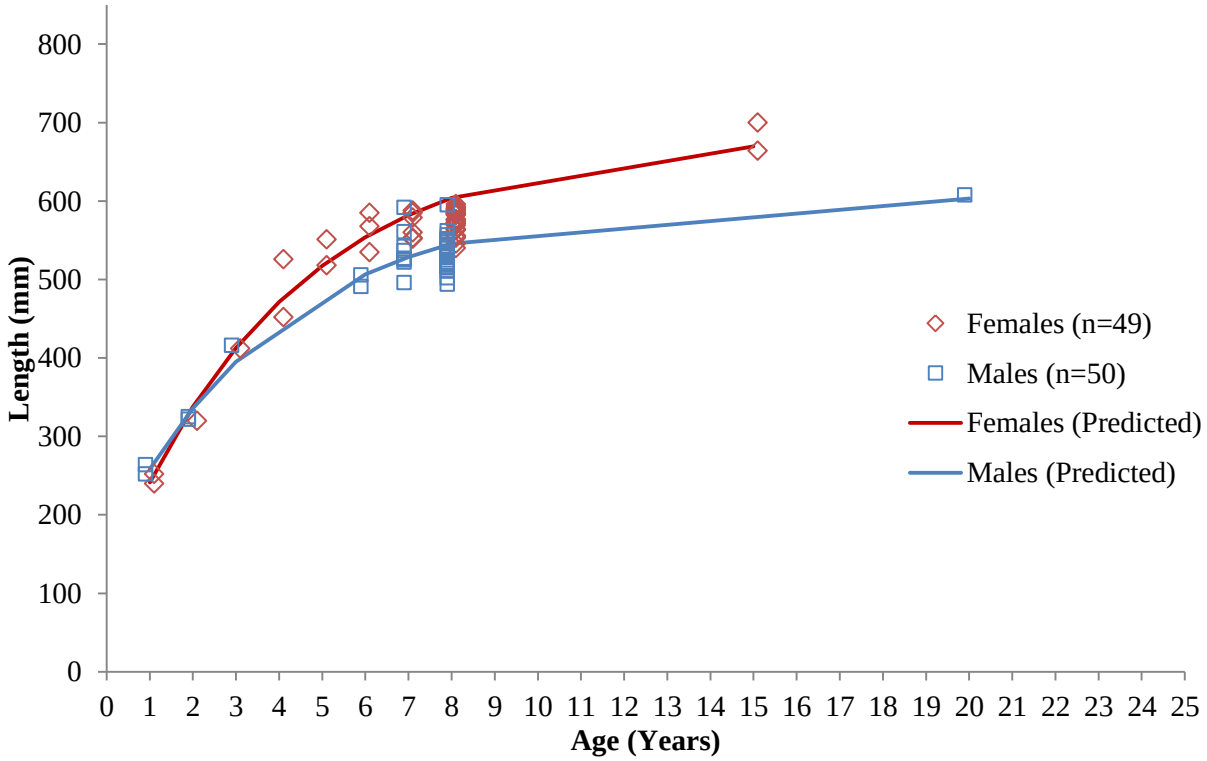

Figure 6. Total length-at-age for walleye caught during the 2011 Heart Lake FWIN survey (Females: L_{inf} = 6839, K = 0.2, t_o = -0.8, R^2 = 0.98, Prob > F= 0.0001; Males: L_{inf} = 606.1, K = 0.2, t_o = -1.2, R^2 = 0.99, Prob > F= 0.0001).

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Appendix 1. 8 panel catch summary from the Heart Lake FWIN survey September 12 to 16, 2005. Set coordinates are Universal Transverse Mercator Zone 12, North American Datum 83.

Set Number	UTM E	UTM N	Lift Date	Soak Time (h)	Max Depth (m)	Min Depth (m)	Number of Fish Caught							
							SPSH	CISC	LKWH	NRPK	WALL	WHSC	YLPR	Set Total
HL02	468731	6095695	12-Sep-05	23.75	8.5	6.9	0	8	0	4	1	0	6	19
HL03	469427	6099928	12-Sep-05	22.52	9.1	9.0	0	34	0	14	2	2	49	101
HL04	467863	3100316	12-Sep-05	24.35	10.3	10.1	0	2	0	22	0	0	133	157
HL06	468374	6097629	13-Sep-05	22.17	11.0	10.1	0	28	2	7	0	3	51	91
HL07	465177	6095961	13-Sep-05	21.93	7.7	7.7	0	62	0	4	5	0	14	85
HL08	467648	6096854	14-Sep-05	22.98	12.8	12.2	0	15	0	14	0	2	100	131
HL08-S[†]	467875	6096915	14-Sep-05	23.28	11.6	11.6	0	22	0	12	0	0	53	87
HL09	471120	6098020	13-Sep-05	20.33	7.4	6.8	0	9	0	16	0	3	10	38
HL10	466273	6097201	14-Sep-05	23.87	·	·	1	1	0	11	1	0	140	154
HL11	471435	6097580	15-Sep-05	22.63	5.2	4.8	0	7	1	14	1	1	2	26
HL11-S	471602	6097803	15-Sep-05	23.30	5.3	3.4	0	2	0	2	0	6	2	12
HL12	466375	6097701	15-Sep-05	21.78	9.5	9.3	0	5	0	10	1	1	152	169
HL13	467721	6097732	16-Sep-05	24.50	13.5	13.4	0	22	2	11	1	0	103	139
HL13-S	467966	6097679	16-Sep-05	23.12	13.5	13.4	0	2	0	3	1	0	80	86
HL14	47512	6101861	14-Sep-05	23.02	5.9	5.6	0	5	0	12	0	0	33	50
HL14-S	471653	6102031	14-Sep-05	23.17	7.4	6.8	0	6	0	6	0	0	11	23
HL16	468955	6097949	16-Sep-05	23.02	10.9	10.9	0	5	0	12	1	0	104	122
HL16-S	468860	6098188	16-Sep-05	23.05	10.5	10.4	0	0	0	9	1	0	31	41
HL25-S	467740	6097758	12-Sep-05	25.00	13.4	13.0	0	92	0	5	0	0	39	136
HL26	471747	6100490	15-Sep-05	22.02	4.3	4.1	0	1	0	6	0	1	8	16
HL26-S	472018	6100054	15-Sep-05	24.42	3.7	3.6	0	0	0	11	0	1	5	17
HL27-S	467835	6096188	12-Sep-05	24.43	10.6	9.7	0	26	0	8	0	1	76	111
HL30-S	469775	6100059	13-Sep-05	22.07	11.7	11.7	0	1	0	10	3	0	24	38
HL31-S	470511	6098353	13-Sep-05	23.35	7.4	6.8	0	5	0	13	2	1	18	39
HL40	465097	6097474	16-Sep-05	23.48	4.2	2.5	0	1	0	15	6	3	3	39
						Species Total	1	361	5	251	35	16	1,247	1,916

[†]Set numbers identified with "-S" indicate half-length FWIN nets.

Appendix 2. 8 panel catch summary from the Heart Lake FWIN survey October 4 to 5, 2011. Set coordinates are Universal Transverse Mercator Zone 12, North American Datum 83.

Set Number	UTM E	UTM N	Lift Date	Soak Time (h)	Max Depth (m)	Min Depth (m)	Number of Fish Caught							
							SPSH	CISC	LKWH	NRPK	WALL	WHSC	YLPR	Set Total
HL-08	468459	6097143	5-Oct-11	23.05	11.9	11.4	0	38	1	2	1	0	7	49
HL-09	468507	6096350	4-Oct-11	24.33	10.0	9.8	0	15	1	3	4	0	10	33
HL-10	470385	6100291	5-Oct-11	23.32	7.5	7.4	0	16	1	5	3	1	10	36
HL-11	466601	6096759	5-Oct-11	23.13	9.4	9.3	0	14	0	11	0	0	7	32
HL-13	466901	6097849	4-Oct-11	25.15	11.8	6.9	0	20	1	3	21	0	4	49
HL-14	470138	6098429	4-Oct-11	24.55	10.7	10.7	0	19	0	1	2	0	7	29
HL-16	469341	6098903	5-Oct-11	23.15	9.9	5.3	0	5	0	4	14	0	1	24
HL-17	468392	6097800	5-Oct-11	22.87	9.9	9.2	0	19	0	4	5	0	1	29
HL-19	465397	6096877	4-Oct-11	24.50	7.8	7.6	0	14	0	13	1	0	10	38
HL-20	465952	6098459	5-Oct-11	23.48	3.7	2.8	1	0	1	8	14	1	9	34
HL-22	467876	6099682	4-Oct-11	24.52	15.2	10.8	0	7	0	1	0	0	5	13
HL-24	472129	6098149	5-Oct-11	23.28	4.9	4.4	0	8	0	8	3	0	10	29
HL-25	469113	6099679	4-Oct-11	25.20	8.6	8.0	0	8	0	4	4	1	4	21
HL-29	470772	6101428	4-Oct-11	25.75	5.8	5.6	0	18	1	9	4	1	7	40
HL-32	465384	6095269	4-Oct-11	24.88	4.7	4.1	0	15	0	9	3	0	8	35
HL-35	466574	6095928	5-Oct-11	23.13	3.9	2.0	1	2	1	7	21	1	8	41
						Species Total	2	218	7	92	105	5	108	532