2007 Lake St. Lawrence Warmwater Fisheries Assessment

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A cooperative fisheries assessment program for Lake St. Lawrence was initiated between the New York State Department of Environmental Conservation (NYSDEC) and the Ontario Ministry of Natural Resources (OMNR) in 1986. This program originated as an extension of the Thousand Islands and Middle Corridor assessment programs and is intended to measure long term trends in relative abundance, growth, age structure and condition of the fish community. Since 1996 the Lake St. Lawrence program has been maintained by NYSDEC.

Methods

In 2005 gill nets were converted from multifilament to monofilament utilizing the same mesh dimensions, hanging ratios, and panel height/length of the previous net. Monofilament gill nets measuring 200 ft (61 m) long by 8 ft (2.4 m) deep having eight panels measuring 25 ft (7.6 m), with mesh arranged in increasing size from 1.5-6 in (38-152 mm) stretch measure were used for this assessment.

Gill nets were set overnight and fished an average of 16.9 hours at standard New York (n=16) and Ontario (n=16) sites described by Klindt and Town (2002). Due to mechanical problems, 13 nets were set for only 15 hours, bringing the average fishing time down approximately 1.4 hours. Net sites were stratified in equal number by depth as shallow and deep (12-25 ft. and 30-50 ft., respectively).

Data collected from fish included total length (TL), weight, sex, and stage of maturity. Scale samples were taken from percids and centrarchids for age analysis. Cleithra were removed from northern pike for more reliable age determination. Data were entered into the NYSDEC Statewide Fisheries Database.

Total, and species specific, catch per unit effort (CUE; catch per gill net night) was calculated. Other metrics calculated include length-frequency and age-frequency. Yellow perch and smallmouth bass growth rates were plotted by year class using logarithmically transformed mean length at age.

Results and Discussion

The 2007 Lake St. Lawrence assessment was conducted from 17 to 20 September. Surface water temperatures were consistent at 65^{o} F (18.3^{o} C). A sample of 511 fish comprising 16 species was collected (Table 1). The catch was dominated by yellow perch (44.6%), rock bass (25.2%) and smallmouth bass (9.0%). Total CUE increased by 16% from 2006 to 15.96, which remains below the long-term average of 16.7 (Figure 1). Total CUE is driven by fluctuations in the yellow perch population.

Yellow perch CUE increased 88% from 3.78 in 2006 to 7.13 in 2007 (Figure 2). Few perch <6" were collected in this assessment, while a high proportion of fish >9" were collected (Figure 3). Fish greater than age-4 account for 43% of the total yellow perch catch (Figure 4). Mean length of age 5 and 6 fish are 9.4 and 10.0 inches respectively.

Localized impacts on yellow perch populations from predation by Double-crested cormorants (*Phalacrocorax auritus*) have been reported previously in Lake St. Lawrence (Klindt 2006, 2007, Klindt and Town 2003, 2004, 2005). Regurgitated cormorant pellets were collected in 2007 from Strachan Island, located in the lowermost portion of the fisheries assessment area. Pellet analysis described by Johnson et al. (2008) indicated that diet was comprised predominantly of round goby (49.0%) and yellow perch (28.4%). Yellow perch had been the dominant forage until 2005 comprising from 50-60% of the diet (Johnson et.al. 2005, 2006). Total number of fish consumed at the colony in 2007

was estimated at 2.39 million, with round goby and yellow perch dominating at 1.17 and 0.68 million respectively (Johnson et al. 2008). The number of active nests at Strachan Island decreased from 313 in 2006 to 286 in 2007 (J.Farquhar, NYSDEC, pers. communication). While diet and analysis has focused on the Strachan Island colony, it should be noted that the Bergin Island colony (2.1 miles upstream) is almost double the size of the Strachan Island colony, therefore total consumption in lower Lake St. Lawrence is significantly higher.

Gill net sites were stratified by distance from the nesting colony as described by Klindt and Lantry (2001). Yellow perch CUEs for "upriver" (>7.75 mi) and "colony" (within 7.75 mi) net strata were 8.59 and 5.47, respectively (Figure 5), almost two times higher than 2006. The CUE differential between the upriver and colony strata is the highest since 1994 with the upriver sites out producing the colony sites for the first time. Pellet analysis showed relative stability in round goby consumption from 43.4% of the diet in 2006 to 49.0% in 2007 (Johnson et al. 2007, 2008). It is likely that cormorants continue to depress the perch population locally. The selectivity of cormorants for goby has allowed perch to remain relatively stable in the "colony" strata for the past 3 years.

Growth rates of yellow perch were determined by year class for fish ages 2-7 years. Slope of the regression line of log transformed mean length at age for each year class was plotted in Figure 6. Although variability is high within the series (r^2 =0.17), an increasing growth rate trend is apparent. Round goby have become a forage source for most piscivorous species in the river. It is possible that increased growth rates seen since the expansion of gobies (circa 2000) are a result of perch exploiting a new forage base.

Smallmouth bass CUE has been relatively stable since 1998, but decreased to 1.63 in 2006, and continued to decrease in 2007 to 1.44, the lowest catch since 1997 (Figure 7). The bulk of the catch are bass >12" in length (Figure 8). Typically, smallmouth recruit to the gear at ages 3-4, however, the large number of age-2 (2005 year class) implies a strong year class may emerge (Figure 9). Bass from the 2000 year class continue to be non-detectable as fish at age-7 (Figure 9).

Growth rates of smallmouth bass were determined by year class for fish ages 3-9 years. Slope of the regression line of log transformed mean length at age for each year class was plotted in Figure 10. With the addition of the 2001-2 year classes the relationship has strengthened (r^2=0.50) and continues to show an increasing trend in growth rate. Klindt (2006) previously used mean length at age 6 to demonstrate a similar trend. Round goby have become an important forage fish in the lower St. Lawrence River as demonstrated by cormorant consumption increase documented by Johnson et al. (2007, 2008). Data points for year classes 1998-2002 demonstrate a marked increase in growth rate, likely due to round goby exploitation.

Walleye CUE (1.09) decreased by 43% from 2006 and has fallen below the long term average of 1.24 (Figure 11). The length-frequency distribution of the walleye catch (Figure 12) shows the bulk of fish collected as juveniles under 18 inches. Age-2 and 3 fish dominated the catch in 2007 (Figure 13). The 2003 year class remains comparatively strong with the 2004 year class recruiting well to age-3. Young of year and age-1 fish appear sporadically in this assessment, and then, only if strong year classes are recruiting. Johnson et al. (2008) found little evidence of walleye predation from cormorants on Strachan Island, suggesting that the 2006-7 year classes may not be impacted by cormorant predation.

Northern pike CUE decreased slightly from 2006 to 0.41 in 2007, below the long term average of 0.51 (Figure 14). Total length of northern pike ranged from 23.2-33.1 inches (Figure 15). Fish ages 3-8 were represented in the catch (Figure 16). Netting strata were not designed to take advantage of limited littoral zone habitat, therefore northern pike are poorly represented in this assessment.

References

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Table 1. Relative abundance (number of fish per net night) and long term average (LT Avg.) of primary species collected in the assessment of Lake St. Lawrence, 1983-2007.

	Year	1983	1985	1986	1987	1988	1989	1990	1991	1992
SPECIES	**# Nets**	48	47	32	47	32	46	32	47	32
Lake Sturgeon		0.02	0.02	x	x	x	x	x	x	x
Bowfin		x	x	x	x	0.03	x	x	x	x
Alewife		0.73	1.15	1.50	0.11	0.06	0.06	0.34	0.04	0.66
Gizzard Shad		x	x	x	0.26	0.09	0.33	0.13	0.21	x
Rainbow Trout		x	x	0.03	x	x	x	x	x	x
Brown Trout		x	x	0.09	0.02	x	x	x	x	x
Lake Trout		x	x	x	x	x	0.06	x	0.02	x
Rainbow Smelt		x	x	x	x	x	x	x	x	0.02
Northern Pike		0.23	0.62	0.94	0.04	0.63	0.85	0.69	0.66	0.53
Muskellunge		x	x	x	0.02	x	0.02	x	x	0.03
Lake Chub		x	x	x	0.02	x	x	x	x	x
Carp		1.46	0.23	1.94	1.06	0.66	0.72	1.06	0.87	1.13
Golden Shiner		x	x	x	x	x	x	x	0.02	x
Fallfish		0.17	0.21	0.25	0.32	0.19	0.15	0.19	0.09	0.09
White Sucker		1.54	1.45	0.91	1.04	1.41	1.43	1.47	0.89	1.06
Silver Redhorse		0.58	0.21	0.06	0.23	0.44	0.15	0.31	0.15	0.50
Shorthead Redhorse		x	x	x	x	x	x	x	x	x
Yellow Bullhead		x	x	x	x	x	x	x	x	x
Brown Bullhead		1.25	2.15	0.63	0.79	0.97	1.61	2.06	2.55	2.28
Channel Catfish		0.04	0.09	x	x	0.09	0.02	0.03	x	0.03
White Perch		1.23	1.06	0.38	0.96	3.00	0.87	1.50	1.09	0.91
White Bass		0.06	0.13	x	0.02	x	0.04	0.03	0.11	x
Rock Bass		2.19	1.23	2.41	1.36	1.84	1.02	2.03	1.17	2.00
Pumpkinseed		0.33	0.21	0.13	0.26	0.28	0.74	0.19	0.21	0.34
Bluegill		x	x	x	x	x	x	x	x	x
Smallmouth Bass		3.77	2.15	2.03	2.36	2.28	2.65	1.97	1.68	2.94
Largemouth Bass		x	x	x	x	x	0.02	0.03	0.04	x
Black Crappie		0.08	0.09	x	0.02	0.16	0.13	0.09	0.04	0.22
Yellow Perch		7.60	11.3	9.63	8.61	6.94	4.41	4.34	5.83	4.72
Walleye		0.42	1.38	0.53	1.04	1.38	0.83	1.34	1.21	0.94
Freshwater Drum		0.02	0.02	x	x	x	0.06	x	x	0.03
TOTAL CATCH		21.7	25.9	21.5	18.9	20.4	16.2	17.8	16.9	18.5

Table 1. Relative abundance (number of fish per net night) and long term average (LT Avg.) of primary species collected in the assessment of Lake St. Lawrence, 1983-2007 (continued).

	Year	1993	1994	1995	1996	1997	1998	1999	2000	2001
SPECIES	**# Nets**	47	32	47	32	32	32	32	32	32
Lake Sturgeon		x	0.03	x	x	0.09	x	x	x	x
Bowfin		x	x	x	x	x	x	x	0.03	0.03
Alewife		0.02	0.28	0.43	x	x	x	x	0.03	x
Gizzard Shad		0.32	x	x	0.09	x	x	0.13	0.03	x
Rainbow Trout		x	x	x	x	x	x	x	x	x
Brown Trout		0.02	x	0.21	x	x	x	x	x	x
Lake Trout		0.02	x	x	x	x	x	x	x	x
Rainbow Smelt		x	x	x	x	x	x	x	x	x
Northern Pike		0.32	0.31	0.36	0.22	0.41	0.50	0.91	0.44	0.59
Muskellunge		x	x	x	x	x	x	x	x	x
Lake Chub		x	x	x	x	x	x	x	x	x
Carp		0.64	0.75	0.43	0.56	0.41	1.16	0.78	0.38	0.47
Golden Shiner		x	x	x	x	x	x	x	x	x
Fallfish		0.06	0.63	0.13	0.09	0.06	x	0.03	0.09	0.06
White Sucker		0.87	0.94	0.55	1.28	0.47	0.53	1.16	0.69	0.66
Silver Redhorse		0.17	0.28	0.13	0.53	0.53	0.94	1.19	1.06	0.94
Shorthead Redhorse		x	x	x	x	x	x	0.28	0.03	0.13
Yellow Bullhead		x	x	x	x	x	x	0.03	x	x
Brown Bullhead		0.21	0.31	0.36	0.63	0.81	1.34	2.69	0.56	2.94
Channel Catfish		x	0.16	0.02	0.06	0.03	0.09	0.03	0.06	0.41
White Perch		0.70	1.19	0.06	0.69	0.31	0.50	0.44	0.28	0.03
White Bass		x	x	x	0.06	x	x	x	0.13	x
Rock Bass		1.34	1.69	1.21	2.75	2.40	3.44	3.09	3.38	2.72
Pumpkinseed		0.02	0.31	0.36	0.28	0.63	1.16	0.78	0.56	0.75
Bluegill		x	x	x	x	x	x	0.03	x	0.03
Smallmouth Bass		1.51	2.41	1.47	1.22	1.09	2.78	3.28	2.56	2.31
Largemouth Bass		0.02	x	x	x	x	x	x	0.03	x
Black Crappie		0.11	0.03	0.04	x	x	0.06	x	0.03	x
Yellow Perch		4.62	4.56	4.57	4.19	4.59	6.97	3.66	2.59	2.44
Walleye		1.64	0.75	0.94	1.72	1.38	1.34	2.09	1.69	1.06
Freshwater Drum		0.06	x	0.21	x	x	x	0.03	x	x
TOTAL CATCH		12.7	14.1	11.7	14.4	13.2	20.9	20.6	14.7	15.6

Table 1. Relative abundance (number of fish per net night) and long term average (LT Avg.) of primary species collected in the assessment of Lake St. Lawrence, 1983-2007 (continued).

	Year	2002	2003	2004	2005	2006	2007	LT Avg.
SPECIES	**# Nets**	32	32	32	32	32	32	
Lake Sturgeon		x	0.06	0.03	x	x	0.06	0.01
Bowfin		0.06	x	0.03	x	x	x	0.01
Alewife		0.06	x	x	x	x	x	0.24
Gizzard Shad		0.03	x	0.06	0.06	0.06	x	0.08
Rainbow Trout		x	x	x	x	x	x	0.00
Brown Trout		x	x	x	x	0.03	x	0.02
Lake Trout		x	x	x	x	x	x	0.00
Rainbow Smelt		x	x	x	x	x	x	0.00
Northern Pike		0.63	0.56	0.47	0.44	0.59	0.41	0.51
Muskellunge		x	x	x	x	x	x	0.00
Lake Chub		x	x	x	x	x	x	0.00
Carp		0.91	0.41	0.19	0.50	0.25	0.31	0.72
Golden Shiner		x	x	x	x	x	x	0.00
Fallfish		0.03	x	x	x	0.06	0.16	0.13
White Sucker		0.66	0.25	0.16	0.25	0.31	0.44	0.85
Silver Redhorse		0.88	0.28	0.53	0.53	0.25	0.25	0.46
Shorthead Redhorse		0.06	0.03	0.03	0.06	x	0.09	0.03
Yellow Bullhead		x	x	x	x	x	x	0.00
Brown Bullhead		2.47	0.56	0.44	0.22	0.22	0.19	1.18
Channel Catfish		0.06	0.09	0.16	0.03	0.03	0.09	0.07
White Perch		0.09	x	0.19	x	1.75	x	0.75
White Bass		x	x	x	0.06	x	0.06	0.03
Rock Bass		2.59	2.63	2.5	3.38	2.50	4.03	2.29
Pumpkinseed		0.56	1.41	0.09	0.03	0.16	0.16	0.41
Bluegill		x	0.03	x	x	x	x	0.00
Smallmouth Bass		2.53	2.06	2.22	4.28	1.63	1.44	2.28
Largemouth Bass		0.06	x	0.03	0.28	0.13	x	0.03
Black Crappie		0.03	x	x	x	x	x	0.05
Yellow Perch		4.53	4.34	1.78	4.44	3.78	7.13	5.32
Walleye		1.75	1.28	0.72	1.44	1.91	1.09	1.24
Freshwater Drum		x	x	x	0.13	0.06	0.06	0.03
TOTAL CATCH		17.9	14.0	9.69	16.19	13.78	15.96	16.74

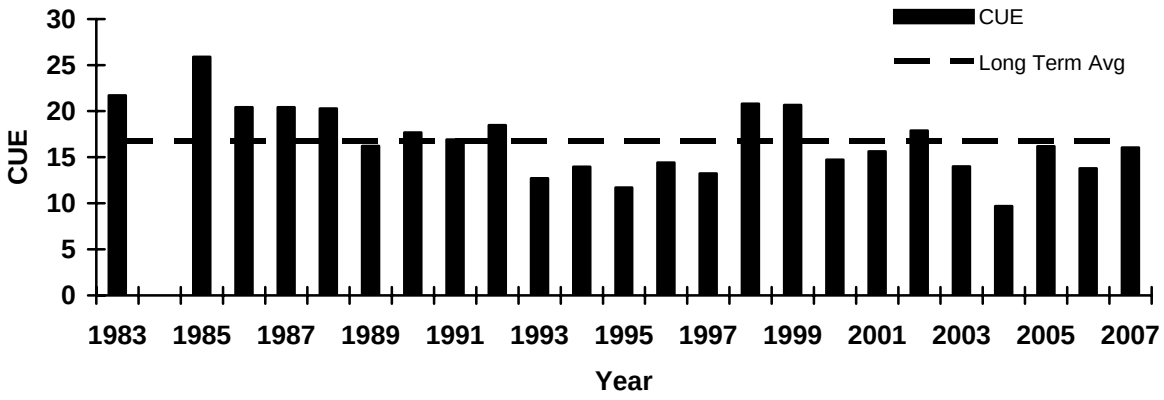

Figure 1. Total CUE for Lake St. Lawrence, 1983-2007.

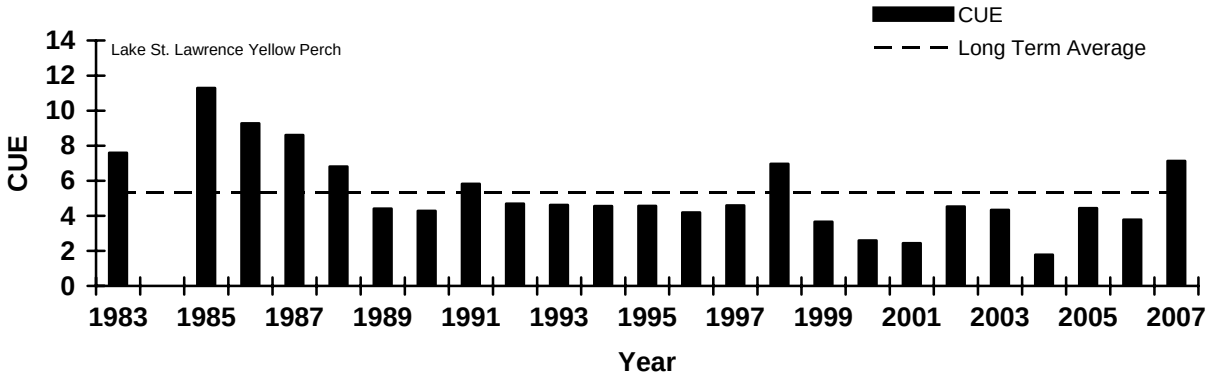

Figure 2. Yellow perch total CUE for Lake St. Lawrence, 1983-2007.

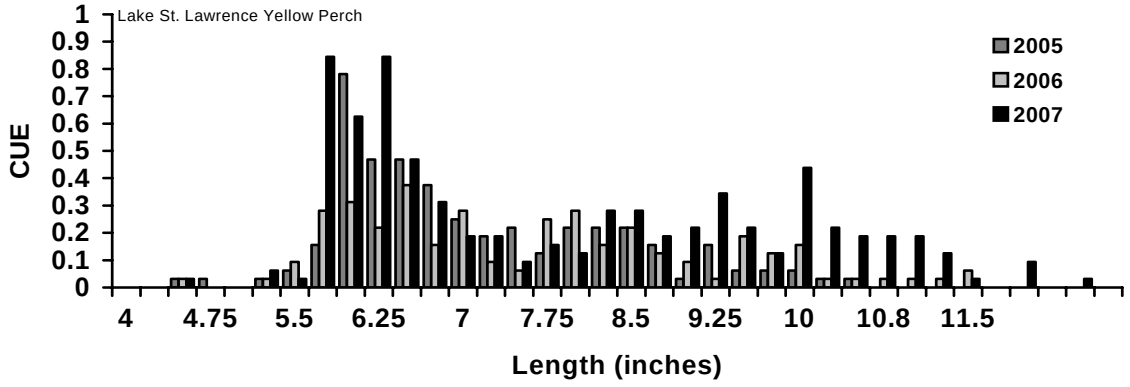

Figure 3. Yellow perch length-frequency distribution for Lake St. Lawrence.

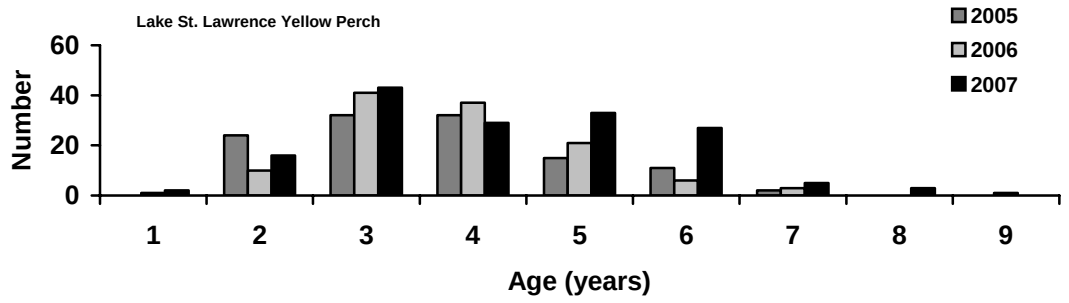

Figure 4. Yellow perch age-frequency distribution for Lake St. Lawrence.

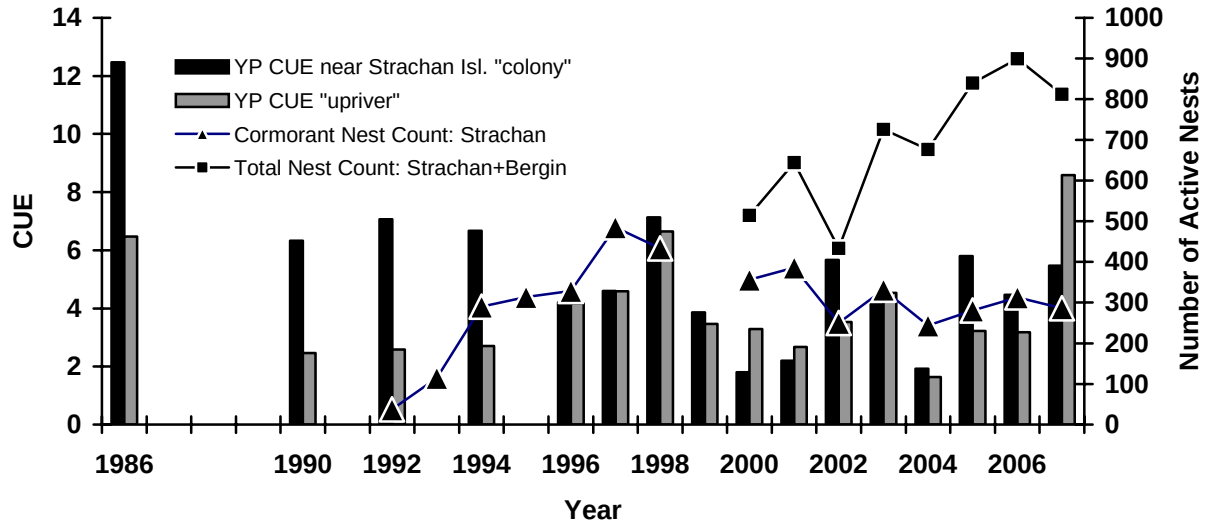

Figure 5. Yellow perch CUE separated by distance from the Strachan Island cormorant colony. The "colony" designation incorporates net sites within 7.75 mi. of Strachan Island, "upriver" incorporates net sites greater than 7.75 mi. from the colony in a given year. A total of all nest counts in lower Lake St. Lawrence is illustrated by "Strachan + Bergin".

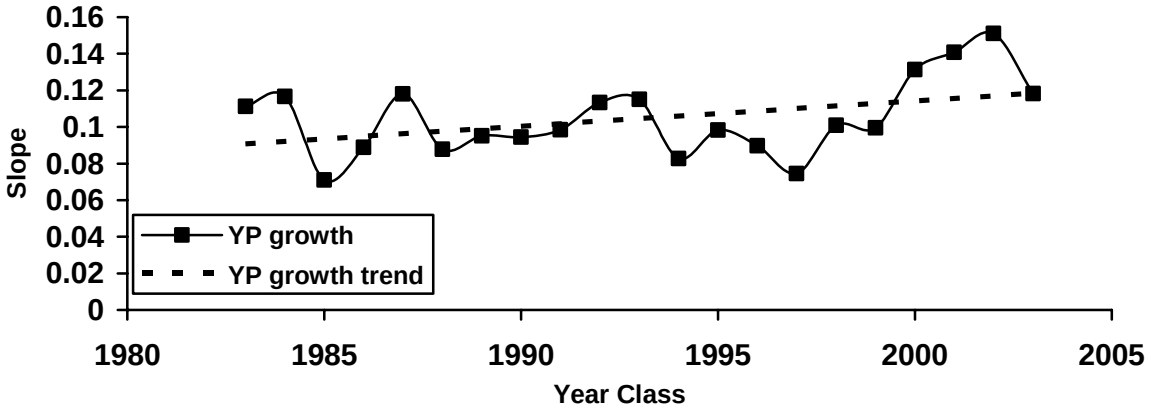

Figure 6. Yellow perch growth rates by year class using fish ages 2-7.

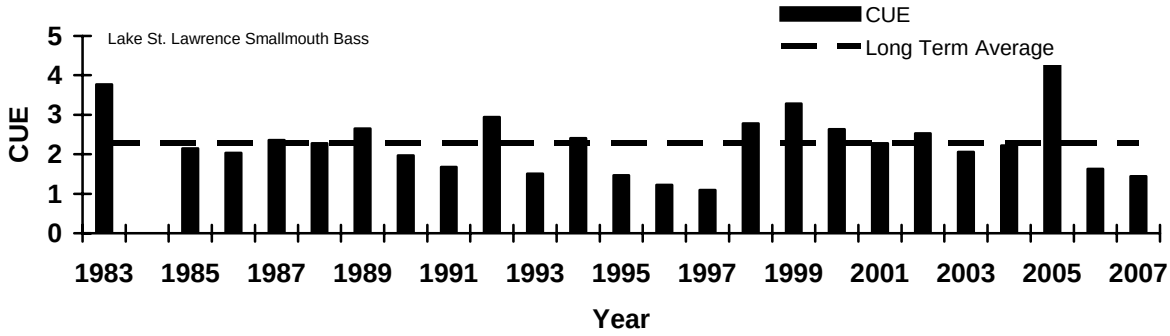

Figure 7. Total CUE for smallmouth bass in Lake St. Lawrence, 1983-2007.

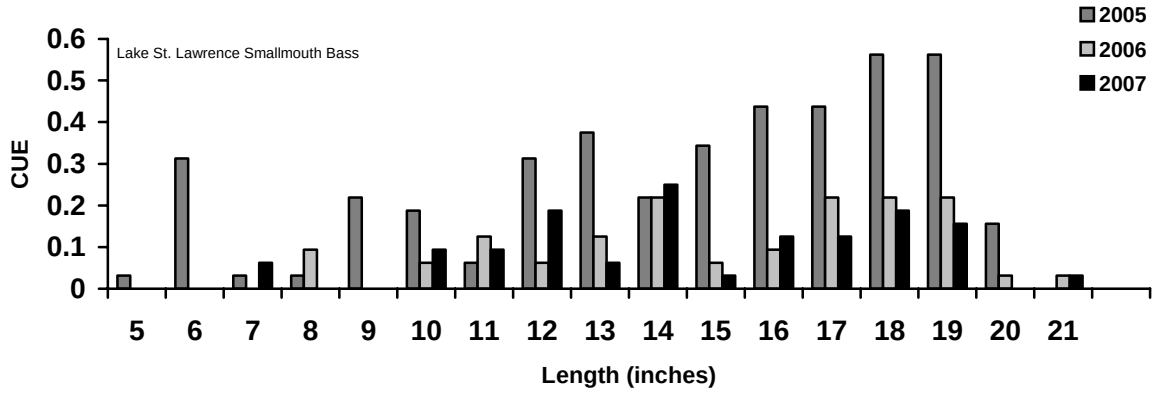

Figure 8. Smallmouth bass length-frequency distribution for Lake St. Lawrence.

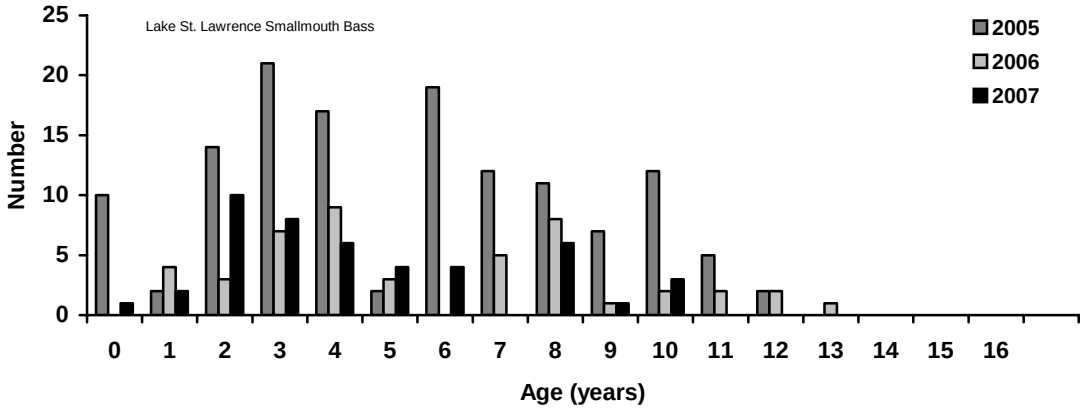

Figure 9. Smallmouth bass age-frequency distribution for Lake St. Lawrence.

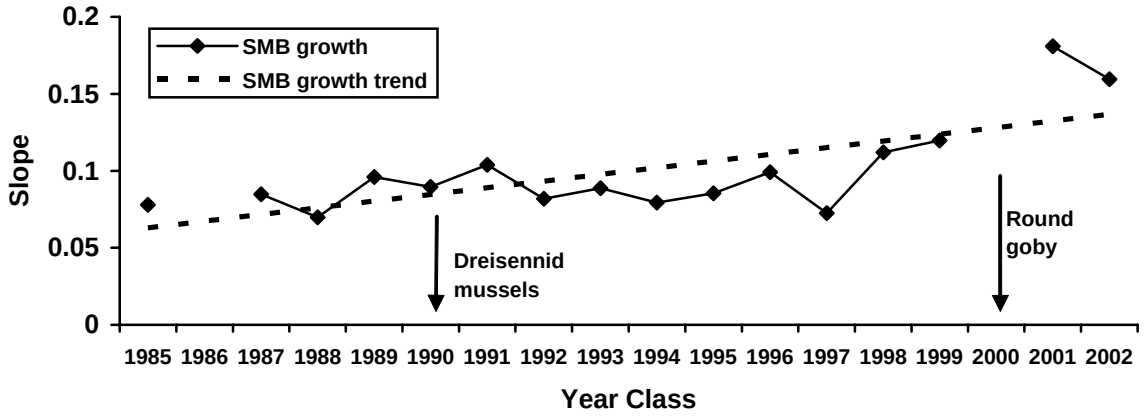

Figure 10. Smallmouth bass growth rates by year class using fish ages 3-9.

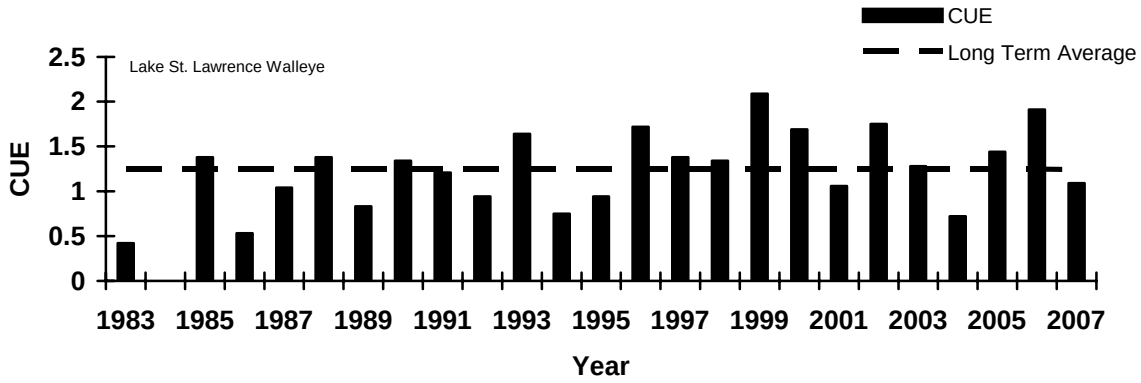

Figure 11. Total CUE for walleye in Lake St. Lawrence, 1983-2007.

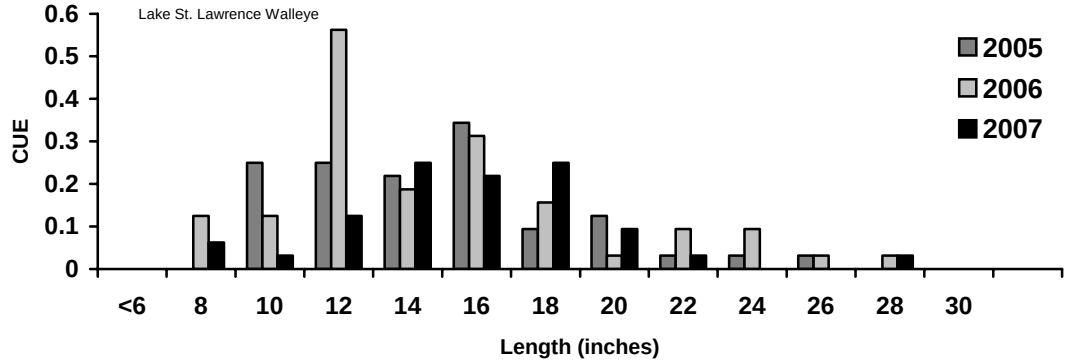

Figure 12. Walleye length-frequency distribution for Lake St. Lawrence.

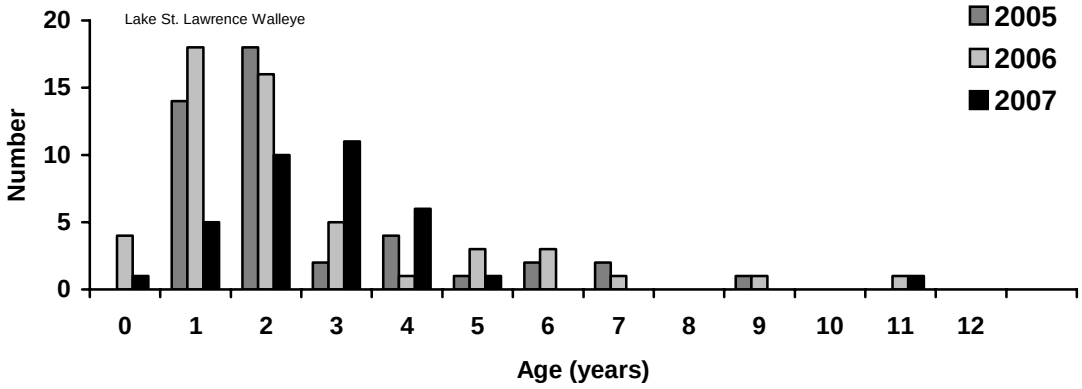

Figure 13. Walleye age-frequency distribution for Lake St. Lawrence.

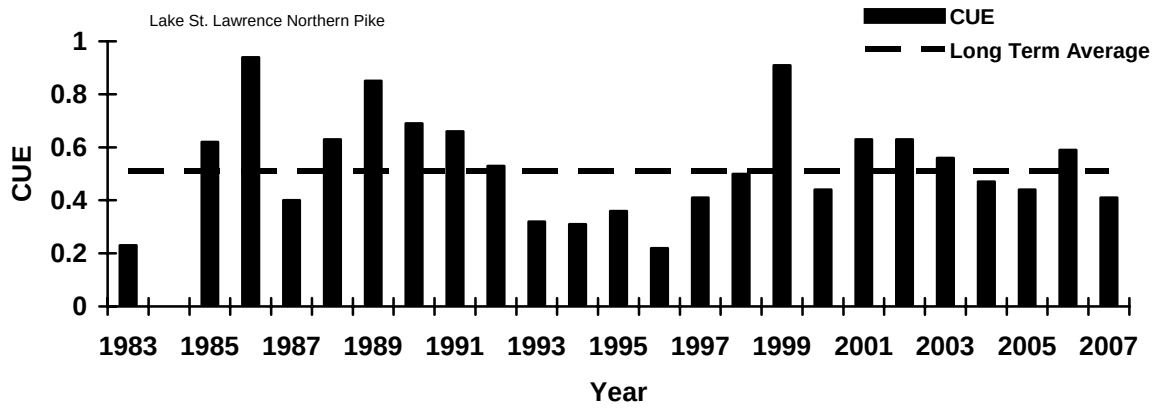

Figure 14. Total CUE for northern pike in Lake St. Lawrence, 1983-2007.

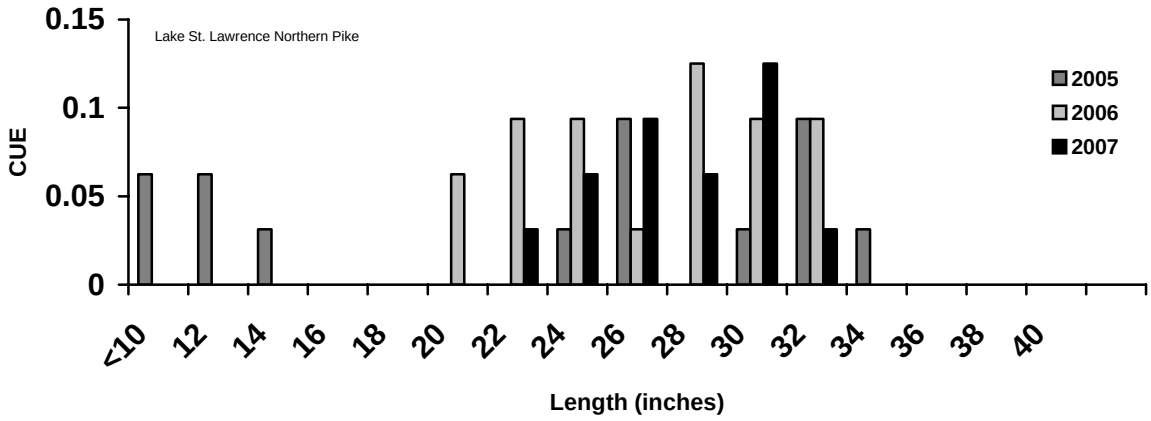

Figure 15. Northern pike length-frequency distribution for Lake St. Lawrence.

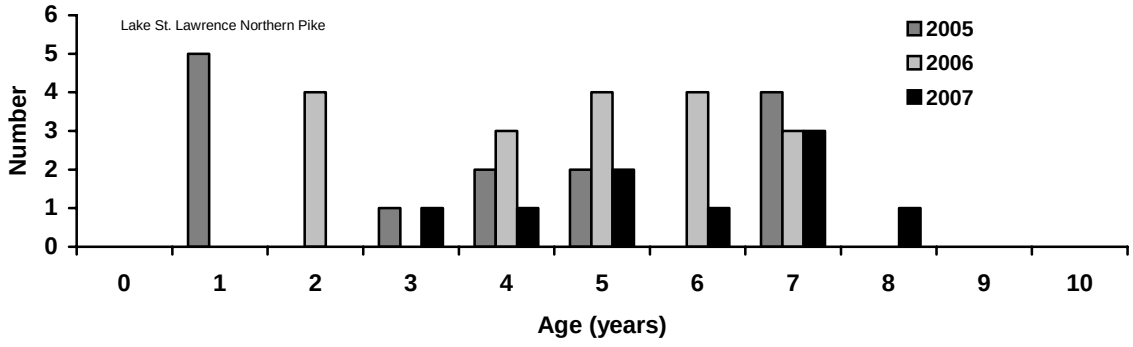

Figure 16. Northern pike age-frequency distribution for Lake St. Lawrence.