

Leech Lake Walleye Population Metrics

Prepared for Leech Lake Advisory Committee, December 2009
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SUMMARY

- Walleye fry were stocked during May 19-21, 2009 (Table 1). Fry (22.67 million) were distributed among major bays based on proportion of littoral acres. OTC mark detection and hatch rate estimation is pending; OTC efficacy was 100% (Table 2).
- Incomplete year class strength (YCS) indices suggest strong 2006 and 2007 walleye cohorts and a below-average cohort produced during 2008 (Figure 1). Abundance of the 2008 year class as young-of-year, indexed by trawl and fall electrofishing catch rates, was relatively high compared to 2005-2007 year classes (Figure 2; Table 3). Potential below-average recruitment of the 2008 year class was likely most influenced by slow growth during summer which led to elevated winter mortality.
- Predicted 2009 walleye YCS is below average. Similar to 2008, a cool growing season led to slow growth of young-of-year fish and size-specific winter mortality is anticipated to influence recruitment. Walleye population goal of establishing two strong year classes by 2010 was achieved during 2005-2007.
- Gill net catch rates of northern pike, walleye, and yellow perch declined slightly from 2008 (Figures 3-4) but remain above the long-term average. Cisco catch rates were the highest observed since 1988. Changes in catch rates reflect recruitment variability (eg. cisco and walleye). Walleye goal of a gill net catch rate at or above 7.4 fish/net has been maintained.
- Of total walleye sampled with gill nets (Figure 5), 42% were shorter than 15.0 inches; this is the first time since 2006 that the goal of 50% has not been met. Similar to changes in gill net catch rates, this metric was strongly influenced by below-average recruitment of 2008 year class and also the fast growth experienced by older year classes, specifically 2006-2007.
- Walleye growth has slowed (Figure 6), suggesting a density-dependent response within the population.
- Estimated biomass of mature female walleye was up slightly from 2008 (Figure 7) in spite of slowing maturity rates (Figure 8) and is within the target range of 1.25-1.75 lbs/a. The slowing maturity rates also indicate a density-dependent response within the population.
- Fishing pressure was approximately 785,000 angler-hours, the highest observed since 1999 but still below the historical average (Figure 9).
- Approximately 102,000 pounds of walleye were harvested during 2009 (Figure 10).
- Walleye harvest rates near (all anglers) or above (targeting anglers) respective long-term averages (Figure 10). Walleye catch rates were above average for both angler groupings (Figure 11).
- Approximately 35% of all walleye caught by anglers during 2009 open water season were within the 18-26" protected slot limit (Figure 13).

STATUS & RECOMMENDATIONS

- With strong year classes produced during 2005-2007, potential below-average recruitment during 2008 and again during 2009 in spite of higher total fry densities is not a surprise. While cool summers and slow growth appear to be the primary cause, interactions between year classes (ie. suppression) and competition within a year class (ie. density-dependence increases with increasing fry densities) should not be discounted as possible contributors. This further illustrates that survival of young fish has a greater influence on recruitment to the population than fry density does.
- Regarding stocking, estimated walleye hatch rates in Leech Lake are within the range observed in the Red Lakes and three cohorts have successfully survived to and entered the recreational fishery, indicating no problems with either natural reproduction or juvenile survival. If a potential egg predator was having a significant impact on walleye production, then hatch rate estimates in Leech Lake would be expected to be lower than in other lakes (eg. Red Lake).
- The utility of stocking blanks (years where zero fry are stocked) should be strongly considered to: 1) fully evaluate the capacity for a self-sustaining fishery, and 2) if supplemental stocking is required for fishery maintenance, blanks would facilitate tuning stocking frequency and amounts to optimize fiscal and biological effectiveness.
- With exception to the frequency of gill-netted walleye shorter than 15 inches, all walleye population goals have been maintained. Since the metrics used to gauge population status during 2005-2010 can be influenced by recruitment variability, they will continue to fluctuate as year classes are produced and fish within these cohorts grow, mature, reproduce, and are harvested.
- Currently the Leech Lake walleye population is in good condition and anglers have been enjoying excellent fishing. However, as density-dependence continues to manifest and recruitment variability continues to influence metrics based on catch, population indicators which are less influenced by recruitment patterns, such as growth and maturity rates, should be taken into consideration when framing management decisions.

Table 1. Spawner biomass estimates (SSB) per surface acre (111,841 acres, Leech Lake), stocking totals (per littoral acre; 57,994 LA, Leech Lake), hatch rate estimates, and fry density estimates for Red and Leech lakes. Potential egg production is estimated as 25,000 eggs per pound of mature female (SSB).

Lake	Year	SSB (lbs/A)	Amount Stocked/LA	YOY Marked (%)	Hatch Rate (%)	Fry per LA	
						Wild	Total
Red	1999	0.17	521	86	0.60	86	607
	2001	1.31	400	70	0.16	174	574
	2003	0.76	414	97	0.02	11	425
	Mean	0.74	445	84	0.26	90	535
Leech	2005	1.91	130	39	0.22	203	334
	2006	1.04	380	86	0.12	61	440
	2007	1.67	129	23	0.54	432	561
	2008	2.13	382	55	0.31	317	699
	2009	1.32	391	50	0.60	385	775
	Mean	1.61	282	51	0.36	280	562

Table 2. OTC efficacy results for Leech Lake walleye fry stockings, 2005-2009.

Year	Hatchery	Rearing Pond	Age	Month Read	Number Examined	% Marked
2005	Bemidji	Aquaria, Waterville	Fry	May, 2005	20	100
2006	Bemidji	Pond 8, LLBO	Fingerling	Jul, 2006	69	100
2007	Bemidji	Ponds 9 & 10, LLBO	Fingerling	Jul, 2007	100	100
		Tower, Bemidji	Fingerling	Feb, 2008	121	90
2008	Bemidji	Curly's, Bemidji	Fingerling	Nov, 2008	100	100
		Kinn's, Bemidji	Fingerling	Nov, 2008	100	100
2009	Bemidji	Pony Lake	Fingerling	Sep, 2009	100	100

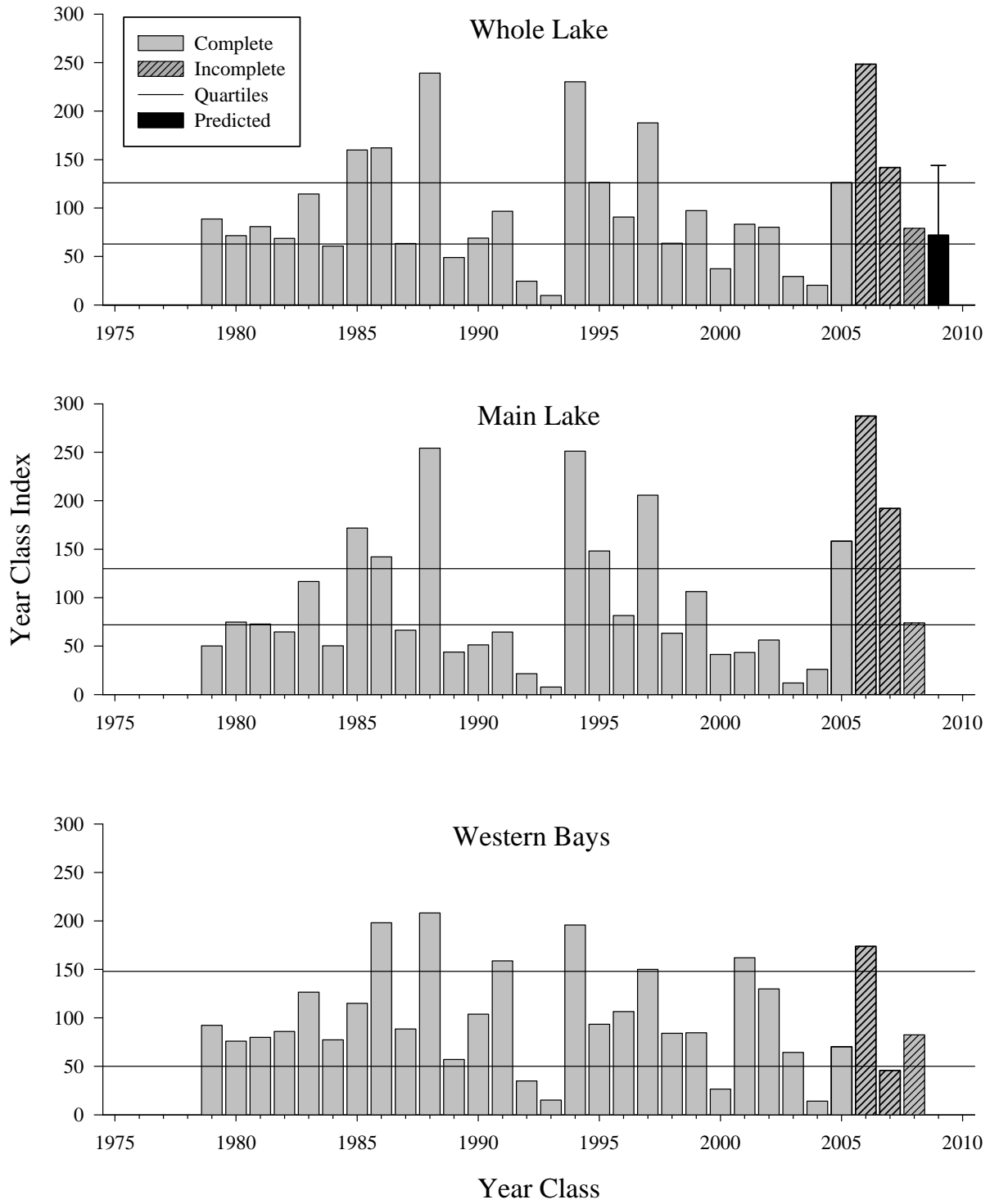
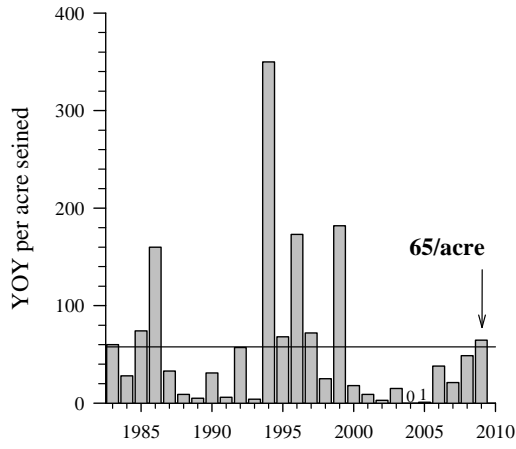


Figure 1. Year class strength index (Schupp) for Leech Lake walleye, 1979-2009. Hatched bars are incomplete estimates; black bar is the predicted estimate based on young-of-year catch rates in trawl hauls and gillnets. Horizontal lines denote the lower (1st) and upper (3rd) quartiles for each group.

Walleye



Yellow perch

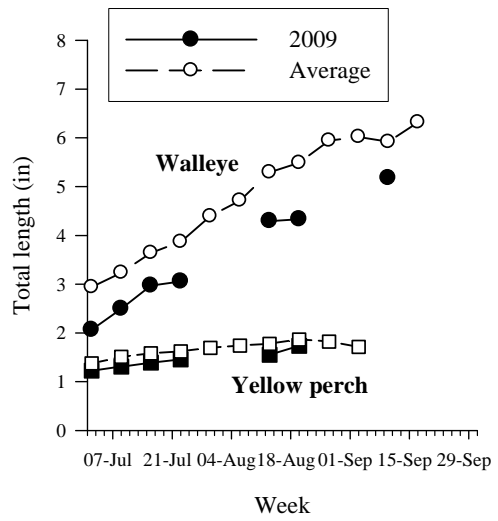
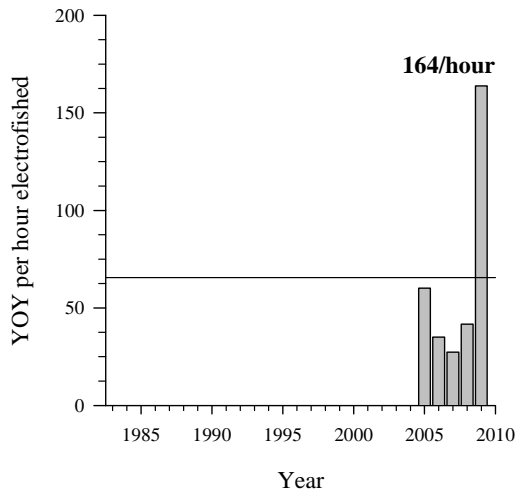
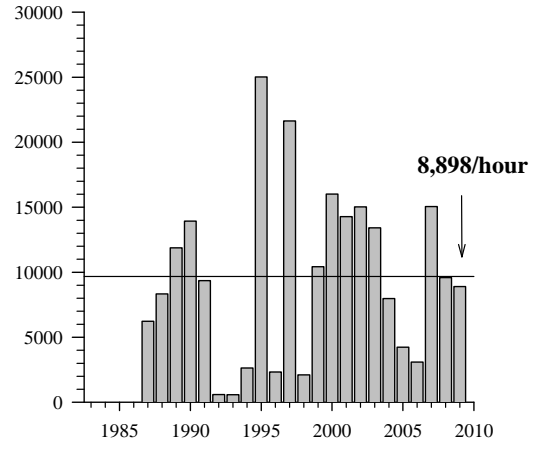
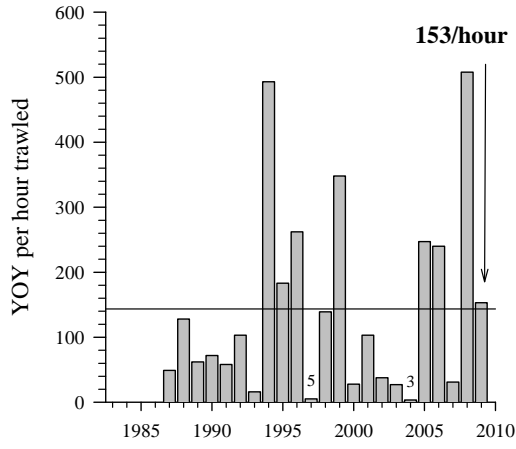
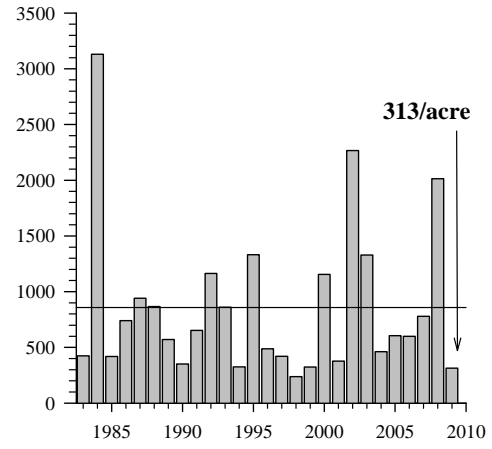


Figure 2. Young-of-year catch and growth rates for walleye and yellow perch, Leech Lake, 1983-2009. Horizontal lines denote respective long-term average catch rates.

Table 3. Catch-per-effort (CPE) of young-of-year walleye in selected gears and associated year class strength (YCS) indices. Incomplete estimates of observed and predicted walleye YCS (\pm 95% confidence intervals) are in bold.

Year Class	Trawl CPE (fish/hour)	Gillnet CPE (fish/net)	Electrofishing CPE (fish/hour)	Year Class Strength (Schupp)		
				Observed	Eq. 1 Predicted	Eq. 2 Predicted
1983		0.22		115		
1984		0.36		61		
1985		0.03		160		
1986		0.08		162		
1987	49	0.11		63	82	56
1988	128	1.81		239	97	232
1989	62	0.06		49	84	55
1990	72	0.03		69	86	55
1991	58	0.47		97	84	91
1992	103	0.00		25	92	62
1993	16	0.00		10	76	36
1994	493	0.08		230	166	182
1995	183	0.51		126	107	131
1996	262	0.14		91	122	120
1997	5	0.29		188	73	59
1998	139	0.47		64	99	114
1999	348	0.56		97	139	183
2000	28	0.14		37	78	53
2001	103	0.69		83	92	124
2002	38	0.31		80	80	71
2003	27	0.08		29	78	47
2004	3	0.00		20	73	33
2005	247	0.03	60	126	120	106 \pm 36
2006	240	0.69	35	248	118 \pm 35	150 \pm 32
2007	31	1.47	27	142	78 \pm 37	176 \pm 60
2008	508	0.00	42	79	169 \pm 79	145 \pm 62
2009	153	0.03	164		102 \pm 30	72 \pm 28
Mean	143.3	0.32	66	103		

Equation 1: $YCS = (0.19069 * \text{trawl CPE}) + 72.45884$

Equation 2: $YCS = (0.21488 * \text{trawl CPE}) + (90.54184 * \text{gillnet CPE}) + 36.3263$

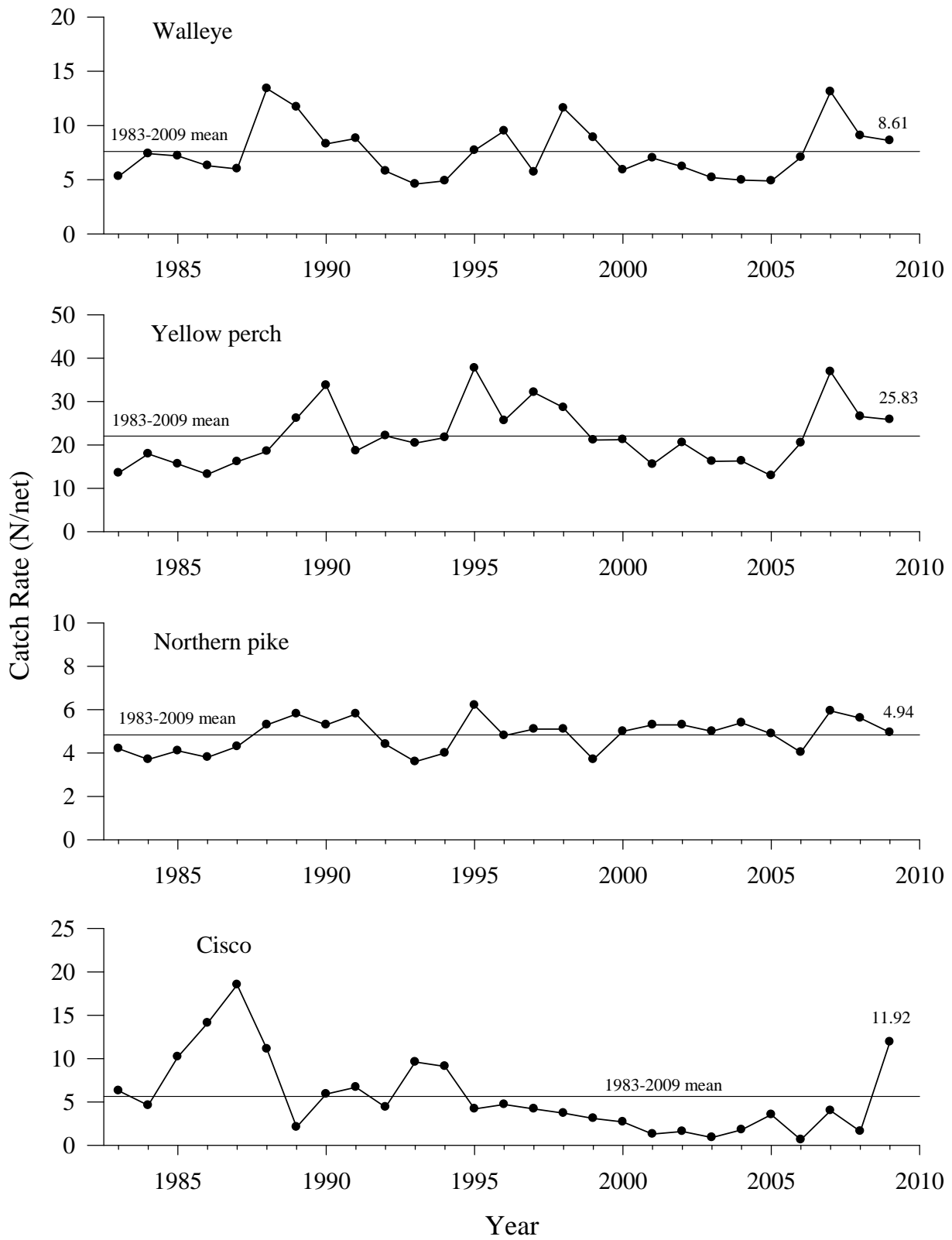


Figure 3. Gill net catch rates (fish/net) of selected species in Leech Lake, 1983-2009.

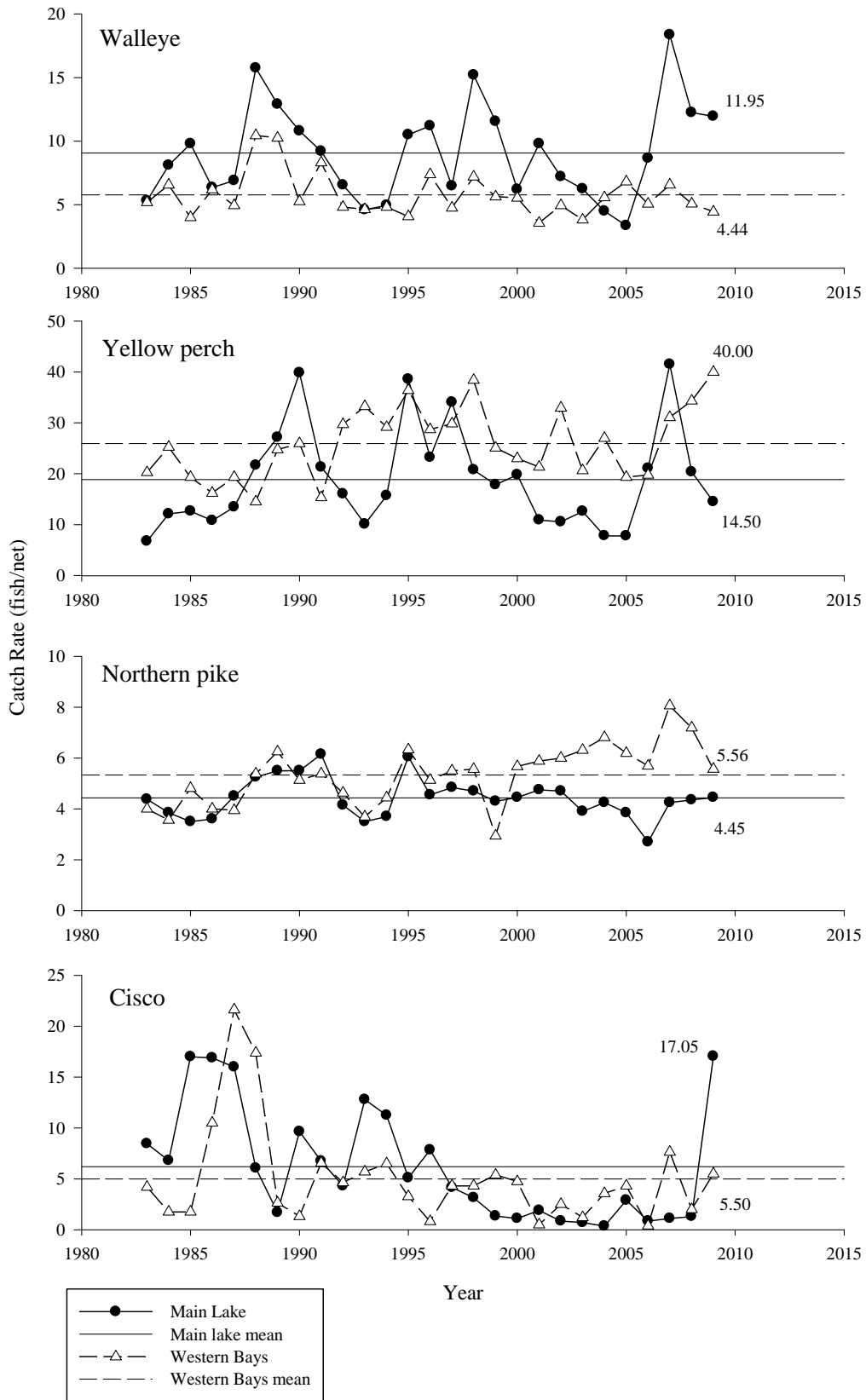


Figure 4. Gillnet catch rates (fish/net) of selected species by basin in Leech Lake, 1983-2009.

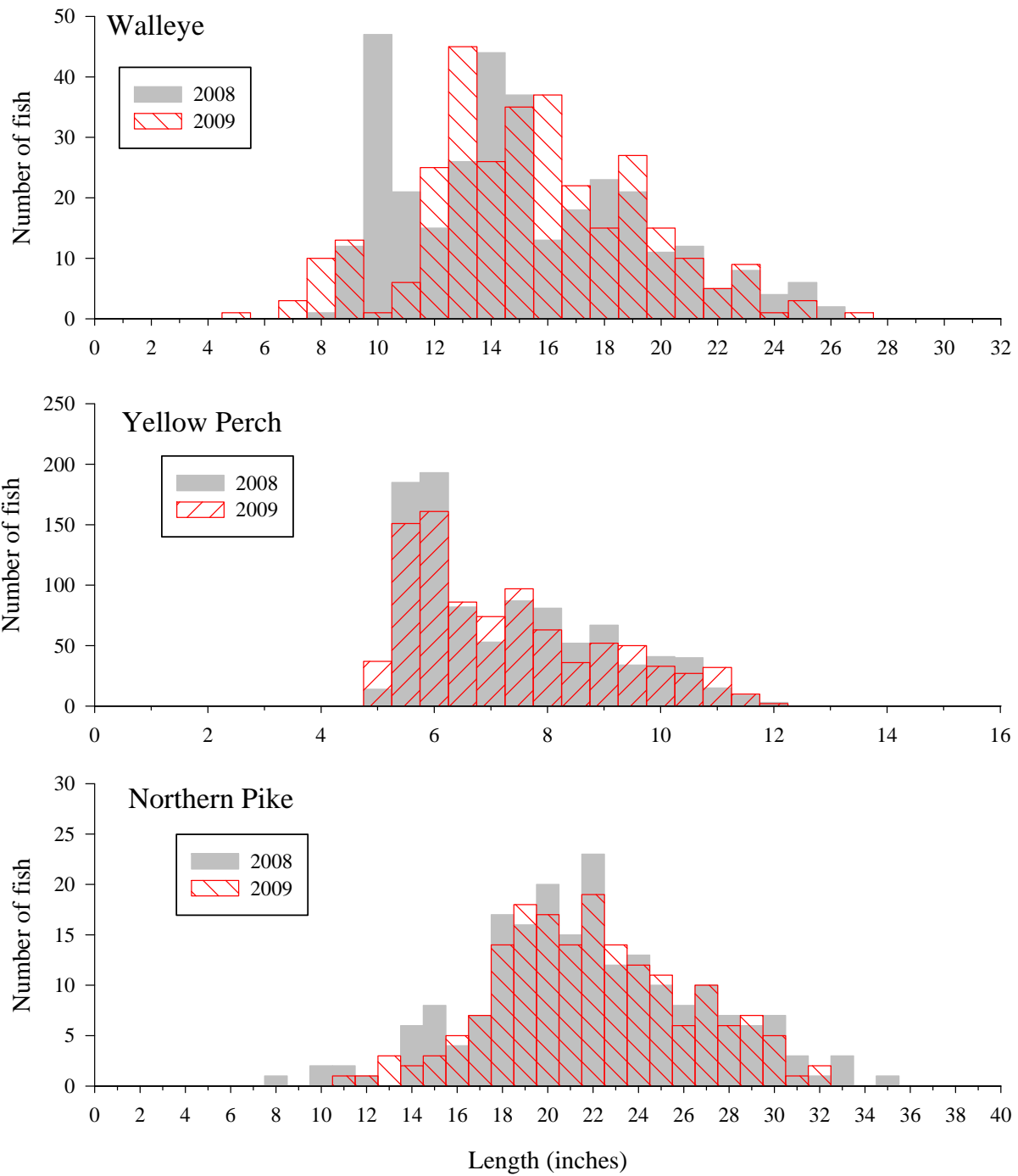


Figure 5. Length-frequency distributions of walleye, yellow perch, and northern pike sampled with experimental gillnets in Leech Lake, 2008 and 2009.

Mean Length at Age-3

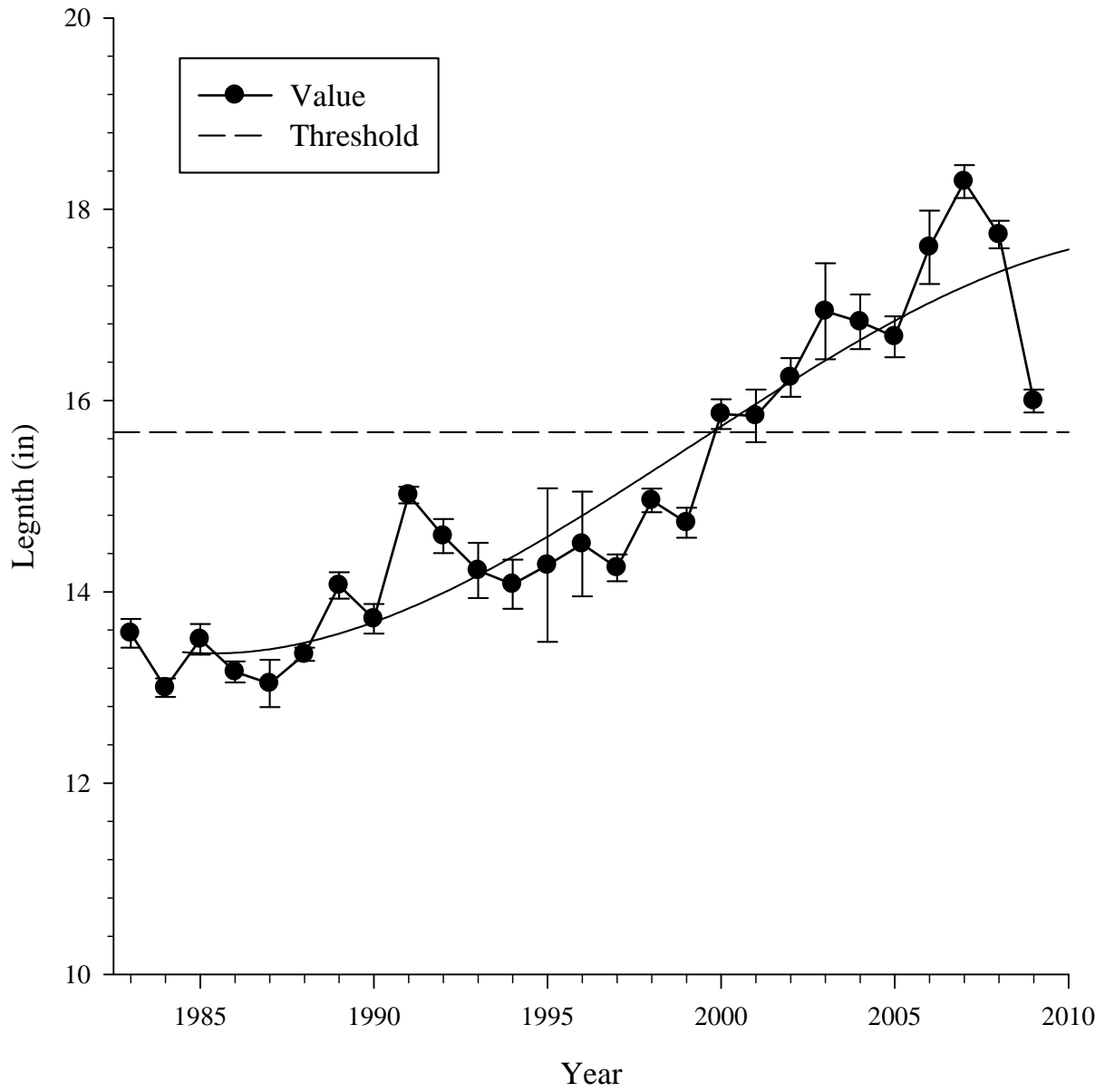


Figure 6. Mean length of age-3 Leech Lake walleye, 1983-2009.

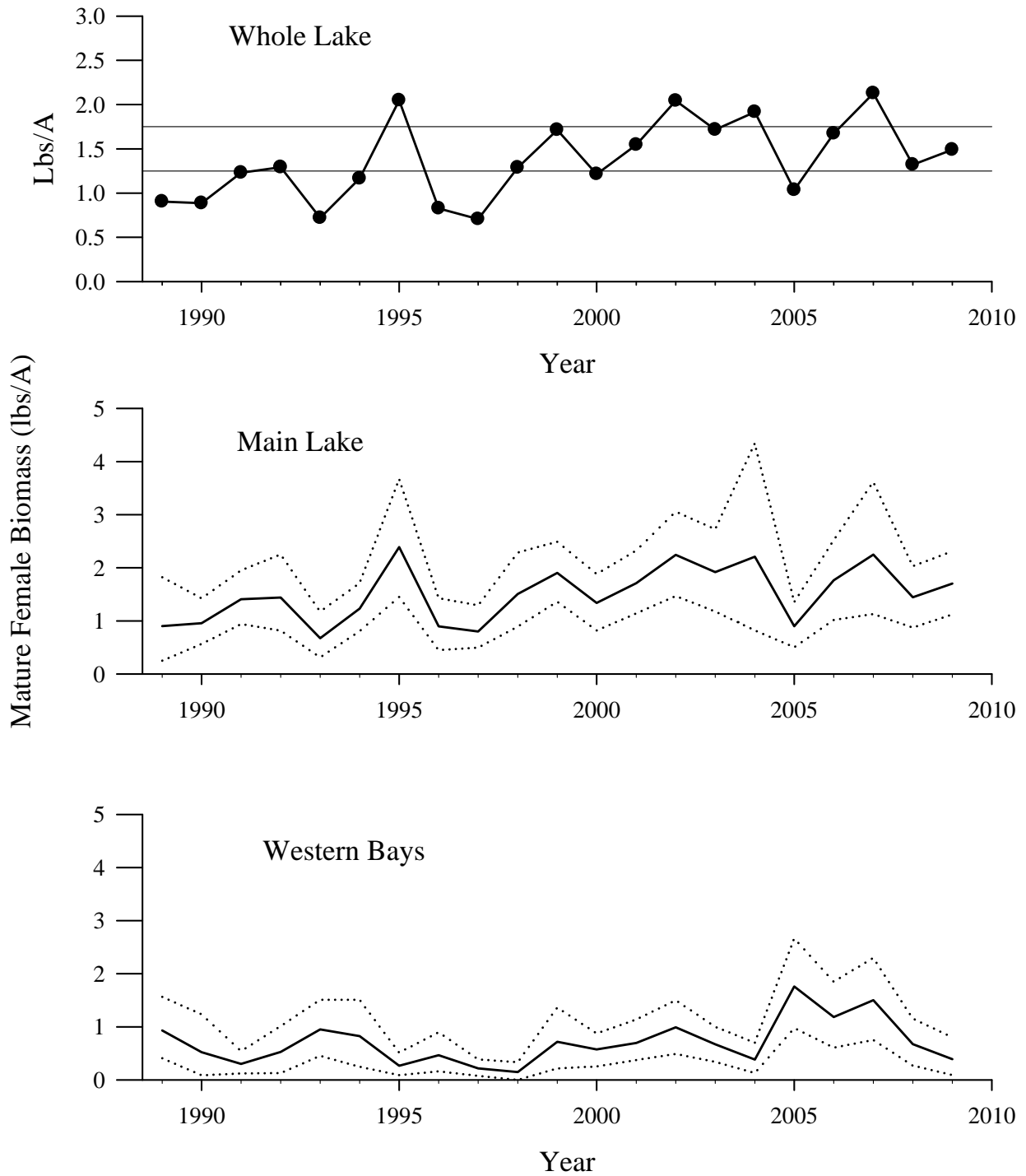


Figure 7. Spawner biomass estimates (lbs/a) for Leech Lake walleye, 1989-2009. Dashed lines for basin-specific estimates represent 95% confidence intervals.

Female age at 50% maturity

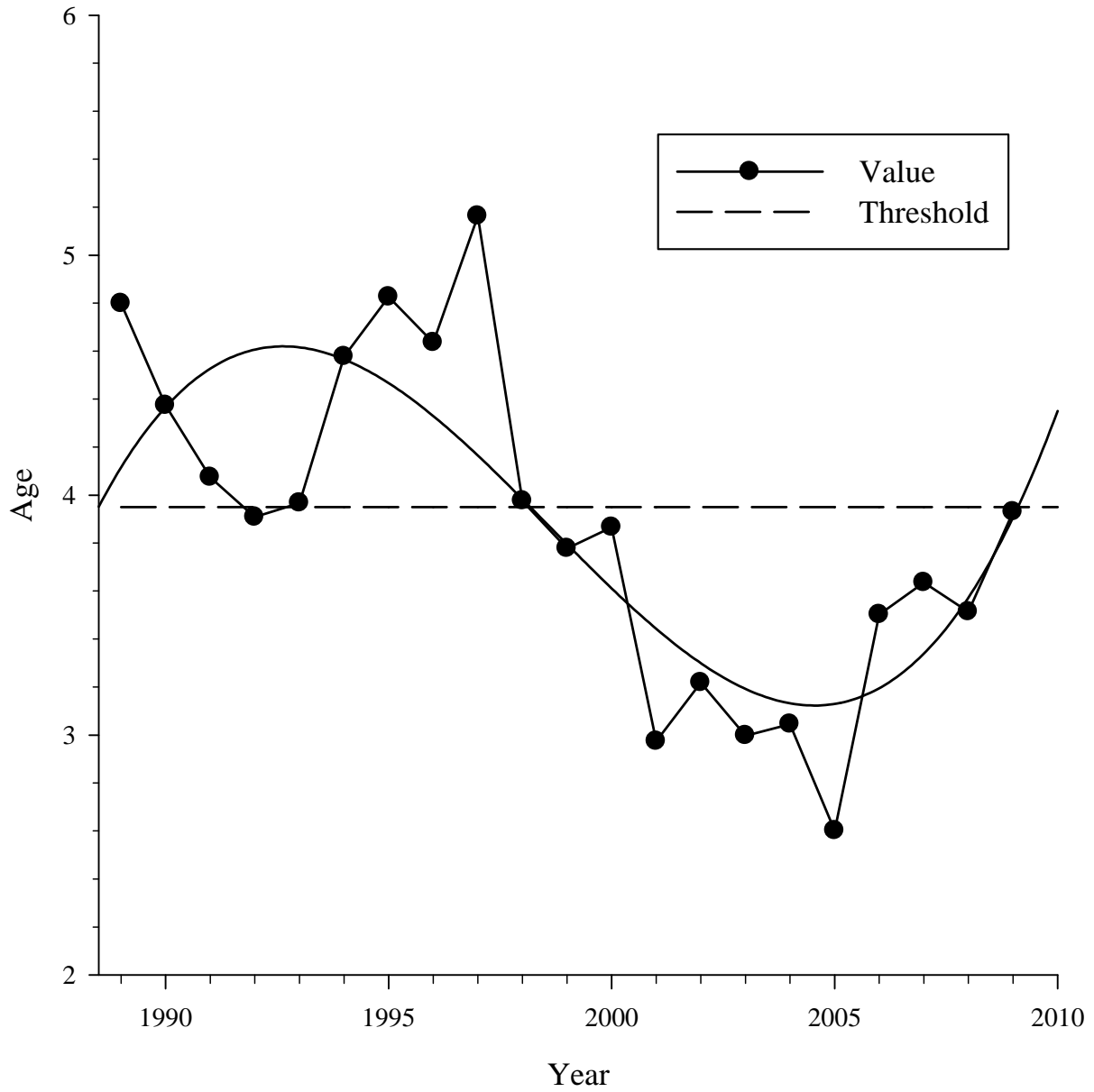


Figure 8. Estimated age of 50% maturity for female Leech Lake walleye, 1989-2009.

Total Angler-Hours in Leech Lake Fishery, 1965-2008

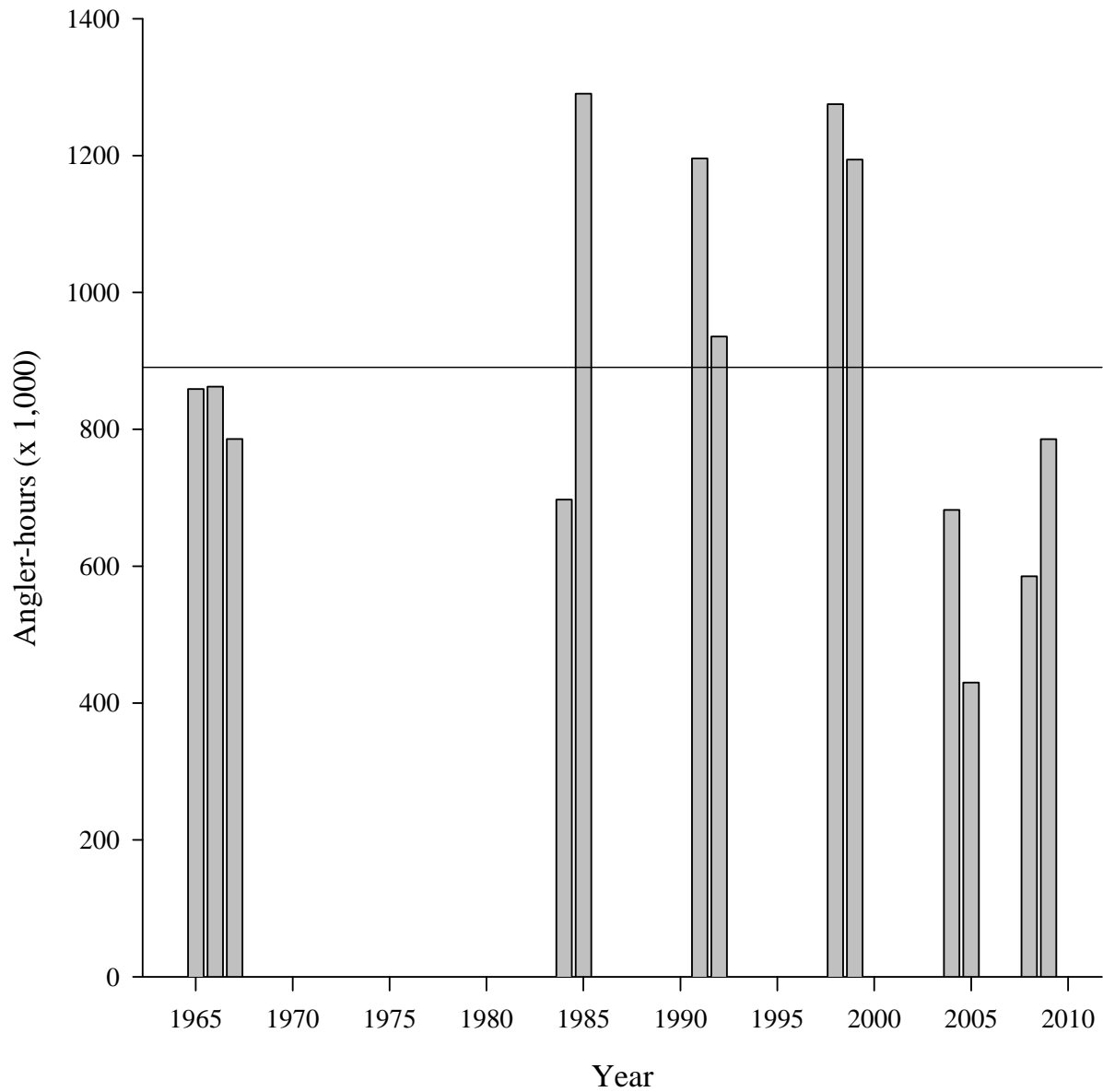


Figure 9. Total estimated fishing pressure (angler-hours x 1,000) on Leech Lake during open-water season, 1964-2009.

Total Walleye Harvest (lbs. x 1,000) in Leech Lake, 1965-2008

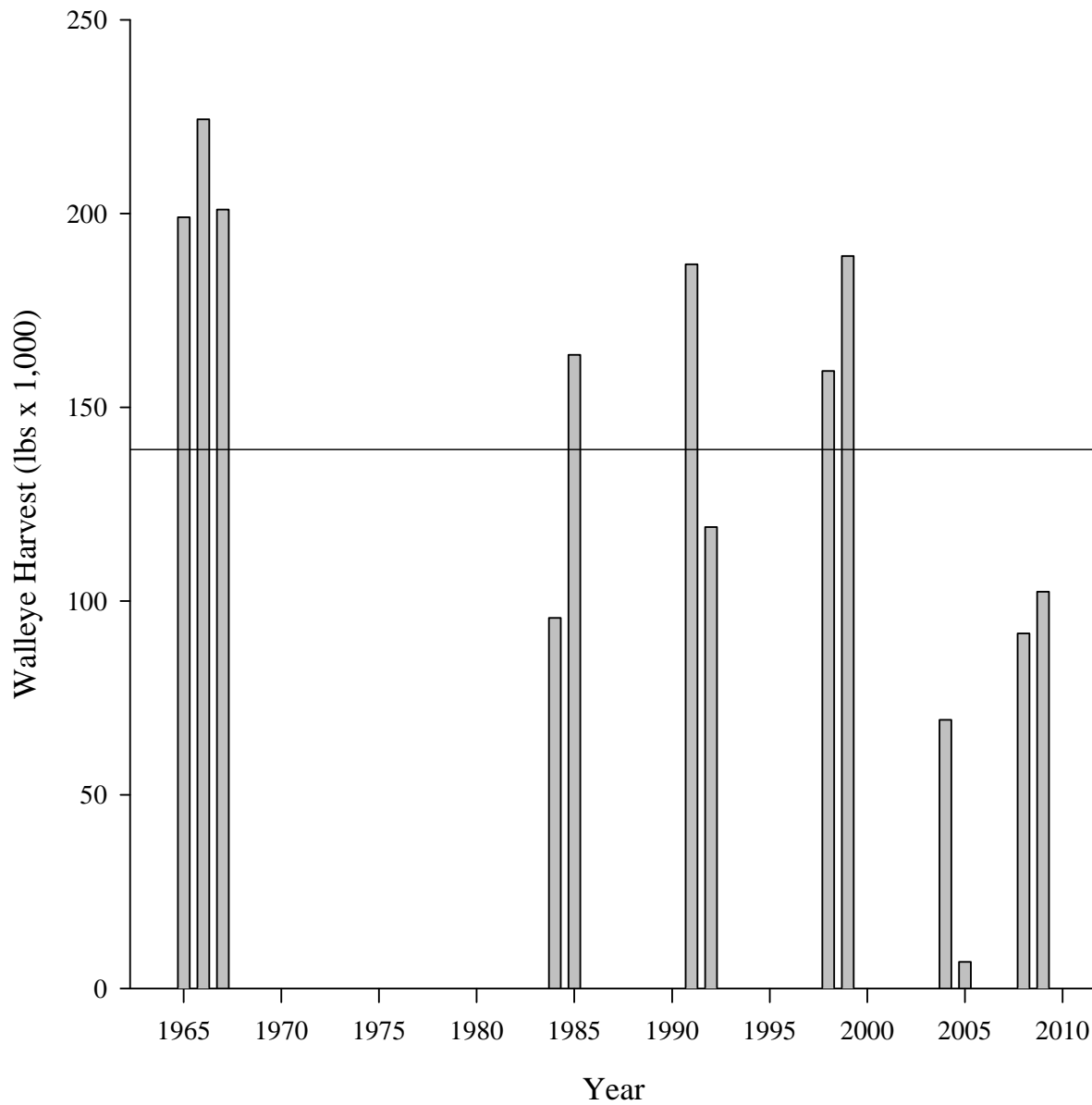


Figure 10. Total estimated walleye harvest (lbs. x 1,000) during the open-water season on Leech Lake, 1964-2009.

Walleye Harvest Rates in Leech Lake, 1964-2008

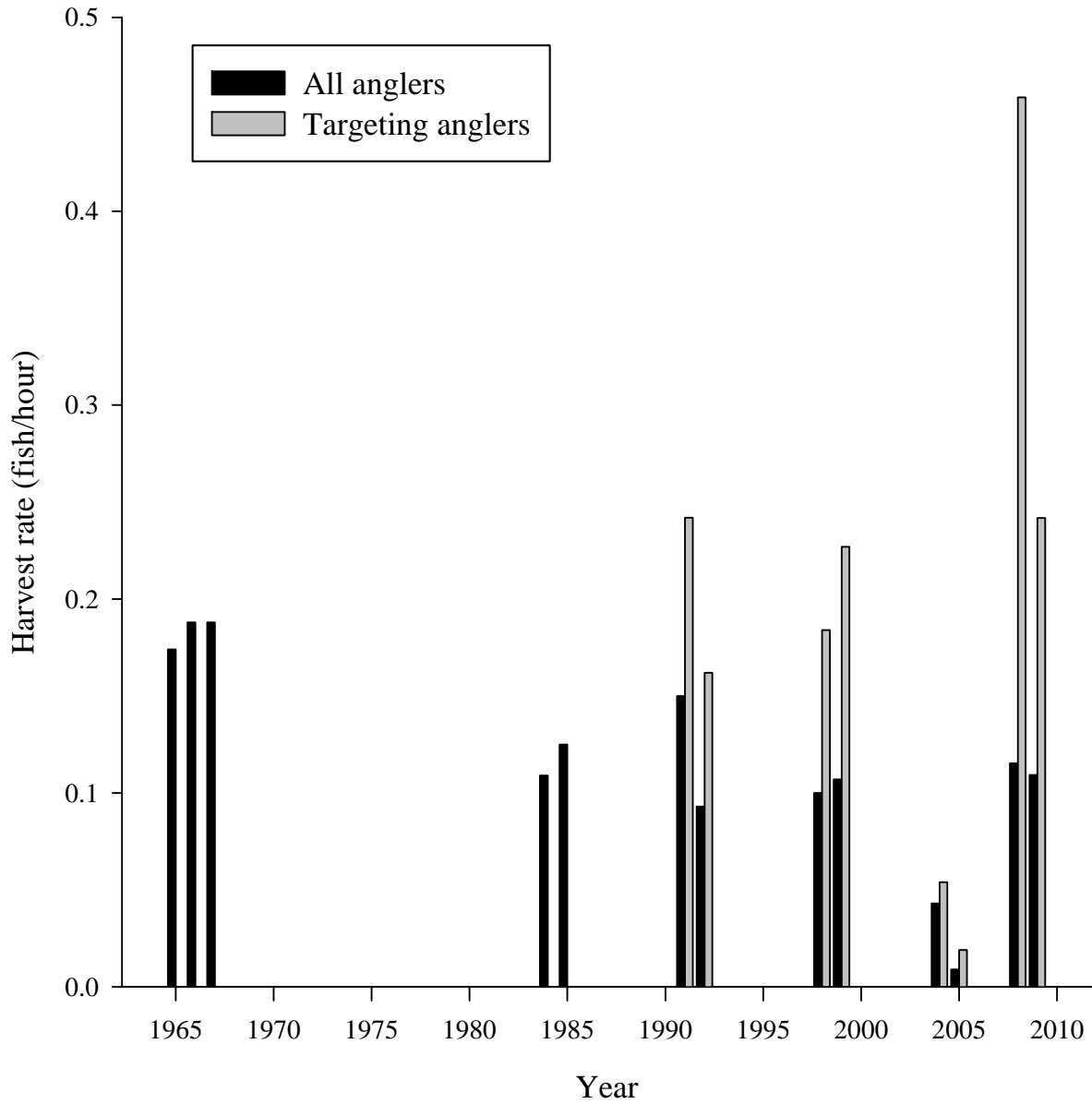


Figure 11. Walleye harvest rates by All and Targeting angler groups during open-water season on Leech Lake, 1964-2009.

Walleye Catch Rates in Leech Lake, 1964-2008

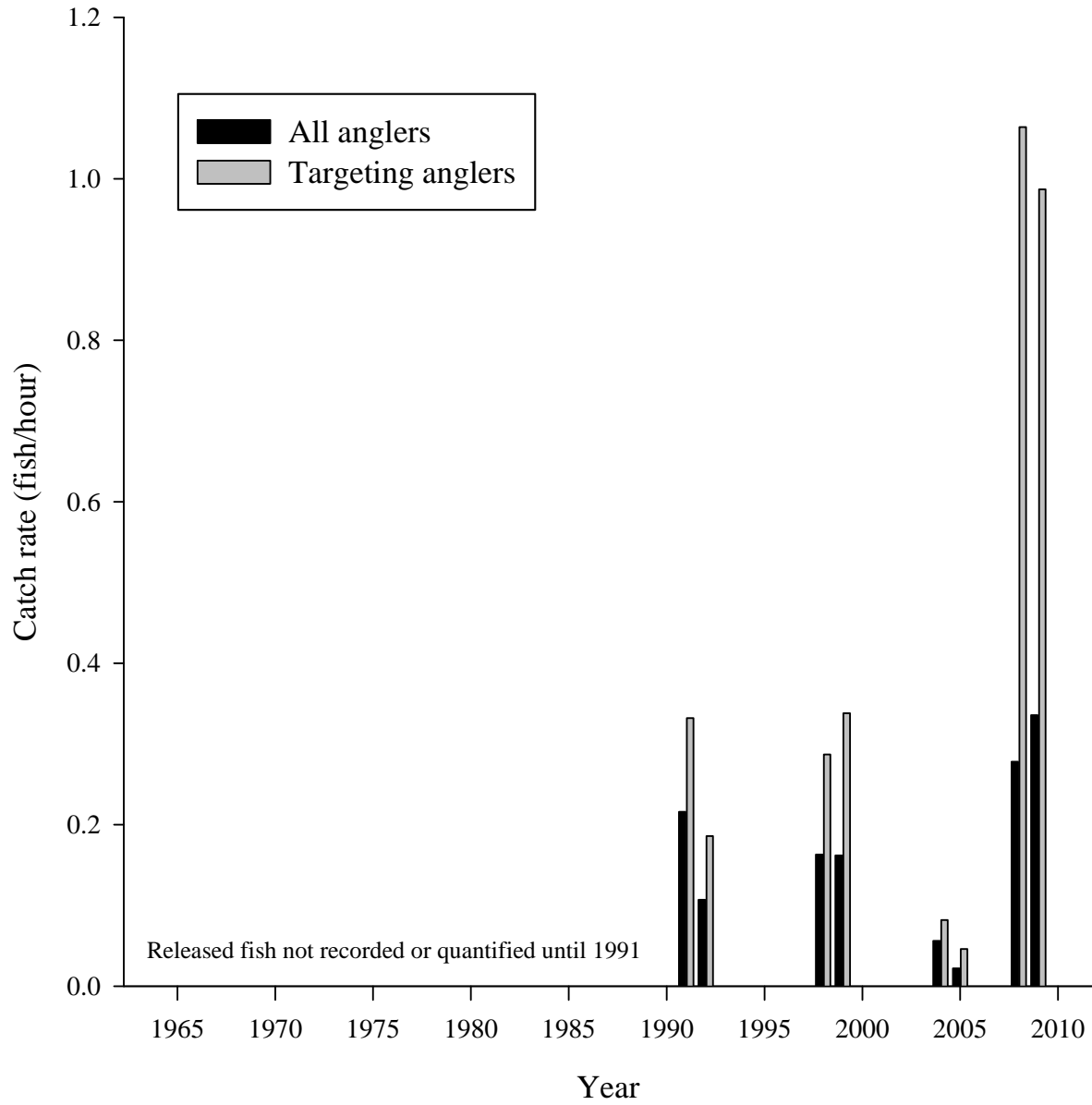


Figure 12. Walleye catch rates by All and Targeting angler groups during open-water season on Leech Lake, 1964-2009.

Walleye Caught by Leech Lake Anglers, 2009

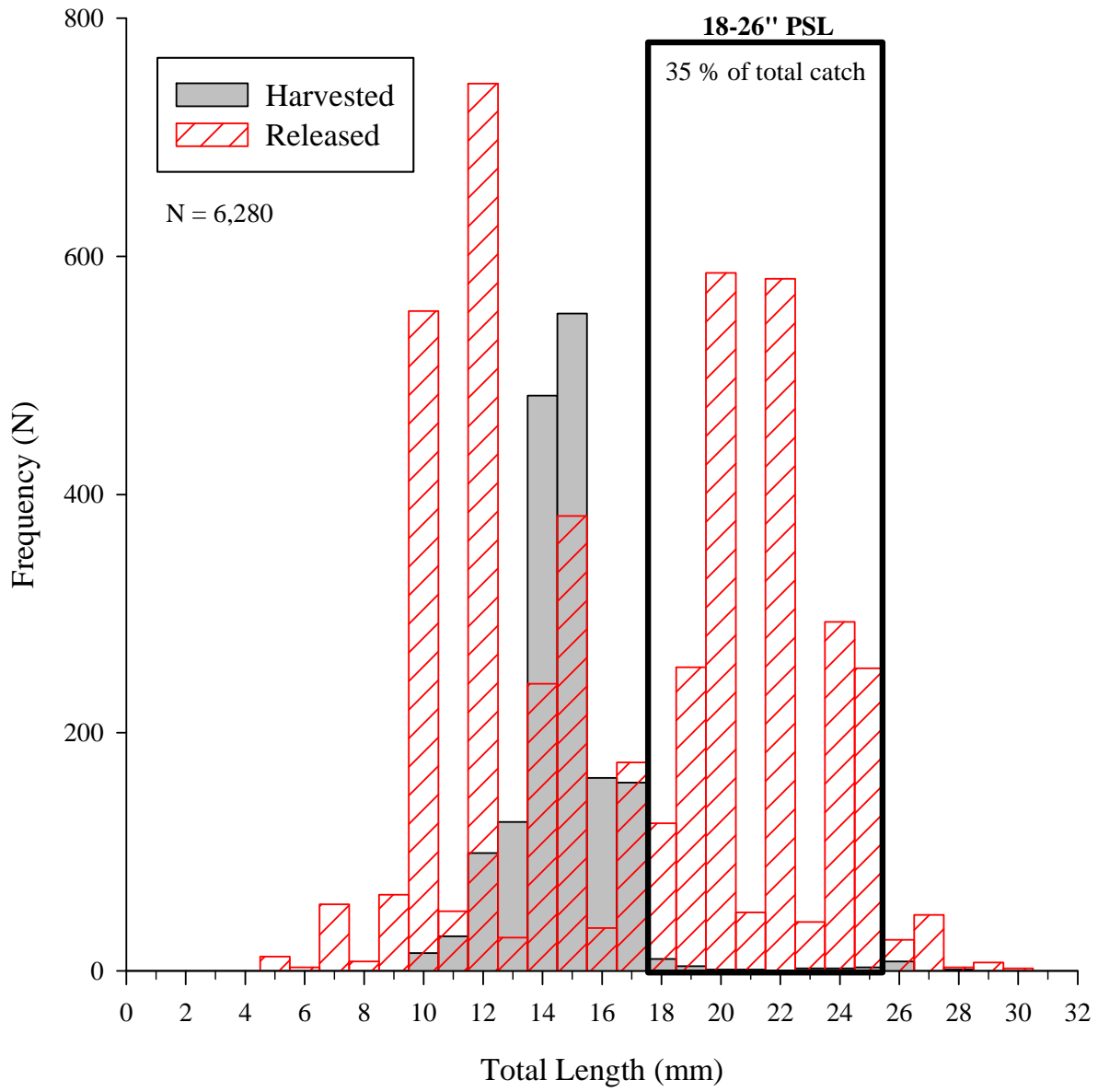


Figure 13. Length-frequency distribution of walleye caught and released by Leech Lake anglers, 9 May – 30 September 2009.