Big Butternut Lake
Fisheries Assessment Survey
Polk County, Wisconsin
2003-2004
MWBIC (2641000)

By

Heath M. Benike
Senior Fisheries Biologist
Wisconsin Department of Natural Resources
Northern Region-Barron
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Executive Summary

Big Butternut Lake, a 378-acre drainage lake located in north central Polk County in Luck, Wisconsin was surveyed in 2003-2004 following the Wisconsin Department of Natural Resources Treaty Assessment protocol. Projected angler effort for all species of fish in was 60.3 hours/acre, of which 71% was directed towards panfish. Largemouth bass were the most common gamefish caught by anglers followed by northern pike and walleye, but northern pike were the most common gamefish harvested by anglers. Largemouth bass relative abundance has increased 1,850% since 1985. Conversely, the 2003 adult walleye population estimate of 1.0 fish/acre was 77% lower compared to a past survey of 4.7 fish/acre in 1990. More importantly, a strong relationship exists that documents a decrease in walleye abundance coinciding with a subsequent increase in largemouth bass abundance. Based on this information, largemouth bass regulation changes are recommended in an effort to reduce largemouth bass densities and potentially restore walleye abundance to historic levels.

Introduction

Big Butternut Lake is a 378-acre drainage lake located in Luck, Wisconsin in north central Polk County. There are two small intermittent inlets, and one permanent outlet, Butternut Creek, which flows into nearby Little Butternut Lake.

Big Butternut Lake has 3.4 miles of shoreline and a maximum and mean depth of 19 and 13 feet, respectively. One public boat landing is present on Big Butternut Lake. Most of the shoreline has been developed into residential and recreational housing. Big Butternut Lake has a diverse fishery consisting of walleye Sander vitreus, northern pike Esox lucius, largemouth bass Micropterus salmoides as well as bluegill Lepomis macrochirus, black crappie Pomoxis nigromaculatus, pumpkinseed Lepomis gibbosus, green sunfish Lepomis cyanellus, yellow perch Perca flavescens, rock bass Ambloplites rupestris, bowfin Amia calva and bullheads Ameiurus sp.

Walleye stocking in Big Butternut Lake was initiated in 1934. Walleye stocking from 1934-1980 consisted of sporadic fry or small fingerling (< 3 in) stockings. Regular stocking of small fingerling walleye began in 1980 (Table 1). Although walleye stocking occurred, there also appeared to be some natural walleye reproduction over that time period (Cornelius, 1992). According to Becker (1983), Big Butternut Lake was not within the native range of walleye in Wisconsin. No other fish stocking occurs. Fisheries management goals for Big Butternut Lake were to provide a walleye fishery with an adult walleye population of 5-7 adult fish/acre (Cornelius 1992). In addition, largemouth bass electrofishing catch per unit of effort (CPUE) values should range between 40 to 50 fish/hour and northern pike electrofishing CPUE should range between 15 to 20 fish/hour. The objectives of this study were to assess the status of the walleye population as part of the treaty assessment sampling rotation of lakes for the Ceded Territory of Wisconsin. Secondary objectives included assessing the status of other important fish species such as largemouth bass, northern pike, and panfish.

Methods

Big Butternut Lake was sampled during 2003-2004 following the Wisconsin Department of Natural Resources treaty assessment protocol (Hennessy 2002). This sampling included spring fyke netting and electroshocking to estimate walleye abundance, fall electroshocking to estimate year class strength of walleye young-of-the-year (YOY) and gamefish relative abundance as well as a creel survey (both open water and ice). Walleye abundance was determined for the total population and separately for adult fish.

Adult walleye were defined as being ≥ 15 in or sexable (Hennessy 2002). Survey data were also collected to estimate abundance and angler catch information on other species such as bass, northern pike, and panfish.

Creel census data were collected in 2003-2004 beginning the first Saturday in May and continuing through 1 March of the following year (the open season for game fish angling in Wisconsin). No creel survey data were collected during November because thin ice created dangerous fishing conditions. Creel survey methods followed a stratified random design as described by Rasmussen et al. (1998). The minimum length limit for walleye in Big Butternut Lake was 15 in with a daily bag that fluctuates on an annual basis dependent on annual safe harvest estimates. The minimum length limit for bass was 14 in with a daily bag of 5. No minimum length limits are in effect for northern pike or panfish and the bag limits were 5 and 25, respectively.

Data collected during the 2003-2004 survey were compared with a previous treaty assessment survey on Big Butternut Lake in 1990-1991 and historic fall electrofishing surveys from 1977, 1985 and 1990. In addition, northern pike catch and harvest statistics were compared with 55 northern Wisconsin lakes (Margenau et al. 2003). Growth data were compared with local (Barron and Polk County) and regional (18 county WDNR Northern Region) means utilizing the WDNR Fisheries and Habitat database. Age assessment for walleye was determined from both scale samples (< 12 in) and dorsal spine sections (≥ 12.0 in). Juvenile walleye (YOY) electrofishing runs were conducted in 1981-1994 and 1997, 2000 and 2003. Cost analysis for stocked walleye utilized cost figures reported by WDNR (1999).

Results

Angling Effort. Projected angling pressure for all species in 2003-2004 was 60.3 hours/acre. In 2003-2004 open water angling pressure increased to 41.9 hours/acre when compared to 20.6 hours/acre in 1990-1991. Overall, 69% of the angling pressure in 2003-2004 was during the open water season, whereas in 1990-1991, 50% was during the open water season. Ice angling decreased in 2003-2004 to 18.4 hours/acre compared to 20.1 hours/acre in 1990-1991 (Table 2).

Walleye. The total walleye population in 2003 was 419 or 1.1 fish/acre (95% C.I. 115-723). Walleye abundance in 2003 was 88% less compared to a previous survey in 1990 (Figure 1). The total walleye population in 1990 was 3,521 or 9.3 fish/acre (95% C.I. 722-6320). The adult walleye population in 2003 was 388 or 1.0 fish/acre (95% C.I. 308-468). Adult walleye abundance was 77% lower in 2003 compared

to 1990 (Figure 2). The adult walleye population in 1990 was 1,772 or 4.7 fish/acre (95% C.I. 1,117-2,427). In addition, relative abundance of all walleye sampled during fall electrofishing surveys suggests a strong negative correlation ($r = -0.92$) of decreasing walleye abundance with time in Big Butternut Lake from 1977 to 2003 (Figure 3).

Walleye YOY were collected in only four years (1992, 1994, 1997 and 2003) of the seven years of fall electroshocking surveys since 1991 (Table 1). Catch per mile during the 1992, 1994, 1997 and 2003 were 0.9, 8.8, 0.3 and 0.3, respectively. All four years that YOY walleye were collected, were years in which walleye were stocked and 1994 was the only year a respectable year class was present.

Angling effort for walleye made up 5% of the total directed effort (open water and ice combined) on Big Butternut Lake in 2003-2004. This compares to 26% of the directed angling effort for walleye in 1990-1991. In addition, both catch and harvest rates for walleye decreased over this period. Angler catch/hr during the open water season decreased from 0.11 fish/hr in 1990-1991 to 0.02 fish/hr in 2003-2004 (Table 3).

Angler projected harvest in 2003-2004 was 10 walleye during the open water and ice fishing periods combined. Tribal spear fishers harvested 26 walleye in 2003. Combined tribal and angler exploitation was estimated at 9% of the adult population. In comparison, combined tribal and angler exploitation in 1990-1991 was 11% of the adult population.

Growth of walleye in Big Butternut Lake was good. Growth rates for age 4 through 7 walleye increased by several inches per age group from previous surveys in 1990 (Table 4). In addition, walleye growth was faster than the local and regional means (Table 5).

Largemouth Bass. No historic population estimates were available for largemouth bass on Big Butternut Lake. Historic fall electrofishing surveys for largemouth bass suggests largemouth bass relative abundance has increased 1,850% from 8/hr in 1985 to 156/hr in 2003 (Figure 4). These data also show a strong positive correlation ($r = 0.94$) of increasing largemouth bass densities from 1977 to 2003.

Anglers directed similar effort toward largemouth bass in 2003-2004 compared to the 1990-1991 survey. Eight percent of the directed angling effort (open water and ice combined) targeted largemouth bass in 2003-2004 compared to 10% of the directed angling effort in 1990-1991. Although directed effort was similar, angler catch rate for largemouth bass increased from 0.40 fish/hr to 1.00 fish/hr during the open water season in 1990-1991 and 2003-2004, respectively (Table 3). Projected angler harvest for largemouth bass in 2003-2004 was 181 fish during the open water and ice fishing periods combined.

Projected angler harvest of largemouth bass in 1990-1991 was 89. Mean length of largemouth bass harvested in 2003-2004 was 15.1 in (SD =1.42 , N = 46) and 17.1 in (SD = 2.75, N = 5) during the open water and ice fishing seasons, respectively. In comparison, mean lengths of largemouth bass harvested in 1991 during the open water and ice fishing seasons were 14.2 in (SD = N/A, N = 9) and 15.5 in (SD = 1.29, N= 4) respectively.

Northern Pike. Northern pike abundance was not estimated during the 2003 sampling event (netting, electroshocking). Fall electrofishing surveys suggest an increase in relative abundance since 1985 (Figure 5). An estimated 13% of the directed angling effort was for northern pike in 2003-2004, compared to 16% in 1990-1991. Open water angler catch rates increased from 0.15 fish/hr to 0.47 fish/hr and ice angler catch rates were similar with 0.13 fish/hr to 0.14 fish/hr in 1990-1991 and 2003-2004, respectively. Projected angler harvest was 456 northern pike during the openwater and ice fishing seasons of which 55% was open water angler harvest and 45% was ice angler harvest. Mean length of northern pike harvested in 2003-2004 was 22.7 in (SD = 4.41, N= 68) and 23.8 in (SD = 3.13, N = 79) during the open water season and ice fishing season, respectively. Harvest rates were 0.07 and 0.05 fish/hr during open water and ice fishing, respectively. Mean length of northern pike harvested in 1990-1991 during the open water and ice fishing seasons was 23.6 in (SD = N/A, N = 18) and 22.7 in (SD = 3.96, N = 11), respectively.

Panfish. Population abundance was not estimated for panfish during 2003-2004 netting and electroshocking. Twenty percent of the directed angling effort was for bluegill in 2003-2004, compared to 8% in 1990-1991. Thirty-three percent of the directed angling effort was for black crappie in 2003-2004 when compared to 25% in 1990-1991. Combined, 53% of the directed angling effort in 2003-2004 was for black crappie and bluegill compared to 33% of the total directed effort in 1990-1991. The projected number of bluegill harvested in 2003-2004 was 6,107 and the projected number of black crappie harvested in 2003-2004 was 16,327. The average length of bluegill and black crappie harvested in 2003-2004 was 7.4 in (SD = 0.48, N = 1,302), and 9.3 in (SD = .49, N = 2,357), respectively. Yellow perch were also targeted in modest numbers by anglers. In 2003-2004, 18% of the directed angling effort was for yellow perch, compared to 23% in 1990-1991. The average length of yellow perch harvested in 2003-2004 was 9.1 inches (SD=.83, N=1,733). Projected angler harvest of yellow perch in 2003-2004 was 6,624.

Discussion

Walleye. Total and adult walleye abundance decreased from 1990-2003. This decrease is likely related to poor year class strength over the past decade (1990-2003). The higher number of walleye in 1990 was

due to the presence of smaller walleye (≤ 12.0 in) compared to the 2003 population estimates. Fall YOY walleye surveys conducted over the past decade suggest that year class strength has been poor. Only 1994 provided any measurable recruitment of YOY walleye into the fishery.

Walleye abundance in 2003 remained below the management goal of 5.0-7.0 fish/acre. The likely reason that walleye abundance has not increased may be due to two factors. First, walleye natural reproduction appears to be non-existent in Big Butternut Lake, whereas historically it appeared some natural reproduction contributed to the fishery (Cornelius, 1992). Second, small fingerling walleye stocking has generally failed during the 1990s, whereas it appeared to be very successful prior to 1990.

Predation on early life stages of walleye may be affecting year class strength and subsequent adult densities. Brooking et al. (2001) stated that when other top predators such as largemouth bass and northern pike increase in relative abundance in a lake, the likelihood of increased predation on small fingerling walleye is high and likely hinders stocking success. Largemouth bass have also been found to be effective predators on other stocked fish such as esocids (Stein et al. 1981). This study found that largemouth bass predation accounted for up to 45% of stocked hybrid muskellunge (Esox masquinongy x E. lucius) within 40 d of stocking. In addition, Nate et al. (2003) indicated that high largemouth bass and northern pike densities characterized lakes with walleye populations that are maintained by stocking versus natural reproduction. Two other studies completed on nearby Ward and Half Moon Lakes (Benike 2005a; Benike 2005b) in Polk County also showed a similar trend of decreasing walleye abundance with a increase in largemouth bass abundance during the same time period. Considering the relative abundance of largemouth bass in Big Butternut have increased 1,850% since 1985 it's reasonable to assume largemouth bass may be utilizing walleye as prey items. Some circumstances may require the stocking of larger fish to improve survival if predation by other fish is considered to be a major limiting factor (WDNR 1999). Such scenarios may also prove more cost-effective (Benike 2005a; Benike 2005b). In 2003-2004, the WDNR quota of small fingerling walleye was 50 fish/acre or 18,900 @ $0.06/fish. The estimated cost of this effort in 2003 for Big Butternut Lake was $1,134. Converting to extended growth fingerling at 10 fish/acre or 3,780 @ $0.65/fish would cost approximately $2,457 (WDNR 1999). Changes in walleye stocking should be considered even though there is an increase in cost, because the existing stocking strategy is not meeting management goals and objectives. A more practical alternative that would have little to no cost impact would be to try and reduce largemouth bass densities on Big Butternut Lake. The most logical solution would be to remove the current 14-inch minimum length limit for largemouth bass.

The goal of this effort would be to lower largemouth bass densities to a point where stocked small fingerling walleye survival would be enhanced. More importantly, if it were successful, adult walleye abundance would also increase and natural reproduction could once again contribute to the fishery. If nothing is done, it is likely that within the next decade the walleye fishery in Big Butternut Lake would be nearly extirpated.

Largemouth Bass. Largemouth bass were not heavily targeted by anglers even though they were very abundant. Although no historic population estimates were available for largemouth bass in Big Butternut Lake, the data indicates largemouth bass have increased substantially since 1985.

Of special concern is the potential for the largemouth bass population to get so high that it creates a high-density stunted fishery. Nearby Balsam and Big Round Lakes in Polk County, Wisconsin, which are similar to Big Butternut Lake in terms of productivity and fish assemblages, are examples of the potential consequences of high-density largemouth bass populations. In 2002, a new bass regulation went into effect for Balsam and Big Round Lakes, which allowed one bass less than 14 in to be part of the 5 daily bag limit. This regulation went into effect because recent fisheries surveys documented high-density largemouth bass populations with a sub-optimal size structure and very slow growth when compared to past surveys (Cornelius 1999; Cornelius 2000). Considering that the current largemouth bass fishery was expanded considerably over the same time period, it is reasonable to assume that a similar condition exists on Big Butternut Lake.

Northern Pike. Northern pike were an important component of both the open water and ice fishery of Big Butternut Lake. Directed effort, catch, and harvest rates increased in 2003-2004 when compared to 1990-1991. In addition, the 2003-2004 creel indicated that effort, catch and harvest rates were similar to those noted for 55 northern Wisconsin lakes by Margenau et al. (2003). However in 2003-2004, mean length of harvested northern pike was longer than the average reported by Margenau et al. (2003). Overall, the northern pike fishery is currently considered adequate and should provide above average angling opportunities.

Panfish. Panfish were most heavily targeted fish in terms of angling effort, catch and harvest. In addition, there was a large increase in panfish angling effort, catch and harvest in 2003-2004 when compared to 1990-1991. One likely reason for the increase in panfish angling could be related to a decrease in walleye angling pressure over the same time period.

Management Recommendations

1. The current 14-inch minimum length for bass appears to be resulting in a high-density fishery and very few anglers are targeting largemouth bass. In addition, this study, and other recent studies have provided support that indicates high largemouth bass densities could be causing the decline of historic walleye fisheries in Polk County lakes. It is recommended that the 14-inch minimum length limit be removed for bass on Big Butternut Lake on an experimental basis. The goal of this regulation proposal is to reduce largemouth bass densities, reduce predation and enhance survival of stocked walleye, and ultimately increase walleye densities in an effort to restore the walleye fishery similar to historic conditions found prior to 1990.

2. Walleye stocking should be converted from small fingerlings to extended growth fingerlings if available from WI DNR hatcheries. Currently, small walleye fingerling stocking is not cost effective and there has been little contribution of stocked small walleye fingerlings over the past decade.

3. The northern pike population seems stable and harvest suggests fish are larger than average compared to other northern Wisconsin waters. No management changes are recommended at this time.

4. The existing panfishery appears to stable and the majority of the angling effort is targeted towards these species. No management changes are recommended at this time.

5. Littoral zone areas should be protected to provide critical spawning, nursery and overwintering habitat for the existing fish community in Big Butternut Lake. No large-scale chemical treatment of aquatic plants is recommended, unless deemed appropriate at some future point. Minor chemical treatments for navigational purposes should be considered on a case by case basis.

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Table 1. Walleye stocking and fall fingerling catch per unit of effort (CPUE) from electrofishing for Big Butternut Lake, Polk County, Wisconsin. Fall fingerling CPUE may also include naturally reproduced walleye.

Year	Length (in)	Number Stocked	Stocking rate (no/acre)	Fall Electrofishing (no YOY/mile)
1980	< 3	13,665	36	
1981				
1982	< 3	19,072	50	
1983				
1984	< 3	19,080	50	
1985				0.0
1986	< 3	19,006	50	
1987				
1988	< 3	19,809	52	
1989				0.0
1990	< 3	19,596	52	3.2
1991				0.0
1992	< 3	22,231	59	0.9
1993				0.0
1994	< 3	23,858	63	8.8
1995				
1996	< 3	9,252	25	
1997	< 3	9,648	25	0.3
1998	< 3	6,819	18	
1999				
2000				0.0
2001	< 3	18,900	50	
2002				
2003	< 3	18,900	50	0.3

Table 2. Projected angling pressure 1990-1991 and 2003-2004, Big Butternut Lake, Polk County, Wisconsin.

Season	Years	Hrs/Acre
Open water	1990-1991	20.6
	2003-2004	41.9
Ice	1990-1991	20.1
	2003-2004	18.4
Total	1990-1991	40.7
	2003-2004	60.3

Table 3. 1990-1991 and 2003-2004 creel survey data by season for major game and panfish species, Big Butternut Lake, Polk County, Wisconsin.

Species	Season	Year	Directed Effort %	Catch rate (fish/hr)	Harvest rate (fish/h)	Mean len. (in) harvested
Walleye	Open water	1990	34.3	0.1848	0.0414	18.0
		2003	3.5	0.0254	0.0000	N/A
	Ice	1991	20.6	0.0220	0.0073	19.3
		2004	7.6	0.0242	0.0076	19.4
Largemouth bass	Openwater	1990	20.0	0.4001	0.0152	14.2
		2003	10.1	1.1817	0.0497	15.1
	Ice	1990	2.0	0.1326	0.1144	15.5
		2003	3.5	0.0759	0.0260	17.1
Northern pike	Openwater	1990	7.1	0.1449	0.0622	23.6
		2003	6.8	0.4731	0.0729	22.7
	Ice	1991	22.9	0.0155	0.0134	22.7
		2004	23.2	0.1428	0.0565	23.8
Bluegill	Openwater	1990	7.3	1.3216	1.0218	N/A
		2003	21.3	1.9373	0.8398	7.4
	Ice	1991	7.7	0.6418	0.5799	N/A
		2004	17.3	0.5582	0.2564	7.7
Black crappie	Openwater	1990	26.1	2.0044	1.6296	N/A
		2003	41.5	2.1865	1.4871	9.3
	Ice	1991	24.1	0.4008	0.3889	N/A
		2004	17.1	0.1426	0.0693	9.5
Yellow Perch	Openwater	1990	4.6	1.1410	0.9722	N/A
		2003	11.4	2.3641	0.9601	9.1
	Ice	1991	22.6	0.7867	0.5941	N/A
		2004	31.2	1.7278	0.5356	9.0

Table 4. Walleye mean length (in) at age,1990 and 2003, Big Butternut Lake, Polk County, Wisconsin.

Age	N	Big Butternut Lake Mean 2003	SD	Age	N	Big Butternut Lake Mean 1990	SD
4	3	16.7	2.5	4	38	13.6	0.9
5	9	18.3	1.2	5	29	15.6	1.5
6	55	19.7	2.3	6	43	18.8	2.0
7	24	21.3	1.8	7	31	18.8	2.2

Table 5. Walleye mean length (in) at age, Big Butternut Lake 2003, and local and regional means, Wisconsin. Local and regional mean length information is from WDNR Fisheries and Habitat database.

		Big Butternut Lake Mean 2003	SD	Barron & Polk County (Local Mean)	SD	Northern Region (Regional Mean)	SD
Age	4	16.7	2.5	15.4	2.3	14.1	
	5	18.3	1.2	17.5	1.9	16.1	
	6	19.7	2.3	18.8	2.0	17.7	
	7	21.2	1.8	20.4	2.5	19.3	

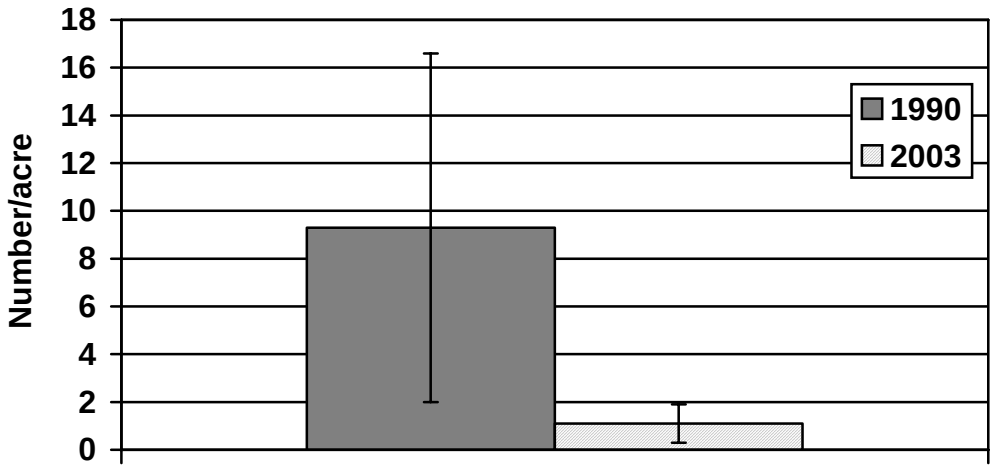

Figure 1: Total walleye population density, 1990 and 2003. Big Butternut Lake, Polk County, Wisconsin. Error bars represent 95% confidence intervals.

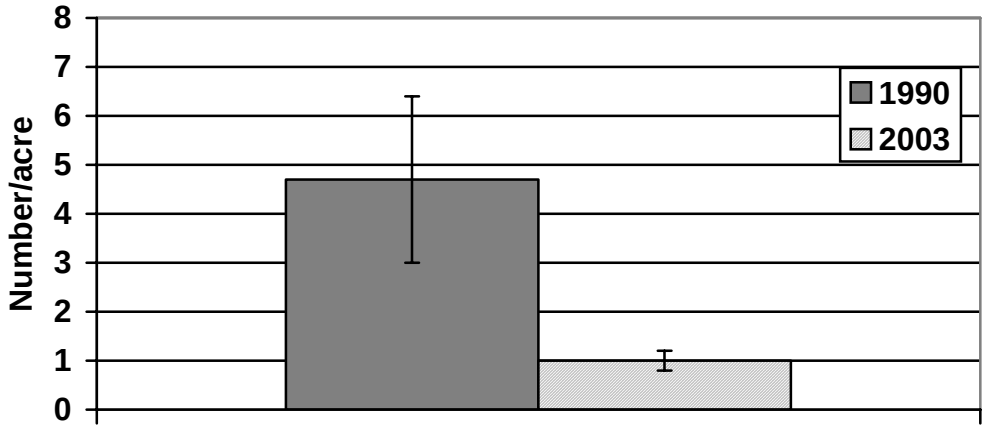

Figure 2: Adult walleye population density, 1990 and 2003. Big Butternut Lake, Polk County, Wisconsin. Error bars represent 95% confidence intervals.

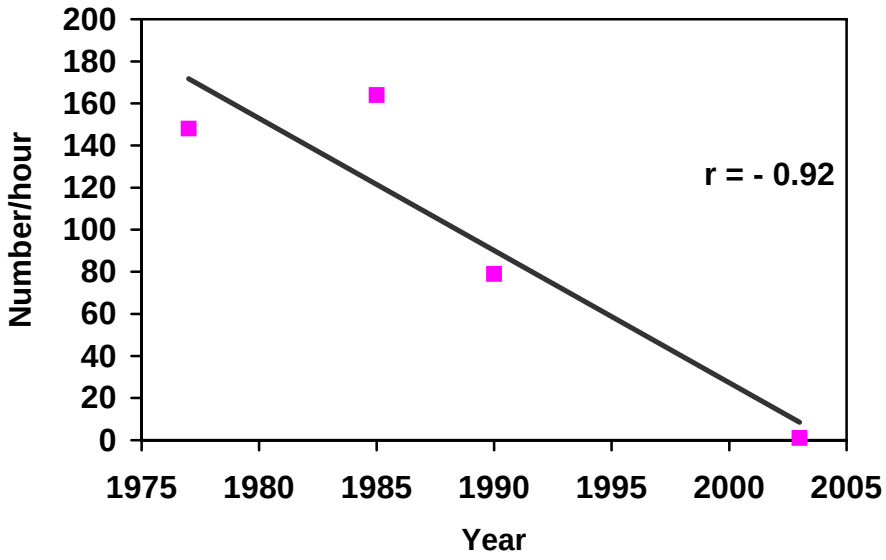

Figure 3. Relative abundance of walleye from fall electrofishing surveys, Big Butternut Lake, Polk County, Wisconsin.

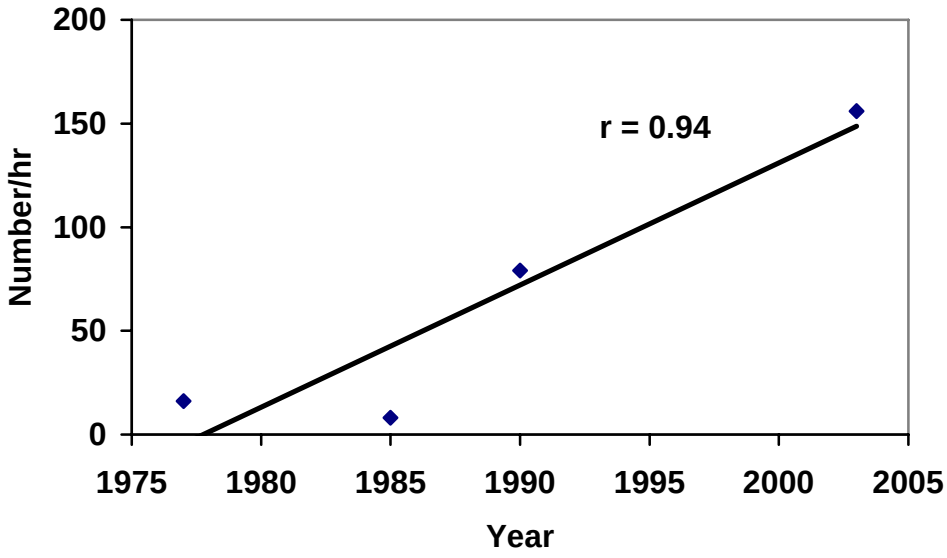

Figure 4: Relative abundance of largemouth bass from fall electrofishing surveys, Big Butternut Lake, Polk County, Wisconsin.

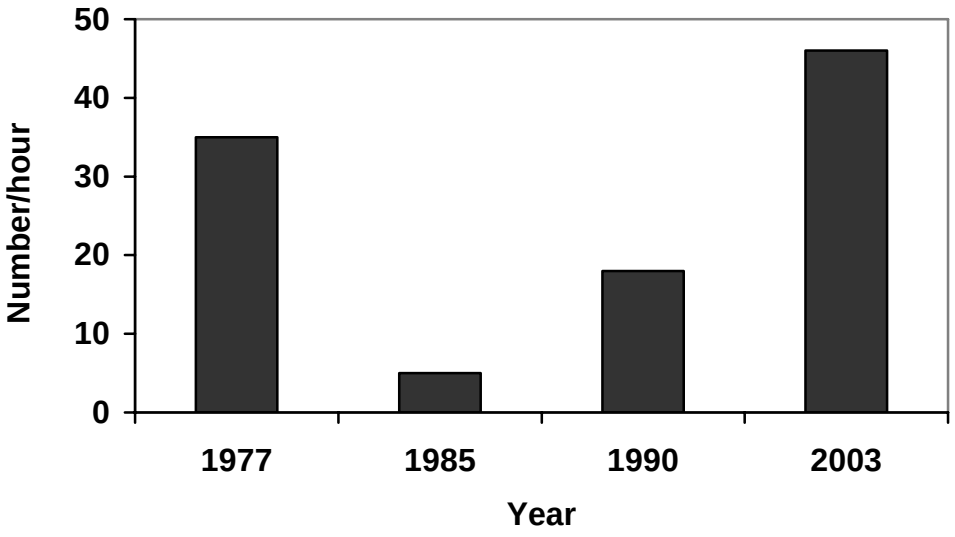

Figure 5: Relative abundance of northern pike from fall electrofishing surveys, Big Butternut Lake, Polk County, Wisconsin.