

WINONA LAKE
Kosciusko County
2005 Fish Management Report

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EXECUTIVE SUMMARY

- A general lake survey was completed on Winona Lake from June 27 to 29, 2005. During this survey, water chemistry data was also collected. Two aquatic vegetation surveys were conducted on May 25 and July 28, 2005. General lake surveys include fish, chemistry and plants. The dates may be important but saying chemistry and not fish is confusing.
- The Secchi disk reading was 15 ft on May 25 and 6 ft on July 28 and dissolved oxygen concentration was not adequate for fish survival below 40 ft on June 27. Submersed vegetation was found to a maximum depth of 12.5 ft on May 25 and 13ft on July 28. Coontail dominated the plant community in the spring vegetation survey, but a combination of coontail, chara, wild celery, and leafy pondweed dominated the vegetation community in summer.
- A total of 828 fish, representing 27 species, was collected during this survey. By number, bluegill ranked first, walleye ranked second, and largemouth bass ranked third in the survey sample. By weight, walleye ranked first followed by bluegill and northern pike. Bluegill PSD was 54. Bluegill collected in 2005 grew similar to those captured in 1995 and reached 6.0 in TL by age 3. Largemouth bass PSD was 47. Bass captured during this survey grew faster than those captured in 1995.
- There has been a decrease in the number of forage species found during the survey and a decrease in abundance for those forage species that were sampled, particularly logperch and yellow perch.
- In Winona Lake, the DFW should maintain a 14-in minimum size limit on largemouth bass and walleye. A work plan should be written to investigate the impacts of walleye stocking on the amount of available forage in lakes that were once dominated by yellow perch. The availability of forage in lakes is important if we want to continue creating quality walleye fisheries.

TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
INTRODUCTION	1
METHODS	1
RESULTS	2
DISCUSSION.....	4
RECOMMENDATIONS	4
LITERATURE CITED	5
APPENDIX: Lake pages	9

LIST OF TABLES

Table	Page
1. Winona Lake vegetation survey results by rake score on May 25 (a) and July 28 (b), 2005. A total of 100 sites was sampled during each survey (88 littoral sites in May and 93 in July)	6
2. Fish species and number of individuals captured in Winona Lake general surveys from 1976 through 2005. The letter 'P' denotes presence	7
3. Age-length key with mean length-at-each-age and the associated variance for bluegill captured using night electrofishing on Winona Lake in June 2005.....	8

INTRODUCTION

Winona Lake is a 562-acre natural lake located on the southeast side of Warsaw in Kosciusko County, Indiana. The state-owned access at the Kiwanis Park at the northwest corner of the lake provides a handicap accessible boat ramp, dock, and parking. Maximum depth is 72 ft and average depth is 30 ft. Previous fisheries surveys were conducted in 1970, 1976, 1982, and 1995. Largemouth bass and walleye population surveys were conducted in 2003 and 2004, in addition to a creel survey from April 2003 to May 2004 (Pearson 2006).

The Indiana DNR stocked walleye fry in 1986 and walleye fingerlings from 1987 to 1990, then discontinued stocking due to poor survival of walleye. The fish population of Winona Lake was dominated by small yellow perch, bluegill, logperch, and largemouth bass (Braun 1995). Winona Lake has historically had problems not only with point source pollution from industries, but also with non-point source pollution in the form of nutrient runoff that contributes to accelerated eutrophication of the lake. This is most obvious from the filling in of the ditches that drain into Winona Lake (International Science and Technology 1991). The Winona Lake Preservation Association has actively pursued funding for dealing with both sedimentation and erosion problems in the lake through Lake and River Enhancement funds, in addition to controlling their Eurasian watermilfoil problems. From 2001 to 2005, Winona Lake has been one of four study lakes used to evaluate whether stocking advanced fingerling walleye successfully creates a quality fishery (Burlingame 2006). Each year, walleye were stocked at a rate of approximately 20/acre and averaged 6.8 in TL. A fisheries survey was conducted on Winona Lake in 2005 to determine the changes to the general fish community in the lake since the previous fisheries survey in 1995 and to evaluate the effects, if any, of both Eurasian watermilfoil control and the stocking of advanced fingerling walleye in this lake.

METHODS

The Winona Lake general survey was conducted from June 27 to 29, 2005 as part of DFW Work Plan 204137. Some physical and chemical characteristics of the water were measured in the deepest area of the lake (Indiana Division of Fish and Wildlife 2001). Submersed aquatic vegetation was sampled on May 25 and July 28, 2005 using guidelines written by Pearson (2004; WP 204755). A global positioning system (GPS) device was used to

record the location of the limnological data collection site, aquatic vegetation sample sites, and fish collection sites.

Fish were collected by pulsed D.C. electrofishing (EF) the shoreline at night with two dippers at 6, 15-minute stations (total EF time = 1.5 h). Three trap nets and four experimental-mesh gill nets were also fished for two nights for a total of six trap-net lifts and eight gill-net lifts. All fish collected were measured to the nearest 0.1 in TL and weighed in the field to the nearest 0.01 lb.

Fish scale samples were taken from bluegill, largemouth bass, walleye, white bass, and northern pike for age and growth analysis. Proportional stock density (PSD) and relative stock density (RSD) were calculated for bluegill, largemouth bass, and walleye (Anderson and Neumann 1996). Additionally, an age-length key was created and mean length-at-age calculated for bluegill captured during this general survey (DeVries and Frie 1996).

RESULTS

Winona Lake was at normal pool. On June 27, dissolved oxygen concentrations were not adequate for fish survival below 40 ft and Secchi depth was 7 ft. The thermocline was located between 12 and 26 ft.

The Secchi disk reading was 15 ft on May 25 and 6 ft on July 28. Submersed vegetation was found to a maximum depth of 12.5 ft on May 25 and 13 ft on July 28 (Table 1). In 100 sites sampled (88 littoral sites), coontail (36%) dominated the vegetation community on May 25. Chara (19%), curly-leaf pondweed (15%), sago pondweed (14%), Eurasian watermilfoil, (12%), slender naiad (2%), and leafy pondweed (2%) were also present in the lake. Filamentous algae were present at 53% of the sampled sites. On the July 28 vegetation survey, in 100 sampled sites (93 littoral sites), coontail (40%), wild celery (36%), chara (34%), and leafy pondweed (28%) dominated the plant community. Other species present included slender naiad (9%), flat-stem pondweed (8%), water stargrass (5%), Eurasian watermilfoil (5%), Sago pondweed (4%), brittle naiad (3%), southern naiad (3%), curly-leaf pondweed (2%), northern naiad (2%), small pondweed (2%), northern watermilfoil (1%), and long-leaf pondweed (1%). Filamentous algae were present at 34% of the sampled sites.

A total of 828 fish, representing 27 species, was collected during this survey. Total weight of the fish sample was approximately 417 lbs. Species collected in past surveys, but not

in this survey, include black bullhead, brook silverside, bluntnose minnow, Johnny darter, shorthead redhorse, bowfin, fathead minnow, white crappie, and lake chubsucker (Table 2). By number, bluegill ranked first, walleye ranked second, and largemouth bass ranked third in the survey sample. By weight, walleye ranked first followed by bluegill and northern pike.

A total of 490 bluegills were collected that weighed about 66 lbs. They ranged in length from 1.9 to 8.5 in TL. Relative abundance by number and weight were 59.2% and 15.9%, respectively. The electrofishing, gill net, and trap net catch rates were 116.0 fish/h, 4.3 fish/lift, and 46.8 fish/lift, respectively. The bluegill PSD was 54, which indicates a balanced population (Ney 1999). The bluegill RSD-8 was 4. Growth of bluegill collected during this survey appeared to be similar for all ages to that of bluegill captured in the 1995 survey. Overall mean length of bluegill was 5.3 in. Mean length-at-age data from the age-length key indicated bluegill reached 6 in (i.e., quality size) at age 3.

A total of 68 walleye, weighing 73 lbs was captured during this survey. These fish ranged in size from 9.2 to 24.9 in TL. Walleye were captured by electrofishing, in gill nets, and in trap nets at rates of 15.3 fish/h, 5.5 fish/lift, and 0.2 fish/lift. The walleye PSD was 0. Walleye harvest from spring 2003 to spring 2004 was 927 fish and the population estimates were 3,657 fish and 3,978 fish in spring 2003 and 2004, respectively (Pearson 2006).

Collections also yielded 45 largemouth bass that weighed 33 lbs. They ranged in length from 4.3 to 20.3 in TL. Relative abundance by number and weight were 5.4% and 7.9%, respectively. The electrofishing and gill net catch rates were 26.7 fish/h and 0.6 fish/lift, respectively, while no fish were caught in trap nets. The largemouth bass PSD was 47 and RSD-14 was 30, indicative of a quality largemouth bass fishery (Ney 1999). Average length data from back-calculation indicated bass reached 14 in (i.e., harvestable size) between age 4 and 5. Growth of largemouth bass in 2005 was faster than the growth of bass determined from the 1995 survey. In 1995, bass reached harvestable size between ages 5 and 6.

Gizzard shad, northern pike, yellow perch, and carp were also captured during the general survey. Shad ranked fifth by number (N = 21), pike ranked sixth (N = 19), and yellow perch ranked eighth (N = 16). Gizzard shad numbers remain relatively low compared to the popular game fish species, which indicates a better quality lake since this species tends to proliferate in lakes where it has been introduced at the expense of more valuable game species. Captured northern pike ranged in TL from 18.4 to 35.3 in and ages 1 to 5. Yellow perch ranged in TL

from 4.0 to 10.5 in and ages 1 to 5. Numbers of yellow perch have sharply declined since the 1982 and 1995 surveys were conducted, similar to what was observed in the walleye stocking history of Clear and Maxinkuckee lakes. Six carp were captured, ranging in size from 11.8 to 29.0 in TL and were ranked seventh by weight (5.7 lbs).

DISCUSSION

Water quality in Winona Lake is improved compared to that found during the 1995 general survey. This lake was classified as mesotrophic in 2004 based on the Indiana Trophic Status Index (Indiana Department of Environmental Management [IDEM], 2004). The water quality in this lake has consistently improved since the early 1980's. Based on the Winona Lake Feasibility Study conducted in 1991 by International Science and Technology, Inc., sedimentation and erosion are contributing to accelerated eutrophication in Winona. If the Winona Lake Preservation Association is interested in continuing to improve the water quality of this lake and decreasing the amount of sediment and nutrient input, then best management practices should be implemented in the Winona Lake watershed.

Bluegills now dominate the fishery at Winona Lake unlike what was observed in all of the previous general surveys. In the previous general surveys, yellow perch were typically the most abundant species, far outnumbering bluegill. However, few yellow perch were captured during this survey. The sharp decline in relative abundance was not only observed for yellow perch, but also for logperch, in addition to some other species that were not found during this survey at all. As a result of these declines, in addition to decreasing walleye stocking rate, a workplan should be written to allow the DFW to investigate the cause and improve forage fish abundance in order to continue to produce a quality walleye fishery in Winona Lake.

RECOMMENDATIONS

- The DFW should maintain the 14-inch minimum size limit on largemouth bass and walleye at Winona Lake.
- The DFW should consider reducing the walleye stocking rate to ten advanced fingerlings per acre.
- A work plan should be written to investigate the impacts of walleye stocking on the amount of available forage in lakes that were once dominated by yellow perch. The availability of forage in lakes is important if we want to continue creating quality walleye fisheries.

LITERATURE CITED

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-481 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Braun, E. R. 1995. Winona Lake Kosciusko County Fish Management Report. Indiana Department of Natural Resources, Indianapolis, Indiana.
- Burlingame, M. 2006. Assessment of advanced fingerling walleye stockings at northern Indiana lakes. Indiana Department of Natural Resources, Indianapolis, Indiana.
- DeVries, D. R., and R. V. Frie. 1996. Determination of age and growth. Pages 483-512 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Indiana Department of Environmental Management (IDEM). 2005. IDEM's Surface Water Quality Assessment Program, Lake Water Quality Assessment Fact Sheet.
- Indiana Division of Fish and Wildlife. 2001. S. Shipman, editor. Manual of Fisheries Survey Methods. Indiana Division of Fish and Wildlife, Indianapolis, Indiana.
- International Science and Technology, Inc. 1991. Winona Lake Feasibility Study. International Science and Technology, Inc., Fishers, Indiana. 115 pp.
- Ney, J. J. 1999. Practical use of biological statistics. Pages 167-191 *in* C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Pearson, J. 2006. Largemouth bass density and size structure in large Indiana natural lakes. Indiana Department of Natural Resources, Indianapolis, Indiana.
- Pearson, J. 2004. A proposed sampling method to assess occurrence, abundance and distribution of submersed aquatic plants in Indiana lakes. Indiana Department of Natural Resources, Indianapolis, Indiana.
- Shipman, S. 1996. Project Evaluation: Monitor walleye and hybrid walleye year class strength, determine factors which limit stocking success and relate those factors to survival and harvest. Indiana Department of Natural Resources, Indianapolis, Indiana.
- Submitted by: Angela C. Benson, Assistant Fisheries Biologist
Date: March 7, 2006
- Approved by: Ed Braun, Fisheries Biologist
- Approved by: Stu Shipman, Fisheries Supervisor
Date: March 13, 2006

Table 1. Winona Lake vegetation survey results by rake score on May 25 (a) and July 28 (b), 2005. A total of 100 sites was sampled during each survey (88 littoral sites in May and 93 in July).

a)

Date	5/25/2005							
Secchi depth (ft)	15							
Max plant depth (ft)	12.5							
Species	Rake score					# sites w/vegetation	% sites w/vegetation	
	1	2	3	4	5			
Overall	49	4	2	0	6	61	61	
Sago pondweed	12	0	0	0	0	12	12	
Coontail	29	2	0	0	1	32	32	
Curly-leaf pondweed	10	1	0	0	2	13	13	
Eurasian watermilfoil	10	0	0	0	1	11	11	
Chara	13	1	1	0	2	17	17	
Leafy pondweed	2	0	0	0	0	2	2	
Slender naiad	2	0	0	0	0	2	2	

b)

Date	7/28/2005							
Secchi depth (ft)	6							
Max plant depth (ft)	13							
Species	Rake score					# sites w/vegetation	% sites w/vegetation	
	1	2	3	4	5			
Overall	41	20	5	6	16	88	88	
Chara	18	4	3	1	6	32	32	
Sago pondweed	4	0	0	0	0	4	4	
Coontail	31	2	0	2	2	37	37	
Wild celery	27	4	0	0	2	33	33	
Northern watermilfoil	1	0	0	0	0	1	1	
Northern naiad	2	0	0	0	0	2	2	
Leafy pondweed	18	3	1	1	3	26	26	
Slender naiad	6	2	0	0	0	8	8	
Water stargrass	4	0	0	0	1	5	5	
Eurasian watermilfoil	5	0	0	0	0	5	5	
Long-leaf pondweed	1	0	0	0	0	1	1	
Southern naiad	2	0	0	1	0	3	3	
Small pondweed	2	0	0	0	0	2	2	
Unknown species	1	0	0	0	0	1	1	
Unknown naiad	1	0	0	0	0	1	1	
Flatstem pondweed	5	1	0	1	0	7	7	
Curly-leaf pondweed	2	0	0	0	0	2	2	
Brittle naiad	2	0	0	0	1	3	3	

Table 2. Fish species and number of individuals captured in Winona Lake general surveys from 1976 through 2005. The letter 'P' denotes presence.

Species	1976	1982	1995	2005
Bluegill	208	85	266	490
Walleye			14	68
Largemouth bass	64	23	192	45
White sucker	42	41	38	31
Gizzard shad	374	21	74	21
Northern pike	5	5	8	19
Redear sunfish	4	1	7	17
Yellow perch	318	698	860	16
Yellow bullhead	4	4	9	15
Spotted sucker	48	37	29	14
Golden redhorse		1	1	13
White bass	27	20	17	10
Rock bass	10	8	25	10
Longnose gar	11	4	12	10
Spotted gar	1	7	16	9
Pumpkinseed	12		7	7
Black crappie	6	55	67	6
Carp	17	22	3	6
Channel catfish	51	62	18	6
Brown bullhead	5	30	10	4
Warmouth	6	3	8	3
Longear sunfish	74		4	2
Logperch	14	P	195	2
Spotfin shiner	10		2	1
Golden shiner	1	1		1
Green sunfish	2	1	1	1
Quillback	6		4	1
Brook silverside	P	P	31	
Bluntnose minnow	1		7	
Johnny darter		P	2	
Shorthead redhorse			2	
Bowfin		1	1	
Black bullhead	1	8		
Fathead minnow		P		
Lake chubsucker	3			
White crappie	1			
Total	1322	1138	1930	828

1976 effort: gill net = 16 lifts, AC electrofishing = 1.5 h day, 2 h night

1982 effort: gill net = 12 lifts, trap nets = 9 lifts; DC? electrofishing = 1 h

1995 effort: gill net = 9 lifts, trap net = 9 lifts, DC electrofishing = 1.5 h

2005 effort: gill net = 8 lifts, trap net = 6 lifts, DC electrofishing = 1.5 h

Table 3. Age-length key with mean length-at-each-age and the associated variance for bluegill captured using night electrofishing on Winona Lake in June 2005.

Length group	# in sample	age 1	age 2	age 3	age 4	age 5
2.0	10	10				
2.5	30	30				
3.0	35	35				
3.5	10	10				
4.0	42		42			
4.5	57		57			
5.0	29		21	8		
5.5	28			28		
6.0	86			86		
6.5	69			61	8	
7.0	50			30	20	
7.5	27			24	3	
8.0	13				11	2
8.5	4				4	
Total	490	85	120	237	46	2
Mean length		2.8	4.4	6.3	7.3	8.0
Variance		0.182	0.124	0.384	0.399	0.000

APPENDIX

Lake Pages

LAKE SURVEY REPORT

Type of Survey	<input type="checkbox"/> Initial Survey	<input checked="" type="checkbox"/> Re-Survey
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Lake Name Winona	County Kosciusko	Date of survey (Month, day, year) 6/27-29/2005
Biologist's name Edward R. Braun and Angela C. Benson		Date of survey (Month, day, year)

LOCATION		
Quadrangle Name Warsaw	Range 6E	Section 15, 16, 17, 21, 22
Township Name 32N	Nearest Town Warsaw	

ACCESSIBILITY						
State owned public access site Kiwanis Park at Smith St. and Country Club Rd.		Privately owned public access site Winona Marina - north end of lake		Other access site		
Surface acres 562	Maximum depth 72 ft	Average depth 30 ft	Acre feet 16,860	Water level 811 ft	Extreme fluctuations none	
Location of benchmark NW corner of lake, adjacent to control dam						

INLETS		
Name Peterson Ditch	Location South end of lake	Origin T31N:R7E:S29
Wyland Ditch	SE corner	Tennant Lake
Keeper-Evans Ditch	South end of lake	T31N:R6E:S6

OUTLETS			
Name Eagle Creek	Location NE end of lake		
Water level control Concrete dam with 2, 3x4 adjustable gates			
POOL	ELEVATION (Feet MSL)	ACRES	Bottom type <input type="checkbox"/> Boulder <input checked="" type="checkbox"/> Gravel <input checked="" type="checkbox"/> Sand <input checked="" type="checkbox"/> Muck <input checked="" type="checkbox"/> Clay <input type="checkbox"/> Marl
TOP OF DAM			
TOP OF FLOOD CONTROL POOL			
TOP OF CONSERVATION POOL			
TOP OF MINIMUM POOL			
STREAMBED			

Watershed use Agricultural row crops, woodlots, and some municipal drainage
Development of shoreline 95% residential and municipal
Previous surveys and investigations General surveys: 1970, 1976, 1982, and 1994.

SAMPLING EFFORT						
ELECTROFISHING	Day hours			Night hours		Total hours
	0			1.5		1.5
TRAP NETS	Number of traps			Number of Lifts		Total effort
	3			2		6
GILL NETS	Number of nets			Number of Lifts		Total effort
	4			2		8
ROTENONE	Gallons	ppm	Acre Feet Treated	SHORELINE SEINING	Number of 100 Foot Seine Hauls	

Winona Lake 6/27-29/2005

PHYSICAL AND CHEMICAL CHARACTERISTICS			
Color	Turbidity		Air temperature: 88 F
Green	7 Feet	0 Inches (SECCHI DISK)	
Water chemistry GPS coordinates: N 41.22322977 W -85.83190628			

WATER QUALITY PARAMETERS															
DEPTH (Feet)	Degrees (F)	D.O.	SpC	pH	TDS	D.O.%	Turb.	DEPTH	Degrees (F)	D.O.	SpC	pH	TDS	D.O.%	Turb.
SURFACE	82.4	10.62	0.454	8.61	0.3	139.6	5.0	52	45.8	0.73	0.517	7.60	0.3	6.3	2.9
2	82.2	10.52	0.458	8.62	0.3	138.0	5.6	54	45.7	0.48	0.518	7.60	0.3	4.2	2.7
4	82.1	10.38	0.460	8.61	0.3	135.9	6.0	56	45.6	0.26	0.518	7.60	0.3	2.2	2.8
6	81.9	10.37	0.463	8.64	0.3	135.6	5.0	58	45.5	0.17	0.518	7.61	0.3	1.5	2.7
8	78.9	11.53	0.469	8.61	0.3	146.3	7.1	60	45.4	0.00	0.519	7.62	0.3	0.0	3.0
10	74.7	9.86	0.485	8.58	0.3	119.8	8.9	62	45.3	0.00	0.519	7.62	0.3	0.0	2.7
12	72.7	7.79	0.495	8.45	0.3	92.7	7.4	64	45.2	0.00	0.519	7.62	0.3	0.0	2.6
14	69.9	5.56	0.505	8.22	0.3	64.2	3.7	66	45.2	0.00	0.521	7.62	0.3	0.0	2.4
16	66.8	4.14	0.511	8.02	0.3	46.2	5.6	68	45.2	0.00	0.520	7.62	0.3	0.0	2.4
18	63.9	3.12	0.517	7.89	0.3	33.8	2.5	70	45.1	0.00	0.520	7.62	0.3	0.0	2.3
20	60.9	2.46	0.518	7.79	0.3	25.7	3.1	72	45.0	0.00	0.521	7.62	0.3	0.0	2.8
22	55.7	2.29	0.520	7.72	0.3	22.5	13.4	74	45.0	0.00	0.522	7.62	0.3	0.0	2.9
24	53.1	2.76	0.520	7.72	0.3	26.1	9.9	76	44.9	0.00	0.606	7.52	0.4	0.0	5999
26	51.9	3.02	0.520	7.72	0.3	28.2	6.4	78							
28	50.7	3.12	0.520	7.71	0.3	28.7	3.7	80							
30	49.6	3.28	0.520	7.71	0.3	29.7	3.2	82							
32	48.7	4.13	0.519	7.78	0.3	37.0	2.2	84							
34	48.3	3.55	0.518	7.74	0.3	31.7	2.3	86							
36	47.8	3.39	0.519	7.72	0.3	30.1	2.4	88							
38	47.4	2.92	0.519	7.69	0.3	25.7	2.6	90							
40	47.1	2.33	0.518	7.69	0.3	20.4	2.6	92							
42	46.8	1.92	0.519	7.68	0.3	16.8	3.1	94							
44	46.6	1.69	0.518	7.67	0.3	14.7	2.7	96							
46	46.5	1.81	0.518	7.69	0.3	15.8	2.8	98							
48	46.1	1.07	0.518	7.66	0.3	9.2	2.7	100							
50	45.9	0.91	0.517	7.61	0.3	7.9	2.8								

Occurrence and Abundance of Submersed Aquatic Plants in Winona Lake

Date: 5/25/05	Littoral sites with plants: 59	Species diversity: 0.78
Littoral depth (ft): 12.5	Number of species: 7	Native diversity: 0.65
Littoral sites: 88	Maximum species/site: 4	Rake diversity: 0.89
Total sites: 100	Mean number species/site: 0.18	Native rake diversity: 0.65
Secchi: 15.0	Mean native species/site: 0.13	Mean rake score: 0.93

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	36.36	0.38	1.19	8.64
Chara	19.32	0.28	1.65	6.36
Curly-leaf pondweed	14.77	0.22	1.69	5.00
Sago	13.64	0.12	1.00	2.73
Eurasian watermilfoil	12.50	0.15	1.36	3.41
Leafy pondweed	2.27	0.02	1.00	0.45
Slender naiad	2.27	0.02	1.00	0.45
Filamentous Algae	53.4			
Other Observed Plants: white water lily, spatterdock				

Occurrence and Abundance of Submersed Aquatic Plants in Winona Lake

Date: 7/28/05	Littoral sites with plants: 86	Species diversity: 0.85
Littoral depth (ft): 13.0	Number of species: 18	Native diversity: 0.84
Littoral sites: 93	Maximum species/site: 5	Rake diversity: 1.73
Total sites: 100	Mean number species/site: 0.35	Native rake diversity: 1.66
Secchi: 6.0	Mean native species/site: 0.33	Mean rake score: 2.00

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	39.8	0.53	1.43	11.40
Wild celery	35.5	0.45	1.36	9.68
Chara	34.4	0.69	2.16	14.84
Leafy pondweed	28.0	0.46	1.77	9.89
Slender naiad	8.6	0.10	1.25	2.15
Flat-stem pondweed	7.5	0.11	1.57	2.37
Water stargrass	5.4	0.09	1.80	1.94
Eurasian watermilfoil	5.4	0.05	1.00	1.08
Sago pondweed	4.3	0.04	1.00	0.86
Southern naiad	3.2	0.06	2.00	1.29
Brittle naiad	3.2	0.07	2.33	1.51
Small pondweed	2.2	0.02	1.00	0.43
Northern naiad	2.2	0.02	1.00	0.43
Curly-leaf pondweed	2.2	0.02	1.00	0.43
Long-leaf pondweed	1.1	0.01	1.00	0.22
Unknown species	1.1	0.01	1.00	0.22
Unknown naiad	1.1	0.01	1.00	0.22
Northern watermilfoil	1.1	0.01	1.00	0.22
Filamentous Algae	34.4			
Other Observed Plants: none				

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Bluegill	490	59.2	1.9 - 8.5	66.36	15.9
Walleye	68	8.2	9.2 - 24.9	73.44	17.6
Largemouth bass	45	5.4	4.3 - 20.3	32.86	7.9
White sucker	31	3.7	11.4 - 21.6	41.37	9.9
Gizzard shad	21	2.5	13.0 - 15.8	12.24	2.9
Northern pike	19	2.3	18.4 - 35.3	60.66	14.5
Redear sunfish	17	2.1	4.0 - 9.4	2.39	0.6
Yellow perch	16	1.9	4.0 - 10.5	1.71	0.4
Yellow bullhead	15	1.8	7.5 - 13.4	10.68	2.6
Spotted sucker	14	1.7	10.0 - 16.0	11.26	2.7
Golden redhorse	13	1.6	6.2 - 19.2	6.55	1.6
White bass	10	1.2	13.6 - 15.1	13.07	3.1
Rock bass	10	1.2	2.4 - 8.4	2.76	0.7
Longnose gar	10	1.2	22.0 - 43.0	4.59	1.1
Spotted gar	9	1.1	16.0 - 29.6	6.43	1.5
Pumpkinseed	7	0.8	3.3 - 6.8	0.78	0.2
Black crappie	6	0.7	4.3 - 12.4	1.68	0.4
Carp	6	0.7	11.8 - 29.0	23.89	5.7
Channel catfish	6	0.7	17.8 - 33.2	38.56	9.2
Brown bullhead	4	0.5	11.9 - 14.2	4.81	1.2
Warmouth	3	0.4	4.0 - 6.5	0.55	0.1
Longear sunfish	2	0.2	4.1 - 5.8	0.24	0.1
Logperch	2	0.2	3.2 - 3.8	0.00	0.0
Spotfin shiner	1	0.1	3.8	0.01	0.0
Golden shiner	1	0.1	8.5	0.00	0.0
Green sunfish	1	0.1	3.8	0.04	0.0
Quillback	1	0.1	19.0	0.00	0.0
Total (27 Species)	828	100.0		416.93	100.0

*Common names of fishes recognized by the American Fisheries Society.

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLUEGILL										
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	
1.0					19.0					
1.5					19.5					
2.0	10	2.0	0.00	1	20.0					
2.5	30	6.1	0.01	1	20.5					
3.0	35	7.1	0.01	1	21.0					
3.5	10	2.0	0.02	1	21.5					
4.0	42	8.6	0.04	2	22.0					
4.5	57	11.6	0.06	2	22.5					
5.0	29	5.9	0.08	2, 3	23.0					
5.5	28	5.7	0.12	3	23.5					
6.0	86	17.6	0.16	3	24.0					
6.5	69	14.1	0.19	3, 4	24.5					
7.0	50	10.2	0.25	3, 4	25.0					
7.5	27	5.5	0.32	3, 4	25.5					
8.0	13	2.7	0.40	4, 5	26.0					
8.5	4	0.8	0.48	4	TOTAL	490	100.0	2.13		
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0										
12.5										
13.0										
13.5										
14.0										
14.5										
15.0										
15.5										
16.0										
16.5										
17.0										
17.5										
18.0										
18.5										
ELECTROFISHING CATCH		116/h		GILL NET CATCH		4.3/lift		TRAP NET CATCH		46.8/lift

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF LARGEMOUTH BASS									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5	1	2.2	4.78	8
2.0					20.0				
2.5					20.5	1	2.2	4.29	9
3.0					21.0				
3.5					21.5				
4.0	1	2.2	0.00		22.0				
4.5	5	11.1	0.03	1	22.5				
5.0	3	6.7	0.07	1	23.0				
5.5					23.5				
6.0					24.0				
6.5					24.5				
7.0					25.0				
7.5					25.5				
8.0	6	13.3	0.25	2	26.0				
8.5	2	4.4	0.30	3	TOTAL	45	100	24.18	
9.0	5	11.1	0.26	2, 3					
9.5	1	2.2	0.39	2					
10.0	1	2.2	0.00	3					
10.5	1	2.2	0.51	2					
11.0									
11.5	2	4.4	0.00	3					
12.0	1	2.2	0.00	3					
12.5	2	4.4	0.48	3, 4					
13.0	1	2.2	0.00	4					
13.5	2	4.4	1.16	3, 4					
14.0	2	4.4	0.74	4					
14.5	2	4.4	1.54	4, 5					
15.0	1	2.2	1.70	4					
15.5	2	4.4	1.93	4, 5					
16.0	1	2.2	0.00	5					
16.5									
17.0	1	2.2	2.70	6					
17.5									
18.0	1	2.2	3.07	6					
18.5									

ELECTROFISHING CATCH	26.7/h	GILL NET CATCH	0.62/lift	TRAP NET CATCH	0/lift
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF WALLEYE									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0	2	2.9	2.58	3, 4
1.5					19.5	1	1.5	2.82	4
2.0					20.0	3	4.4	2.72	4, 5
2.5					20.5				
3.0					21.0				
3.5					21.5	1	1.5	3.67	4
4.0					22.0	1	1.5	3.62	5
4.5					22.5				
5.0					23.0				
5.5					23.5	1	1.5	4.76	5
6.0					24.0				
6.5					24.5				
7.0					25.0	1	1.5	4.53	7
7.5					25.5				
8.0					26.0				
8.5					TOTAL	68	100	36.20	
9.0	1	1.5	0.00	1					
9.5	2	2.9	0.26	1					
10.0									
10.5	1	1.5	0.35	1					
11.0	3	4.4	0.24	1					
11.5	6	8.8	0.41	1					
12.0	8	11.8	0.58	1					
12.5	5	7.4	0.30	1					
13.0	4	5.9	0.52	1					
13.5	9	13.2	0.84	1					
14.0	6	8.8	0.87	1, 2					
14.5	4	5.9	0.96	2					
15.0	4	5.9	1.08	2					
15.5	3	4.4	1.21	2, 3					
16.0									
16.5	1	1.5	1.47	2					
17.0									
17.5									
18.0									
18.5	1	1.5	2.42	3					
ELECTROFISHING CATCH	15.3/h			GILL NET CATCH	5.5/lift		TRAP NET CATCH	0.2/lift	

Back-calculated lengths-at-age for bluegill, largemouth bass, and walleye from Winona Lake in 2005.

Bluegill Intercept = 0.8	Year	Number	Back Calculated Length (inches) at Each Age				
	Class	Aged	I	II	III	IV	V
	2004	19	1.9				
	2003	19	1.6	3.4			
	2002	42	1.9	3.7	5.6		
	2001	14	1.8	3.9	6.5	7.5	
	2000	1	1.6	4.3	6.7	7.6	8.0
	Average Length		1.8	3.7	6.0	7.5	0
	Standard Deviation		0.118	0.265	0.607	0	0

Largemouth bass Intercept = 0.8	Year	Number	Back Calculated Length (inches) at Each Age								
	Class	Aged	I	II	III	IV	V	VI	VII	VIII	IX
	2004	8	3.0								
	2003	12	3.9	7.9							
	2002	9	3.7	8.1	10.3						
	2001	7	4.2	10.2	12.6	13.9					
	2000	3	5.0	9.8	12.8	13.9	15.0				
	1999	2	4.3	10.1	13.1	16.1	16.8	17.4			
	1998	0	0	0	0	0	0	0	0		
	1997	1	2.9	9.9	13.3	16.3	18.1	18.7	19.0	19.2	
	1996	1	5.4	9.7	13.2	15.8	17.2	18.4	18.8	19.3	20.1
	Average Length		4.0	9.0	11.9	13.9	15.0	0	0	0	0
	Standard Deviation		0.746	1.1616	1.3476	0.0596	0	0	0	0	0

Walleye
Intercept = 2.2

Year Class	Number Aged	Back Calculated Length (inches) at Each Age						
		I	II	III	IV	V	VI	VII
2004	41	11.2						
2003	13	10.7	13.8					
2002	3	11.9	14.9	17.2				
2001	4	8.8	14.3	17.4	19.3			
2000	4	8.8	14.8	18.1	19.7	20.8		
1999	0	0	0	0	0	0	0	
1998	1	8.2	14.6	18.7	21.5	22.9	24.3	24.8
Average Length		10.3	14.4	17.6	19.5	20.8	0	0
Standard Deviation		1.388	0.521	0.502	0.332	0	0	0

Locations of gear types in Winona Lake given in decimal degrees.

GILL NETS				TRAP NETS				ELECTROFISHING			
1 N	41.21776879	W	-85.82596251	1 N	41.22743011	W	-85.83934137	1 N		W	
2 N	41.23144805	W	-85.82603761	2 N	41.23056829	W	-85.83016285	N	41.21581078	W	-85.82232007
3 N	41.22477472	W	-85.83614417	3 N	41.21495247	W	-85.82196602	2 N	41.22226954	W	-85.82365044
4 N	41.22902334	W	-85.84274241	4 N	41.21509194	W	-85.83121427	N	41.22572958	W	-85.82631656
5 N	41.21930838	W	-85.83239981	5 N	41.22255385	W	-85.82295307	3 N	41.22830451	W	-85.82344123
6 N	41.22542918	W	-85.82706221	6 N	41.22541308	W	-85.83612272	N	41.23113155	W	-85.82580158
7 N	41.22932911	W	-85.83478161								
8 N	41.22718871	W	-85.84293553								