

## STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-5

Study No.: 230646

Title: Inland creel surveys

Period Covered: October 1, 2003 to September 30, 2004

**Study Objective:** To provide a consistent series of guidelines, data collection methods, and timely analysis to fisheries managers and research biologists conducting access point creel surveys on inland waters.

**Summary:** Winter surveys were conducted on lakes: Crystal, Green, and Manistique. Open water surveys were conducted on lakes: Grand and Long, and Peavy Pond; and rivers: Upper Grand, Lower Grand, Rogue, Escanaba, Kalamazoo, Tahquamenon, and Manistee. General survey dates are given in Table 1. All lake and river sites were surveyed to estimate angling pressure, harvest and catch by species. In addition, Grand, Long and Manistique lakes, Peavy Pond, and Tahquamenon River were surveyed to evaluate the walleye fishery. Crystal and Green lakes, Upper Grand, Lower Grand, Rogue, Escanaba, Kalamazoo (salmon, steelhead, and warmwater fishery), and Manistee rivers were surveyed to evaluate the trout fishery.

Effort and catch estimates were calculated for summer 2002 fisheries on Leelanau Lake and Muskegon Lake, winter 2002-2003 fisheries on Leelanau Lake and Muskegon Lake.

To fulfill the objective of this study and to aid in the DNR Fish Division's creel survey design, a creel survey design and scheduling computer program, named as Creel Survey Designer, has been completed. This program will be used for the future creel survey design for both inland and Great Lakes waters.

An inland creel survey estimation computer program has also been finished. This program is capable of reading in or querying creel survey data stored in plain text, Excel (.xls), dbase (.db), and Access database (.mdb) formats. The calculations of catch rate, effort and catch estimates are based on Lockwood et al. (1999) multiple-day estimation methods. The output from the program includes detailed interview and count summary for each survey by site, mode, month, and day types, as well as monthly catch and effort estimates by species.

**Findings:** Jobs 1 through 7 were scheduled for 2003-04, and progress is reported below.

**Job 1. Title: Examine creel survey sites.**—Crystal, Green, and Manistique lakes and Upper Grand, Lower Grand, and Rogue rivers were examined during previous segment (Su and Lockwood 2003). Grand Lake and Long Lake were examined with field personnel. Field personnel examined Peavy Pond, Escanaba, Kalamazoo, Tahquamenon, and Manistee rivers. Each site sampled during current segment was examined to determine appropriate locations for counting and interviewing anglers, and sampling methods.

**Job 2. Title: Sampling intensity, techniques, and proposed level of statistical significance.**—Statistical significance of 75% or greater was considered appropriate by all unit managers conducting surveys. Error bounds (2 SE) were calculated for each estimate and provided statistical significance, depending on distribution shape and  $N \geq 10$ , of 75% to 95% (Dixon and Massey 1957).

Rates of precision (mean/2 SE) were not predetermined for any of the surveys. Unless otherwise noted, all estimates in this report were  $\pm 2$  SE.

Design and estimation methods used for surveys given in this report followed the multiple-day period (Lockwood et al. 1999). Survey planning in each instance followed general funding and supervisory procedures given in Lockwood (2000a). Survey design naming conventions followed those given Lockwood (2000b).

**Job 3. Title: Prepare stratified-random schedules.**—Schedules were prepared and distributed to appropriate personnel. Random numbers used in schedule preparation were derived from the dBase IV (software) random number function or tables of random numbers found in Arkin and Colton (1962).

General information for surveys given in this report is listed in Table 1 and illustrated on Figures 1 through 7. Work shifts and expansion values for these surveys are available in a database file. Instructions for these surveys are available on separate documents.

**Job 4. Title: Train creel clerks.**—A two-day training session was given to clerks. Written instructions were prepared for all surveys conducted during current segment. Management Unit personnel provided additional on-site training for clerks. Training descriptions for surveys conducted during previous segments were given in Lockwood (2000a).

**Job 5. Title: Supervise count and interview data processing, and quality control.**—Count and interview data from current segment surveys were processed at the Institute for Fisheries Research. Additional range checking of all data was done at the Institute for Fisheries Research.

**Job 6. Title: Calculate and distribute catch and pressure estimates.**—Effort and catch estimates were calculated for summer 2002 fisheries on Muskegon Lake and Leelanau Lake, and for winter 2002~2003 fisheries on Muskegon Lake and Leelanau Lake.

*Leelanau Lake, summer 2002*— Anglers fished a total of  $106,415 \pm 14,876$  hours (Table 2). A total of  $14,898 \pm 2,627$  fish were harvested. Walleye were the predominate fish harvested ( $10,165 \pm 2,017$ ), followed by yellow perch ( $3,050 \pm 1,589$ ) and rock bass ( $631 \pm 405$ ).

*Leelanau Lake, winter 2002 through 2003* — Anglers fished a total of  $19,068 \pm 4,769$  hours (Table 3). A total of  $2,530 \pm 1,348$  fish were harvested. Yellow perch were the predominate fish harvested ( $1,748 \pm 1,295$ ), followed by walleye  $480 \pm 268$  and lake trout ( $206 \pm 214$ ).

*Muskegon Lake, summer 2002*— Anglers fished a total of  $122,396 \pm 18,557$  hours (Table 4). A total of  $85,460 \pm 14,790$  fish were harvested. Bluegill and yellow perch were the predominate fish harvested  $34,807 \pm 9,812$  and  $33,950 \pm 10,427$ , respectively, followed by pumpkinseed sunfish ( $9,791 \pm 3,154$ ) and walleye ( $1,686 \pm 721$ ).

*Muskegon Lake, winter 2002 through 2003* — Anglers fished a total of  $85,759 \pm 16,353$  hours (Table 5). A total of  $95,390 \pm 21,711$  fish were harvested. Yellow perch were the predominate fish harvested ( $49,286 \pm 12,158$ ), followed by bluegill ( $43,773 \pm 17,823$ ).

**Job 7. Title: Prepare annual report.**—This report was prepared on schedule.

**Literature Cited:**

- Arkin, H., and R. R. Colton. 1962. Tables for statisticians, second edition. Barnes and Noble, Inc., New York, New York.
- Dixon, W. J., and F. J. Massey, Jr. 1957. Introduction to statistical analysis, second edition. McGraw-Hill Book Company, Inc., New York, New York.
- Lockwood, R. N. 2000a. Conducting roving and access site angler surveys. Chapter 14 *in* Schneider, James C. (ed.) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.
- Lockwood, R. N. 2000b. Sportfishing angler surveys on Michigan Inland waters, 1993-99. Michigan Department of Natural Resources, Fisheries Technical Report 2000-3, Ann Arbor.
- Lockwood, R. N., D. M. Benjamin, and J. R. Bence. 1999. Estimating angling effort and catch from Michigan roving and access site angler survey data. Michigan Department of Natural Resources, Fisheries Research Report 2044, Ann Arbor.
- Su, Z., and R. N. Lockwood. 2003. Inland creel surveys, progress report, study 646. Michigan Department of Natural Resources, Federal Aid in Sport Fish Restoration, Annual Reports for Projects F-81-R-2, F-80-R-2, and F-80-R-3. [http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrhome/FederalAid/FRI\\_F81R4/Study646.pdf](http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrhome/FederalAid/FRI_F81R4/Study646.pdf)

**Prepared by:** Zhenming Su

**Date:** September 30, 2004

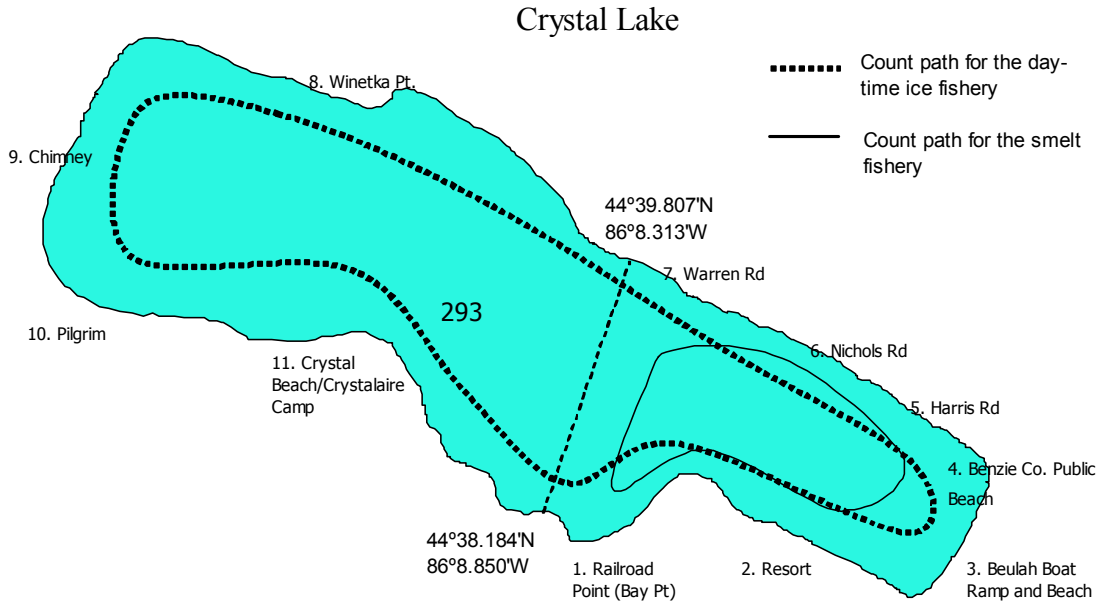


Figure 1.—Crystal Lake map with markers used as starting points for interviewing and counting, as well as count path for both day-time fishery and night smelt fishery for winter 2003-2004 creel survey. Site code is 293.

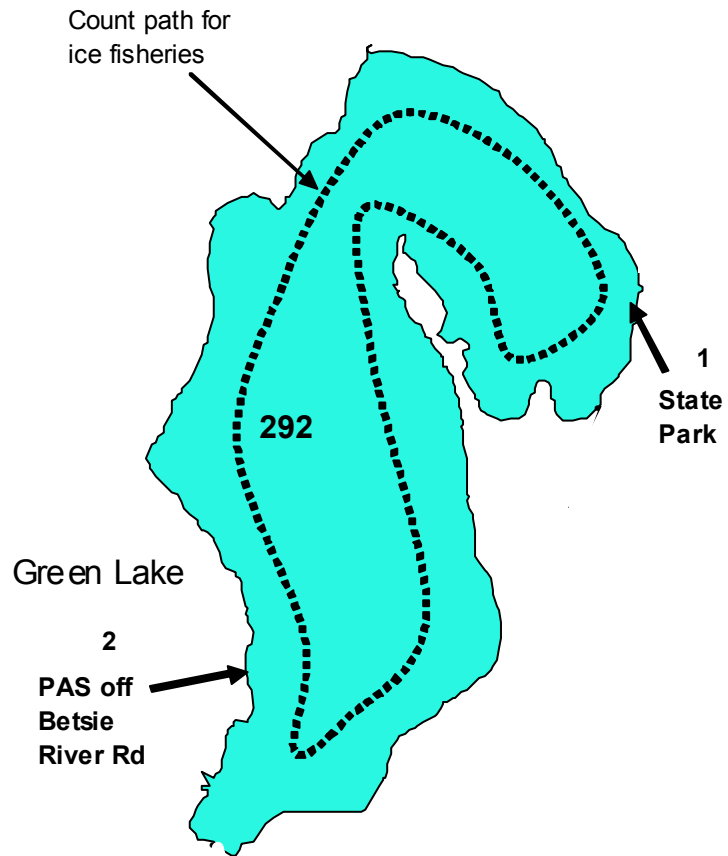


Figure 2.—Green Lake map with markers used as starting points for interviewing and counting, as well as count path for winter 2003-2004 creel survey. Site code is 292.

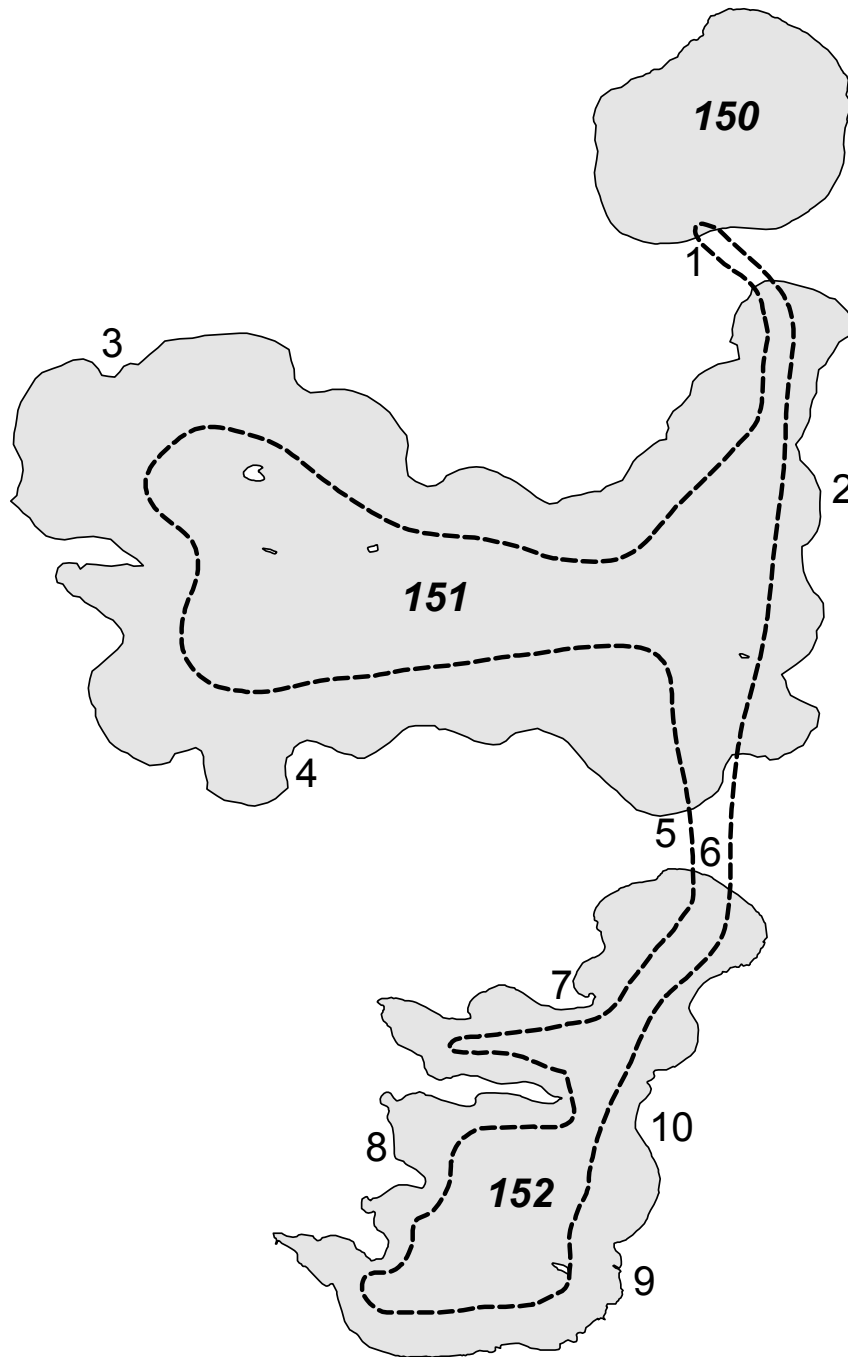


Figure 3.—Manistique Lake map with markers used as starting points for interviewing and counting, as well as count path for winter 2003-2004 angler survey.

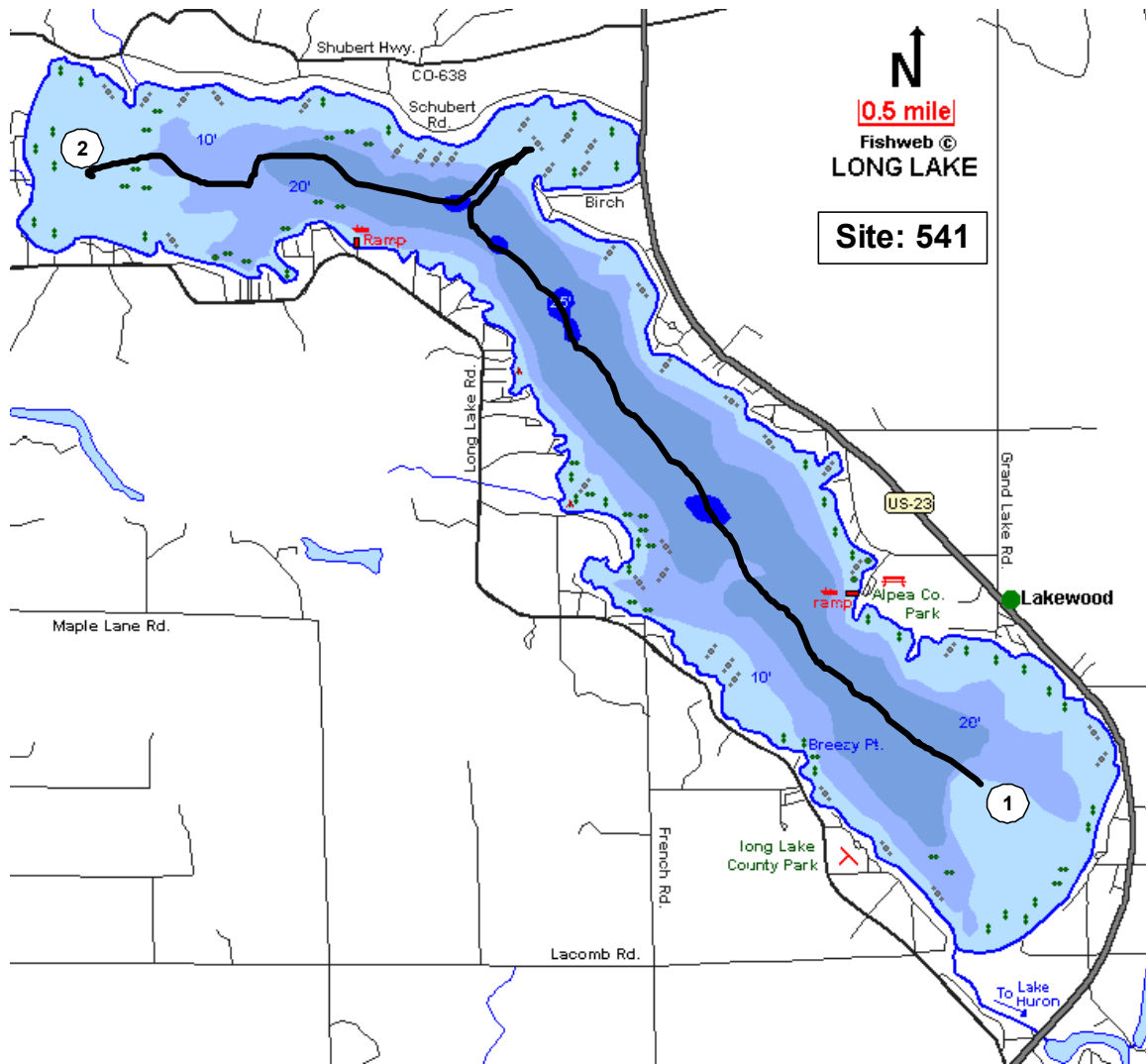


Figure 4.—Long Lake map with markers used as starting points for interviewing and counting, as well as count path used during summer 2004 angler survey.

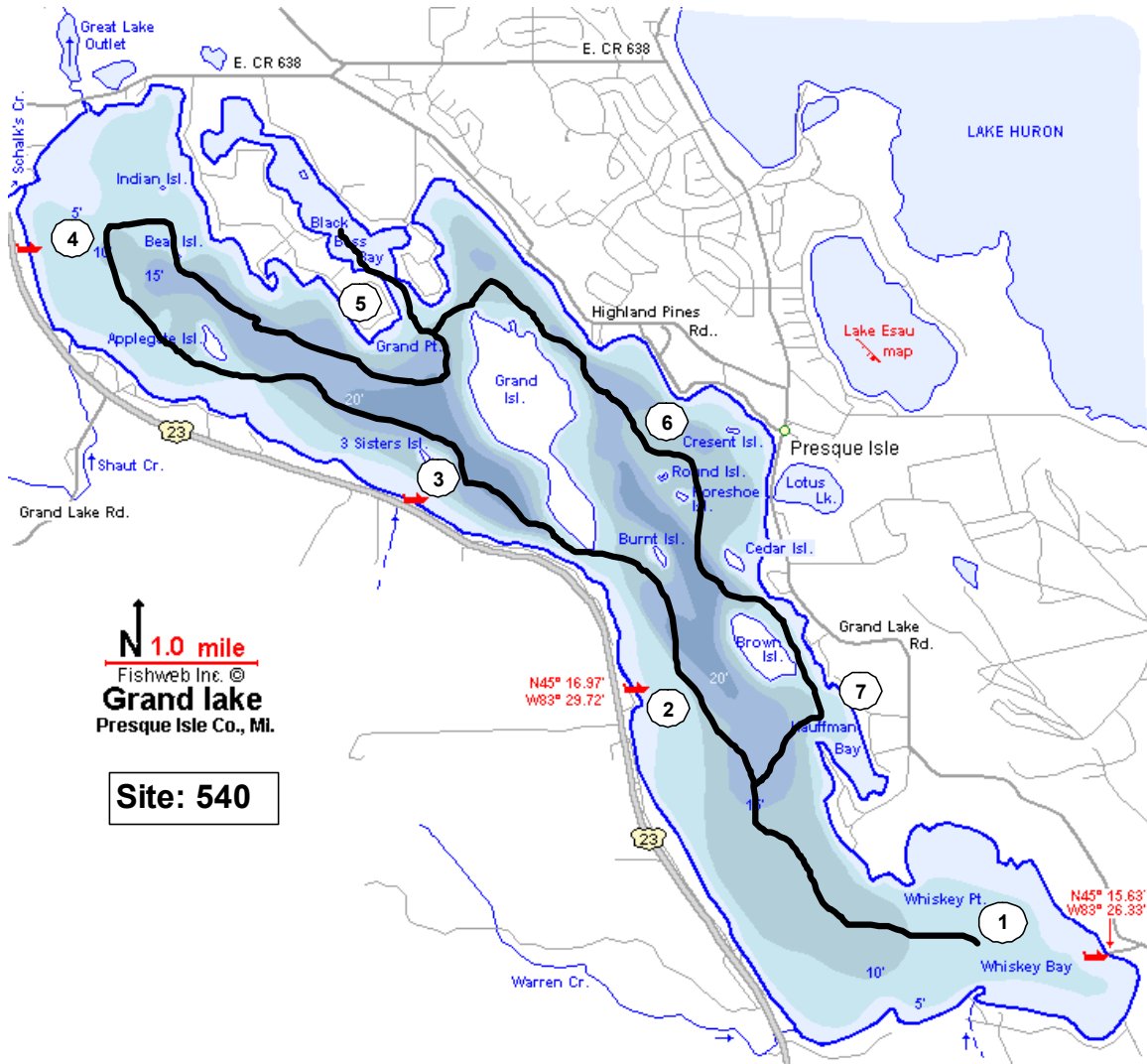


Figure 5.—Grand Lake map with markers used as starting points for interviewing and counting, as well as count path used during summer 2004 angler survey.



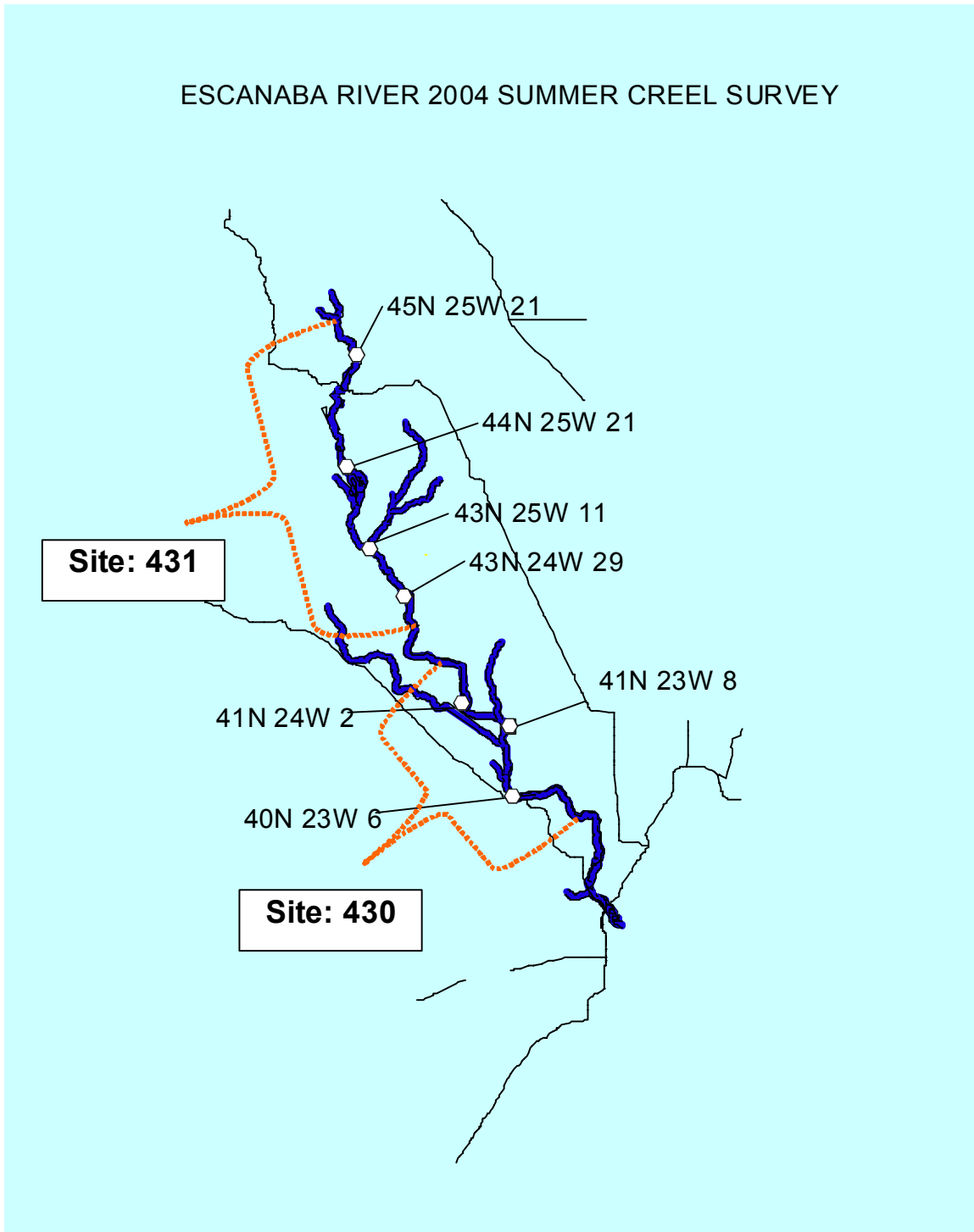


Figure 6.—Escanaba River map with markers used as starting points for interviewing and counts during summer 2004 angler survey.

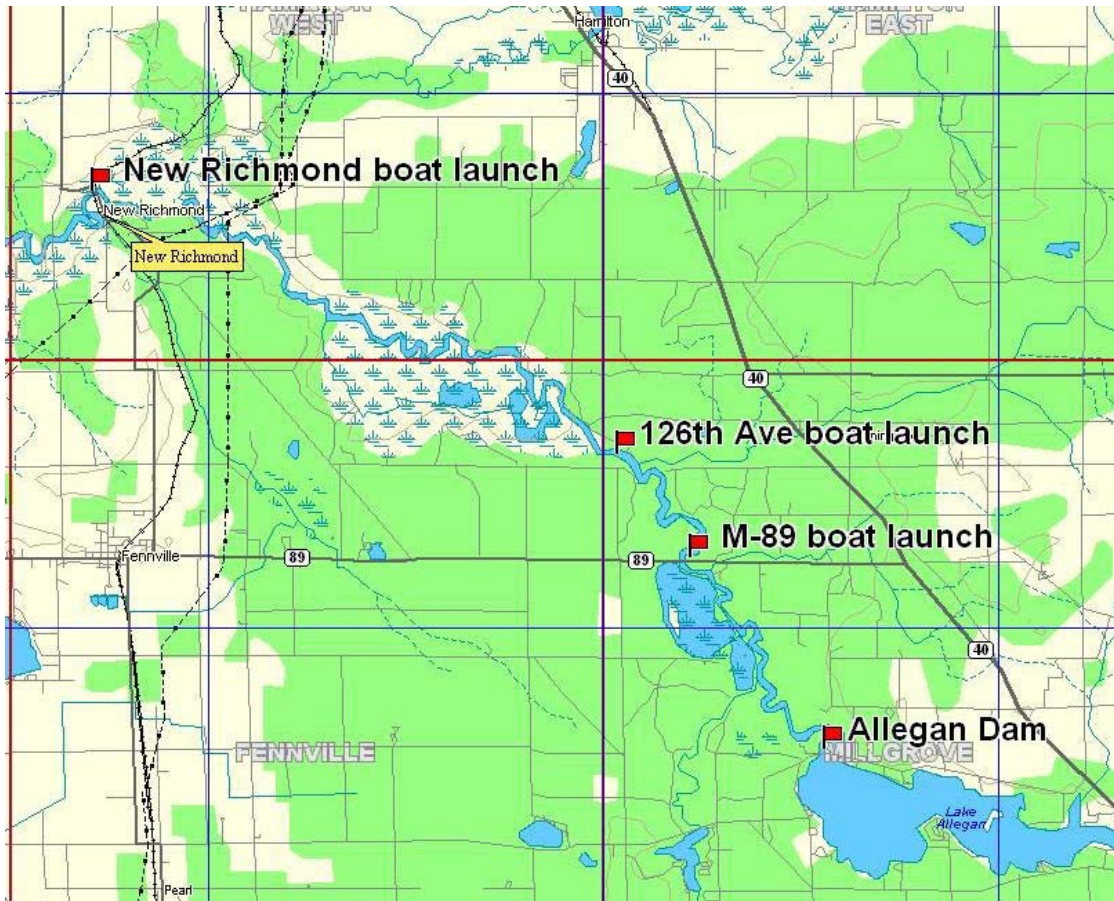


Figure 7.—Kalamazoo River map with markers used as starting points for interviewing and counts during summer 2004 angler survey.

Table 1.–Inland creel surveys conducted from October 1, 2003 to October 31, 2004.

Water body	County	Sites	Survey period	Count method	Interview method	Clerk time	Notes
Crystal Lake	Benzie	Crystal Lake	1/1/03–3/28/04	progressive	Roving	1	Three shifts. Evening shift surveyed smelt fishery
Green Lake	Traverse	Green Lake	1/1/03–3/28/04	progressive	Roving	1	Three shifts. Evening shift surveyed smelt fishery
Manistique Lake	Luce, Mackinac	Manistique Lake	1/1/03–3/28/04	progressive	Roving	1	
Grand Lake	Alpena	Grand Lake	4/23–10/31/04	N/A	Roving	1	Only make interviews
Long Lake	Alpena	Long Lake	4/23–10/31/04	N/A	Roving	1	Only make interviews
Grand & Long lakes	Alpena	Grand & Long Lake	4/23–10/31/04	progressive	N/A	1	Only make counts
Peavy Pond	Iron	Peavy Pond	5/8–10/31/04	progressive	Roving	1	
Escanaba River	Delta, Marquette	Burnt Camp - Boney Falls Dam; Swimming Hole - Gwinn	4/10–10/31/04	progressive	Access	1	
Kalamazoo River	Allegan	Allegan Dam, M-89 Access site, 126th Avenue access, New Richmond Access site	4/3–10/31/04	progressive	Access	1/2	Share time with Great Lakes survey
Tahquamenon River	Chippewa	Boat launch at mouth - Base of lower falls	5/1–10/30/04	progressive	Roving	1/2	Share time with Great Lakes survey
Little Manistee River	Lake, Mason, Manistee	Driftwood Valley Campground - Mouth of River	6/1–8/31/04	progressive	Counting as interviewing	1/3	Share time with Great Lakes survey

Table 2.—Total estimated boat angler harvest, catch-and-released fish, catch per hour and fishing pressure, Lake Leelanau, Leelanau County. Period is from April 27, 2002 through September 30, 2002. Two standard errors are given in parentheses.

Species	C/H	April-May	June	July	August	September	Season
Harvested							
Brook trout	0.0003 (0.0005)	27 (55)	0 (0)	0 (0)	0 (0)	0 (0)	27 (55)
Lake trout	0.0023 (0.0022)	60 (73)	29 (59)	160 (217)	0 (0)	0 (0)	249 (236)
Smallmouth bass	0.0045 (0.0023)	120 (121)	105 (98)	0 (0)	72 (87)	177 (161)	474 (240)
Walleye	0.955 (0.0232)	139 (83)	2,023 (861)	3,154 (1,096)	3,242 (1,193)	1,607 (832)	10,165 (2,017)
Yellow perch	0.0287 (0.0155)	0 (0)	60 (79)	148 (172)	513 (457)	2,329 (1,510)	3,050 (1,589)
Northern pike	0.0015 (0.0012)	34 (50)	57 (82)	71 (83)	0 (0)	0 (0)	162 (127)
Bluegill	0.0009 (0.0011)	0 (0)	19 (39)	0 (0)	0 (0)	73 (106)	92 (113)
Largemouth bass	0.0002 (0.0004)	0 (0)	23 (45)	0 (0)	0 (0)	0 (0)	23 (45)
Rock bass	0.0059 (0.0039)	6 (12)	10 (19)	145 (167)	46 (61)	424 (363)	631 (405)
White sucker	0.0002 (0.0005)	0 (0)	25 (50)	0 (0)	0 (0)	0 (0)	25 (50)
Total	0.1400 (0.0315)	386 (180)	2,351 (880)	3,678 (1,145)	3,873 (1,282)	4,610 (1,772)	14,898 (2,627)
Released							
Lake trout	0.0023 (0.0035)	0 (0)	80 (161)	166 (332)	0 (0)	0 (0)	246 (369)
Smallmouth bass	0.0580 (0.0162)	835 (415)	2,574 (1,093)	794 (443)	554 (315)	1,418 (743)	6,175 (1,488)
Largemouth bass	0.0012 (0.0011)	23 (27)	15 (29)	49 (98)	23 (46)	23 (28)	133 (119)
Walleye	0.2488 (0.0611)	189 (114)	4,756 (2,280)	10,489 (3,464)	6,103 (2,287)	4,936 (2,469)	26,473 (5,342)
Northern pike	0.0263 (0.0090)	277 (164)	705 (406)	619 (395)	306 (199)	894 (608)	2,801 (870)

Table 2.—Continued.

Species	C/H	April-May	June	July	August	September	Season
Yellow perch	0.0179 (0.0078)	28 (30)	33 (66)	816 (519)	228 (172)	795 (565)	1,900 (790)
Total	0.3545 (0.0728)	1,352 (462)	8,163 (2,567)	12,933 (3,568)	7,214 (2,323)	8,066 (2,708)	37,728 (5,681)
Total Catch	0.4945 (0.0908)	1,738 (495)	10,514 (2,713)	16,611 (3,747)	11,087 (2,654)	12,676 (3,236)	52,626 (6,258)
Angler Hours		9,716 (3,293)	25,693 (8,026)	32,009 (6,900)	19,276 (5,384)	19,721 (8,333)	106,415 (14,876)
Angler Trips		3,083 (1,415)	9,151 (2,585)	13,033 (7,415)	5,352 (1,977)	6,256 (3,472)	36,875 (8,923)

Table 3.—Total estimated harvest, catch-and-released fish, catch per hour and fishing pressure, Lake Leelanau, Leelanau County. Period is from January 1 through March 31, 2003. Two standard errors are given in parentheses.

Species	C/H	January	February	March	Season
Harvested					
Lake trout	0.0108 (0.0116)	0 (0)	119 (127)	87 (173)	206 (214)
Lake herring	0.0041 (0.0082)	0 (0)	78 (155)	0 (0)	78 (155)
Walleye	0.0252 (0.0154)	28 (54)	245 (186)	207 (186)	480 (268)
Yellow perch	0.0917 (0.0717)	453 (549)	189 (173)	1,106 (1,160)	1,748 (1,295)
Northern pike	0.0009 (0.0016)	0 (0)	14 (29)	4 (8)	18 (30)
Total	0.1327 (0.0781)	481 (551)	645 (324)	1,404 (1,187)	2,530 (1,348)
Released					
Walleye	0.0212 (0.0150)	62 (94)	178 (176)	164 (178)	404 (268)
Northern pike	0.0018 (0.0030)	28 (56)	0 (0)	6 (10)	34 (57)
Muskellunge	0.0044 (0.0088)	84 (167)	0 (0)	0 (0)	84 (167)
Yellow perch	0.0031 (0.0062)	60 (117)	0 (0)	0 (0)	60 (117)
Total	0.0305 (0.0194)	234 (231)	178 (176)	170 (178)	582 (341)
Total Catch	0.1632 (0.0835)	715 (597)	823 (368)	1,574 (1,200)	3,112 (1,390)
Angler Hours		6,628 (2,829)	6,486 (1,735)	5,954 (3,425)	19,068 (4,769)
Angler Trips		2,122 (937)	1,933 (778)	2,243 (1,703)	6,298 (2,094)

Table 4.—Total estimated boat and shore angler harvest, catch-and-released fish, catch per hour and fishing pressure, Lake Muskegon, Muskegon County. Period is from April 27, 2002 through November 30, 2002. Two standard errors are given in parentheses.

Species	C/H	April- May	June	July	August	September	October	November	Season
		Harvest							
Coho salmon	0.0007 (0.0010)	0 (0)	0 (0)	0 (0)	0 (0)	81 (115)	7 (14)	0 (0)	88 (116)
Chinook salmon	0.0077 (0.0066)	77 (85)	0 (0)	0 (0)	0 (0)	825 (782)	0 (0)	43 (86)	945 (791)
Rainbow trout	0.0001 (0.0002)	0 (0)	0 (0)	0 (0)	0 (0)	13 (26)	0 (0)	0 (0)	13 (26)
Brown trout	0.0022 (0.0038)	31 (45)	233 (465)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	264 (467)
Smallmouth bass	0.0013 (0.0015)	0 (0)	0 (0)	153 (182)	0 (0)	0 (0)	7 (14)	0 (0)	160 (183)
Walleye	0.0138 (0.0063)	61 (79)	140 (241)	464 (358)	68 (96)	393 (471)	35 (45)	525 (308)	1,686 (721)
Yellow perch	0.2774 (0.0950)	3,115 (2,205)	14,507 (7,409)	5,072 (2,018)	4,762 (3,447)	5,563 (5,703)	396 (525)	535 (471)	33,950 (10,427)
Northern pike	0.0048 (0.0027)	213 (236)	0 (0)	0 (0)	34 (68)	158 (145)	42 (44)	146 (124)	593 (314)
Muskellunge	0.0001 (0.0003)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	18 (36)	18 (36)
Black crappie	0.0163 (0.0112)	31 (61)	568 (649)	194 (261)	0 (0)	26 (38)	728 (1,014)	448 (524)	1,995 (1,341)
Bluegill	0.2844 (0.0910)	3,633 (3,302)	7,320 (3,856)	9,116 (3,885)	4,314 (2,243)	6,834 (6,796)	3,267 (2,011)	323 (396)	34,807 (9,812)
Largemouth bass	0.0009 (0.0011)	0 (0)	57 (112)	0 (0)	34 (68)	0 (0)	21 (32)	0 (0)	112 (135)
Pumpkinseed sunfish	0.0800 (0.0285)	942 (979)	3,653 (2,141)	2,935 (1,620)	949 (784)	274 (547)	1,016 (931)	22 (43)	9,791 (3,154)
Rock bass	0.0049 (0.0051)	142 (283)	93 (186)	0 (0)	34 (68)	329 (510)	0 (0)	0 (0)	598 (616)
Channel catfish	0.0024 (0.0021)	0 (0)	186 (224)	67 (96)	0 (0)	39 (49)	0 (0)	0 (0)	292 (249)
Drum	0.0010 (0.0013)	0 (0)	70 (105)	0 (0)	0 (0)	55 (110)	0 (0)	0 (0)	125 (152)
Common white sucker	0.0002 (0.0004)	0 (0)	23 (47)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	23 (47)
Other	0.0181 (0.0151)	0 (0)	0 (0)	0 (0)	579 (832)	493 (722)	0 (0)	1,138 (1,446)	2,210 (1,818)
Total	0.6982 (0.1606)	8,245 (4,108)	26,850 (8,669)	18,001 (4,693)	10,195 (4,189)	14,590 (8,952)	5,519 (2,494)	2,060 (879)	85,460 (14,790)

Table 4.—Continued.

Species	C/H	April- May	June	July	August	September	October	November	Season
		Released							
Chinook salmon	0.0001 (0.0002)	0 (0)	0 (0)	0 (0)	0 (0)	13 (26)	0 (0)	0 (0)	13 (26)
Smallmouth bass	0.0588 (0.0457)	859 (892)	403 (333)	5,080 (5,384)	473 (296)	325 (273)	28 (45)	29 (42)	7,197 (5,482)
Largemouth bass	0.0386 (0.0183)	1,247 (947)	380 (381)	803 (597)	886 (775)	586 (641)	782 (1,452)	37 (74)	4,721 (2,127)
Walleye	0.0083 (0.0072)	396 (792)	47 (67)	329 (311)	34 (67)	106 (137)	36 (73)	72 (70)	1,020 (873)
Northern pike	0.0195 (0.0078)	527 (524)	263 (277)	471 (387)	135 (166)	364 (312)	250 (207)	377 (324)	2,387 (880)
Yellow perch	0.1711 (0.0624)	5,700 (5,166)	6,379 (3,164)	3,170 (1,378)	1,867 (1,122)	3,064 (2,811)	583 (706)	184 (227)	20,947 (6,950)
Total	0.3145 (0.0902)	8,729 (5,410)	7,472 (3,216)	9,853 (5,611)	3,974 (1,634)	4,951 (3,004)	1,679 (1,630)	1,837 (1,503)	38,495 (9,365)
Total Catch	1.0127 (0.2098)	16,974 (6,793)	34,322 (9,246)	27,854 (7,315)	14,169 (4,496)	19,541 (9,443)	7,198 (2,979)	3,897 (1,741)	123,955 (17,505)
Angler Hours		9,513 (2,781)	23,581 (5,808)	30,048 (6,314)	22,986 (5,055)	25,333 (15,221)	5,659 (1,622)	5,276 (1,779)	122,396 (18,557)
Angler Trips		2,346 (702)	5,974 (1,531)	7,715 (1,668)	4,942 (1,078)	6,579 (4,193)	1,612 (525)	1,336 (462)	30,504 (4,985)



Table 5.— Muskegon Lake winter 2003 combined shanty and open ice estimates. Total estimated harvest, catch-and-released fish, catch per hour and fishing pressure, Lake Muskegon, Muskegon County. Period is from January 4 through March 31, 2003. Two standard errors are given in parentheses.

Species	C/H	January	February	March	Season
			Harvest		
Walleye	0.0037 (0.0036)	146 (178)	98 (197)	76 (150)	320 (305)
Yellow perch	0.5747 (0.1792)	6,727 (4,160)	31,421 (9,768)	11,138 (5,924)	49,286 (12,158)
White perch	0.0002 (0.0004)	17 (34)	0 (0)	0 (0)	17 (34)
Black crappie	0.0012 (0.0017)	101 (144)	0 (0)	0 (0)	101 (144)
Bluegill	0.5104 (0.2295)	8,116 (7,170)	8,285 (7,072)	27,372 (14,705)	43,773 (17,823)
Rock bass	0.0221 (0.0284)	122 (165)	1,771 (2,407)	0 (0)	1,893 (2,413)
Total	1.1123 (0.3303)	15,229 (8,294)	41,575 (12,297)	38,586 (15,854)	95,390 (21,711)
			Released		
Smallmouth bass	0.0008 (0.0012)	21 (43)	44 (88)	0 (0)	65 (98)
Largemouth bass	0.0010 (0.0015)	86 (127)	0 (0)	0 (0)	86 (127)
White bass	0.0017 (0.0020)	0 (0)	148 (171)	0 (0)	148 (171)
Yellow perch	0.2610 (0.1000)	7,304 (4,975)	10,925 (4,771)	4,157 (2,786)	22,386 (7,435)
Total	0.2645 (0.1003)	7,411 (4,977)	11,117 (4,775)	4,157 (2,786)	22,685 (7,439)
Total catch	1.3768 (0.3749)	22,640 (9,673)	52,692 (13,192)	42,743 (16,097)	118,075 (22,950)
Angler hours		21,932 (10,129)	42,867 (10,594)	20,960 (7,253)	85,759 (16,353)
Angler trips		6,173 (2,873)	11,014 (2,764)	4,914 (1,749)	22,101 (4,353)