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THE 2013 SUMMER STREAM TROUT FISHERY IN SOUTHEAST MINNESOTA:

HISTORICAL CHANGES AND INFLUENCE OF ANGLING REGULATIONS AND INSTREAM HABITAT ENHANCEMENT PROJECTS[1]

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PROLOGUE: 2013 Angler Survey, a Detailed Examination

Southeast Minnesota maintains an exceptional recreational fishery for stream trout on over 800 miles of coldwater streams. These trout populations and the coldwater habitats that support them are managed in large part by the Minnesota Department of Natural Resources' Section of Fisheries for the recreational benefit and wise use of anglers, and more broadly, Minnesota citizens. A comprehensive trout stream resource plan was developed to guide regional management efforts in 2003, updated in 2010, and is anticipated to be updated again in 2015 (MN DNR 2003; 2010). This plan proposed specific action items for management that included: (1) periodic assessment of angler pressure, characteristics, attitudes, and satisfaction levels to track temporal changes [Goal 3.2 Angler Use and Angler Attitudes - Action items 22 and 23]; (2) implementation of a tiered angling regulations system [Goal 1.3 Fishing Regulations - Action item 6]; and (3) enhancement of instream habitat improvement projects to provide maximum benefits to trout and trout anglers [Goal 2.1 Instream Habitat Rehabilitation - Action items 9]. Success in achieving these goals for the benefit of the angling constituency can only be determined by the collection of information. Angler surveys to determine what angler groups use this resource and the benefits they derive from it are uncommon because such surveys are often costly to implement. In addition, time constraints often result in a basic summary of the major findings of such surveys with more detailed information simply reported in large data tables. Thus, such survey reports are often data rich but information poor.

Resources became available to conduct another angler creel survey on southeast Minnesota trout streams in 2013. This report presents a detailed examination of sociodemographic information collected in 2013. We present this information with the goals of (1) continuing to track sociodemographic trends among the southeast Minnesota trout angling constituency; (2) seizing the rare opportunity to examine patterns among sociodemographic variables collected in conjunction with two of the primary tools used to manage stream trout fisheries in southeast Minnesota: angling regulations and instream habitat enhancement; and (3) providing an easily accessible document for persons searching for this information and specifically interested in using it to evaluate future management actions on specific streams. We hope these findings will be used by stream scientists and managers, but are also hopeful that nonscientists, including nongovernmental organizations, decision makers, and the general public will find the information useful as well. We are especially hopeful that this information will be used during the next revision of the Fisheries Long-Range Plan for Trout Stream Resource Management in Southeast Minnesota.

CHAPTER 1: Sociodemographics, Pressure, Catch, Harvest and Satisfaction of Anglers Fishing 17 Southeast Minnesota Coldwater Streams during the 2013 Summer Season

Abstract.–Twenty four trout stream areas were surveyed across southeast Minnesota from April 1 to September 30, 2013 in a roving-roving creel survey. Five stream areas were randomly selected within four strata based on each of four angling regulation types: catch and release, a 12-16 inch protected slot with only use of artificial flies and lures, a 12-16 inch protected slot that allowed all angling gears (including live bait) and areas under general trout angling regulations (five trout daily limit only one of which can be longer than 16 inches). An additional four general regulation areas were also surveyed to increase the sample of those regulations which were more common among southeast Minnesota streams than the other three regulation types. Anglers were enumerated and interviewed while a letter and postage paid envelope were left on their vehicles to return to provide completed trip length information. Summer anglers consisted of mostly males (90.1%) using a variety of bait (27.3%), fly (42.8%), lure (24.2%), and mixed method (5.8%) gear types. Mean angler trip length was 3.11 hours with a catch rate of 1.45 trout/hour. An estimated 56,192 trout were caught in 44,673 angler-hours. This creel provides information that will allow better management of the trout stream resources of southeast Minnesota.

INTRODUCTION

Managing fishery resources requires information on the three broad components of a fishery: the fish populations, their habitat, and the people that use them (Krueger and Decker 1999). Fish populations and fish habitat conditions are often routinely assessed, but periodic monitoring of the people component, through sociodemographic assessments, are rare. This is often due to the high cost of collecting such information. Nevertheless, periodic monitoring of sociodemographic information is needed for a variety of reasons.

Sociodemographic information can be used to identify and ensure angler needs and desires are addressed by management actions (Knuth and McMullin 1996). For example, sociodemographic information may be used to identify distinct user groups within a fishery (e.g., anglers that use a specific gear type). This information might then be used to allocate different parts of a resource (e.g., different streams) to different user groups so that conflicts among them can be reduced (Noble and Jones 1999). Alternatively, sociodemographic information may be used to identify changes in participation among different user groups, such as groups based on gender, residence or age category. This information could then be used to target communication efforts to a specific user group to reinvigorate their participation.

Periodic assessment of other fundamental angler characteristics are also needed to monitor how anglers use a resource and what benefits they derive. Common measures include angler pressure, catch rate, catch and harvest. Angler pressure can be used to track angler use of a resource over time or to identify certain parts of a resource, such as a specific stream, that are highly valued. This information can then be used to prioritize management efforts either to streams with high use or alternatively, to streams with less use that might represent locations that could benefit from enhanced management. Catch rates, catch, and harvest represent tangible, quantifiable benefits that anglers receive from a fishery resource. Periodic monitoring of these factors can help inform success or failure of a fishery management program.

Sociodemographic and associated information on angler pressure, catch and harvest can be collected via angler interviews during creel surveys, mail surveys, or telephone surveys (Knuth and McMullin 1996). Southeast Minnesota supports a coldwater stream fishery for Brown Trout *Salmo trutta*, Brook Trout *Salvelinus fontinalis*, and Rainbow Trout *Oncorhynchus mykiss* (Thorn et al. 1997; Snook and Dieterman 2006). Sporadic sociodemographic and fishery related information has been collected on this coldwater fishery through past creel and mail surveys (e.g., Bushong 1996; Weiss 1999; 2000; Vlaming and Fulton 2003). Collectively, these surveys have historically indicated a popular fishery with over 28,000 anglers estimated to have spent over 31,000 days fishing these streams in 2001 (Vlaming and Fulton 2003). The most recent survey of the summer angling season was completed almost 10 years ago in 2005 and estimated that over 190,000 angler-hours were expended on 42 miles of the most popular trout streams (Snook and Dieterman 2006). Further, trout anglers were mostly male (90%), used a variety of gear types, fished for an average of 3.77 hours, and caught about 1.1 trout per hour.

Management of this stream trout fishery in southeast Minnesota is guided by a Long-Range Plan for Trout Stream Resource Management, 2010-2015 (MN DNR 2010) (LRP). The LRP specifically recommends assessment of angler demographics and attitudes to monitor trends and to aid sociodemographic evaluations of management actions. In 2013, funding became available to complete another recreational angler creel survey to fulfill Goals and Action Items identified in the LRP [Specifically: Goal 3.2 Angler Use and Angler Attitudes; Action Items 22 and 23: Periodically assess angling pressure and success to answer specific management questions.] The overall goal of this creel survey was to gather sociodemographic and fishery related information (i.e., angler pressure, catch, and harvest) on a selected group of coldwater trout streams in southeast Minnesota during the summer angling season in 2013 to monitor temporal trends. Specific objectives included:

1. Assess angler characteristics of age, gender, residency, gear choice, target species and fishing experience.
2. Determine why anglers were motivated to fish each stream site.
3. Estimate resource benefits in terms of angler trip length, pressure, catch rate, catch and harvest.
4. Determine angler satisfaction with their overall fishing experience, size of trout caught, and numbers of trout caught.

METHODS

Sampling Design - A roving-roving creel survey was conducted from April 1 to September 30, 2013 following methods in Pollock et al. (1994). Groups of streams were randomly selected from within four strata to simultaneously address several objectives identified in the LRP [see subsequent chapters in this report]. A balanced study design was followed with five stream areas randomly selected within each of four angling regulation types: catch-and-release (artificial lures and flies only), slot (no gear restrictions), slot (artificial lures and flies only), and general trout regulations. Funding and logistics allowed the hiring of four creel clerks which allowed an additional four stream areas (general trout regulation areas) to be surveyed as well (Appendix 1). Five streams (Hay Creek, South Branch Root River, South Fork Root River, Trout Run and West Indian Creek) contained two sampling areas, whereas one stream (Middle Branch Whitewater River) contained three sampling areas. Each area was considered an individual replicate, because fewer than 10% of adult brown trout typically move among stream reaches during the summer season (Dieterman and Hoxmeier 2011). The 24 total stream areas were assigned to the four clerks (six areas each) (Table 1-1). The six areas for each clerk were then grouped into two sets of three, based on their proximity to each other to reduce travel time (Figure 1-1). Because all 24 stream areas for this creel survey were randomly selected, with additional sampling effort given to more abundant general regulation streams, sociodemographic information was assumed to represent all trout anglers fishing southeast Minnesota.

TABLE 1-1. Selected trout streams as assigned for each of four creel clerks in the southeast Minnesota angling creel survey conducted from April 1 to September 30, 2013. LTM = a site specifically designated for long-term monitoring of fish populations and aquatic habitat features.

Clerk	Area		Stream (area)	Length of route on stream (feet)	Specific Area Description
1	A	1)	Hay Creek (State Land)	3,500	State Forest Unit
		2)	Hay Creek (Upper)	4,300	Upper Habitat Improvement project
		3)	West Indian Creek (LTM)	3,500	LTM station
	B	1)	North Branch Whitewater River	3,500	Upstream of Fairwater
		2)	Middle Branch Whitewater River (Quincy)	3,500	Quincy bridge
		3)	West Indian Creek (County 4)	2,500	Downstream of Cty 4 bridge
2	C	1)	Pine Creek (Andersons)	3,500	Downstream of Anderson's
		2)	Middle Branch Whitewater River (County 9)	3,500	Downstream of Cty 9 bridge
		3)	Middle Branch Whitewater River (Crow Springs)	3,200	Crow Springs
	D	1)	Trout Run (Lohman's)	3,600	Lohman's slab bridge
		2)	Trout Run (Bucksnort)	4,000	Downstream of Bucksnort dam
		3)	Mill Creek (City Property)	3,300	City Park
3	E	1)	Willow Creek	2,900	Soland's
		2)	Forestville Creek (State Park)	3,500	State Park
		3)	South Branch Root River (State Park)	3,500	State Park
	F	1)	South Branch Root River (Lanesboro)	3,500	Downstream of Lanesboro dam
		2)	Camp Creek (Maust's)	4,000	Maust's pasture
		3)	Gribben Creek	3,500	Valley Rd to Dancer Rd
4	G	1)	South Fork Root River (Million Dollar)	3,500	Million Dollar bridge
		2)	South Fork Root River (LTM)	3,500	LTM station
		3)	Wisel Creek (Chickentown)	3,500	Chickentown bridge
	H	1)	West Beaver Creek	3,500	Skifton bridge
		2)	East Beaver Creek	3,500	State Park
		3)	Crooked Creek	3,500	Road side to mouth S. Fork Crooked

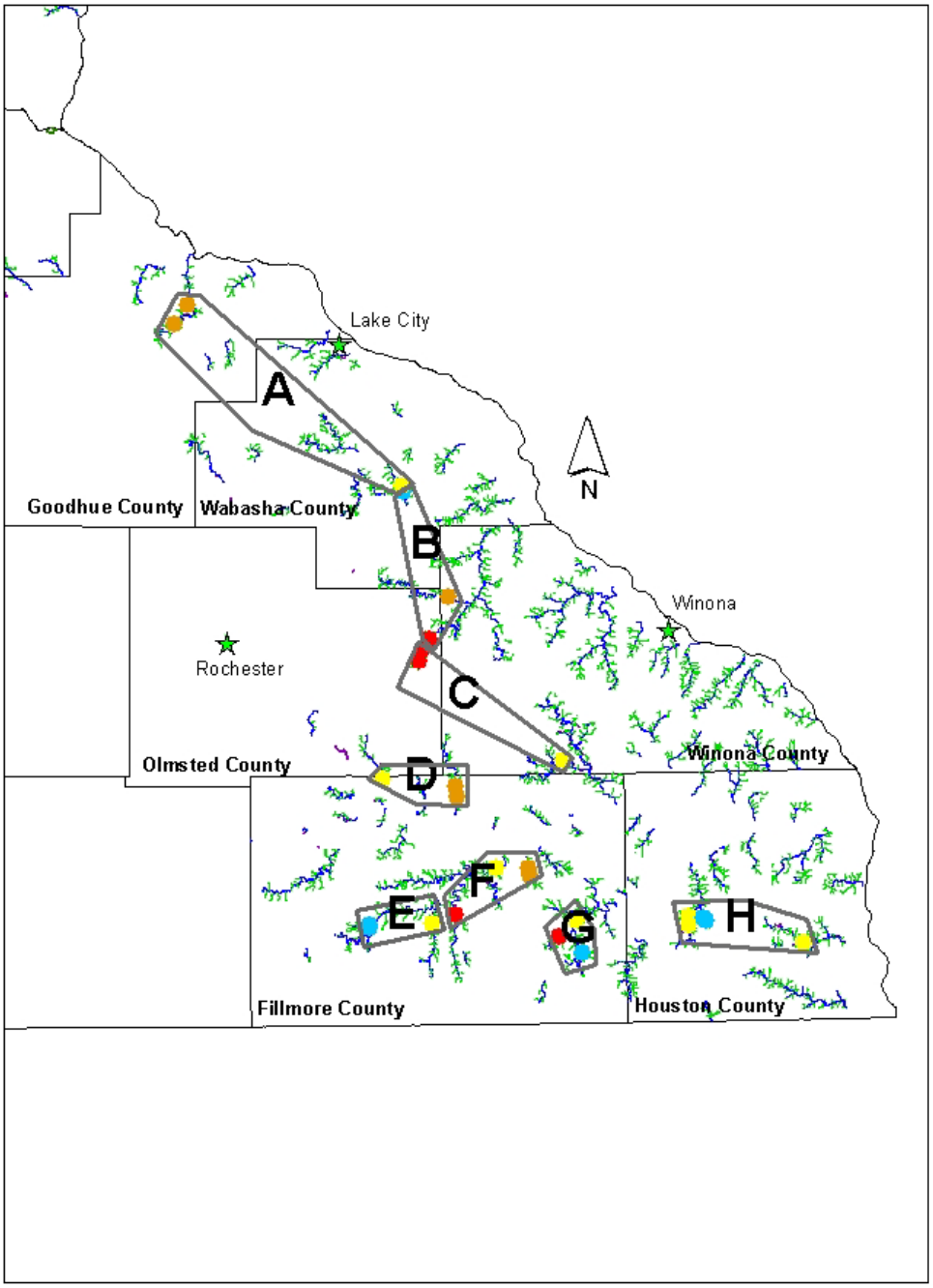

FIGURE 1-1. Map of all designated trout streams in southeast Minnesota in 2013 with selected trout stream areas (grouped into sets of three indicated by letters) surveyed in a summer creel survey, April 1 to September 30, 2013. Stream area colors denote angling regulation type with yellow = general trout regulations, blue = 12-16 inch protected slot all gear types allowed, gold = 12-16 inch protected slot artificial lures and flies only, and red = catch and release only. Area A (northwest to southeast) = Hay Creek (State), Hay Creek (Upper), West Indian Creek (LTM); Area B (north to south) = West Indian Creek (County 4), North Branch Whitewater, Middle Branch Whitewater (Quincy); Area C (northwest to southeast) = Middle Branch Whitewater (County 9), Middle Branch Whitewater (Crow Springs), Pine Creek; Area D (west to east) = Mill Creek, Trout Run (Lohman's), Trout Run (Bucksnort); Area E (west to east) = Forestville Creek (State Park), South Branch Root River (State Park), Willow Creek; Area F (west to east) = Camp Creek (Maust's), South Branch Root River (Lanesboro), Gribben Creek; Area G (north to south) = South Fork Root River (Million Dollar), South Fork Root River (Long-term monitoring site), Wisel Creek; Area H (west to east) = West Beaver Creek, East Beaver Creek, Crooked Creek.

Each clerk was responsible for sampling a set of three stream areas on a survey day. Days, time periods and travel routes were randomly selected. On each survey day, the creel clerk conducted 2-hour samples at each of their three stream areas along a randomly selected route. Day types were weekdays (WD) and weekend/holiday (WEH) strata. Creel clerks were given four randomly selected weekdays off during each two week pay period. Remaining WD and WEH were then randomly selected without replacement. For example, if a Saturday was randomly selected for the first set of three streams, then the clerk automatically sampled the remaining set of three stream areas on the following Sunday. Time periods were AM (6 am to 2 pm) and PM (1 pm to 9 pm) and were given 0.50 sampling probability with replacement. An efficient circular route through each set of three stream areas was determined. The starting location was then randomly selected with replacement each day. Two 1-hour periods for drive time and breaks were provided between specific stream areas each day but clerks were required to reach each stream area at a specific time along their daily route to minimize angler length-of-stay biases inherent in roving creel surveys (Pollock et al. 1994).

At each stream area, clerks walked the entire area and counted and interviewed all anglers observed during their 2-hour survey. Clerks also left letter surveys on vehicles to gather additional information. Creel clerks completed a contact form for each interview (Appendix 2). Sociodemographic information included: the angler's home zip code, age, gender, gear type used, fish species sought, trout angling experience (i.e., number of years the angler has been fishing for trout), and the reason why the angler decided to fish that stream area. Angler satisfaction with their overall fishing experience, size of trout caught, and numbers of trout caught were also assessed, but only for anglers that had been fishing for longer than 1-hr. To allow estimates of angler pressure, catch and harvest, the clerk also asked when the angler started fishing (and noted the time of the interview) and asked how many fish and their approximate lengths that had been caught. Creel clerks then enumerated and measured each harvested fish that the angler possessed. At each stream area, clerks also recorded the number of letter surveys (Appendix 3) placed on vehicles, counted the number of anglers present and noted fishing conditions including air and water temperature, water clarity, water level, and general weather conditions. Letter surveys gathered information from any anglers that were missed during the interview process and supplemented information on party size, home zip code, and completed trip length. However, catch and harvest information was not gathered from letter surveys due to concerns with angler recall bias.

Analysis - Overall angler characteristics, such as age, gender and residency, were summarized from interviews and returned letter surveys. Estimates of angler pressure, catch, harvest and their respective variance and standard errors, followed calculations in Pollock et al. (1994). In all three calculations, each day represented a statistical replicate. To estimate angler pressure, we first multiplied the number of anglers counted during each 2-hour survey period x 2-hours to convert the number of anglers observed to an estimate of angler-hours (Table 1-2). Then that number was divided by 0.133, the proportion of the entire sampling day that the 2-hour survey period represented (i.e., 2-hours/a total 15-hour angling day = 0.133). This essentially extrapolated the 2-hour survey period estimate up to a total estimate of angler-hours for an entire day which is equivalent to one statistical replicate. These daily effort estimates were then averaged for each stream area, month, and day type (WD, WEH) combination to obtain a mean daily pressure estimate. Mean daily pressure estimates were then multiplied by the total number of WD or WEH available within each month for each stream area to obtain an estimate of total pressure for each stream area, month, and day type combination.

For calculations of catch and harvest, methods followed those for pressure where each day represented a statistical replicate. Mean daily catch had to be estimated first and then extrapolated to all the days available to get total catch estimates. Daily catch was the product of multiplying daily effort (i.e., angler-hours for each day as determined in angling pressure calculations above) times the mean daily catch rate (number of fish/hour) for each day (Table 1-3). Mean daily catch was then calculated as the average of the daily catch estimates.

TABLE 1-2. Example calculations to estimate angler-pressure for a summer creel survey in southeast Minnesota in 2013 for a hypothetical stream area in the month of April. Calculations follow Pollock et al. (1994) for a roving-roving angler survey. Creel clerks counted anglers during a randomly selected 2-hr survey period. The entire survey day was 15 hours.

Date or statistic	Angler count in 2-hour survey period	Survey period effort (angler count x 2 hours)	Daily effort (survey period effort / 0.133)
Weekdays (WD)			
April 1	3	3 x 2 = 6 angler-hours	6 / 0.133 = 45.11 angler-hours
April 5	1	1 x 2 = 2 angler-hours	2 / 0.133 = 15.04 angler-hours
April 9	0	0 x 2 = 0 angler-hours	0 / 0.133 = 00.00 angler-hours
April 22	1	1 x 2 = 2 angler-hours	2 / 0.133 = 15.04 angler-hours
April 24	0	0 x 2 = 0 angler-hours	0 / 0.133 = 00.00 angler-hours
Number of WD surveyed (n_1) = 5			
Mean daily pressure estimate (e_1)			15.03 angler-hours
Total WD available (N_1) = 22			15.03 x 22 = 330.66 angler-hours
Weekends and Holidays (WEH)			
April 7	2	2 x 2 = 4 angler-hours	4 / 0.133 = 30.07 angler-hours
April 14	1	1 x 2 = 2 angler-hours	2 / 0.133 = 15.04 angler-hours
April 20	4	4 x 2 = 8 angler-hours	8 / 0.133 = 60.15 angler-hours
April 27	1	1 x 2 = 2 angler-hours	2 / 0.133 = 15.04 angler-hours
Number of WEH surveyed (n_2) = 4			
Mean daily pressure estimate (e_2)			30.07 angler-hours
Total WEH available (N_2) = 8			30.07 x 8 = 240.56 angler-hours

TABLE 1-3. Example calculations to estimate fish catch or harvest for a summer creel survey in southeast Minnesota in 2013 for a hypothetical stream area in the month of April. Calculations follow Pollock et al. (1994) for a roving-roving angler survey.

Date or statistic	Daily effort (angler-hours; see Table 1-2)	Daily catch rate[a] (fish/hour)	Daily catch
Weekdays (WD)			
April 1	45.11	1.90	45.11 x 1.90 = 85.71
April 5	15.04	0.00	15.04 x 0.00 = 0.00
April 9	0.00	0.00	0.00
April 22	15.04	12.74	15.04 x 12.74 = 191.61
April 24	0.00	0.00	0.00
Sub-Total			277.32
Number of WD surveyed (n_1) = 5			
Mean daily WD catch estimate (c_1)			277.32 / 5 = 55.46 fish/day
Total WD available (N_1) = 22			55.46 x 22 = 1,220 total fish caught
Weekends and Holidays (WEH)			
April 7	30.07	0.57	30.07 x 0.57 = 17.14
April 14	15.04	0.00	15.04 x 0.00 = 0.00
April 20	60.15	0.00	60.15 x 0.00 = 0.00
April 27	15.04	3.50	15.04 x 3.50 = 52.64
Sub-Total			69.78
Number of WEH surveyed (n_2) = 4			
Mean daily WEH catch estimate (c_2)			69.78 / 4 = 17.44 fish/day
Total WEH available (N_2) = 8			17.44 x 8 = 140 total fish caught

[a] We used the average of the individual catch rates for each angler for each day, and we ignored all short trips (less than 0.5 hour).

Mean daily catch rate is typically calculated as the average of all the individual angler catch rates on a given day, and usually for anglers that have been fishing for some minimum length of time (Pollock et al. 1994). In this survey, we only included individual angler catch rate data for anglers that had been fishing for longer than 0.5 hour. However, this requirement along with the infrequent number of anglers observed fishing, resulted in very low sample sizes for catch rates for some strata. For example, the creel survey on Gribben Creek only encountered anglers that had been fishing longer than 0.5 hour on two weekdays during the entire summer of 2013. Also, both of these days were in July, so there were no samples for weekdays for any other month. Sample sizes at the lowest level of stratification (i.e., for a specific stream area, month, and day type combination) were often represented by a single day (n = 1) which would have precluded variance and standard error estimates at that level. A preliminary two-way analysis of variance procedure (not shown) comparing catch rates among months and stream areas found that catch rates varied more among stream areas than among months. Thus, it was decided to combine catch rate data among months within stream areas to bolster sample sizes. This resulted in extrapolations for total catch for each stream area and day type combination but across the entire summer angling season. Harvest estimates were made similarly, but because harvest was not allowed during the two-week early and late catch-and-release seasons, harvest estimates were calculated separately for the early catch-and-release season (April 1-12), the summer harvest season (April 13-September 14), and the late catch-and-release season (September 15-30). We specifically calculated harvest during the catch-and-release seasons in the event clerks observed and reported any illegal trout harvest. Finally, general trout regulations, including harvest (5 trout in the angler's daily/ possession limit with only one >16 inches), was allowed in the catch-and-release regulation area of Camp Creek on the third Saturday in May for a children's trout fishing event (as per Minnesota state statute). Thus, we estimated fish harvest for this single day on this stream.

RESULTS

Four creel clerks interviewed 1,314 anglers on 17 selected trout streams on 24 routes in southeast Minnesota from April 1 to September 30, 2013. This creel survey required 3.1 hours of clerk effort to obtain each interview. Twenty-seven anglers refused interviews, mostly on the South Branch Root River (Lanesboro area = 12, Park area = 7). Other areas of refused interviews included East Beaver Creek (1), Middle Branch Whitewater River (1), North Branch Whitewater River (1), Willow Creek (1) and Wisel Creek (4). The anglers that refused interviews on Middle Branch Whitewater River (Quincy) and North Branch Whitewater River were both in violation of the gear restriction (Table 1-4). A total of 44 violations were observed with 30% of these committed by anglers younger than 16 years old (resident and nonresident anglers less than 16 years old are not required to purchase a fishing license). All violations committed by the youngest ages were due to use of bait where it was prohibited. Two anglers that refused interviews at the Lanesboro Dam on the South Branch Root River indicated they did not speak English. Answers pertaining to questions of angler satisfaction were obtained from 692 returned letter surveys.

Angler Characteristics - Most anglers were male (90.1%) and were between 20 and 69 years old (79.0%) (Figure 1-2). Mean and median age was 42 and 43, respectively. Only 9.7% of anglers were younger than 16 years old, whereas 7.2% were 70 years or older.

Ninety-two percent of anglers were Minnesota residents. Although few anglers were non-residents, they came from across the United States (Table 1-5). Iowa was the most common home state of non-residents in 2013, followed by Illinois, Wisconsin, Arizona, Florida, South Dakota and Texas. One angler was from the Netherlands.

Anglers living in the eleven counties in the Lanesboro and Lake City Fish Management Areas (Fillmore, Goodhue, Houston, Olmsted, Rice, Wabasha, Winona, Dodge, Freeborn, Mower and Steele) were defined as "Local" anglers. These anglers represented 53.7% of those interviewed. "Metro" anglers were defined as those living in the seven counties surrounding the Minneapolis/St. Paul area (Dakota, Ramsey, Washington, Anoka, Scott, Carver and Hennepin) and represented 37.3% of anglers interviewed. Those living outside these two areas made up the remainder of Minnesota resident anglers at 9.0%.

TABLE 1-4. Noted gear restriction violations (using bait in artificial lures and flies only regulation areas) during a survey of anglers fishing southeast Minnesota trout streams, April 1 to September 30, 2013.

Stream	Month	# of observed violations	# of total anglers surveyed	Violation rate (percent)	Hometown
Camp Creek	April	3			Minneapolis
	July	2			Lanesboro
			32	15.6	
Gribben Creek	May	4			Stewartville
			17	23.5	
Hay Creek	April	3			Faribault, Wanamingo, Harris
	May	1			Wanamingo
			42	9.5	
Middle Branch Whitewater (Quincy)	July	4			Minneapolis
	August	4			St. Paul, Minneapolis
			103	7.8	
North Branch Whitewater	April	3			St. Paul, Minneapolis, Plainview
	May	1			Stewartville
	July	15			St. Paul, Owasso, Hastings, Minneapolis
	September	3			South St. Paul
			56	39.3	
Trout Run	July	1			Altura
			234	0.4	
Total observed		44			

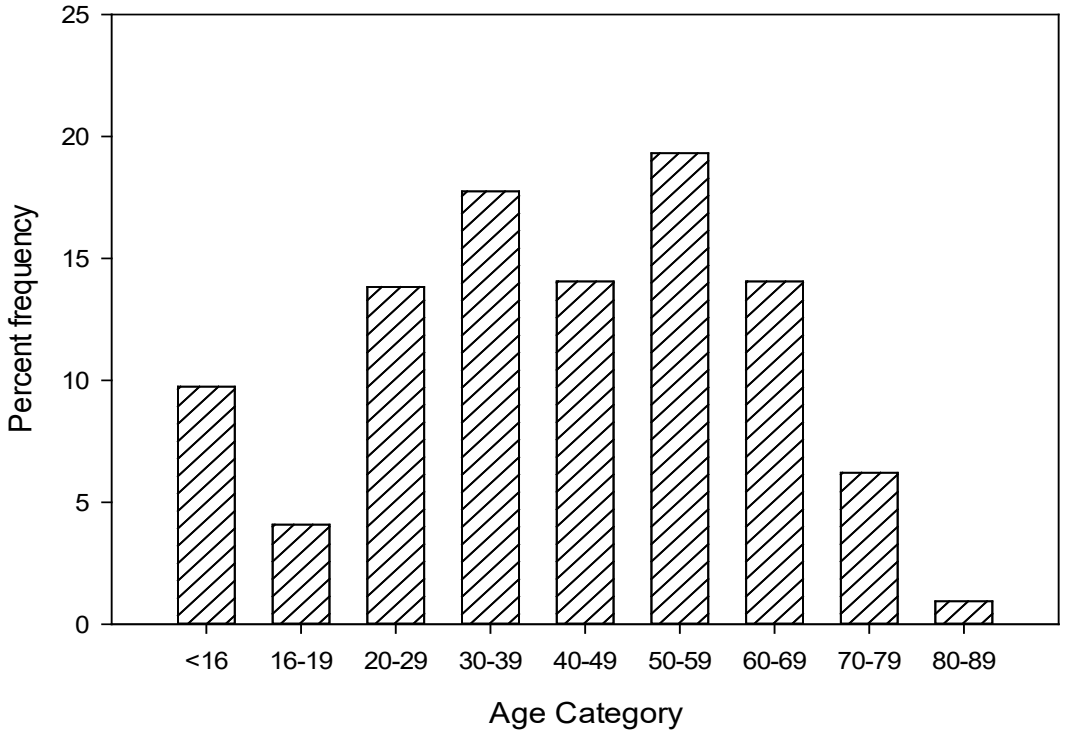

FIGURE 1-2. Age distribution of anglers fishing southeast Minnesota trout streams, April 1 to September 30, 2013.

TABLE 1-5. Percent composition of non-resident anglers by state of residence surveyed on selected trout streams in southeast Minnesota, April 1 to September 30, 2013. Information from creel survey in 2005 (Snook and Dieterman 2006) also presented for comparison.

State of residence	2013 Percent	2005 Percent
Iowa	16.3	10.1
Illinois	10.2	10.1
Wisconsin	10.2	42.0
Arizona	6.1	
Florida	5.1	1.5
South Dakota	5.1	1.5
Texas	5.1	
Missouri	4.1	4.4
North Dakota	4.1	
Alaska	3.1	1.5
California	3.1	
Indiana	3.1	1.5
Alabama	2.0	1.5
Arkansas	2.0	
Colorado	2.0	
Kansas	2.0	
Nebraska	2.0	4.4
New York	2.0	1.5
Washington	2.0	7.3
Netherlands (country)	1.0	
Kentucky	1.0	2.9
Montana	1.0	
North Carolina	1.0	1.5
Oklahoma	1.0	
Oregon	1.0	
Pennsylvania	1.0	
Utah	1.0	
Virginia	1.0	
West Virginia	1.0	
South Carolina		1.5
Georgia		1.5
Wyoming		1.5
New Mexico		1.5
New Jersey		1.5

The most common angling gear used in 2013 was fly fishing (42.8%), followed by bait angling (27.3%) and lure angling (24.2%). Mixed method angling (Bait/Lure, Bait/Fly, Fly/Lure and Bait/Lure/Fly) was uncommon (5.8%).

Most anglers were fishing for any trout species (90.2%). Only 9.6% of interviewed anglers actually targeted a specific trout species. Brook Trout were specifically targeted on Camp Creek, Middle Branch Whitewater (Crow Springs) and Mill Creek. Brook Trout were available in 33.3% of surveyed routes but were absent in Camp and Mill creeks. Rainbow Trout were only specifically targeted on Wisel Creek though they were available on 29.2% of surveyed routes. A few anglers (0.1%) stated they were specifically fishing for White Suckers *Catostomus commersoni*.

Just over half of anglers (53.8%) had less than 16 years of trout fishing experience (Figure 1-3). Anglers with less than 5 years of trout fishing experience represented 29.2% of those interviewed. For some, this was their first trout fishing experience. One angler fishing Pine Creek stated he had 75 years of trout fishing experience. He was 81 years old.

Fly anglers had been fishing for trout for the longest average period of time (mean = 24.8 years, median = 22 years, range 0-75 years). Anglers using bait were typically the least experienced (mean = 14.6 years, median = 8 years, range 0-75 years). Mean trout fishing experience was 18.4 years for lure anglers and 17.3 years for mixed method anglers.

Anglers estimated they fish a mean of 5.6 times (median = 2, mode = 1) on their interviewed stream each year. Anglers also indicated that they fished other trout streams in Minnesota a mean of 14.1 times each year (median = 6, mode = 0).

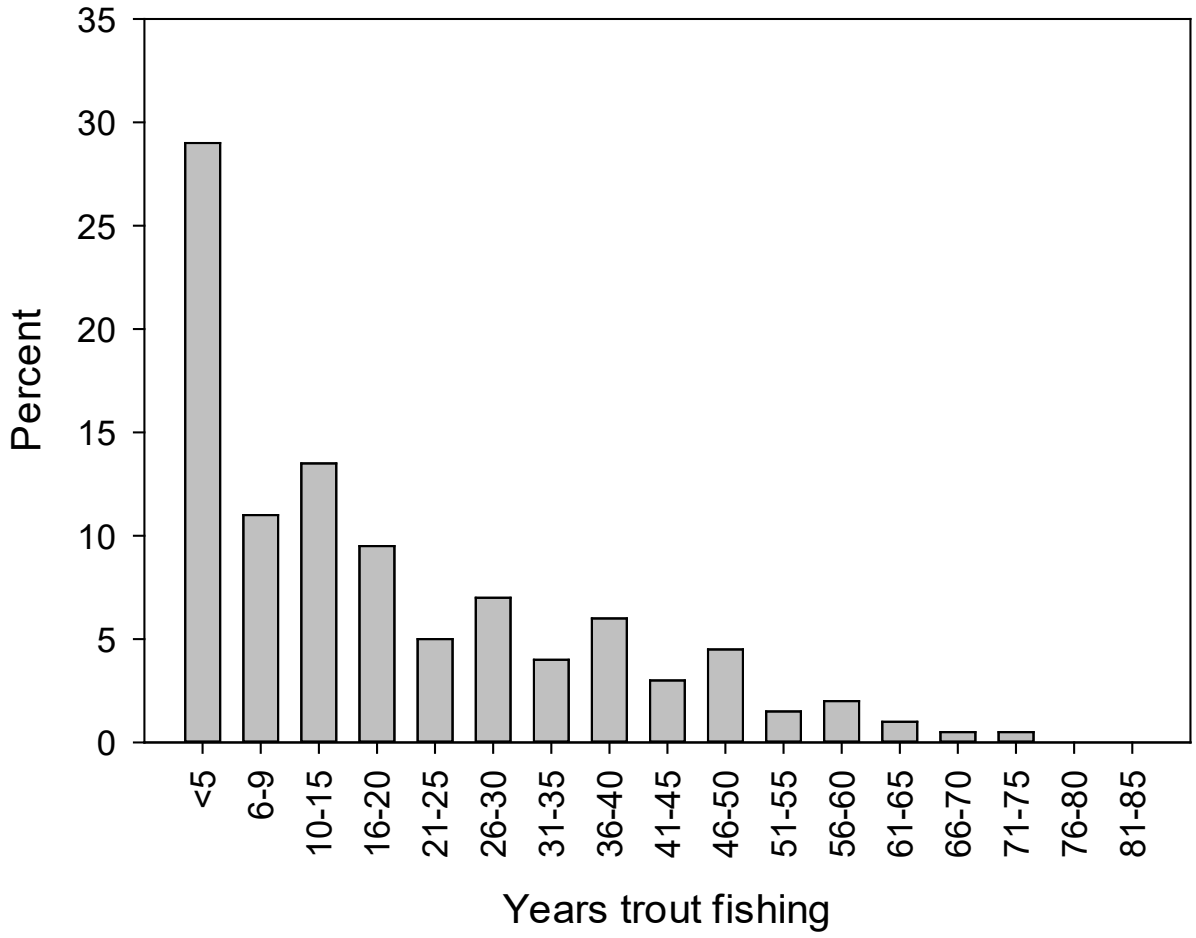

FIGURE 1-3. Years of trout angling experience taken from surveys of anglers fishing selected southeast Minnesota trout streams, April 1 to September 30, 2013.

When gear choice was examined by time period, certain gear types were dominant in specific seasons (Table 1-6). No anglers using bait were interviewed in the early catch-and-release season (April 1 to April 12) and anglers fly fishing dominated the gear choice during that time. During the first few weeks (April 13 to April 30) of the harvest season, bait anglers were the primary users (35.9%), whereas during May and June, fly anglers represented about half of all anglers fishing. In July and August, the gear choice was evenly represented by all gear types. During September, the dominant trout fishing gear was fly angling. Mixed method angling never dominated a time period but was most common during the last two weeks of the harvest season (September 1 to September 14). Anglers using lures were represented evenly throughout the trout angling seasons.

Anglers younger than 16 years old used bait angling techniques more than any other method (53.6%) (Table 1-7). Bait angling was never the primary gear choice beyond this age category. Trout anglers in their 20's most frequently used lures. Once past this age category all older ages most frequently used flies in this survey with the exception of those in their 80's, who were more likely to use lures than bait or flies.

TABLE 1-6. Percent gear choice within time period among surveyed anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Time Period	Harvest allowed [1]	Bait	Lure	Fly	Mixed
April 1 – 12	No	0.0	14.3	78.6	7.1
April 13 – 30	Yes	35.9	25.2	33.8	5.1
May	Yes	23.2	24.6	45.8	6.4
June	Yes	21.5	21.5	51.8	5.1
July	Yes	39.1	27.0	29.8	4.0
August	Yes	34.8	28.4	31.8	5.0
September 1 – 14	Yes	11.0	19.2	58.9	11.0
September 15 – 30	No	7.3	18.8	68.1	5.8

[1] Also, harvest was not allowed on catch-and-release streams and some other streams had a protected slot (12-16 inches).

TABLE 1-7. Percent gear choice by age among surveyed anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Age (years)	Sample size (percent overall)	Bait	Lure	Fly	Mixed
< 16	112 (9.2%)	53.6	25.9	7.1	13.4
16-19	49 (4.0%)	40.8	42.9	8.2	8.2
20-29	170 (13.9%)	27.7	37.1	30.0	5.3
30-39	222 (18.2%)	25.7	27.0	42.3	5.0
40-49	168 (13.8%)	24.4	28.0	40.0	7.7
50-59	235 (19.3%)	28.1	20.0	48.9	3.0
60-69	175 (14.4%)	14.3	13.1	67.4	5.1
70-79	76 (6.2%)	19.7	9.2	67.1	4.0
80-89	12 (1.0%)	25.0	41.7	33.3	0.0

Local and Metro anglers were primarily composed of anglers using flies 36.9% and 43.5%, respectively (Table 1-8). This was the case for those living in other areas of the state as well, but many were also anglers using bait (34.7%). Using lures was the second most common choice among Local anglers but was the third choice for Metro and Other anglers. Mixed method angling was the least common choice for all resident categories.

Stream Motivation - Seven possible answers were provided to answer the question, "Why did you decide to fish here today?". "Easy access" was the most frequent reply (43.5%) followed by "favorite stream" (21.5%), "numbers of fish" (14.0%), "live close by" (13.1%), "like the regulation" (3.9%), "size of fish" (3.6%) and "dislike the regulation elsewhere" (0.1%). Though anglers were asked to pick one answer, a small percentage of anglers (0.4%) provided two answers.

When the answer to the question, "Why did you decide to fish here today?" was examined by stream, some interesting patterns emerged (Table 1-9). Hay Creek (both sites combined) was most frequently answered with "numbers of fish" (33.9%); one of two streams with this as the most frequent answer. The other was South Fork Root River (20%). Other streams such as East Beaver Creek, Crooked Creek and North Branch Whitewater River had "numbers of trout" as the second most selected answer. West Beaver Creek was the only stream with "size of fish" as the primary answer. South Fork Root River had this answer as its second most chosen answer.

TABLE 1-8. Percent gear choice by resident Minnesota locality for anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013. Local residents were those living in Fillmore, Goodhue, Houston, Olmsted, Rice, Wabasha, Winona, Dodge, Freeborn, Mower and Steele counties. Metro residents were those living in Dakota, Ramsey, Washington, Anoka, Scott, Carver and Hennepin counties. Other were those living in any county in Minnesota not mentioned above.

Resident category	Bait	Lure	Fly	Mixed
Local	28.1	29.6	36.9	5.5
Metro	29.1	21.2	43.5	6.3
Other	34.7	21.8	35.6	7.9

TABLE 1-9. Percent answer to "Why did you decide to fish here today?" by stream. A. Favorite stream, B. Live close by, C. Easy access, D. Like regulation, E. Dislike regulation elsewhere, F. Numbers of fish, G. Size of fish. The modal response is highlighted in grey, second most common response highlighted in light grey.

Stream	A	B	C	D	E	F	G	A/C	A/F	B/C	C/F
Camp Creek	20.4	6.1	63.3	2.0	-	8.2	-	-	-	-	-
Crooked Creek	37.9	10.3	24.1	-	-	27.6	-	-	-	-	-
East Beaver Creek	10.3	-	55.2	3.5	-	31.0	-	-	-	-	-
Forestville Creek	15.5	-	79.3	-	-	5.2	-	-	-	-	-
Gribben Creek	47.1	5.9	23.5	-	-	11.8	11.8	-	-	-	-
Hay Creek	6.8	23.7	28.8	1.7	-	33.9	5.1	-	-	-	-
Middle Branch Whitewater River	8.7	23.3	41.8	5.8	-	14.6	5.8	-	-	-	-
Mill Creek	14.8	44.3	23.0	13.1	-	3.3	-	-	-	1.6	-
North Branch Whitewater River	46.2	5.8	11.5	11.5	1.9	19.2	3.9	-	-	-	-
Pine Creek	30.7	17.8	30.7	4.8	-	16.1	-	-	-	-	-
South Branch Root River	15.4	4.4	72.8	-	-	6.7	0.7	-	-	-	-
South Fork Root River	20.0	7.7	20.0	13.9	-	20.0	15.4	1.5	-	-	1.5
Trout Run	31.0	14.6	28.8	4.0	-	18.1	2.7	0.4	0.4	-	-
West Beaver Creek	16.7	11.1	22.2	-	-	11.1	38.9	-	-	-	-
West Indian Creek	19.2	38.5	11.5	11.5	-	15.4	3.9	-	-	-	-
Willow Creek	7.1	21.4	67.9	-	-	3.6	-	-	-	-	-
Wisel Creek	33.9	12.3	27.7	1.5	-	15.4	9.2	-	-	-	-

Resource Benefits - Mean trip length was estimated from a total of 583 anglers, with 277 returned letter surveys (representing 436 anglers) and interviews of 147 anglers intercepted at the end of their fishing trip. Overall mean trip length was 3.11 hours (SE = 0.07). The longest completed fishing trip by an individual angler was 12 hours and the shortest was 8 minutes. Mean trip length was four hours or longer on four stream areas: South Fork Root River-Million Dollar Bridge (4.00 hours, SE = 0.38), North Branch Whitewater (4.05 hours, SE = 0.31), West Beaver Creek (4.32 hours, SE = 0.28), and South Branch Root River in Forestville State Park (4.35 hours, SE = 0.49). On average, anglers fished he shortest time on Gribben Creek (1.34 hours, SE = 0.42), Willow Creek (1.52 hours, SE = 0.19), and the Middle Branch Whitewater at Crow Springs (1.98 hours, SE = 0.50). From a seasonal perspective, anglers fished the longest time in May (mean = 4.40 hours, SE = 0.21, n = 73) and the shortest in July (mean = 2.54 hours, SE = 0.14, n = 133).

Anglers spent an estimated 44,673 hours (SE = 2,063) fishing the 24 selected stream areas during the summer angling season in 2013 (Table 1-10). The South Branch Root River downstream from the Lanesboro dam had the highest estimated pressure (7,353 hours), which was more than 1.5 times higher than the next two highest stream areas: the South Branch Root River in Forestville State Park (4,401 hours) and Trout Run at Lohman's (4,101 hours). The next highest estimated pressure was nearly 3,000 angler hours on Trout Run below Bucksnort dam (2,935 hours) and Wisel Creek (2,849 hours). Angler pressure was estimated to be lowest at the West Indian Creek long-term monitoring area (442 hours), Middle Branch Whitewater at Crow Springs (627 hours), Hay Creek-State Forest (664 hours), and Gribben Creek (689 hours). Mean estimated pressure peaked in April (8,881 hours) and July (8,752 hours) and declined through late summer and early fall (Figure 1-4). Overall, an estimated 14,364 individual angler trips were completed during the summer angling season in 2013 (i.e., 44,673 hours/3.11 hours (mean trip length)).

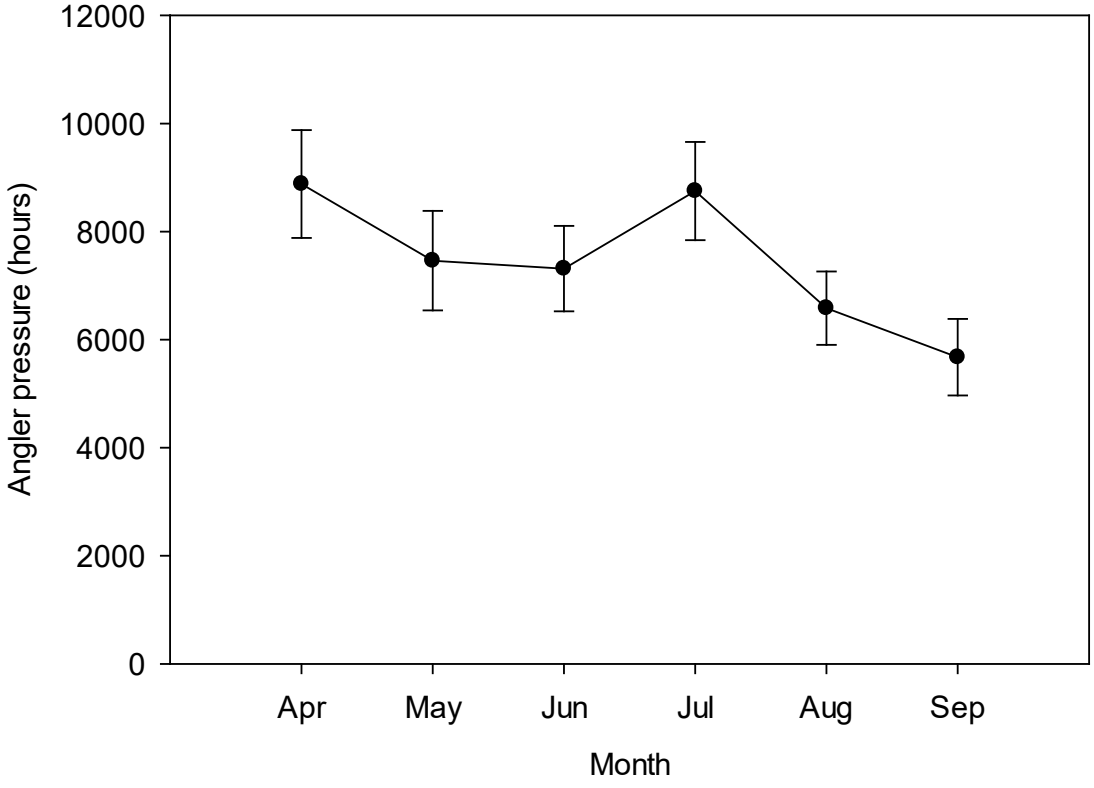

FIGURE 1-4. Monthly changes in estimated angler pressure (± 1 SE) for 24 selected stream areas in southeast Minnesota during the summer angling season, April 1 to September 30, 2013.

TABLE 1-10. Angling-hours calculated from information on surveys of anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Stream	Month	Day type	# of days of day type surveyed	# of days of day type in survey	Angler-hours	SE (±)
Camp Creek	April	WD	7	22	0.0	0.0
		WEH	4	8	300.8	143.2
	May	WD	5	22	132.3	81.0
		WEH	5	9	433.1	433.1
	June	WD	6	20	0.0	0.0
		WEH	4	10	74.2	75.2
	July	WD	7	22	330.8	191.0
		WEH	5	9	108.3	27.1
	August	WD	7	22	47.3	47.3
		WEH	5	9	51.1	33.2
	September	WD	5	20	300.8	134.5
		WEH	3	10	0.0	0.0
	Subtotal				1,783	528
Crooked Creek	April	WD	7	22	236.3	94.5
		WEH	3	8	401.0	174.8
	May	WD	6	22	55.1	55.1
		WEH	4	9	203.0	130.0
	June	WD	5	20	0.0	0.0
		WEH	4	10	0.0	0.0
	July	WD	6	22	0.0	0.0
		WEH	4	9	101.5	101.5
	August	WD	7	22	47.3	47.3
		WEH	5	9	0.0	0.0
	September	WD	7	20	43.0	43.0
		WEH	4	10	37.6	37.6
	Subtotal				1,125	274
East Beaver Creek	April	WD	7	22	236.3	118.9
		WEH	3	8	80.2	40.1
	May	WD	6	22	110.3	69.8
		WEH	4	9	169.2	64.8
	June	WD	5	20	0.0	0.0
		WEH	4	10	188.0	112.8
	July	WD	6	22	110.3	110.3
		WEH	4	9	169.2	169.2
	August	WD	7	22	47.3	47.3
		WEH	5	9	108.3	78.9
	September	WD	7	20	171.9	128.9
		WEH	4	10	0.0	0.0
	Subtotal				1,391	322
Forestville Creek	April	WD	7	22	0.0	0.0
		WEH	4	8	210.5	173.0
	May	WD	6	22	55.1	55.1
		WEH	4	9	135.3	135.3
	June	WD	6	20	200.5	200.5
		WEH	5	10	30.1	30.1
	July	WD	6	22	55.1	55.1
		WEH	4	9	203.0	87.4
	August	WD	6	22	110.3	110.3
		WEH	4	9	67.7	67.7
	September	WD	6	20	0.0	0.0
		WEH	5	10	54.3	73.7
	Subtotal				1,188	354

(TABLE 1-10 continued on next page)

TABLE 1-10. Continued.

Stream	Month	Day type	# of days of day type surveyed	# of days of day type in survey	Angler-hours	SE (±)
Gribben Creek	April	WD	7	22	0.0	0.0
		WEH	4	8	60.1	60.2
	May	WD	5	22	0.0	0.0
		WEH	5	9	135.3	104.8
	June	WD	6	20	0.0	0.0
		WEH	4	10	112.8	112.8
	July	WD	7	22	94.5	61.0
		WEH	5	9	27.1	27.1
	August	WD	7	22	94.5	94.5
		WEH	5	9	54.1	54.1
	September	WD	5	20	60.2	60.2
		WEH	3	10	50.1	50.1
	Subtotal				689	223
Hay Creek – State	April	WD	6	22	55.1	55.1
		WEH	4	8	210.5	102.7
	May	WD	7	22	94.5	94.5
		WEH	5	9	27.1	27.1
	June	WD	7	20	0.0	0.0
		WEH	6	10	125.3	46.2
	July	WD	6	22	0.0	0.0
		WEH	4	9	0.0	0.0
	August	WD	7	22	94.5	61.0
		WEH	5	9	27.1	27.1
	September	WD	5	20	0.0	0.0
		WEH	5	10	30.1	30.1
	Subtotal				664	175
Hay Creek – Upper	April	WD	6	22	165.4	113.0
		WEH	4	8	210.5	172.8
	May	WD	7	22	94.5	94.5
		WEH	5	9	108.3	108.2
	June	WD	7	20	43.0	43.0
		WEH	5	10	210.5	60.2
	July	WD	6	22	275.7	101.7
		WEH	4	9	101.5	101.5
	August	WD	7	22	236.3	118.9
		WEH	5	9	27.1	27.1
	September	WD	5	20	120.3	120.3
		WEH	5	10	90.2	60.2
	Subtotal				1,683	350
Middle Branch Whitewater (Crow)	April	WD	8	22	82.7	54.1
		WEH	4	8	90.2	57.6
	May	WD	5	22	66.2	66.2
		WEH	4	9	0.0	0.0
	June	WD	7	20	85.9	55.5
		WEH	5	10	150.4	67.3
	July	WD	6	22	0.0	0.0
		WEH	4	9	0.0	0.0
	August	WD	6	22	0.0	0.0
		WEH	4	9	101.5	33.8
	September	WD	6	20	50.1	50.1
		WEH	5	10	0.0	0.0
	Subtotal				627	148

(TABLE 1-10 continued on next page)

TABLE 1-10. Continued.

Stream	Month	Day type	# of days of day type surveyed	# of days of day type in survey	Angler-hours	SE (±)
Middle Branch Whitewater (Cty 9)	April	WD	8	22	0.0	0.0
		WEH	4	8	30.1	30.1
	May	WD	5	22	66.2	66.2
		WEH	4	9	33.8	33.8
	June	WD	7	20	85.9	55.5
		WEH	5	10	150.4	47.6
	July	WD	6	22	55.1	55.1
		WEH	4	9	67.7	67.7
	August	WD	6	22	165.4	113.0
		WEH	4	9	135.3	0.0
	September	WD	6	20	50.1	50.1
		WEH	5	10	30.1	30.1
	Subtotal				870	189
Middle Branch Whitewater (Quincy)	April	WD	7	22	47.3	47.3
		WEH	4	8	60.2	60.2
	May	WD	6	22	441.1	236.5
		WEH	4	9	101.5	101.5
	June	WD	4	20	300.8	212.7
		WEH	5	10	60.2	36.8
	July	WD	6	22	220.6	139.5
		WEH	5	9	189.5	101.3
	August	WD	7	22	47.3	47.3
		WEH	4	9	406.0	156.3
	September	WD	6	20	150.4	67.3
		WEH	5	10	150.4	95.1
	Subtotal				2,175	434
Mill Creek	April	WD	6	22	110.3	110.3
		WEH	4	8	271.0	102.8
	May	WD	7	22	0.0	0.0
		WEH	6	9	203.0	83.8
	June	WD	5	20	240.6	60.2
		WEH	3	10	200.5	132.6
	July	WD	6	22	0.0	0.0
		WEH	5	9	54.1	54.1
	August	WD	7	22	47.3	47.3
		WEH	5	9	54.1	33.2
	September	WD	5	20	0.0	0.0
		WEH	3	10	150.4	86.8
	Subtotal				1,331	254
North Branch Whitewater	April	WD	7	22	189.0	122.1
		WEH	4	8	330.8	252.2
	May	WD	6	22	110.3	69.7
		WEH	4	9	236.8	150.0
	June	WD	4	20	0.0	0.0
		WEH	5	10	60.2	60.2
	July	WD	6	22	771.9	338.1
		WEH	5	9	297.7	236.0
	August	WD	7	22	141.8	98.4
		WEH	4	9	101.5	101.5
	September	WD	6	20	0.0	0.0
		WEH	5	10	90.2	90.2
	Subtotal				2,330	555

(TABLE 1-10 continued on next page)

TABLE 1-10. Continued.

Stream	Month	Day type	# of days of day type surveyed	# of days of day type in survey	Angler-hours	SE (±)
Pine Creek	April	WD	8	22	82.7	54.1
		WEH	4	8	210.5	124.0
	May	WD	5	22	264.7	123.8
		WEH	4	9	101.5	33.8
	June	WD	7	20	43.0	43.0
		WEH	5	10	60.2	60.2
	July	WD	6	22	165.4	113.0
		WEH	4	9	236.8	194.4
	August	WD	6	22	110.3	110.3
		WEH	4	9	101.5	64.8
	September	WD	6	20	0.0	0.0
		WEH	5	10	150.4	116.5
	Subtotal				1,527	347
South Branch Root River (Lanesboro)	April	WD	7	22	189.0	122.0
		WEH	3	8	360.9	360.9
	May	WD	5	22	330.8	181.2
		WEH	5	9	379.0	168.0
	June	WD	6	20	200.5	200.5
		WEH	4	10	300.8	162.4
	July	WD	7	22	1,228.8	503.9
		WEH	5	9	1,218.1	176.5
	August	WD	7	22	992.5	314.7
		WEH	5	9	839.1	258.2
	September	WD	5	20	962.4	440.0
		WEH	3	10	350.9	50.1
	Subtotal				7,353	959
South Branch Root River (State Park)	April	WD	7	22	47.3	47.3
		WEH	5	8	769.9	354.0
	May	WD	6	22	330.8	170.8
		WEH	4	9	203.0	203.0
	June	WD	6	20	401.0	241.4
		WEH	5	10	751.9	242.5
	July	WD	6	22	330.8	148.0
		WEH	4	9	541.4	146.2
	August	WD	6	22	386.0	157.9
		WEH	4	9	67.7	67.7
	September	WD	6	20	300.8	205.5
		WEH	5	10	270.7	137.8
	Subtotal				4,401	670
South Fork Root River (LTM)	April	WD	7	22	189.0	141.8
		WEH	4	8	270.7	172.8
	May	WD	5	22	132.3	81.0
		WEH	5	9	27.1	27.0
	June	WD	7	20	214.8	170.1
		WEH	4	10	75.2	75.2
	July	WD	6	22	55.1	55.1
		WEH	4	9	0.0	0.0
	August	WD	7	22	0.0	0.0
		WEH	4	9	33.8	33.8
	September	WD	5	20	0.0	0.0
		WEH	5	10	240.6	102.0
	Subtotal				1,239	326

(TABLE 1-10 continued on next page)

TABLE 1-10. Continued.

Stream	Month	Day type	# of days of day type surveyed	# of days of day type in survey	Angler-hours	SE (±)
South Fork Root River (Million)	April	WD	7	22	236.3	118.9
		WEH	4	8	300.8	104.1
	May	WD	5	22	0.0	0.0
		WEH	5	9	108.3	78.9
	June	WD	7	20	128.9	128.9
		WEH	4	10	225.6	179.0
	July	WD	6	22	0.0	0.0
		WEH	4	9	203.0	67.7
	August	WD	7	22	94.5	94.5
		WEH	4	9	33.8	33.8
	September	WD	5	20	0.0	0.0
		WEH	5	10	150.4	95.1
	Subtotal				1,482	322
Trout Run (Bucksnort)	April	WD	6	22	110.3	69.7
		WEH	4	8	240.6	170.1
	May	WD	7	22	283.6	151.9
		WEH	6	9	112.8	64.6
	June	WD	5	20	180.5	73.7
		WEH	4	10	451.1	184.2
	July	WD	6	22	496.2	280.1
		WEH	5	9	270.7	74.1
	August	WD	7	22	236.3	94.5
		WEH	5	9	162.4	99.4
	September	WD	5	20	240.6	112.5
		WEH	3	10	150.4	0.0
	Subtotal				2,935	465
Trout Run (Lohman's)	April	WD	6	22	441.1	184.5
		WEH	4	8	330.8	165.6
	May	WD	7	22	330.8	125.0
		WEH	6	9	293.2	107.2
	June	WD	5	20	721.8	120.3
		WEH	4	10	451.1	267.6
	July	WD	6	22	330.8	85.4
		WEH	5	9	216.5	54.1
	August	WD	7	22	283.6	112.5
		WEH	5	9	189.5	54.1
	September	WD	5	20	360.9	221.0
		WEH	3	10	150.4	86.8
	Subtotal				4,101	510
West Beaver Creek	April	WD	7	22	0.0	0.0
		WEH	3	8	120.3	120.3
	May	WD	6	22	0.0	0.0
		WEH	4	9	169.2	67.8
	June	WD	5	20	0.0	0.0
		WEH	4	10	37.6	37.6
	July	WD	6	22	55.1	55.1
		WEH	4	9	0.0	0.0
	August	WD	7	22	141.8	98.4
		WEH	5	9	135.3	135.3
	September	WD	7	20	43.0	43.0
		WEH	4	10	37.6	37.6
	Subtotal				740	233

(TABLE 1-10 continued on next page)

TABLE 1-10. Continued.

Stream	Month	Day type	# of days of day type surveyed	# of days of day type in survey	Angler-hours	SE (±)
West Indian Creek (Cty 4)	April	WD	7	22	236.3	139.1
		WEH	4	8	0.0	0.0
	May	WD	6	22	275.7	132.8
		WEH	4	9	101.5	101.5
	June	WD	4	20	0.0	0.0
		WEH	5	10	60.2	60.2
	July	WD	6	22	0.0	0.0
		WEH	5	9	0.0	0.0
	August	WD	7	22	0.0	0.0
		WEH	4	9	101.5	101.5
	September	WD	6	20	0.0	0.0
		WEH	5	10	0.0	0.0
	Subtotal				775	247
West Indian Creek (LTM)	April	WD	6	22	0.0	0.0
		WEH	4	8	30.1	30.1
	May	WD	7	22	94.5	94.5
		WEH	5	9	0.0	0.0
	June	WD	7	20	128.9	89.4
		WEH	5	10	0.0	0.0
	July	WD	6	22	0.0	0.0
		WEH	4	9	33.8	33.8
	August	WD	7	22	94.5	61.0
		WEH	5	9	0.0	0.0
	September	WD	5	20	0.0	0.0
		WEH	5	10	60.2	60.2
	Subtotal				442	162
Willow Creek	April	WD	7	22	0.0	0.0
		WEH	4	8	8.3	180.5
	May	WD	6	22	0.0	0.0
		WEH	4	9	169.2	64.8
	June	WD	6	20	0.0	0.0
		WEH	5	10	90.2	90.2
	July	WD	6	22	0.0	0.0
		WEH	4	9	33.8	33.8
	August	WD	6	22	0.0	0.0
		WEH	4	9	169.2	169.2
	September	WD	6	20	150.4	102.7
		WEH	5	10	60.2	60.2
	Subtotal				974	298
Wisel Creek	April	WD	7	22	283.6	133.7
		WEH	4	8	751.9	412.0
	May	WD	5	22	661.7	431.3
		WEH	5	9	81.2	54.1
	June	WD	7	20	171.9	129.0
		WEH	4	10	300.8	162.4
	July	WD	6	22	0.0	0.0
		WEH	4	9	101.5	64.8
	August	WD	7	22	94.5	61.0
		WEH	4	9	101.5	64.8
	September	WD	5	20	120.3	73.7
		WEH	5	10	180.5	110.5
	Subtotal				2,849	670
Total					44,673	2,063

The overall catch rate for all trout species and sizes combined was 1.45 trout/hour but varied among months and streams (Table 1-11). Mean catch rate for all trout was highest in May (2.14 trout/hour) and lowest in July (1.01 trout/hour). Among stream areas, mean catch rate was highest at the South Fork Root River (Long-Term Monitoring station (LTM)) and Crooked Creek sites where catch rates exceeded 3.0 trout/hour. Six stream areas had mean catch rates exceeding 2.0 trout/hour. Only six stream areas had catch rates lower than 1.0 trout/hour and included Trout Run (Bucksnort), Middle Branch Whitewater (Quincy), East Beaver Creek, South Branch Root River (Lanesboro and State Park) and Forestville Creek. Although many anglers reported a catch rate of zero trout/hour, the highest individual catch rate reported was 16.22 trout/hour at South Fork Root River (LTM) in August.

The overall mean catch rate for all trout that were ≥ 12 inches TL was 0.32 trout/hour (Table 1-12). This indicates that on average, it took about three hours to catch one trout 12 inches or longer in these southeast Minnesota streams. Mean monthly catch rate for trout ≥ 12 inches was highest in May (0.50 trout/hour) and lowest in August (0.15 trout/hour). Mean catch rates increased in September for trout in this size category (Figure 1-5). Among stream areas, mean catch rates for trout ≥ 12 inches were highest at Crooked Creek (1.11 trout/hour) and West Beaver Creek (0.83 trout/hour). Stream areas with the four lowest mean catch rates for trout ≥ 12 inches were West Indian Creek (LTM) (0.06/hour), Gribben Creek (0.09/hour), South Branch Root River (Forestville State Park) (0.13/hour), and Forestville Creek (0.14/hour).

The overall mean catch rate for large trout, those ≥ 16 inches TL, was 0.014 trout/hour or about 71 hours to catch a large trout (Table 1-13). However, large trout were only reportedly caught at 14 of the 24 stream areas. The two stream areas with the highest mean catch rates of large trout were Hay Creek (Upper) and West Indian Creek (County 4) where mean catch rates were 0.05 large trout/hour. Mean monthly catch rates for large trout increased slightly from April through June, declined in July, and then increased again to the highest value in September (Figure 1-5). However, there was considerable variability among monthly catch rates due to differences among streams and low sample sizes.

A total of 56,192 (SE = 4,462) trout were estimated to have been caught during the summer 2013 angling season. Brown Trout was the most common trout species caught representing 88.2% of the known trout catch (i.e., a few anglers only reported total trout caught and did not specify species). Rainbow Trout represented 9.5% and Brook Trout 2.3% of the known trout catch. Percent of the catch harvested was estimated at 9.0% for Brown Trout, 36.5% for Rainbow Trout, and 12.9% for Brook Trout. Percent harvest of trout was highest on Willow Creek where 47.4% of trout caught were harvested (Table 1-14). Willow Creek receives annual stocking of about 400 Rainbow Trout yearlings. Harvest on West Indian Creek (LTM) and Hay Creek (State) were also high at 37.7% and 35.4%, respectively. The South Branch Root River (Lanesboro) receives numerous stockings of yearling Rainbow Trout (up to 5,500 annually), is easily accessible for all anglers, and harvest rate was 33.5%. Mill Creek and North Branch Whitewater also receive stocked yearling Rainbow Trout with harvest rate there being 29.2% and 23.9%, respectively. Mill Creek receives 2,500 Rainbow Trout yearlings and the North Branch Whitewater River receives 4,000 Rainbow Trout yearlings annually.

TABLE 1-11. Mean catch rate (number/hour) for all trout species and sizes combined from a roving-roving creel survey of 24 selected stream areas in southeast Minnesota April 1 to September 30, 2013. Numbers in parentheses represent SE and sample size (number of anglers). Catch rate data was only compiled for anglers that fished for longer than 0.5 hour. n/a means no data were available.

	Months						
Stream areas	April	May	June	July	August	September	Totals
Camp Creek	0.53 (0.53, 2)	1.00 (0.40, 5)	n/a	2.93 (0.61, 3)	0.60 (0.47, 3)	0.00 (n/a, 1)	1.19 (0.33, 14)
Crooked Creek	2.20 (0.87, 8)	4.79 (0.91, 8)	n/a	3.89 (1.39, 3)	3.28 (n/a, 1)	4.41 (3.01, 2)	3.62 (0.56, 22)
East Beaver Creek	1.47 (n/a, 1)	0.88 (0.47, 6)	0.53 (0.48, 3)	0.00 (0.00, 2)	0.00 (0.00, 2)	1.58 (0.74, 4)	0.81 (0.26, 18)
Forestville Creek	1.32 (n/a, 1)	0.00 (n/a, 1)	1.00 (n/a, 1)	0.72 (0.52, 4)	0.10 (0.10, 4)	0.00 (0.00, 4)	0.37 (0.17, 15)
Gribben Creek	n/a	n/a	1.09 (0.15, 3)	1.58 (0.84, 3)	1.69 (1.69, 2)	0.00 (n/a, 1)	1.27 (0.42, 9)
Hay Creek (State Forest)	1.23 (0.42, 7)	0.00 (0.00, 2)	1.16 (1.10, 5)	n/a	0.77 (0.77, 2)	2.76 (n/a, 1)	1.10 (0.37, 17)
Hay Creek (Upper)	0.73 (0.32, 10)	1.51 (0.46, 4)	2.79 (0.68, 6)	0.87 (0.34, 6)	0.96 (0.52, 6)	0.84 (0.32, 5)	1.22 (0.21, 37)
Middle Branch Whitewater (Crow Springs)	4.73 (2.69, 2)	5.00 (n/a, 1)	0.65 (0.65, 2)	n/a	0.38 (0.38, 2)	4.00 (n/a, 1)	2.56 (0.94, 8)
Middle Branch Whitewater (County 9)	n/a	n/a	1.61 (0.34, 8)	0.00 (0.00, 2)	2.81 (2.04, 3)	6.01 (2.32, 2)	2.22 (0.63, 15)
Middle Branch Whitewater (Quincy)	0.49 (0.25, 3)	0.57 (0.22, 11)	2.30 (0.76, 5)	1.05 (0.51, 12)	0.69 (0.32, 12)	0.69 (0.31, 7)	0.90 (0.18, 50)
Mill Creek	0.30 (n/a, 1)	1.87 (1.27, 3)	0.15 (0.15, 3)	1.33 (1.33, 2)	2.47 (0.11, 2)	0.53 (0.53, 4)	1.07 (0.36, 15)
North Branch Whitewater	1.23 (0.50, 7)	1.38 (0.76, 8)	n/a	1.32 (0.32, 17)	1.09 (0.29, 2)	1.99 (0.87, 3)	1.36 (0.24, 37)
Pine Creek	4.66 (2.31, 3)	5.31 (2.01, 3)	0.31 (n/a, 1)	1.38 (0.60, 4)	2.20 (1.91, 3)	0.14 (0.08, 4)	2.38 (0.71, 18)
South Branch Root River (Lanesboro)	2.12 (0.54, 8)	0.68 (0.26, 13)	0.40 (0.27, 10)	0.73 (0.16, 41)	0.48 (0.11, 36)	1.07 (0.35, 10)	0.74 (0.09, 118)
South Branch Root River (State Park)	1.39 (0.53, 3)	0.61 (0.26, 4)	0.55 (0.20, 17)	0.66 (0.24, 19)	3.07 (1.63, 3)	0.34 (0.17, 7)	0.76 (0.16, 53)
South Fork Root River (LTM)	n/a	7.68 (3.44, 3)	4.22 (n/a, 1)	n/a	16.22 (n/a, 1)	0.92 (0.38, 8)	3.91 (1.49, 13)
South Fork Root River (Million Dollar)	2.06 (0.45, 4)	0.80 (0.56, 3)	3.24 (2.24, 4)	1.17 (n/a, 1)	0.25 (0.25, 3)	1.14 (0.79, 4)	1.58 (0.52, 19)
Trout Run (Bucksnort)	1.47 (0.29, 5)	1.92 (0.43, 6)	1.67 (0.62, 6)	0.12 (0.07, 14)	0.25 (0.16, 7)	1.89 (0.95, 5)	0.97 (0.19, 43)
Trout Run (Lohman's)	4.09 (1.05, 12)	5.43 (0.72, 6)	1.36 (0.41, 14)	1.84 (0.29, 12)	2.05 (1.25, 10)	2.63 (1.44, 4)	2.65 (0.38, 58)
West Beaver Creek	n/a	0.78 (0.02, 2)	6.21 (n/a, 1)	n/a	2.98 (1.11, 3)	3.52 (n/a, 1)	2.89 (0.82, 7)
West Indian Creek (County 4)	2.27 (0.55, 2)	1.75 (0.84, 8)	2.32 (0.00, 2)	n/a	2.00 (n/a, 1)	n/a	1.93 (0.51, 13)
West Indian Creek (LTM)	1.96 (n/a, 1)	0.96 (n/a, 1)	1.02 (0.52, 3)	n/a	1.79 (1.52, 2)	1.09 (0.00, 2)	1.30 (0.32, 9)
Willow Creek	1.80 (n/a, 1)	n/a	0.00 (0.00, 2)	1.60 (n/a, 1)	0.00 (0.00, 4)	7.66 (0.23, 3)	2.40 (1.04, 11)
Wisel Creek	0.66 (0.24, 7)	4.09 (1.64, 7)	0.97 (0.41, 7)	1.64 (0.87, 3)	0.95 (0.81, 2)	1.11 (0.47, 5)	1.69 (0.45, 31)
Totals	1.93 (0.24, 88)	2.14 (0.27, 105)	1.30 (0.16, 104)	1.01 (0.11, 149)	1.11 (0.21, 116)	1.49 (0.22, 88)	1.45 (0.08, 650)

TABLE 1-12. Mean catch rate (number/hour) for all trout species ≥ 12 inches TL combined from a roving-roving creel survey of 24 selected stream areas in southeast Minnesota April 1 to September 30, 2013. Numbers in parentheses represent SE and sample size (number of anglers). Catch rate data was only compiled for anglers that fished for longer than 0.5 hour. n/a means no data were available.

	Months						
Stream areas	April	May	June	July	August	September	Totals
Camp Creek	0.00 (0.00, 2)	0.11 (0.11, 5)	n/a	1.12 (0.69, 3)	0.00 (0.00, 3)	0.00 (n/a, 1)	0.28 (0.18, 14)
Crooked Creek	0.36 (0.18, 6)	1.57 (0.75, 8)	n/a	1.45 (0.63, 3)	0.66 (n/a, 1)	1.24 (1.12, 2)	1.11 (0.34, 20)
East Beaver Creek	0.00 (n/a, 1)	0.55 (0.31, 6)	0.00 (0.00, 3)	0.00 (0.00, 2)	0.00 (0.00, 2)	0.41 (0.15, 4)	0.28 (0.12, 18)
Forestville Creek	0.20 (n/a, 1)	0.00 (n/a, 1)	1.00 (n/a, 1)	0.22 (0.18, 4)	0.00 (0.00, 4)	0.00 (0.00, 4)	0.14 (0.08, 15)
Gribben Creek	n/a	n/a	0.00 (0.00, 3)	0.00 (0.00, 3)	0.42 (0.42, 2)	0.00 (n/a, 1)	0.09 (0.09, 9)
Hay Creek (State Forest)	0.41 (0.20, 7)	0.00 (0.00, 2)	0.18 (0.18, 5)	n/a	0.00 (0.00, 2)	1.11 (n/a, 1)	0.29 (0.11, 17)
Hay Creek (Upper)	0.17 (0.09, 10)	0.00 (0.00, 4)	0.50 (0.17, 6)	0.06 (0.06, 6)	0.24 (0.17, 6)	0.32 (0.17, 5)	0.22 (0.05, 37)
Middle Branch Whitewater (Crow Springs)	0.15 (0.15, 2)	1.92 (n/a, 1)	0.00 (0.00, 2)	n/a	0.00 (0.00, 2)	0.00 (n/a, 1)	0.28 (0.24, 8)
Middle Branch Whitewater (County 9)	n/a	n/a	0.46 (0.16, 8)	0.00 (0.00, 2)	0.53 (0.26, 3)	1.00 (1.00, 2)	0.49 (0.15, 15)
Middle Branch Whitewater (Quincy)	0.00 (0.00, 3)	0.12 (0.11, 11)	0.61 (0.37, 5)	0.17 (0.11, 12)	0.13 (0.09, 12)	0.22 (0.11, 7)	0.19 (0.06, 50)
Mill Creek	0.30 (n/a, 1)	0.86 (0.86, 3)	0.00 (0.00, 3)	0.67 (0.67, 2)	0.12 (0.12, 2)	0.00 (0.00, 4)	0.30 (0.19, 15)
North Branch Whitewater	0.50 (0.20, 7)	0.06 (0.04, 8)	n/a	0.10 (0.07, 17)	0.40 (0.01, 2)	0.00 (0.00, 3)	0.18 (0.06, 37)
Pine Creek	1.01 (0.57, 3)	1.56 (0.78, 3)	0.31 (n/a, 1)	0.00 (0.00, 4)	1.00 (1.00, 3)	0.06 (0.06, 4)	0.63 (0.24, 18)
South Branch Root River (Lanesboro)	0.74 (0.66, 6)	0.10 (0.09, 12)	0.00 (0.00, 10)	0.24 (0.07, 41)	0.09 (0.04, 36)	0.24 (0.11, 10)	0.18 (0.05, 115)
South Branch Root River (State Park)	0.00 (0.00, 3)	0.00 (0.00, 4)	0.18 (0.16, 17)	0.09 (0.08, 19)	0.14 (0.14, 3)	0.24 (0.18, 7)	0.13 (0.06, 53)
South Fork Root River (LTM)	n/a	0.93 (0.20, 2)	0.56 (n/a, 1)	n/a	0.41 (n/a, 1)	0.00 (0.00, 8)	0.23 (0.11, 12)
South Fork Root River (Million Dollar)	0.45 (0.26, 4)	0.16 (0.08, 3)	1.71 (1.43, 4)	0.00 (n/a, 1)	0.00 (0.00, 3)	0.26 (0.20, 4)	0.53 (0.31, 19)
Trout Run (Bucksnort)	0.25 (0.25, 5)	0.41 (0.16, 6)	0.19 (0.12, 6)	0.02 (0.02, 14)	0.05 (0.05, 7)	0.60 (0.26, 5)	0.20 (0.06, 43)
Trout Run (Lohman's)	1.05 (0.36, 12)	0.67 (0.35, 6)	0.26 (0.15, 14)	0.75 (0.14, 12)	0.10 (0.07, 10)	0.22 (0.13, 4)	0.54 (0.10, 58)
West Beaver Creek	n/a	0.52 (0.27, 2)	1.24 (n/a, 1)	n/a	0.81 (0.50, 3)	1.10 (n/a, 1)	0.83 (0.22, 7)
West Indian Creek (County 4)	0.35 (0.35, 2)	0.27 (0.19, 8)	0.56 (0.28, 2)	n/a	0.00 (n/a, 1)	n/a	0.30 (0.13, 13)
West Indian Creek (LTM)	0.24 (n/a, 1)	0.00 (n/a, 1)	0.10 (0.10, 3)	n/a	0.00 (0.00, 2)	0.00 (0.00, 2)	0.06 (0.04, 9)
Willow Creek	0.00 (n/a, 1)	n/a	0.00 (0.00, 2)	0.00 (n/a, 1)	0.00 (0.00, 4)	2.67 (0.57, 3)	0.73 (0.40, 11)
Wisel Creek	0.27 (0.27, 7)	1.62 (0.98, 7)	0.06 (0.04, 7)	1.07 (0.54, 3)	0.00 (0.00, 2)	0.42 (0.27, 5)	0.61 (0.25, 31)
Totals	0.44 (0.09, 84)	0.50 (0.11, 103)	0.29 (0.07, 104)	0.26 (0.04, 149)	0.15 (0.04, 116)	0.35 (0.07, 88)	0.32 (0.03, 644)

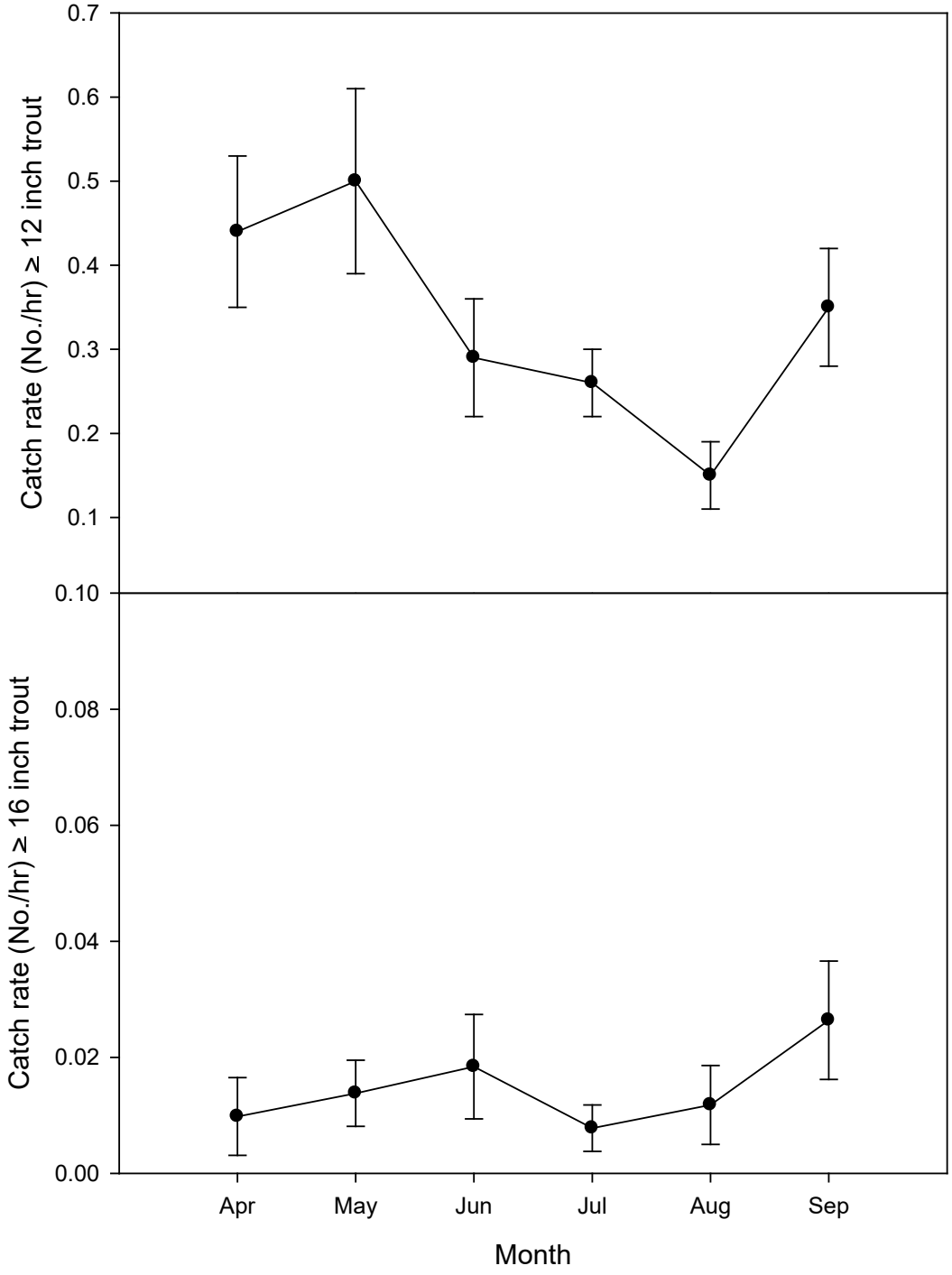

FIGURE 1-5. Monthly changes in mean angler catch rates (± 1 SE) for all trout ≥12 inches TL (top figure) and all trout ≥ 16 inches TL (bottom figure) caught from 24 selected stream areas in southeast Minnesota during the summer angling season, April 1 to September 30, 2013.

TABLE 1-13. Mean catch rate (number/hour) for all trout species ≥ 16 inches TL combined from a roving-roving creel survey of 24 stream areas in southeast Minnesota April 1-September 30, 2013. Numbers in parentheses represent SE and sample size (number of anglers). Catch rate data was only compiled for anglers that fished for longer than 0.5 hour. n/a means no data were available.

	Months						
Stream areas	April	May	June	July	August	September	Totals
Camp Creek	0.00 (0.00, 2)	0.00 (0.00, 5)	n/a	0.00 (0.00, 3)	0.00 (0.00, 3)	0.00 (n/a, 1)	0.00 (0.00, 14)
Crooked Creek	0.00 (0.00, 6)	0.03 (0.03, 8)	n/a	0.00 (0.00, 3)	0.00 (n/a, 1)	0.00 (0.00, 2)	0.01 (0.01, 20)
East Beaver Creek	0.00 (n/a, 1)	0.00 (0.00, 6)	0.00 (0.00, 3)	0.00 (0.00, 2)	0.00 (0.00, 2)	0.00 (0.00, 4)	0.00 (0.00, 18)
Forestville Creek	0.00 (n/a, 1)	0.00 (n/a, 1)	0.00 (n/a, 1)	0.00 (0.00, 4)	0.00 (0.00, 4)	0.00 (0.00, 4)	0.00 (0.00, 15)
Gribben Creek	n/a	n/a	0.00 (0.00, 3)	0.00 (0.00, 3)	0.00 (0.00, 2)	0.00 (n/a, 1)	0.00 (0.00, 9)
Hay Creek (State Forest)	0.00 (0.00, 7)	0.00 (0.00, 2)	0.00 (0.00, 5)	n/a	0.00 (0.00, 2)	0.00 (n/a, 1)	0.00 (0.00, 17)
Hay Creek (Upper)	0.01 (0.01, 10)	0.00 (0.00, 4)	0.00 (0.00, 6)	0.00 (0.00, 6)	0.16 (0.10, 6)	0.14 (0.09, 5)	0.05 (0.02, 37)
Middle Branch Whitewater (Crow Springs)	0.00 (0.00, 2)	0.00 (n/a, 1)	0.00 (0.00, 2)	n/a	0.00 (0.00, 2)	0.00 (n/a, 1)	0.00 (0.00, 8)
Middle Branch Whitewater (County 9)	n/a	n/a	0.08 (0.08, 8)	0.00 (0.00, 2)	0.00 (0.00, 3)	0.00 (0.00, 2)	0.04 (0.04, 15)
Middle Branch Whitewater (Quincy)	0.00 (0.00, 3)	0.00 (0.00, 11)	0.06 (0.06, 5)	0.00 (0.00, 12)	0.00 (0.00, 12)	0.00 (0.00, 7)	0.01 (0.01, 50)
Mill Creek	0.00 (n/a, 1)	0.00 (0.00, 3)	0.00 (0.00, 3)	0.00 (0.00, 2)	0.00 (0.00, 2)	0.00 (0.00, 4)	0.00 (0.00, 15)
North Branch Whitewater	0.00 (0.00, 7)	0.00 (0.00, 8)	n/a	0.00 (0.00, 17)	0.00 (0.00, 2)	0.00 (0.00, 3)	0.00 (0.00, 37)
Pine Creek	0.18 (0.18, 3)	0.00 (0.00, 3)	0.00 (n/a, 1)	0.00 (0.00, 4)	0.00 (0.00, 3)	0.00 (0.00, 4)	0.03 (0.03, 18)
South Branch Root River (Lanesboro)	0.00 (0.00, 6)	0.00 (0.00, 12)	0.00 (0.00, 10)	0.01 (0.01, 41)	0.00 (0.00, 36)	0.02 (0.02, 10)	0.004 (0.003, 115)
South Branch Root River (State Park)	0.00 (0.00, 3)	0.00 (0.00, 4)	0.00 (0.00, 17)	0.00 (0.00, 19)	0.00 (0.00, 3)	0.12 (0.08, 7)	0.02 (0.01, 53)
South Fork Root River (LTM)	n/a	0.00 (0.00, 2)	0.00 (n/a, 1)	n/a	0.41 (n/a, 1)	0.00 (0.00, 8)	0.03 (0.03, 12)
South Fork Root River (Million Dollar)	0.00 (0.00, 4)	0.00 (0.00, 3)	0.14 (0.14, 4)	0.00 (n/a, 1)	0.00 (0.00, 3)	0.00 (0.00, 4)	0.03 (0.03, 19)
Trout Run (Bucksnort)	0.00 (0.00, 5)	0.04 (0.04, 6)	0.02 (0.02, 6)	0.00 (0.00, 14)	0.00 (0.00, 7)	0.08 (0.08, 5)	0.02 (0.01, 43)
Trout Run (Lohman's)	0.02 (0.02, 12)	0.04 (0.04, 6)	0.00 (0.00, 14)	0.05 (0.04, 12)	0.00 (0.00, 10)	0.00 (0.00, 4)	0.02 (0.01, 58)
West Beaver Creek	n/a	0.00 (0.00, 2)	0.00 (n/a, 1)	n/a	0.00 (0.00, 3)	0.22 (n/a, 1)	0.03 (0.03, 7)
West Indian Creek (County 4)	0.00 (0.00, 2)	0.05 (0.05, 8)	0.14 (0.14, 2)	n/a	0.00 (n/a, 1)	n/a	0.05 (0.03, 13)
West Indian Creek (LTM)	0.00 (n/a, 1)	0.00 (n/a, 1)	0.00 (0.00, 3)	n/a	0.00 (0.00, 2)	0.00 (0.00, 2)	0.00 (0.00, 9)
Willow Creek	0.00 (n/a, 1)	n/a	0.00 (0.00, 2)	0.00 (n/a, 1)	0.00 (0.00, 4)	0.00 (0.00, 3)	0.00 (0.00, 11)
Wisel Creek	0.00 (0.00, 7)	0.05 (0.03, 7)	0.00 (0.00, 7)	0.08 (0.08, 3)	0.00 (0.00, 2)	0.00 (0.00, 5)	0.02 (0.01, 31)
Totals	0.010 (0.006, 84)	0.014 (0.006, 103)	0.018 (0.009, 104)	0.008 (0.004, 149)	0.012 (0.007, 116)	0.026 (0.010, 88)	0.014 (0.003, 644)

TABLE 1-14. The percent of trout caught that were subsequently harvested by anglers, by stream and overall (all trout species) calculated from surveys given to anglers fishing selected trout streams in southeast Minnesota, April 1 and September 30, 2013. The early (April 1 to April 12, 2013) and late (September 15 to September 30, 2013) catch-and-release seasons were excluded.

Stream	Regulation	Percent harvest
Willow Creek	General	47.4
West Indian Creek (LTM)	Slot – no gear restrictions	37.7
Hay Creek (State Forest)	General	35.4
South Branch Root River (Lanesboro)	General	33.5
Mill Creek	General	29.2
North Branch Whitewater River	Slot – artificial lures/flies	23.9
Forestville Creek	Slot – no gear restrictions	17.5
Pine Creek	General	14.0
West Beaver Creek	General	11.8
East Beaver Creek	Slot – no gear restrictions	11.1
Trout Run (Bucksnort)	Slot – artificial lures/flies	10.9
South Branch Root River (State Park)	Slot – no gear restrictions	8.9
Hay Creek (Upper)	Slot – artificial lures/flies	8.3
Wisel Creek	Slot – no gear restrictions	6.8
West Indian Creek (County 4)	General	5.4
Gribben Creek	Slot – artificial lures/flies	4.2
South Fork Root River (Million Dollar)	General	2.7
Crooked Creek	General	2.8
Trout Run (Lohman's)	Slot – artificial lures/flies	2.5
Overall		13.0

A total of 47,695 (SE = 4,046) Brown Trout were estimated to have been caught with about 24% of these ≥ 12 inches, and 1.2% ≥ 16 inches (Table 1-15 and 1-16). The greatest number of Brown Trout was estimated to have been caught at Trout Run (Lohman's) (9,755) followed by the South Branch Root River (Lanesboro Dam) (4,047), Pine Creek (3,745), South Branch Root River (Forestville State Park) (3,301) and Wisel Creek (2,996). About one-third of all Brown Trout < 12 inches that were caught, were harvested at the West Indian Creek (LTM), Hay Creek (State Forest), and South Branch Root River (Lanesboro Dam) sites (Table 1-17). Harvest percentages for 12-16 inch Brown Trout were similarly highest at the South Branch Root River (Lanesboro Dam) and Hay Creek (State Forest) sites, where more than half of the trout caught were harvested. Violations were noted for harvesting Brown Trout in the 12-16 inch protected slot on Forestville Creek and Hay Creek (Upper) (Table 1-17). No harvest violations were noted in either the early or late catch-and-release seasons. The one day on Camp Creek open to general fishing regulations (third Saturday in May) resulted in an estimate of 48 harvested Brown Trout, all between 10 and 11 inches. Finally, very few Brown Trout > 16 inches were caught (566) and of these, only 16 (3%) were estimated to have been harvested, all at Trout Run (Lohman's) (Table 1-17).

TABLE 1-15. Brown Trout catch and harvest calculated from surveys given to anglers fishing selected trout streams in southeast Minnesota, April 1 and September 30, 2013.

Stream	Day type	Brown Trout			
		Total catch	SE (±)	Total harvest	SE (±)
Camp Creek	WD	739	474		
	WEH	390	219		
	All	1,129	522		
Crooked Creek	WD	752	437		
	WEH	1,326	606	42	30
	All	2,078	747	42	30
East Beaver Creek	WD	519	387		
	WEH	161	114	45	45
	All	680	404	45	45
Forestville Creek	WD	0	0		
	WEH	165	92	38	24
	All	165	92	38	24
Gribben Creek	WD	104	104		
	WEH	342	189	17	17
	All	446	216	17	17
Hay Creek – State Forest	WD	104	104	104	75
	WEH	508	209	141	79
	All	612	233	245	109
Hay Creek – Upper	WD	835	299	206	125
	WEH	1,167	374	96	68
	All	2,002	479	302	142
Middle Branch	WD	431	307	162	102
Whitewater (Crow)	WEH	139	98	165	94
	All	570	322	327	139
Middle Branch	WD	1,119	738		
Whitewater (Cty 9)	WEH	444	210		
	All	1,563	767		
Middle Branch	WD	1,516	538		
Whitewater (Quincy)	WEH	552	202		
	All	2,068	574		
Mill Creek	WD	0	0		
	WEH	453	356		
	All	453	356		

(TABLE 1-15 continued on next page)

TABLE 1-15. Continued (Brown Trout).

Stream	Day type	Brown Trout			
		Total catch	SE (±)	Total harvest	SE (±)
North Branch Whitewater	WD	678	395		
	WEH	1,012	487		
	All	1,690	628		
Pine Creek	WD	1,671	1,119	37	37
	WEH	2,074	1,178	243	133
	All	3,745	1,625	280	138
South Branch Root River	WD	1,167	379	509	171
(Lanesboro)	WEH	2,880	1,226	1,157	404
	All	4,047	1,283	1,666	438
South Branch Root River	WD	1,579	592		
(State Park)	WEH	1,722	843	143	104
	All	3,301	1,030	143	104
South Fork Root River	WD	741	414		
(LTM)	WEH	849	608		
	All	1,590	736		
South Fork Root River	WD	633	591		
(Million)	WEH	1,334	556	20	20
	All	1,967	811	20	20
Trout Run (Bucksnort)	WD	969	472	226	132
	WEH	1,834	768	62	62
	All	2,803	902	289	146
Trout Run (Lohman's)	WD	5,405	1,419	44	33
	WEH	4,350	1,300	173	114
	All	9,755	1,925	217	119
West Beaver Creek	WD	457	260		
	WEH	1,148	851	66	41
	All	1,605	890	66	41
West Indian Creek	WD	1,158	586	180	118
(Cty 4)	WEH	321	225		
	All	1,479	628	180	118
West Indian Creek	WD	371	173	171	72
(LTM)	WEH	127	88		
	All	498	194	171	72
Willow Creek	WD	0	0		
	WEH	457	425		
	All	457	425		
Wisel Creek	WD	1,748	918		
	WEH	1,248	435	7	7
	All	2,996	1,016	7	7
Total	All	47,695	4,046	4,055	577

TABLE 1-16. Brown Trout >12 inches and >16 inches catch and harvest calculated from surveys given to anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

		Brown Trout >12 inches				Brown Trout >16 inches			
Stream	Day type	Total catch	SE (±)	Total harvest	SE (±)	Total catch	SE (±)	Total harvest	SE (±)
Camp Creek	WD	75	60			0	0		
	WEH	103	103			0	0		
	All	178	119			0	0		
Crooked Creek	WD	220	125			12	12		
	WEH	255	153	19	19	0	0		
	All	475	197	19	19	12	12		
East Beaver Creek	WD	200	140			0	0		
	WEH	59	59			0	0		
	All	259	152			0	0		
Forestville Creek	WD	0	0			0	0		
	WEH	39	27	5	5	0	0		
	All	39	27	5	5	0	0		
Gribben Creek	WD	0	0			0	0		
	WEH	31	30			0	0		
	All	31	30			0	0		
Hay Creek – State	WD	62	62	62	62	0	0		
	WEH	117	55	35	35	0	0		
	All	179	83	97	71	0	0		
Hay Creek – Upper	WD	171	73	39	39	63	37		
	WEH	171	73			18	14		
	All	342	103	39	39	81	39		
Middle Branch Whitewater (Crow)	WD	109	109			0	0		
	WEH	20	20			0	0		
	All	129	111			0	0		
Middle Branch Whitewater (Cty 9)	WD	217	140			0	0		
	WEH	126	66			13	13		
	All	343	155			13	13		
Middle Branch Whitewater (Quincy)	WD	317	137			17	17		
	WEH	125	58			0	0		
	All	442	153			17	17		
Mill Creek	WD	0	0			0	0		
	WEH	213	213			0	0		
	All	213	213			0	0		
North Branch Whitewater	WD	60	48			0	0		
	WEH	237	227			0	0		
	All	297	232			0	0		
Pine Creek	WD	643	451			0	0		
	WEH	350	242	56	56	42	42		
	All	993	512	56	56	42	42		

(TABLE 1-16 continued on next page)

TABLE 1-16. Continued.

Stream	Day type	Brown Trout >12 inches: Total catch	SE (±)	Total harvest	SE (±)	Brown Trout >16 inches: Total catch	SE (±)	Total harvest	SE (±)
South Branch Root River	WD	254	132	113	80	43	43		
(Lanesboro)	WEH	1,088	609	735	353	0	0		
	All	1,342	623	472	362	43	43		
South Branch Root River	WD	366	319			106	106		
(State Park)	WEH	897	832			0	0		
	All	1,263	891			106	106		
South Fork Root River	WD	141	82			0	0		
(LTM)	WEH	15	15			15	15		
	All	156	84			15	15		
South Fork Root River	WD	148	148			0	0		
(Million)	WEH	409	252			21	21		
	All	557	292			21	21		
Trout Run (Bucksnort)	WD	230	140			30	29		
	WEH	392	204			36	36		
	All	622	247			66	47		
Trout Run (Lohman's)	WD	634	171			8	8		
	WEH	1,026	405	16	16	42	25	16	16
	All	1,660	439	16	16	50	26	16	16
West Beaver Creek	WD	94	67			11	11		
	WEH	449	356	44	35	0	0		
	All	543	362	44	35	11	11		
West Indian Creek	WD	156	94			20	20		
(Cty 4)	WEH	34	34			9	9		
	All	190	100			29	22		
West Indian Creek (LTM)	WD	15	14			0	0		
	WEH	8	8			0	0		
	All	23	16			0	0		
Willow Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Wisel Creek	WD	988	509			51	51		
	WEH	213	122			9	9		
	All	1,201	524			60	52		
Total	All	11,474	1,568	1,124	378	565	151	16	16

TABLE 1-17. Estimated total catch, harvest, and percent harvest of three size groups of Brown Trout caught during the summer angling season April 1 to September 30, 2013 on selected stream areas in southeast Minnesota.

	≤ 11 inches			12-16 inches			> 16 inches		
Stream	Catch	Harvest	% Harvest	Catch	Harvest	% Harvest	Catch	Harvest	% Harvest
Camp Creek	951	0	0%	178	0	0%	0		
Crooked Creek	1603	23	1%	463	19	4%	12	0	0%
East Beaver Creek	421	45	11%	259	0	0%	0		
Forestville Creek	126	33	26%	39	5[a]	13%[a]	0		
Gribben Creek	415	17	4%	31	0	0%	0		
Hay Creek (State Forest)	433	148	34%	179	97	54%	0		
Hay Creek (Upper)	1660	263	16%	261	39[a]	15%[a]	81	0	0%
Middle Branch Whitewater (Crow)	441	0	0%	129	0	0%	0		
Middle Branch Whitewater (Cty 9)	1220	0	0%	330	0	0%	13	0	0%
Middle Branch Whitewater (Quincy)	1626	0	0%	425	0	0%	17	0	0%
Mill Creek	240	0	0%	213	0	0%	0		
North Branch Whitewater	1393	327	23%	297	0	0%	0		
Pine Creek	2752	224	8%	951	145	15%	42	0	0%
South Branch Root (Lanesboro)	2705	818	30%	1299	848	65%	43	0	0%
South Branch Root (State Park)	2038	143	7%	1157	0	0%	106	0	0%
South Fork Root (LTM)	1434	0	0%	141	0	0%	15	0	0%
South Fork Root (Million)	1410	20	1%	536	0	0%	21	0	0%
Trout Run (Bucksnort)	2181	289	13%	556	0	0%	66	0	0%
Trout Run (Lohman's)	8095	201	2%	1610	0	0%	50	16	32%
West Beaver Creek	1062	22	2%	532	44	8%	11	0	0%
West Indian Creek (Cty 4)	1289	180	14%	161	0	0%	29	0	0%
West Indian Creek (LTM)	475	171	36%	23	0	0%	0		
Willow Creek	457	0	0%	0			0		
Wisel Creek	1795	130	7%	1141	0	0%	60	0	0%
Totals	36,222	3,054	8%	10,911	1,197	11%	566	16	3%

[a] Illegal harvest

A total of 1,250 (SE = 397) Brook Trout were estimated to have been caught but only from eight stream areas which included Middle Branch Whitewater (Crow Springs and County 9), South Fork Root River (LTM), West Beaver Creek, West Indian Creek (County 4 and LTM), and Wisel Creek (Table 1-18). Two hundred and fifty eight (20%) of these trout were ≥ 10 inches. The highest estimated catch of Brook Trout ≥ 10 inches was from Wisel Creek (80), and 75 were estimated to have been caught from Middle Branch Whitewater (Crow Springs). The percentage of Brook Trout < 10 inches that were harvested was 0% at all sites except for Wisel Creek (96% harvested) and West Indian Creek (LTM) (100% harvested) (Table 1-19). The percentage of Brook Trout ≥ 10 inches that were harvested was similar with harvest only at Wisel Creek (61%) and West Indian Creek (LTM) (100% harvested).

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TABLE 1-18. Brook Trout and Brook Trout (>10 inches) catch and harvest calculated from surveys given to anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

		Brook Trout				Brook Trout >10 inches			
Stream	Day type	Total catch	SE (±)	Total harvest	SE (±)	Total catch	SE (±)	Total harvest	SE (±)
Camp Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Crooked Creek	WD	0	0			0	0		
	WEH	34	28			9	9		
	All	34	28			9	9		
East Beaver Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Forestville Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Gribben Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Hay Creek – State Forest	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Hay Creek – Upper	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Middle Branch	WD	78	60			57	57		
Whitewater (Crow)	WEH	373	217			18	18		
	All	451	226			75	59		
Middle Branch	WD	237	176			3	3		
Whitewater (Cty 9)	WEH	0	0			0	0		
	All	237	176			3	3		
Middle Branch	WD	0	0			0	0		
Whitewater (Quincy)	WEH	0	0			0	0		
	All	0	0			0	0		
Mill Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
North Branch Whitewater	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		

(TABLE 1-18 continued on next page)

TABLE 1-18. Continued (Brook Trout).

Stream	Day type	Brook Trout Total catch	Brook Trout SE (±)	Brook Trout Total harvest	Brook Trout SE (±)	Brook Trout >10 inches Total catch	Brook Trout >10 inches SE (±)	Brook Trout >10 inches Total harvest	Brook Trout >10 inches SE (±)
Pine Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
South Branch Root River	WD	0	0			0	0		
(Lanesboro)	WEH	0	0			0	0		
	All	0	0			0	0		
South Branch Root River	WD	0	0			0	0		
(State Park)	WEH	0	0			0	0		
	All	0	0			0	0		
South Fork Root River	WD	0	0			0	0		
(LTM)	WEH	46	34			11	11		
	All	46	34			11	11		
South Fork Root River	WD	0	0			0	0		
(Million)	WEH	0	0			0	0		
	All	0	0			0	0		
Trout Run (Bucksnort)	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Trout Run (Lohman's)	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
West Beaver Creek	WD	0	0			0	0		
	WEH	236	236			59	59		
	All	236	236			59	59		
West Indian Creek	WD	52	52			0	0		
(Cty 4)	WEH	0	0			0	0		
	All	52	52			0	0		
West Indian Creek	WD	63	63	63	47	21	21	21	21
(LTM)	WEH	0	0			0	0		
	All	63	63	63	47	21	21	21	21
Willow Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Wisel Creek	WD	103	103	98	69	52	52	49	49
	WEH	28	28			28	28		
	All	131	107	98	69	80	58	49	49
Total	All	1,250	397	161	83	256	105	70	53

TABLE 1-19. Estimated total catch, harvest, and percent harvest of two size groups of Brook Trout caught during the summer angling season April 1 to September 30, 2013 on selected trout streams areas in southeast Minnesota.

	< 10 inches			≥ 10 inches		
Stream	Catch	Harvest	% Harvest	Catch	Harvest	% Harvest
Camp Creek	0			0		
Crooked Creek	25	0	0%	9	0	0%
East Beaver Creek	0			0		
Forestville Creek	0			0		
Gribben Creek	0			0		
Hay Creek (State Forest)	0			0		
Hay Creek (Upper)	0			0		
Middle Branch Whitewater (Crow)	376	0	0%	75	0	0%
Middle Branch Whitewater (Cty 9)	234	0	0%	3	0	0%
Middle Branch Whitewater (Quincy)	0			0		
Mill Creek	0			0		
North Branch Whitewater	0			0		
Pine Creek	0			0		
South Branch Root (Lanesboro)	0			0		
South Branch Root (State Park)	0			0		
South Fork Root (LTM)	35	0	0%	11	0	0%
South Fork Root (Million)	0			0		
Trout Run (Bucksnort)	0			0		
Trout Run (Lohman's)	0			0		
West Beaver Creek	177	0	0%	59	0	0%
West Indian Creek (Cty 4)	52	0	0%	0		
West Indian Creek (LTM)	42	42	100%	21	21	100%
Willow Creek	0			0		
Wisel Creek	51	49	96%	80	49	61%
Totals	992	91	9%	258	70	27%

A total of 5,138 (SE = 1,230) Rainbow Trout were estimated to have been caught from 10 of the 24 stream areas (Table 1-20). About one-fourth of these trout were ≥ 12 inches. The highest estimated catch of Rainbow Trout was at the South Branch Root River (Lanesboro). The overall estimated percent harvest was similar for both Rainbow Trout ≤ 11 inches (36%) and for those trout ≥ 12 inches (38%) (Table 1-21). Multiple violations were noted on the North Branch Whitewater River for anglers harvesting Rainbow Trout in the 12-16 inch protected slot. This resulted in a total illegal harvest estimate of 63 Rainbow Trout. Also, some North Branch Whitewater anglers used bait, in violation of the gear restriction (artificial lures and flies only). The one day on Camp Creek open to general fishing regulations (May 18, 2013; third Saturday in May) resulted in an estimate of 98 harvested Rainbow Trout, all ≤ 11 inches.

TABLE 1-20. Rainbow Trout and Rainbow Trout (>12 inches) catch and harvest calculated from surveys given to anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Stream	Day type	Rainbow Trout Total catch	SE (±)	Total harvest	SE (±)	Rainbow Trout >12 inches Total catch	SE (±)	Total harvest	SE (±)
Camp Creek	WD	17	17			17	17		
	WEH	285	285			0	0		
	All	302	302			17	17		
Crooked Creek	WD	203	145			56	33		
	WEH	249	178	11	11	158	100	11	11
	All	452	229	11	11	214	105	11	11
East Beaver Creek	WD	0	0			0	0		
	WEH	4	4			0	0		
	All	4	4			0	0		
Forestville Creek	WD	0	0			0	0		
	WEH	36	36			36	36		
	All	36	36			36	36		
Gribben Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Hay Creek – State Forest	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Hay Creek – Upper	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Middle Branch Whitewater (Crow)	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Middle Branch Whitewater (Cty 9)	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Middle Branch Whitewater (Quincy)	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Mill Creek	WD	28	28			0	0		
	WEH	281	149	189	95	85	85	82	61
	All	309	152	189	95	85	85	82	61

(TABLE 1-20 continued on next page)

TABLE 1-20. Continued (Rainbow Trout).

Stream	Day type	Rainbow Trout Total catch	SE (±)	Total harvest	SE (±)	Rainbow Trout >12 inches Total catch	SE (±)	Total harvest	SE (±)
North Branch Whitewater	WD	319	275	303	271	0	0		
	WEH	383	254	384	243	63	63	63	63
	All	702	374	687	364	63	63	63	63
Pine Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
South Branch Root River	WD	1,158	590	149	71	204	146	67	41
(Lanesboro)	WEH	716	279	580	248	209	106	168	99
	All	1,874	652	729	258	413	181	235	107
South Branch Root River	WD	0	0			0	0		
(State Park)	WEH	0	0			0	0		
	All	0	0			0	0		
South Fork Root River	WD	0	0			0	0		
(LTM)	WEH	0	0			0	0		
	All	0	0			0	0		
South Fork Root River	WD	0	0			0	0		
(Million)	WEH	104	104			0	0		
	All	104	104			0	0		
Trout Run (Bucksnort)	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
Trout Run (Lohman's)	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
West Beaver Creek	WD	0	0			0	0		
	WEH	0	0			0	0		
	All	0	0			0	0		
West Indian Creek	WD	0	0			0	0		
(Cty 4)	WEH	0	0			0	0		
	All	0	0			0	0		
West Indian Creek	WD	0	0			0	0		
(LTM)	WEH	0	0			0	0		
	All	0	0			0	0		
Willow Creek	WD	1,196	874	208	150	417	417	83	83
	WEH	32	32			0	0		
	All	1,228	874	208	150	417	417	83	83
Wisel Creek	WD	115	115	55	55	0	0		
	WEH	14	14			0	0		
	All	129	116	55	55	0	0		
Total	All	5,138	1,230	1,879	483	1,244	412	474	162

TABLE 1-21. Estimated total catch, harvest, and percent harvest of two size groups of Rainbow Trout caught during the summer angling season April 1 to September 30, 2013 on selected stream areas in southeast Minnesota.

	≤ 11 inches			12-16 inches		
Stream	Catch	Harvest	% Harvest	Catch	Harvest	% Harvest
Camp Creek	285	0	0%	17	0	0%
Crooked Creek	238	0	0%	214	11	5%
East Beaver Creek	4	0	0%	0		
Forestville Creek	0			36	0	0%
Gribben Creek	0			0		
Hay Creek (State Forest)	0			0		
Hay Creek (Upper)	0			0		
Middle Branch Whitewater (Crow)	0			0		
Middle Branch Whitewater (Cty 9)	0			0		
Middle Branch Whitewater (Quincy)	0			0		
Mill Creek	224	107	48%	85	82	96%
North Branch Whitewater	639	624	98%	63	63[a]	100%[a]
Pine Creek	0			0		
South Branch Root (Lanesboro)	1461	494	34%	413	235	57%
South Branch Root (State Park)	0			0		
South Fork Root (LTM)	0			0		
South Fork Root (Million)	104	0	0%	0		
Trout Run (Bucksnort)	0			0		
Trout Run (Lohman's)	0			0		
West Beaver Creek	0			0		
West Indian Creek (Cty 4)	0			0		
West Indian Creek (LTM)	0			0		
Willow Creek	811	125	15%	417	83	20%
Wisel Creek	129	55	43%	0		
Totals	3,895	1,405	36%	1,245	474	38%

[a] Illegal harvest

Several other fish species were caught and harvested during summer 2013. Anglers reported catching two Tiger Trout, a Brook Trout x Brown Trout hybrid. Also caught were two Bluegill *Lepomis macrochirus,* one Channel Catfish *Ictalurus punctatus*, one unidentified redhorse (*Moxostoma* sp.*)* and one unidentified bullhead (*Amerius sp.)* which was subsequently harvested. Several Smallmouth Bass *Micropterus dolomieu* and White Sucker *Catostomus commersoni* were caught and allowed estimates of total catch. An estimated 482 (SE = 308) Smallmouth Bass were caught, all from the South Branch Root River (Lanesboro Dam) (Table 1-22). All Smallmouth Bass were released. A total of 752 (SE = 650) White Sucker were caught from three stream areas which included Mill Creek, North Branch Whitewater River, and South Branch Root River (Lanesboro Dam) (Table 1-23). A total of 263(SE= 183) of the White Sucker caught were harvested, all from the South Branch Root River at Lanesboro (Table 1-23).

Rainbow Trout yearlings are typically stocked in areas of relatively heavy harvest and a release rate of 55.8% reflects this management strategy. For Brown Trout 92.7% of those caught were released and was similar with Brook Trout at 91.2%. Mean harvested Brown Trout length was 10.5 inches with Rainbow Trout harvested at a mean length of 10.3 inches.

When harvest rates were examined by gear type it was apparent that anglers using bait harvested the largest portion of their catch (40.9%). Mixed method anglers harvested 21.4% of their catch while anglers using lures harvested 10.1%. Fly anglers harvested the smallest portion of their catch at 2.6%.

TABLE 1-22. Smallmouth Bass catch and harvest calculated from surveys given to anglers fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Stream	Day type	# of days surveyed	Total Smallmouth Bass caught	SE (±)	Total Smallmouth Bass harvested	SE (±)
South Branch Root River	WD	31	259	180	0	0
(Lanesboro)	WEH	25	223	128	0	0
	All		482	222	0	0
Total	All		482	308	0	0

TABLE 1-23. White Sucker catch and harvest calculated from surveys given to anglers fishing selected trout streams in southeast Minnesota, April 1 and September 30, 2013.

Stream	Day type	# of days surveyed	Total White Sucker caught	SE (±)	Total White Sucker harvested	SE (±)
Mill Creek	WD	32	56	56	0	0
	WEH	20	110	110	0	0
	All		166	124	0	0
North Branch Whitewater	WD	33	0	0	0	0
	WEH	23	81	59	0	0
	All		81	59	0	0
South Branch Root River	WD	31	264	184	263	183
(Lanesboro)	WEH	25	241	241	0	0
	All		505	303	263	183
Total	All		752	650	263	183

Angler Satisfaction - Anglers were asked about their satisfaction with their overall fishing experience, the size of the trout they caught and the number of trout they caught. Most anglers indicated they were satisfied (53.3%) or very satisfied (32.8%) with their overall fishing experience (Table 1-24). Only 1.4% of anglers were very dissatisfied. Fly anglers had the highest satisfaction levels in 2013 (Table 1-25). The most dissatisfied or very dissatisfied angler age groups in 2013, were anglers < 16 years old (16.3%) and 70-79 years old (11.1%) (Table 1-26). Anglers were least satisfied with their overall fishing experience on Forestville Creek, West Beaver Creek, Camp Creek and Trout Run (Bucksnort) (Table 1-27).

Most anglers indicated that they were satisfied (40.9%) or very satisfied (17.5%) with the size of trout they caught (Table 1-24). In general, more anglers were dissatisfied (14.6%) or very dissatisfied (1.7%) with the size of trout caught than were with their overall fishing experience. Anglers that were least satisfied with the size of trout they caught were mostly mixed method or fly anglers (Table 1-28), and tended to be in 16-19 and 70-79 year old age groups (Table 1-29). Among streams, about half of all anglers fishing Forestville Creek were either dissatisfied or very dissatisfied with the size of trout caught. About one in three anglers were similarly dissatisfied with trout size in the South Branch Root River (State Park), West Indian Creek (Cty 4) and Willow Creek (Table 1-30).

TABLE 1-24. Percent satisfaction of overall fishing experience, size of trout caught and number of trout caught of anglers surveyed fishing trout streams in southeast Minnesota, April 1 to September 30, 2013.

Question	Very Dissatisfied	Dissatisfied	Neither	Satisfied	Very Satisfied
Overall fishing experience	1.4	6.4	6.1	53.3	32.8
Size of trout caught	1.7	14.6	25.3	40.9	17.5
Number of trout caught	1.8	22.5	20.2	38.3	17.2

TABLE 1-25. Percent satisfaction of overall fishing experience relative to each gear type category of anglers surveyed fishing trout streams in southeast Minnesota, April 1 to September 30, 2013.

Gear	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
Bait	2.2	5.7	7.9	6.5	85.7	64.4	21.3
Lure	3.1	7.4	10.5	6.2	83.3	48.2	35.2
Fly	0.0	6.3	6.3	4.6	89.1	51.2	38.0
Mixed	0.0	13.9	13.9	8.3	77.8	61.1	16.7

TABLE 1-26. Percent satisfaction of overall fishing experience relative to each age category of anglers surveyed fishing trout streams in southeast Minnesota, April 1 and September 30, 2013.

Age category (years old)	Very Dissatisfied	Dissatisfied	Neither	Satisfied	Very Satisfied
<16	4.1	12.2	0.0	63.3	20.4
16-19	0.0	2.8	8.3	38.9	50.0
20-29	2.8	5.6	8.3	60.2	23.2
30-39	0.8	7.3	7.3	50.4	34.2
40-49	3.4	3.4	6.7	44.9	41.6
50-59	0.6	7.0	3.8	59.5	29.1
60-69	0.0	5.1	6.1	49.0	39.8
70-79	0.0	11.1	5.6	47.2	36.1
80-89	0.0	0.0	40.0	60.0	0.0

TABLE 1-27. Percent angler satisfaction (overall fishing experience) by stream of those surveyed fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Stream	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
Camp Creek	0.0	16.7	16.7	5.6	77.7	44.4	33.3
Crooked Creek	6.9	0.0	6.9	0.0	92.4	37.9	55.2
East Beaver Creek	0.0	0.0	0.0	0.0	100.0	20.0	80.0
Forestville Creek	6.3	18.8	25.1	18.8	56.3	50.0	6.3
Gribben Creek	0.0	14.3	14.3	0.0	85.7	71.4	14.3
Hay Creek – State Forest	0.0	0.0	0.0	15.8	84.2	26.3	57.9
Hay Creek – Upper	0.0	5.3	5.3	7.9	86.9	55.3	31.6
Middle Branch Whitewater – Quincy	0.0	20.0	20.0	2.0	78.0	60.0	18.0
Middle Branch Whitewater – Crow	0.0	0.0	0.0	18.2	81.8	63.6	18.2
Middle Branch Whitewater – Cty 9	0.0	0.0	0.0	0.0	100.0	40.0	60.0
Mill Creek	0.0	11.1	11.1	0.0	88.9	77.8	11.1
North Branch Whitewater	0.0	2.6	2.6	26.3	71.1	57.9	13.2
Pine Creek	0.0	5.0	5.0	5.0	90.0	70.0	20.0
South Branch Root River – Lanesboro	3.6	6.3	9.9	10.8	79.3	62.2	17.1
South Branch Root River – State Park	0.0	10.0	10.0	0.0	90.0	70.0	20.0
South Fork Root River – LTM	0.0	0.0	0.0	0.0	100.0	14.3	85.7
South Fork Root River – Million	0.0	0.0	0.0	0.0	100.0	16.7	83.3
Trout Run – Lohman's	0.0	5.9	5.9	1.5	92.6	63.2	29.4
Trout Run – Bucksnort	7.3	7.3	14.6	2.4	82.9	70.7	12.2
West Beaver Creek	0.0	22.2	22.2	0.0	77.8	22.2	55.6
West Indian Creek – LTM	0.0	0.0	0.0	0.0	100.0	77.8	22.2
West Indian Creek – Cty 4	0.0	0.0	0.0	25.0	75.0	75.0	0.0
Willow Creek	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Wisel Creek	0.0	2.4	2.4	2.4	95.3	28.6	66.7

TABLE 1-28. Percent satisfaction of size of trout caught relative to each gear type category of anglers surveyed fishing trout streams in southeast Minnesota, April 1 to September 30, 2013.

Gear	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
Bait	4.1	14.2	18.3	27.4	58.5	47.0	11.4
Lure	0.6	13.8	14.4	22.5	63.8	43.8	20.0
Fly	0.7	18.6	19.3	19.9	61.5	38.5	23.0
Mixed	0.0	24.3	24.3	32.4	43.2	35.1	8.1

TABLE 1-29. Percent satisfaction with the size of trout caught relative to each age category of anglers surveyed fishing trout streams in southeast Minnesota, April 1 and September 30, 2013.

Age category (years old)	Very Dissatisfied	Dissatisfied	Neither	Satisfied	Very Satisfied
<16	4.1	12.2	53.1	22.5	8.2
16-19	0.0	23.8	14.3	57.1	4.8
20-29	3.7	14.0	28.0	40.2	14.0
30-39	2.5	9.9	24.8	47.9	14.9
40-49	1.1	17.1	18.2	40.9	22.7
50-59	0.6	16.5	26.7	37.5	18.8
60-69	0.0	14.7	17.9	44.2	23.2
70-79	2.9	17.1	14.3	40.0	25.7
80-89	0.0	0.0	40.0	60.0	0.0

TABLE 1-30. Percent angler satisfaction (size of trout caught) by stream of those surveyed fishing selected trout streams in southeast Minnesota, April 1 to September, 2013.

Stream	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
Camp Creek	0.0	22.2	22.2	27.8	50.0	44.4	5.6
Crooked Creek	3.5	6.9	10.4	3.5	86.2	27.6	58.6
East Beaver Creek	0.0	0.0	0.0	0.0	100.0	31.3	68.8
Forestville Creek	12.5	37.5	50.0	37.5	12.5	12.5	0.0
Gribben Creek	0.0	28.6	28.6	42.9	28.6	28.6	0.0
Hay Creek – State Forest	0.0	15.8	15.8	42.1	42.1	26.3	15.8
Hay Creek – Upper	0.0	10.5	10.5	39.8	52.6	44.7	7.9
Middle Branch Whitewater – Quincy	0.0	24.0	24.0	42.0	34.0	30.0	4.0
Middle Branch Whitewater – Crow	0.0	0.0	0.0	27.3	72.8	54.6	18.2
Middle Branch Whitewater – Cty 9	0.0	0.0	0.0	13.3	86.7	60.0	26.7
Mill Creek	0.0	5.6	5.6	50.0	44.4	44.4	0.0
North Branch Whitewater	0.0	15.8	15.8	31.6	52.7	47.4	5.3
Pine Creek	0.0	5.0	5.0	10.0	85.0	65.0	20.0
South Branch Root River – Lanesboro	2.7	18.9	21.6	22.5	55.9	51.4	4.5
South Branch Root River – State Park	12.0	24.0	36.0	26.0	38.0	36.0	2.0
South Fork Root River – LTM	0.0	0.0	0.0	0.0	100.0	14.3	85.7
South Fork Root River – Million	0.0	4.2	4.2	16.7	79.2	29.2	50.0
Trout Run – Lohman's	0.0	7.3	7.3	34.2	58.6	53.7	4.9
Trout Run – Bucksnort	0.0	18.2	18.2	18.2	63.6	50.0	13.6
West Beaver Creek	0.0	20.0	20.0	0.0	80.0	30.0	50.0
West Indian Creek – LTM	0.0	11.1	11.1	11.1	77.8	77.8	0.0
West Indian Creek – Cty 4	0.0	30.8	30.8	30.8	38.5	30.8	7.7
Willow Creek	0.0	33.3	33.3	0.0	66.7	66.7	0.0
Wisel Creek	0.0	2.6	2.6	0.0	97.5	30.8	66.7

Again most anglers were satisfied (38.3%) or very satisfied (17.2%) with the numbers of trout they caught on the interviewed stream (Table 1-24). More were dissatisfied (22.5%) or very dissatisfied (1.8%) with the numbers of trout they caught then were with their overall fishing experience and size of trout caught. Mixed method and bait anglers tended to be least satisfied with the numbers of trout they caught (Table 1-31). Over a third of anglers less than 30 years old were either dissatisfied or very dissatisfied with the number of trout they caught (Table 1-32). About a third of anglers aged 70-79 year old were similarly dissatisfied.

Streams that had the least satisfied anglers with trout size above, also tended to have the lowest angler satisfaction with numbers of trout caught (Table 1-33). These streams included Willow Creek, Forestville Creek, West Indian (Cty 4) and South Branch Root River (State Park). Other streams with low angler satisfaction with trout numbers included Gribben (71.4%), Mill (38.9%) and Camp (38.9%) creeks.

TABLE 1-31. Percent satisfaction of number of trout caught relative to each gear type category of anglers surveyed fishing trout streams in southeast Minnesota, April 1 to September 30, 2013.

Gear	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
Bait	3.9	25.3	29.3	18.8	52.0	42.4	9.6
Lure	0.6	16.2	16.8	23.6	59.6	38.5	21.1
Fly	0.7	25.3	25.9	16.5	57.6	36.4	21.2
Mixed	2.8	36.1	38.9	36.1	25.0	13.9	11.1

TABLE 1-32. Percent satisfaction with the number of trout caught relative to each age category of anglers surveyed fishing trout streams in southeast Minnesota, April 1 and September 30, 2013.

Age category (years old)	Very Dissatisfied	Dissatisfied	Neither	Satisfied	Very Satisfied
<16	4.1	30.6	38.8	20.4	6.1
16-19	0.0	52.4	19.1	28.6	0.0
20-29	3.7	26.2	21.5	38.3	10.3
30-39	2.5	12.5	23.3	46.7	15.0
40-49	1.1	27.3	15.9	37.5	18.2
50-59	0.6	20.1	17.0	40.3	22.0
60-69	0.0	19.0	15.8	37.9	27.4
70-79	2.9	28.6	14.3	31.4	22.9
80-89	0.0	0.0	40.0	60.0	0.0

TABLE 1-33. Percent angler satisfaction (number of trout caught) by stream of those surveyed fishing selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Stream	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
Camp Creek	0.0	38.9	38.9	5.6	55.6	38.9	16.7
Crooked Creek	3.5	10.3	13.8	6.9	79.3	41.4	37.9
East Beaver Creek	0.0	0.0	0.0	0.0	100.0	43.8	56.3
Forestville Creek	12.5	37.5	50.0	31.3	18.8	18.8	0.0
Gribben Creek	0.0	71.4	71.4	0.0	28.6	14.3	14.3
Hay Creek – State Forest	0.0	10.5	10.5	42.1	47.4	31.6	15.8
Hay Creek – Upper	0.0	13.2	13.2	34.2	52.6	50.0	2.6
Middle Branch Whitewater – Quincy	0.0	29.2	29.2	41.7	29.2	22.9	6.3
Middle Branch Whitewater – Crow	0.0	18.2	18.2	9.1	72.8	54.6	18.2
Middle Branch Whitewater – Cty 9	0.0	6.7	6.7	6.7	86.7	66.7	20.0
Mill Creek	0.0	38.9	38.9	38.9	22.2	22.2	0.0
North Branch Whitewater	0.0	16.2	16.2	29.7	54.0	43.2	10.8
Pine Creek	0.0	15.0	15.0	15.0	70.0	60.0	10.0
South Branch Root River – Lanesboro	2.7	30.6	33.3	22.5	44.1	42.3	1.8
South Branch Root River – State Park	12.0	34.0	46.0	10.0	44.0	42.0	2.0
South Fork Root River – LTM	0.0	0.0	0.0	0.0	100.0	14.3	85.7
South Fork Root River – Million	0.0	0.0	0.0	12.5	87.5	29.2	58.3
Trout Run – Lohman's	0.0	18.2	18.2	22.7	59.1	47.0	12.1
Trout Run – Bucksnort	0.0	24.4	24.4	29.3	46.4	41.5	4.9
West Beaver Creek	0.0	20.0	20.0	0.0	80.0	30.0	50.0
West Indian Creek – LTM	0.0	0.0	0.0	11.1	88.9	88.9	0.0
West Indian Creek – Cty 4	0.0	46.2	46.2	23.1	30.8	23.1	7.7
Willow Creek	0.0	66.7	66.7	25.0	33.3	25.0	8.3
Wisel Creek	0.0	7.7	7.7	18.0	92.4	18.0	74.4

DISCUSSION

Angler Characteristics - The southeast Minnesota stream trout fishery has continued to be composed of primarily male, resident anglers based on sporadic creel and angler surveys conducted over the past 20 years. Males represented 91% of anglers in 2001 (Vlaming and Fulton 2003), 90% in 2005 (Snook and Dieterman 2006) and 90% in 2013. Female anglers continue to be under-represented compared to the broader Minnesota population which was 50.5% female in 2000 and 50.3% in 2010 (US Census data).

Minnesota residents represented 96% of summer trout anglers in 1995 (Bushong 1996), 95% in 1998 (Weiss 1999), 91% in 2005, and 92% in 2013. Minnesota residents have been further partitioned into groups representing "Local" southeast Minnesota anglers, "Metro" anglers from the greater Minneapolis/St. Paul metropolitan area, and residents from all "Other" areas of the state. Proportions of these three groups have remained relatively constant over time as well with local anglers ranging from 44-55% of anglers, metro

from 27-38%, and anglers from other areas from about 3-27%. Although resident anglers have been predominant, the proportion of non-resident anglers has increased slightly from less than 5% in 1995 and 1998 to 9.4% in 2005 and 8.0% in 2013. The top three states for non-resident trout anglers continue to be Iowa, Illinois and Wisconsin (Table 1-5). Several new states for non-resident trout anglers were added in 2013 and included South Carolina, Georgia, Wyoming, New Mexico and New Jersey. Trout anglers have come from well over half the states in the union which suggests that the stream trout fishery in southeast Minnesota should be considered a "national" resource.

Age distributions indicate the aging of a core group of middle-aged anglers. Although median angler ages were similar across time, 42 in 2001, 39 in 2005, and 43 in 2013; age distributions show a different pattern (Figure 1-6). The most common age group in 1995 was 25-34. In 2001, the dominant age group had shifted to 35-44. By 2005, ages between 35to 54 were slightly more common than other age groups. By 2013, the age distribution had become bimodal with peaks in the 25-34 and 55-64 age groups, possibly suggesting loss of younger middle-aged anglers in the 35-54 age groups. Lack of time or competing family responsibilities are frequently cited constraints to fishing participation (Fedler and Ditton 2001; Sutton et al. 2009) and might be expected to be prevalent among middle-aged individuals and parents. These patterns might also simply reflect changes in the broader population of Minnesota residents. For example, between 2000 and 2005 residents in the 35-44 age group declined 5% (Minnesota State Demographic Center 2006), similar to the change we observed between 2001 and 2005 (Figure 1-6). However, while we also observed a decline in the 45-54 age group, this group increased about 15%, suggesting that not all changes can be attributed to the broader population. The mean age of anglers purchasing trout stamps in Minnesota has also increased, from a mean age of 38.4 years old in 2000 to a mean of 39.6 years in 2005 to 43.1 years in 2013 (MN DNR files). Another age group that may be declining is anglers younger than 16 years old. This age group represented 12.5% of anglers in 1995, but constituted less than 10% of anglers in 2005 and 2013.

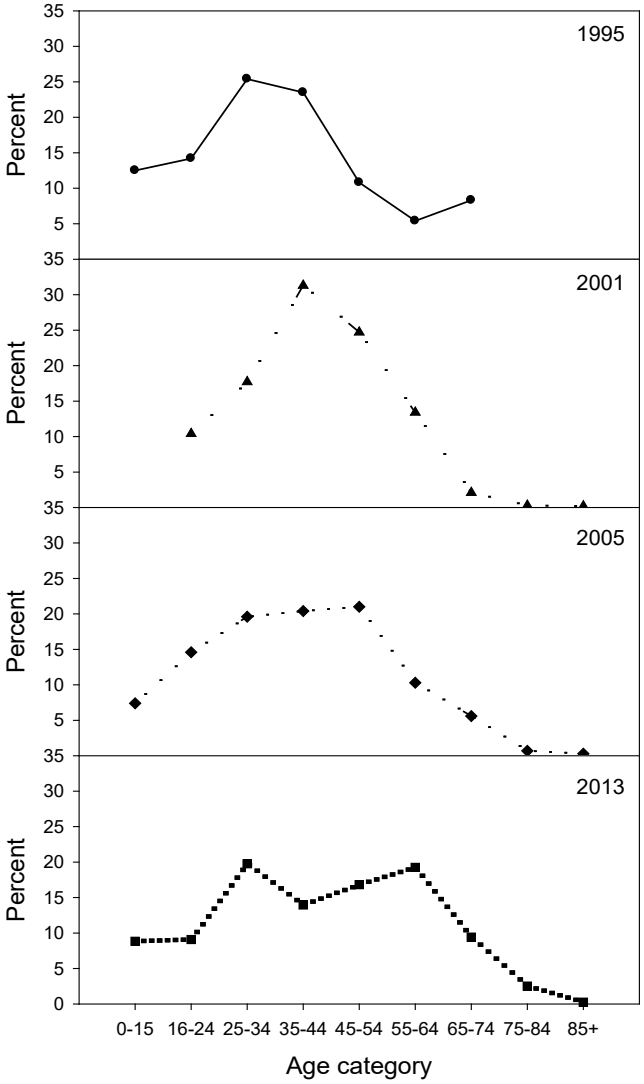

FIGURE 1-6. Age distributions of anglers fishing southeast Minnesota streams during the summer season (April 1 to September 30) in four years. Data were not collected on the same streams each year but were assumed to be representative. Data in 1995 from Bushong (1996) and combined all ages ≥ 65. Data in 2001 from Vlaming and Fulton (2003) and did not include anglers < 16. Data in 2005 from Snook and Dieterman (2006).

The percentage of anglers using bait has declined, whereas percentages of anglers using lures and flies increased (Figure 1-7). This was the first year (2013) in the recorded history of summer angling surveys that fly anglers represented the most common gear type used on southeast Minnesota trout streams. Our survey design was assumed to provide a representative assessment of angler gear use because we sampled more stream areas with no gear restrictions (i.e., bait allowed on 14 of 24 surveyed areas) than areas that

prohibited the use of bait. However, we cannot conclusively discount that our survey design influenced these overall percentages. A broader sample of trout anglers, such as with a mail survey, may be needed to verify these patterns. Fly anglers have commonly dominated western salmonid fisheries for many years which may support our findings (e.g., Peters and Robison 1997; Schmetterling and Bohneman 2000). However, some state fisheries managers, such as in Michigan, do not typically ask gear type related questions during creel surveys. Unlike the other three gear types, there have been no clear temporal trends in the percentages of anglers using mixed methods. Mixed method anglers represented 17% of anglers in 1990, 8.5% in 1995, 27% in 2001, 7% in 2005, and about 6% in 2013.

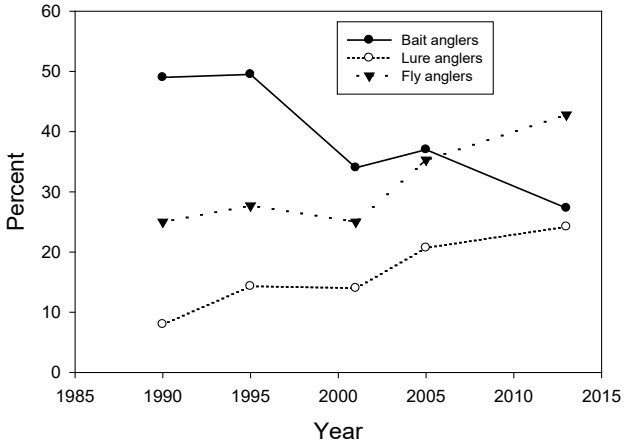

FIGURE 1-7. Temporal trends in the percentage of anglers using each of three primary gear types while fishing the stream trout fishery in southeast Minnesota during the summer season (April 1 to September 30). Data for anglers using more than one gear type, termed mixed-method anglers, are not shown. Also, data were not collected on the same streams each year but were assumed to be representative of all anglers. Data in 1990 from Weichman (1990), in 1995 from Bushong (1996), in 2001 from Vlaming and Fulton (2003), and in 2005 from Snook and Dieterman (2006).

Not surprisingly, most anglers (90.2%) specifically stated they were fishing for "any trout species". However, the percentage of anglers fishing for any trout species in 2005 was much lower (39.5%), perhaps indicating that more anglers were fishing for trout in general in 2013. In the 2005 survey, no anglers specifically stated that they were fishing for a species other than trout, but in 2013, at least a few anglers (0.1%) stated they were specifically fishing for white suckers suggesting the presence of a potential, new user group.

Information on angler experience supported the idea that a core group of anglers is aging but showed that the southeast trout stream resource continued to attract new anglers as well (Figure 1-8). Angler experience data collected in 2001 showed two peaks for anglers at 11-19 and 20-29 years of trout fishing experience. By 2013, the percentage of anglers with 40-49 years of experience increased substantially, whereas those in the 11-19 and 20-29 age groups declined. This may reflect the aging of dominant age groups in 2001. About 30% of anglers had only begun fishing for trout within the past five years.

To identify the newest user group for the southeast Minnesota stream trout resource, we examined the sociodemographics of trout anglers that had just begun trout fishing in 2013 (i.e., those anglers with just one year of trout fishing experience) and compared them to the broader sample of trout anglers interviewed. The newest trout anglers were composed of a larger percentage of female anglers (23.3%) than the broader group of trout anglers (9.9%). Age distributions also differed with first year anglers represented by much larger percentages of anglers younger than 25 years old (Figure 1-9). In fact, the median age of new anglers was 25, versus all anglers, which was 43 years old. Like all anglers, new anglers were almost entirely Minnesota residents (95.9%) but were much more likely to use bait than fly fishing gear (Figure 1-10). Finally, new trout anglers overwhelmingly fished the stream they were interviewed on because of easy access (68.3%), and this percentage was much higher than the broader pool of anglers (43.5%). These data illustrate the importance of catering to both young and female anglers that use bait on easily accessible streams to bolster angler recruitment and retention.

Stream Motivation - Easy access was the most common reason given (43.5%) for why anglers fished the specific stream where they were interviewed. This is consistent with previous surveys. For example, in 2001, easy access at bridge crossings and on private lands under angler easements were used by 67% of anglers (Vlaming and Fulton 2003). In 2005, easy access was the reason given by about 30% of anglers.

Easy access to the trout stream for anglers was of primary importance to where they were fishing specifically on eight streams (Table 1-9). Of those stream areas, all were pastured by cattle or were within a state park. The Lanesboro Dam on the South Branch Root River included a parking area and was frequently chosen because of easy access. Easy access was chosen least in areas that were heavily forested (North Branch Whitewater and West Indian Creek).

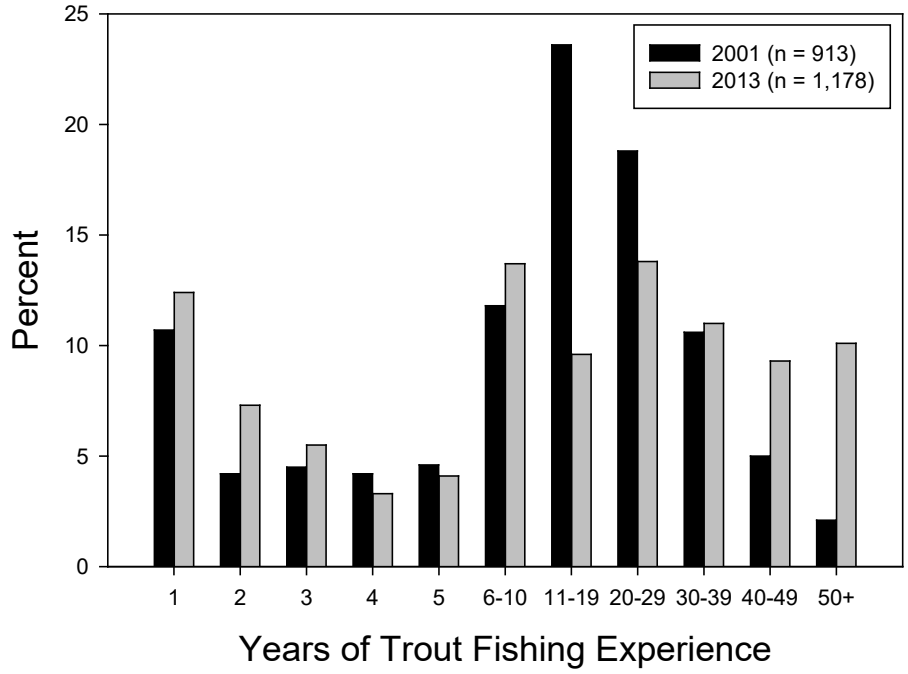

FIGURE 1-8. The number of years of trout fishing experience for anglers fishing southeast Minnesota trout streams in 2001 and 2013. The 2001 data taken from Vlaming and Fulton (2003).

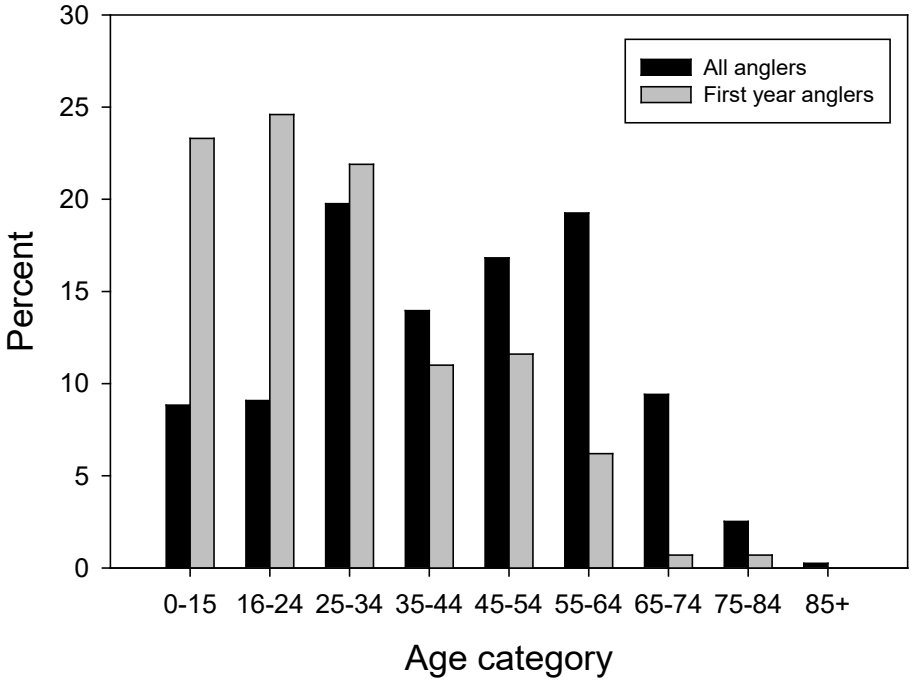

FIGURE 1-9. Comparison of the age distributions of all anglers (black bars, n = 1,189) versus those anglers that had just started trout fishing in 2013 (i.e., their first year trout fishing; grey bars, n = 146) in southeast Minnesota trout streams during the summer angling season (April 1 to September 30).

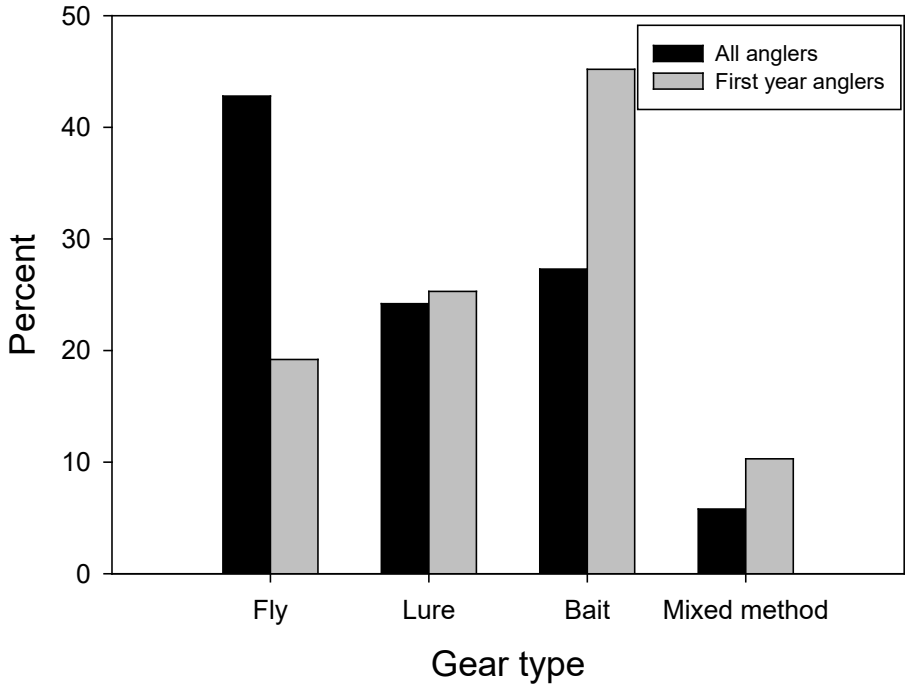

FIGURE 1-10. Comparison of the percentages of primary angling gear used by all anglers (black bars, n = 1,189) versus those anglers that had just started trout fishing in 2013 (i.e., their first year trout fishing; grey bars, n = 146) in southeast Minnesota trout streams during the summer angling season (April 1 to September 30).

Trout stream regulations were not a primary reason for anglers fishing where they were interviewed (Table 1-9). This was also the case in the 2005 creel (Snook and Dieterman 2006).

Resource Benefits - The southeast Minnesota stream trout program provided several tangible benefits that reflected the trout management program's success. Two metrics to evaluate the trout program's success include angler participation (i.e., angler pressure) and how frequently anglers caught trout.

Over the past 20 years, angler pressure has generally increased, suggesting greater angler participation in the trout program. Angler pressure was estimated to be about 1,476 angler-hours/mile in 1995 on 16 reaches across five selected streams (Bushong 1996). Weiss (1999) estimated angler pressure on nine streams in 1998 and found it to be 2,445 hours/mile. Snook and Dieterman (2006) estimated angler pressure to be about 4,581 hours/mile on 33 stream areas in 2005, an increase of 87% over the 1998 estimate. Overall angler pressure per mile dropped in the present survey in 2013, to 2,822 hours/mile (SE = 130) across the 24 stream areas. The slight drop could be due to the infrequent collection of creel information that coincides with either very wet and cold summers or conversely, years with more preferable weather conditions. A cold, wet winter and spring prolonged into the first half of the 2013 summer angling season in southeast Minnesota, and likely discouraged anglers from fishing. For example, Rochester, Minnesota reported over 14 inches of snowfall from May 1 to May 3 (National Weather Service). Alternatively, each of these creel surveys was conducted on somewhat differing streams because of differing survey objectives and consequently should be interpreted cautiously. We recommend that creel surveys continue to be implemented in the future to verify these trends.

Similarly, catch rates for trout (all species combined) appear to have continued to increase over time in southeast Minnesota. In one of the earliest creel surveys conducted, Schumacher (1957) estimated catch rates to be 0.45 trout/hour on Duschee Creek. In the early 1980's, trout catch rates ranged from 0.31 to 0.91 trout/hour on the Middle Branch Whitewater River and Beaver

Creek (Hirsch 1989). In the mid-1990's, Bushong (1996) estimated trout catch rates finally exceeded 1.0 trout per hour (mean = 1.23 trout/hour). In the late 1990's, Weiss (1999; 2000) estimated the highest mean catch rate, about 1.90 trout/hour, ever reported for southeast Minnesota. Snook and Dieterman (2006) estimated catch rates at 1.10 trout/hour in 2005. The drop in catch rates may have been attributed to the increased number of streams in their creel, which included streams with less abundant trout populations. The present creel in 2013 estimated a higher mean catch rate at 1.45 trout/hour suggesting that southeast Minnesota streams continue to maintain some of the highest trout catch rates in the nation (Table 1-34). From the perspective of angler catch rates, the southeast Minnesota trout program should be considered a highly successful management program.

Finally, three sites also had estimates of the trout population which allowed approximations of angler exploitation. All trout population estimates were conducted in the fall after the summer angling season, so all trout harvested over the summer were added back into the fall population estimate to determine the trout population present prior to the summer angling season. Exploitation at the Hay Creek-State Land site was estimated to be 29% of all adult Brown Trout and 40% of all trout ≥ 12 inches. Based on our estimates of trout caught, about 73% of all adult trout present would have at least been caught, had each trout been caught only once. At the West Indian LTM site, exploitation was estimated to be 17% of all adult Brown Trout (50% of adult trout would have been caught once), and 0% of trout ≥ 12 inches (no trout ≥ 12 inches were harvested, likely because of the 12-16 inch protected slot on this stream). About 28% of trout ≥ 12 inches would have been caught at least once. At the Gribben Creek LTM site, exploitation was estimated to be only 2% of all adult trout (43% of trout caught once) and 0% of trout ≥ 12 inches (52% of 12-inch and larger trout would have been caught once). Again, the Gribben Creek LTM site was under a 12-16 inch protected slot which likely explains the absence of exploitation of 12 inch and larger trout. However, no trout ≥ 16 inches were reported caught on either slot stream and in fact no trout ≥ 16 inches were captured by electrofishing at the West Indian LTM site. Perhaps this indicates that the protected slot regulation was not accomplishing much for these trout populations. Overall, these limited data suggest extremely variable exploitation among streams in southeast Minnesota, which is not surprising.

Angler Satisfaction - Angler satisfaction with their overall fishing experience was very good in this survey (Table 1-24) and comparable with the survey conducted in 2005 (Snook and Dieterman 2006). Goals for optimizing angler satisfaction are important for any fisheries management agency (Pollock et al. 1994) and we are optimizing angler satisfaction with the southeast Minnesota trout resource. The least satisfied angling groups tended to be the younger and older age groups. Management programs may need to be rethought to better address the needs and desires of this part of the angling constituency.

Finally, several streams were commonly identified as having lower angler satisfaction with all three questions asked (i.e., satisfaction with overall fishing experience, size of trout caught and numbers of trout caught). These included Forestville Creek, Willow Creek, Camp Creek, and West Indian. Management actions may be warranted to address the lower satisfaction for these streams.

Setting high expectations for anglers through MN DNR communications and outreach could result in some anglers not achieving their fishing goals. This could then inadvertently lower the satisfaction of their overall fishing experience. Better management of angler expectations, especially regarding individual streams may be needed and could be accomplished through continued communications in several forms (newsletters, web, new releases, etc.). These are important communication tools and are listed as such in the LRP (Goal 4.1, Action Item 24 and 25) (MN DNR 2010).

TABLE 1-34. Stream, catch rate, mean size harvested, release rate and estimated pressure comparisons with creel surveys across the United States and the present creel conducted on selected trout streams in southeast Minnesota, April 1 to September 30, 2013.

Stream		Catch rate (mean)	Mean size harvested			Release rate	Estimated pressure
			Brown Trout	Brook Trout	Rainbow Trout		
SE MN trout stream creel 2013 (Dieterman and Snook 2015)		1.45 trout/hour	10.5”		10.3”	92.7% BNT 55.8% RBT 91.2% BKT	44,673 angler-hours on 24 selected trout streams
SE MN trout stream creel 2005 (Snook and Dieterman 2006)		1.10 trout/hour	10.7”		11.1”	82.7% BNT 65.6% RBT	190,859 angler-hours on 33 selected trout streams
Madison River, MT (Lere 1996)	Pine Butte Upper river Lower river	0.63 RBT/hour 0.19 RBT/hour 0.19 RBT/hour					
Rock Creek, MT (Peters and Robison 1997)						97.7% trout 98.3% BNT 94.3% BKT	
Blackfoot River, MT (Schmetterling and Bohneman 2000)		0.79 fish/hour 0.26 RBT/hour 0.06 BNT/hour				95% all fish 94% RBT 94% BNT 99% Westslope cutthroat trout	2,514 angler days (1989) 16,081 angler days (1999)
Four Wisconsin streams[1] (Avery and Hunt 1981)			8.9 to 9.0”				331 to 428 angler-hours/acre
Straight River, MN (Evarts and Sewell 2002)		0.28 trout/hour	14.0”			79% BNT	
Nine Minnesota streams[2] (Weiss 1999)		1.90 trout/hour	11.2”	10.1”	11.1”	83% trout	
Four Minnesota streams[3] (Weiss 2000)		1.90 trout/hour	10.6”			79% trout	
Four Minnesota streams[4] (Hirsch 1989)							
1981 – Middle Branch Whitewater		0.44 trout/hour	11.3”			51% trout	
Beaver Creek (Whitewater)		0.75 trout/hour	9.6”				
1982 – Middle Branch Whitewater		0.31 trout/hour	10.0”			46% trout	
Beaver Creek (Whitewater)		0.63 trout/hour	10.2”			61% trout	
1983 – Beaver Creek (Whitewater)		0.91 trout/hour	10.2”			NA	
Duschee Creek, MN (Schumacher 1957)		0.45 trout/hour				68% trout	7,377 (May 1 - Sept 15, 1954)
Three Michigan streams[5] (Peck 1992)						NA	37,000 angler-hours annually
Five Minnesota streams[6] (Bushong 1996)		0.12 BKT/hour 0.22 BNT/hour 1.23 trout/hour	8.9 to 13.0”			19.7 to 82.6% trout	1,476 angler-hours/mile
	State regulations	0.36 to 1.18 trout/hour					
	Special regulations	0.82 to 3.48 trout/hour					
Seven Michigan streams[7] (Wills 2005)		1.01 BNT/hour					

TABLE 1-34 continued on next page.

TABLE 1-34. Continued.

Stream	Catch rate (mean)	Mean size harvested			Release rate	Estimated pressure
		Brown Trout	Brook Trout	Rainbow Trout		
Boardman River[8] (Su et al. 2007, Su and Clapp 2013)	0.01 BNT/hour					16,724 angler-hours
	0.13 RBT/hour					
Sucker River[9] (Su et al. 2007, Su and Clapp 2013)	0.12 RBT/hour					
	0.01 BKT/hour					
AuSable River[10] (Michigan DNR 2009, Su and Clapp 2013)						
M-33 to Power Line (boat)	1.95 BNT/hour					327 angler-hours
	0.58 RBT/hour					
M-33 to Power Line (shore)	0.75 BNT/hour					3,352 angler-hours
	1.90 RBT/hour					
Comins Flats to McKinley Bridge (boat)	0.50 BNT/hour					4,378 angler-hours
	0.59 RBT/hour					
Comins Flats to McKinely Bridge (shore)	0.72 BNT/hour					7,186 angler-hours
	0.78 RBT/hour					
Betsie River[11] (Michigan DNR 2011, Su and Clapp 2013)						117,952 angler-hours
Pere Marquette River[12] (Michigan DNR 2012, Su and Clapp 2013)						
M37 to Gleason's Landing (boat)	0.04 RBT/hour					7,425 angler-hours
	0.05 BNT/hour					
M37 to Gleason's Landing (shore)	0.07 RBT/hour					57,590 angler-hours
	0.08 BNT/hour					
Gleason's Landing to Rainbow Rapids (boat)	0.06 RBT/hour					3,263 angler-hours
	0.07 BNT/hour					
Gleason's Landing to Rainbow Rapids (shore)	0.02 RBT/hour					18,391 angler-hours
	0.05 BNT/hour					

[1]Emmons Creek, Radley Creek, South Branch Wedde Creek and Mecan River
[2]S. Br. Root River, S. Fork Root River, Camp Creek, Gribben Creek, Diamond Creek, N. Br. Whitewater River, Beaver Creek (Whitewater), West Indian Creek and Cold Spring Brook
[3]Camp Creek, Rush Creek, Trout Run Creek and Winnebago Creek
[4]South Branch Whitewater River, Middle Branch Whitewater River, Beaver Creek (Whitewater)
[5]Dead River, Carp River, and Chocolay River
[6]Spring Creek, Hay Creek, Main Whitewater River, South Branch Whitewater River and Middle Branch Whitewater River
[7]Coldwater River, Fish Creek, Indian River, Manistee River, Muskegon River, Paint Creek and Rogue River
[8]Boardman River, April 26 to September 30, 2005
[9]Sucker River, April 17 to May 13, 2002.
[10]AuSable River, April 25 to September 30, 2009
[11]Betsie River, 2010
[12]Pere Marquette River, April 1 to September 30, 2011

MANAGEMENT IMPLICATIONS

1) Use angler satisfaction and selected measures of trout resource benefits, such as angler catch rates, in setting Goals and Objectives in stream management plans and any revisions to the Long-Range Plan to better gage success or failure of management actions.
2) Maintain and expand the stream easement program and improve riparian vegetation management as these were important factors determining angler satisfaction and participation, especially of new anglers.
3) Investigate why anglers were least satisfied with size and numbers of trout caught on Forestville, Willow, Camp, and West Indian creeks.
4) Continue monitoring existing and potential new user groups (e.g., anglers targeting White Sucker) through future creel surveys (the next one is proposed in about five years or 2018) to verify trends identified in this creel. Specific trends to continue assessing include changes in: angler ages; gear types, especially potential declines in bait anglers; angler pressure; trout catch rates; and angler satisfaction.
5) Conduct additional human dimension surveys to identify factors contributing to retention and recruitment of new anglers, young anglers (< 16 years old), female anglers, and bait anglers.
6) Data acquired in this survey continued to indicate the importance of several streams based on high angler pressure. These streams should continue to be high priorities for management and include the South Branch Root River, Trout Run, and Wisel Creek.
7) Continue to provide and increase education and communication to anglers and angler groups especially those who either have limited opportunities (<16 years old) or those expressing increased interest (women) in trout angling (e.g., MinnAqua and Becoming an Outdoors Woman programs).

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CHAPTER 2: Sociodemographic and Fishery Differences Among Four Tiers of Angling Regulations in Southeast Minnesota During the Summer Angling Season, 2013

Abstract.–A roving-roving creel survey was initiated across 24 trout stream areas in southeast Minnesota (April 1 to September 30, 2013) to assess sociological and fishery differences among four tiers of angling regulations: (1) statewide general regulations allowing harvest of five trout daily and in possession with only one > 16 inches; (2) a 12-16 inch protected slot (no gear restrictions); (3) a 12-16 protected slot (artificial lures and flies only); and (4) catch-and-release only angling (artificial lures and flies only). Sociodemographic data including angler ages, residency, gear choice, and trout-fishing experience were compared to determine if different user groups were using each regulation type. Sociological benefits assessed included trip length; angler pressure; and satisfaction with their overall fishing experience, size of trout caught, and numbers of trout caught. The two slot limits and catch-and-release regulations were implemented in 2005 to improve the fishery in terms of increased angler catch rates of three trout size groups: (a) medium-sized trout ≥ 12 inches, (b) medium-sized trout 12-16 inches, and (c) larger trout ≥ 16 inches. Catch rate comparisons for these size groups were made. Angler ages were similar among regulations although slightly more young (ages < 19) and old (ages 70-89) anglers fished general regulation streams than other regulation types. Anglers fishing general regulation, slot (artificial lures and flies), and catch and release areas were mostly from local southeast Minnesota counties. Anglers fishing slot (bait allowed) areas were mostly from the Twin Cities metropolitan area. Slot (artificial lures and flies only) and catch-and-release areas were mostly fished by anglers that had the most trout fishing experience whereas general regulation and slot (bait allowed) areas were fished by a mix of experienced and newer anglers. Anglers on average fished longer on stream areas with a slot (bait allowed) regulation (3.57 hours) than on general regulation (2.97 hours) or catch-and-release (2.76 hours) areas. However, overall angler pressure was not significantly higher with any regulation type. Most anglers (≈ 85%) were satisfied or very satisfied with their angling trip, however angler satisfaction with size of trout caught was highest on general regulation streams and lowest on catch-and-release areas. Catch rates for all trout size groups were not significantly higher on any of the regulation types relative to general regulation streams, suggesting an insignificant regulation effect. Instead, about 15% of the variation in catch rates was explained by streams within each regulation, suggesting that regulations increased catch rates on some streams but not others. In general, few fishery or sociological metrics assessed in this creel survey differed among angling regulations. However, a more formal creel/angler survey design with more resources and better before-and-after control-treatment areas is needed to make a more conclusive assessment.

INTRODUCTION

Angling regulations have been a popular tool used to manage stream trout populations in North America for almost a century. For example, catch-and-release regulations were used in Pennsylvania on Spring Creek, Centre County as early as 1934 (Billingsley and Haase 1988) and the first fishing regulations in Yellowstone National Park included a 10 fish bag limit in 1929 (Jones 1988). The implementation of angling regulations has traditionally been to improve a biological attribute, such as trout abundance, especially of certain larger size groups (Behnke 1988; Bushong and Anderson 1996). Increased trout abundance is expected to result in higher catch rates for anglers.

More recently, angling regulations have been implemented for a wider variety of reasons that include sociological, as well as biological (Noble and Jones 1999). For example, regulations such as gear restrictions are often implemented for social reasons to reduce conflicts among user groups. The effects of regulation changes should "always be evaluated" and to accomplish this, specific measurable objectives need to be identified to ensure a proper evaluation (Noble and Jones 1999).

Southeast Minnesota maintains an exceptional recreational fishery for stream trout on over 800 miles of coldwater streams (Thorn et al. 1997). A variety of angling regulations have been implemented on several streams in the 1980s and 1990s. These regulations were implemented mostly for biological reasons to increase abundance of larger trout (e.g., > 12 or 14 inches) and consequently angler catch rates (see review in Thorn et al. 2001). Most of these regulations were deemed biological "failures" because of low exploitation, poor trout growth, potential angler non-compliance, or more often because of poor habitat (Thorn et al. 2001). Behnke (1988) specifically noted that managers and anglers need to recognize that each stream sets environmental limits upon the growth and size structure of its resident trout, which may render goals to increase abundance of larger trout sizes unattainable. Despite these results and conclusions, angling regulations were further expanded variously to more southeast Minnesota streams between the late 1990s and early 2000s. By 2002, the result was a patchwork of angling regulations across this trout stream resource.

A comprehensive trout stream resource management plan (Fisheries Long-Range Plan for Trout Stream Resource Management in Southeast Minnesota (LRP)) was developed in 2003 (MN DNR 2003) and updated in 2010 (MN DNR 2010) to guide management efforts. The plan included expansion and consolidation of summer angling regulations into one of six broad tiers [Goal 1.3 Fishing Regulations - Action item 6] (Table 2-1). This latest set of regulations was proposed and then implemented on April 16, 2005. These were added to the current southeast Minnesota general trout stream regulation of five trout in the daily/possession limit with only one of those >16 inches TL. The initial LRP in 2003 noted the general objectives of these regulations were to increase catch rates of larger trout sizes (Table 2-1). The updated LRP in 2010 specifically recommended assessment of angler demographics and attitudes with a creel survey to aid sociodemographic evaluations of the regulations, in addition to biological responses. Sociodemographic information commonly includes age, gender, residence, gear type, and angler satisfaction (Knuth and McMullin 1996).

Creel surveys have been infrequently conducted in southeast Minnesota because of limited resources. The last summer creel was conducted in 2005, the first year with the new tiers of regulations (Snook and Dieterman 2006). Sociodemographic and catch rate comparisons among regulation types were not made in the 2005 creel because it was deemed that not enough time had elapsed to make meaningful comparisons. For example, it might take more than one year for abundance of 12-16 inch trout to increase and subsequently be reflected in higher angler catch rates.

Funding became available to conduct another creel survey in 2013, nine years after the new tiers of angling regulations had been implemented. Based on available funding and precision of previous creel survey estimates (e.g., catch rates), it was decided that five replicate stream areas should be sampled representing each of four regulation types: catch-and-release (artificial lures and flies only), slot (no gear restrictions), slot (artificial lures and flies only), and general trout regulations (i.e., n = 20). Funding and logistics allowed the hiring of four creel clerks which allowed an additional four streams (general trout regulation areas) to be selected to help evaluate broader sociodemographic patterns of anglers (total n = 24 stream areas; Table 2-2 and see Chapter 1).

This design allowed a comparison among regulations, where streams with more restrictive regulations could be compared to those with general trout regulations as a control. From a fishery perspective, the more restrictive regulations were implemented to increase opportunities to catch

medium (12-16 inch) and large (≥16 inch) trout (i.e. higher catch rates) (Table 2-1). Thus, streams with more restrictive regulations should have higher catch rates than general regulation streams. Available abundance data for streams prior to regulation implementation suggested that abundance of adult trout, and more specifically trout ≥ 12 inches, was higher in streams that would receive the new more restrictive regulations (Figure 2-1). Consequently, if catch rates in this creel survey were significantly higher on streams with the more restrictive regulations it would be difficult to determine if the higher catch rates were due to an increase in catch rates (as intended by implementation of the regulations) or if the higher catch rates were simply due to maintenance of higher trout populations in those streams (i.e., maintaining already high catch rates). However, if catch rates in this creel survey were not significantly different between general regulation streams and those with more restrictive regulations, or catch rates were lower on streams with more restrictive regulations, then this might indicate that the regulations were not having the intended benefit to this recreational fishery.

From a sociological perspective, the more restrictive regulations were implemented to increase opportunities for anglers preferring to fish streams with special regulations (MN DNR 2003). These sociological benefits should be reflected in longer trip lengths, higher angler pressure, and higher satisfaction for anglers fishing special regulation stream areas. Additional sociodemographic information was also collected to determine whether different user groups were using different regulations. Specific objectives were to:

1. Compare angler characteristics of age, residency, gear choice, trout angling experience and stream-specific motivations among regulation types.
2. Compare sociological benefits of angler trip length and pressure among regulation types.
3. Compare fishery benefits of catch rates for all trout, trout ≥ 12 inches, 12-16 inches, and ≥ 16 inches among regulation types.
4. Compare angler satisfaction among regulation types.

TABLE 2-1. Trout stream regulations in southeast Minnesota (Houston, Fillmore, Mower, Dodge, Olmsted, Winona, Wabasha and Goodhue counties) during January 1 to December 31, 2013.

Regulation	Stream	Objective
General	All designated trout streams except those below	
Protected Slot (12-16 inches), no gear restrictions	East Beaver Creek Forestville Creek Mahoods Creek South Branch Root River Spring Valley Creek West Indian Creek Wisel Creek	To increase catch rates of 12-16 inch trout
Protected Slot (12-16 inches), artificial lures and flies only	Canfield Creek Garvin Brook Gribben Creek Hay Creek Logan Creek Trout Run Creek North Branch Whitewater River	To increase catch rates of 12-16 inch trout while eliminating the release mortality sometimes associated with bait angling.
Catch-and-release, artificial lures and flies only	Camp Creek Kedron Creek South Fork Root River Middle Branch Whitewater River	To increase overall trout catch rates with emphasis on two size groups (12-16 inches and >16 inches).
12 inch minimum Brook trout, bag limit 1, artificial lures and flies only	Trout Valley Creek	To increase catch rates of brook trout up to 12 inches while eliminating the release mortality sometimes associated with bait angling.
Catch-and-release	Belle Creek Middle Branch Root River North Fork Zumbro River	To protect the limited trout population in coolwater streams and provide continued trout production in small coldwater tributaries associated with these coolwater streams.

TABLE 2-2. Southeast Minnesota trout stream areas randomly selected to be surveyed by each of four creel clerks to evaluate each of four angling regulation types from April 1 to September 30, 2013. General southeast Minnesota trout stream regulation is five trout of any species in the daily/possession limit with only one of those >16 inches. Protected slot is for trout in the 12 to 16 inch range. Catch-and-release includes an artificial lures and flies only restriction. LTM = Long-term monitoring.

Regulation	Stream	Area	Clerk
General regulation	Hay Creek (State Land)	A	1
	West Indian Creek (County 4)	B	1
	Pine Creek (Andersons)	C	2
	Mill Creek (City Property)	D	2
	Willow Creek	E	3
	South Branch Root River (Lanesboro)	F	3
	South Fork Root River (Million Dollar)	G	4
	West Beaver Creek	G	4
	Crooked Creek	G	4
Slot-No gear restriction	West Indian Creek (LTM)	A	1
	Forestville Creek (State Park)	E	3
	South Branch Root River (State Park)	E	3
	Wisel Creek (Chickentown)	G	4
	East Beaver Creek	H	4
Slot-Artificials only	Hay Creek (Upper)	A	1
	North Branch Whitewater	B	1
	Trout Run (Lohman's)	D	2
	Trout Run (Bucksnort)	D	2
	Gribben Creek	F	3
Catch-and-Release	Middle Branch Whitewater (Quincy)	B	1
	Middle Branch Whitewater (County 9)	C	2
	Middle Branch Whitewater (Crow Springs)	C	2
	Camp Creek (Maust's)	F	3
	South Fork Root River (LTM)	G	4

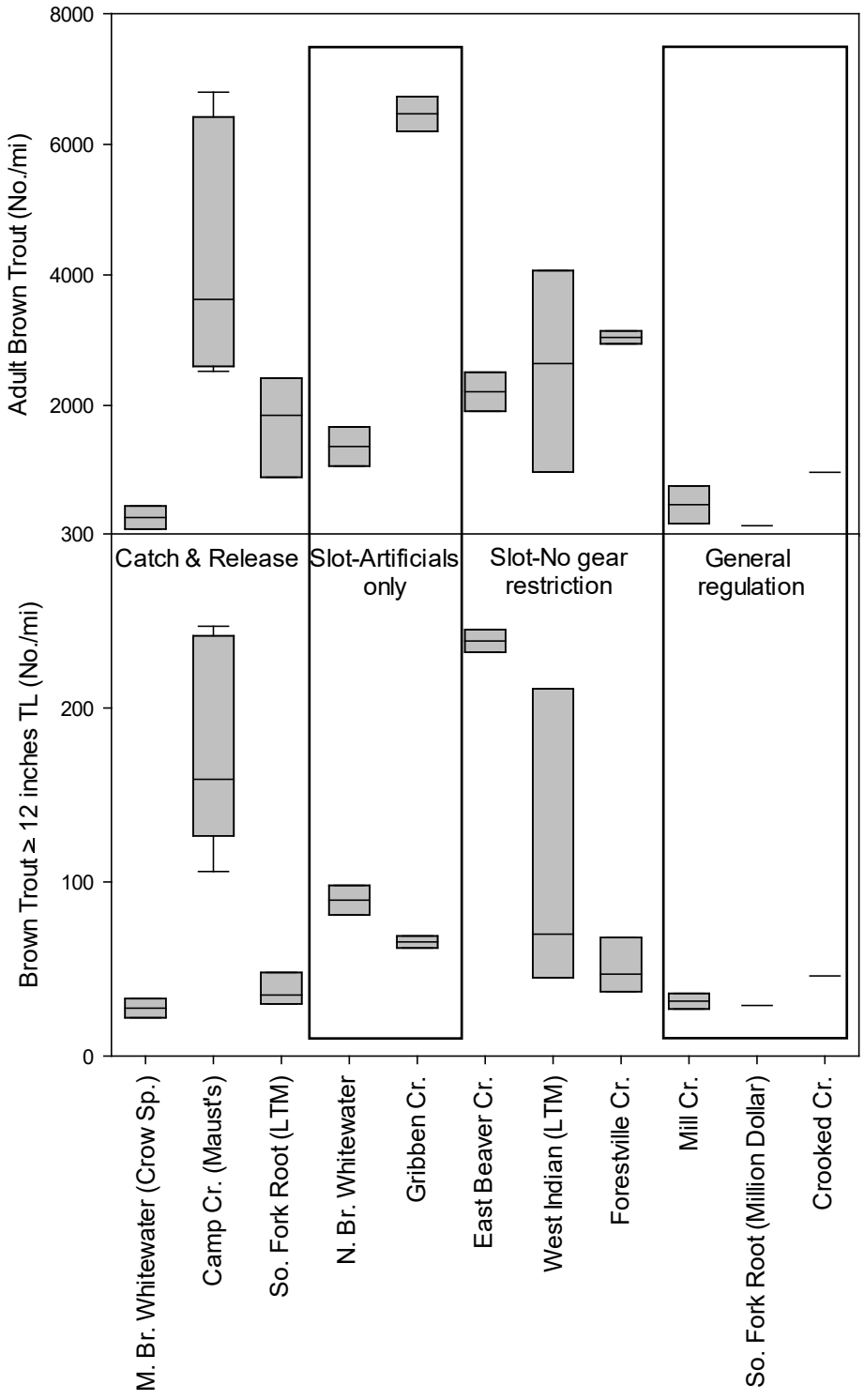

FIGURE 2-1. Box plots of estimated spring abundance (No./mi) of two size groups of Brown Trout (all adults and adults ≥12 inches) prior to implementation of six tiers of angling regulations in 2005 (4 of 6 tiers shown here) in southeast Minnesota. Pre-regulation abundance data were variously collected in the years 2000-2004.

METHODS

Chapter 1 detailed the overall study design of the creel survey. The approach here was to take the results from Chapter 1, and reorganize them into groups representing each of the four regulation types to facilitate comparisons. Angler age, residency, gear choice, trout angling experience and stream motivation data were summarized as percentages and compared among regulation types. Two groups of anglers, based on trout fishing experience, were also created and compared among regulations. The proportion of new anglers, defined as those that had been fishing less than eight years, versus experienced anglers (those with more than eight years of trout fishing experience) was compared among the four angling regulations using a Chi-square Goodness of Fit test. The new anglers represented anglers that had just started trout fishing since the new regulations were implemented eight years previously, in 2005.

To compare angler trip length among regulations, we used completed trip information from field interviews and returned letter surveys. Mean trip lengths were compared among regulations with a one-way ANOVA followed by a Tukey's HSD post-hoc test. For all statistical tests in this report, α was set at 0.05 and all analyses were completed with Statistical Analysis Systems software, version 9.1. To determine if anglers were fishing one type of regulation more than another, we compared mean angler-pressure estimates among regulation types with repeated measures MANOVA. Streams represented statistical replicates within each regulation treatment group and months were the repeated measure. Data were assumed to come from a multivariate normal distribution because the error degrees of freedom exceeded 20 (Hatcher and Stepanski 1994). MANOVA was tested with the Wilk's Lambda statistic.

To test the question of differences in catch rates in streams with a catch-and-release regulation, we compared catch rates for all sizes of all trout species caught with a nested ANOVA, where streams were nested within regulation types. Catch rate data were $\log_{10} + 1$ transformed to better meet the assumption of normality.

Catch rates of larger trout, representing size groups of ≥12 inches, 12-16 inches, and ≥ 16 inches, exhibited non-normal and skewed data distributions because of the large number of zero catches. No transformation adequately approximated a normal distribution. Therefore, to test the questions of higher catch rates in catch-and-release, protected slot (artificial lures and flies only), and protected slot (no gear restrictions) streams, we compared each size group independently with a Kruskal-Wallis non-parametric ANOVA. For each size group we conducted Kruskal-Wallis test comparisons on two angler groups; one with all anglers (i.e., many where nothing was caught) and another on a subset of those anglers that had caught at least one trout in the size group of interest.

RESULTS

Regulations and Angler Characteristics - Angler gear selection and age continue to be a controversial issue because of the possibility of excluding young anglers from trout fishing with restrictive regulations. Where restrictive angling regulations have been implemented, the mean age of anglers tended to be higher in 2013. Streams with the most restrictive regulations (catch-and-release) had a mean angler age of 44.7 years old. The less restrictive regulations of protected slot (artificial lures and flies only) and protected slot (bait allowed) had mean angler ages of 44.5 and 42.7 years old, respectively. The least restrictive general regulation streams had a mean angler age of 40.0 years old.

Angler age comparisons among regulations were also examined in two other ways. The first examined age groups among the regulations themselves. This approach addressed the question, what were the most common ages of anglers that fished streams with each regulation? For example, which age group was most common on stream areas with catch-and-release regulations? The second method organized age data by age group. This approach illustrated which regulation each age group tended to fish most frequently. For example, most anglers aged 50-59 fished general regulation stream areas.

For the first method, there were few differences among regulations. The large majority of anglers fishing each regulation were between the ages of 30 and 59 and this was consistent in both 2013 and in 2005 (Table 2-3). There was a slightly larger percentage of the youngest anglers, those younger than 16 years, fishing the general regulation streams. Anglers younger than 16 represented 9-13% of anglers fishing general regulation streams

in 2005 and 2013 but only represented about 2-8% of anglers fishing all other regulation types. General regulation streams were also essentially the only places where 80+ year old anglers were interviewed in 2005 and 2013.

When each age category was examined independently, > 50% of anglers <16 years old and between 16-19 years old fished stream areas with general trout stream regulations (Table 2-4). Once anglers were in the 20-29 year category some of their effort switched to streams with a protected slot (artificial lures and flies only) regulation. This trend continued until anglers in the 40-49 and 50-59 year categories were shown to once again spend more time on trout streams with general regulations.

TABLE 2-3. The percent of anglers in selected age categories fishing each of four types of angling regulations in the summer stream trout fishery (April 1 to September 30), in southeast Minnesota in 2013 and 2005 (Snook and Dieterman 2006). Data in rows sum to 100. Data taken from angler interviews.

	Age (years)								
Regulation	<16	16-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89
2013									
General	13.0	6.4	13.4	14.6	15.5	20.0	11.4	4.1	1.8
Slot (no gear restrictions)	8.4	3.1	12.2	19.9	17.9	20.6	11.1	6.9	0.0
Slot (artificial lures and flies only)	5.8	3.2	17.3	19.0	11.0	15.9	19.3	7.5	1.2
Catch-and-release	7.4	1.7	11.4	22.7	10.2	21.6	17.1	8.0	0.0
2005									
General	9.0	5.9	19.4	18.6	19.0	17.0	8.5	2.0	0.7
Slot (no gear restrictions)	7.0	6.1	14.0	28.1	19.3	16.7	4.4	4.4	0.0
Slot (artificial lures and flies only)	4.3	7.8	20.0	19.1	20.9	20.0	6.1	1.7	0.0
Catch-and-release	1.8	10.5	15.8	7.0	22.8	22.8	12.3	7.0	0.0

TABLE 2-4. The percent of anglers fishing each of four types of regulations expressed by age category during the 2013 summer trout angling season in southeast Minnesota. Data in rows sum to 100 and were taken from interviews of anglers.

Age category (years)	General	Slot (no gear restrictions)	Slot (artificial lures and flies only)	Catch-and-release
<16	50.9	19.6	17.9	11.6
16-19	56.0	16.0	22.0	6.0
20-29	34.5	18.7	35.1	11.7
30-39	28.8	23.4	29.7	18.0
40-49	37.8	27.5	22.2	10.5
50-59	37.5	23.0	23.4	16.2
60-69	28.4	16.5	38.1	17.1
70-79	23.7	23.7	34.2	18.4
80-89	66.7	0.0	33.3	0.0

Resident anglers using special regulation trout streams were examined for differences in hometown region (Local, Metro and Other) (Table 2-5). Most anglers fishing general regulation streams were Local anglers (62.1%). This was also the case with anglers fishing slot (artificial lures and flies only) (55.3%) streams and stream with catch-and-release regulations (61.3%). Anglers fishing slot (no gear restrictions) were mostly Metro anglers (59.8%). Most of these anglers were fishing the South Branch Root River (State Park area).

Because lure and fly anglers were not restricted from any streams by regulations, stream use was examined for these two gear types. Lure anglers were most common on streams with a protected slot (artificial lures and flies only) (44.4%) followed by general regulations (31.1%), slot (no gear restrictions) (12.8%) and catch-and-release (11.8%) areas. Fly anglers were similar, being most common on streams with a protected slot (artificial lures and flies only) regulation (43.1%). However, fly anglers were next most common on catch-and-release (23.5%) followed by general regulation (19.0%) and finally slot (no gear restrictions) (14.4%) stream areas. The largest difference between the two gear types was the percentage of anglers using lures was 12.1% higher on general regulation streams than fly anglers. On streams with catch-and-release regulations, the difference was 11.7% higher for fly anglers.

Trout angling experience (years) was somewhat different among the four regulation types (Figure 2-2). The proportion of new anglers (defined as those that started trout fishing since the most recent implementation of angling regulations in 2005) was not different than the proportion of experienced anglers (defined as those that started trout fishing before the most recent implementation of regulations) on streams with general and slot (no gear restriction) regulations. However, the proportion of these two categories was different on streams with slot (artificial lures and flies only) and catch-and-release regulations. A higher proportion of experienced anglers used the most restrictive regulation types.

When streams were grouped by regulation, anglers fishing general trout stream, protected slot (no gear restriction) and catch-and-release regulation streams indicated that they were primarily there because it was “easy access” (Table 2-6). Those anglers fishing protected slot (artificial lures and flies only) streams indicated that they were there because it was their “favorite stream” (31.6%). Very few anglers chose “like the regulation” for their primary reason to fish an area.

TABLE 2-5. Percent use of special regulation trout streams during summer 2013 in southeast Minnesota by hometown region (Local = Fillmore, Goodhue, Houston, Olmsted, Rice, Wabasha, Winona, Dodge, Freeborn, Mower, Steele counties; Metro = Dakota, Ramsey, Washington, Anoka, Scott, Carver, Hennepin counties; Other = all other counties in Minnesota).

Regulation	Local	Metro	Other
General	62.1	30.2	7.7
Slot (no gear restrictions)	24.9	59.8	15.3
Slot (artificial lure and flies only)	55.3	37.2	7.5
Catch-and-release	61.3	29.4	9.4

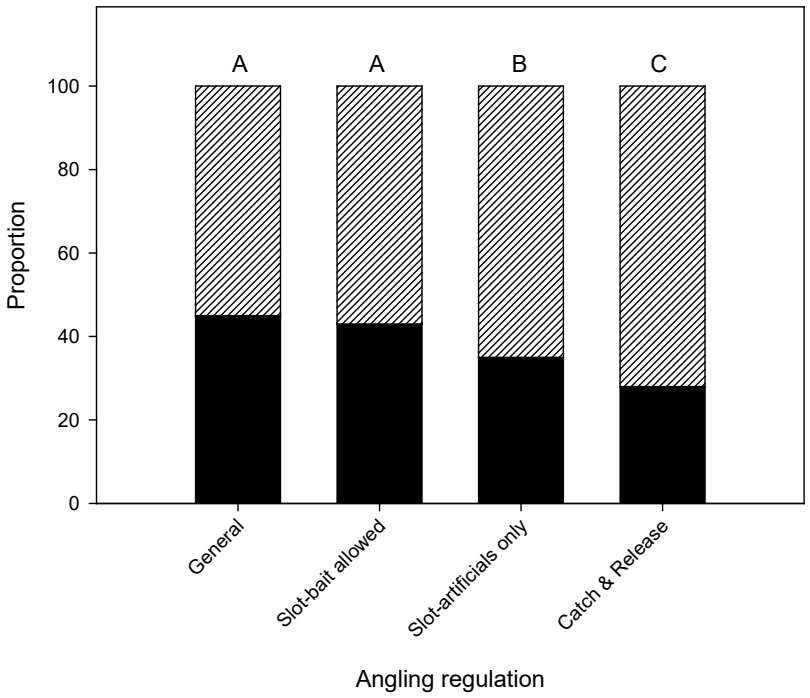

FIGURE 2-2. Proportion of new versus experienced anglers fishing selected trout streams in southeast Minnesota grouped by angling regulation type, April 1 to September 30, 2013. New anglers (solid black bars) were anglers that had only started trout fishing since the most recent establishment of summer angling regulations in 2005 (i.e., within the past eight years). Traditional anglers (cross-hatched bars) had been fishing for trout for more than eight years. Bars with different letters indicate significant differences in proportions of new vs. traditional anglers (Chi-square Goodness of Fit tests, $P \leq 0.05$).

TABLE 2-6. Percent answer to "Why did you decide to fish here today?" by regulation. A. Favorite stream, B. Live close by, C. Easy access, D. Like regulation, E. Dislike regulation elsewhere, F. Numbers of fish, G. Size of fish.

Regulation	A	B	C	D	E	F	G	A/C	A/F	B/C	C/F
General	17.8	16.0	49.1	3.5	-	10.4	2.6	0.2	-	0.2	0.2
Slot (no gear restrictions)	21.3	4.8	55.9	1.1	-	14.3	2.6	-	-	-	-
Slot (artificial lure and flies only)	31.6	14.0	25.3	4.5	0.3	20.2	3.6	0.3	0.3	-	-
Catch-and-release	11.7	16.2	43.6	7.8	-	12.9	7.8	-	-	-	-

Regulations and Sociological Benefits - Mean angler trip length was significantly different among angling regulations (F = 3.79, df = 3, P = 0.01). Anglers fished longer on streams with a 12-16 inch protected slot (no gear restrictions) regulation (mean = 3.57 hours) than on streams with either general regulations (mean = 2.97 hours) or a catch-and-release (mean = 2.76 hours) regulation (Table 2-7; Figure 2-3). This translates to an average of 36 fewer minutes on general regulation streams and 49 fewer minutes on catch-and-release streams than on protected slot (no gear restriction) streams. Although anglers fished longer on some regulation types than others, mean angler pressure overall did not differ among regulations. The regulation x month interaction was not significant (F = 0.62; df = 15, 100; P = 0.85) nor were the main effects of regulation (F = 0.35; df = 3, 20; P = 0.79) or month (F = 1.13; df = 5, 100; P = 0.35) (Figure 2-4). Because angler pressure did not differ between general regulation streams and those with special regulations, this suggests that the regulations neither increased nor reduced the number of angler trips during summer 2013.

TABLE 2-7a. Mean fishing trip length (angler-hours, ± 1 SE, N) estimated from completed trip information during a summer creel (April 1 to September 30) in 2013 for nine selected southeast Minnesota trout streams with the general southeast Minnesota trout regulation of five trout in the daily/possession limit with only one of those >16 inches.

Stream (area)	April	May	June	July	August	September	Totals
Crooked Creek	1.83 (0.16, 6)	4.60 (0.42, 10)	No data	No data	5.50 (nd, 1)	5.25 (0.75, 2)	3.84 (0.40, 19)
Hay Creek (State Forest)	2.87 (0.66, 4)	No data	No data	No data	4.50 (0.50, 2)	No data	3.42 (0.55, 6)
Mill Creek	No data	No data	2.33 (0.17, 3)	1.75 (0.25, 2)	3.08 (1.17, 3)	1.86 (0.65, 4)	2.27 (0.35, 12)
Pine Creek	No data	4.00 (0, 3)	0.42 (nd, 1)	2.78 (0.25, 12)	3.10 (0.61, 8)	3.23 (0.33, 14)	3.05 (0.21, 38)
South Branch Root River (Lanesboro)	2.00 (0.61, 5)	7.20 (0.80, 5)	4.50 (0, 2)	1.96 (0.24, 43)	2.64 (0.27, 38)	2.87 (0.38, 8)	2.60 (0.19, 101)
South Fork Root River (Million Dollar)	No data	4.00 (0, 6)	3.00 (0, 4)	5.58 (0.45, 6)	0.33 (0, 2)	5.00 (1.00, 2)	4.00 (0.38, 20)
West Beaver Creek	3.00 (nd, 1)	4.00 (0, 2)	2.00 (nd, 1)	5.00 (0, 4)	4.56 (0.47, 8)	4.00 (nd, 1)	4.32 (0.28, 17)
West Indian Creek (County 4)	2.17 (0.17, 3)	2.20 (0.34, 5)	No data	No data	2.67 (0.83, 3)	No data	2.32 (0.25, 11)
Willow Creek	2.00 (0, 2)	No data	No data	No data	1.70 (0.30, 4)	0.97 (0.14, 3)	1.52 (0.19, 9)
Subtotal							2.97 (0.11, 233)

TABLE 2-7b. Mean fishing trip length (angler-hours, ± 1 SE, N) estimated from completed trip information during a summer creel (April 1 to September 30) in 2013 for five selected southeast Minnesota trout streams with a 12- 16 inch protected slot (no gear restrictions), five trout in the daily/possession limit with only one of those >16 inches.

Stream (area)	April	May	June	July	August	September	Totals
East Beaver Creek	4.67 (0.33, 3)	4.00 (0, 2)	2.00 (0.31, 5)	2.00 (0, 4)	2.50 (0.50, 2)	No data	2.81 (0.30, 16)
Forestville Creek	No data	5.00 (0, 3)	2.50 (0, 2)	No data	1.77 (0.56, 6)	3.50 (0, 2)	2.89 (0.45, 13)
South Branch Root River (State Park)	5.25 (0.75, 2)	6.20 (1.34, 5)	3.87 (0.63, 4)	3.10 (1.43, 3)	3.46 (1.06, 10)	4.84 (0.86, 7)	4.35 (0.49, 31)
West Indian Creek (LTM)	5.00 (nd, 1)	No data	2.00 (0, 2)	No data	3.00 (nd, 1)	2.00 (0, 2)	2.67 (0.49, 6)
Wisel Creek	2.42 (0.47, 6)	3.75 (0.31, 10)	3.62 (1.87, 4)	3.17 (0.83, 3)	5.90 (0.86, 5)	3.19 (0.72, 8)	3.64 (0.34, 36)
Subtotal							3.57 (0.21, 102)

TABLE 2-7c. Mean fishing trip length (angler-hours, ± 1 SE, N) estimated from completed trip information during a summer creel (April 1 to September 30) in 2013 for five selected southeast Minnesota trout streams with a 12-16 inch protected slot (artificial lures and flies only), five trout in the daily/possession limit with only one of those >16 inches.

Stream (area)	Apr	May	Jun	Jul	Aug	Sep	Totals
Gribben Creek	No data	No data	No data	0.50 (nd, 1)	1.18 (0, 2)	2.50 (nd, 1)	1.34 (0.42, 4)
Hay Creek (Upper)	3.33 (0.17, 9)	6.75 (1.25, 2)	3.04 (0.55, 6)	2.60 (0.19, 5)	3.13 (0.52, 4)	4.00 (0.29, 3)	3.42 (0.24, 29)
North Branch Whitewater River	4.25 (0.72, 8)	4.83 (0.68, 8)	2.08 (0.77, 6)	3.00 (0.33, 10)	6.00 (0, 3)	5.50 (0.63, 8)	4.05 (0.31, 44)
Trout Run (Bucksnort)	No data	No data	2.50 (0.65, 5)	1.94 (0.31, 20)	1.98 (0.51, 13)	3.31 (0.49, 12)	2.33 (0.23, 50)
Trout Run (Lohman's)	No data	3.75 (0.75, 4)	3.21 (0.89, 7)	2.86 (0.30, 14)	3.08 (0.36, 16)	4.31 (0.59, 7)	3.27 (0.22, 48)
Subtotal							3.18 (0.14, 175)

TABLE 2-7d. Mean fishing trip length (angler-hours, ± 1 SE, N) estimated from completed trip information during a summer creel (April 1 to September 30) in 2013 for five selected southeast Minnesota trout streams with a catch-and-release (artificial lures and flies only) regulation.

Stream (area)	Apr	May	Jun	Jul	Aug	Sep	Totals
Camp Creek	No data	2.67 (0.67, 3)	2.00 (0, 2)	1.77 (0.91, 4)	2.31 (0.86, 3)	2.77 (0.68, 5)	2.34 (0.33, 17)
M. Br. Whitewater (Crow Spring)	No data	No data	1.00 (nd, 1)	No data	2.37 (0.63, 5)	1.00 (nd, 1)	1.98 (0.50, 7)
M. Br. Whitewater (County 9)	No data	No data	2.83 (0.17, 3)	No data	1.78 (0.20, 6)	3.75 (0.75, 2)	2.42 (0.29, 11)
M. Br. Whitewater (Quincy)	4.00 (2.00, 2)	3.00 (0, 2)	2.37 (0.37, 4)	4.00 (nd, 1)	2.87 (1.05, 4)	3.50 (1.50, 2)	3.07 (0.39, 15)
South Fork Root River (LTM)	3.3a6 (0.30, 7)	3.83 (0.44, 3)	3.57 (0.37, 7)	2.50 (nd, 1)	4.00 (nd, 1)	2.13 (0.13, 4)	3.26 (0.19, 23)
Subtotal							2.76 (0.15, 73)

TABLE 2-7e. Mean fishing trip length (angler-hours, ± 1 SE, N) estimated from completed trip information during a summer creel (April 1 to September 30) in 2013 from 24 selected southeast Minnesota trout streams.

Stream (area)	Apr	May	Jun	Jul	Aug	Sep	Totals
Totals	3.14 (0.19) (59)	4.40 (0.21) (73)	2.80 (0.19) (69)	2.54 (0.14) (133)	2.91 (0.16) (150)	3.47 (0.18) (98)	3.11 (0.07) (583)

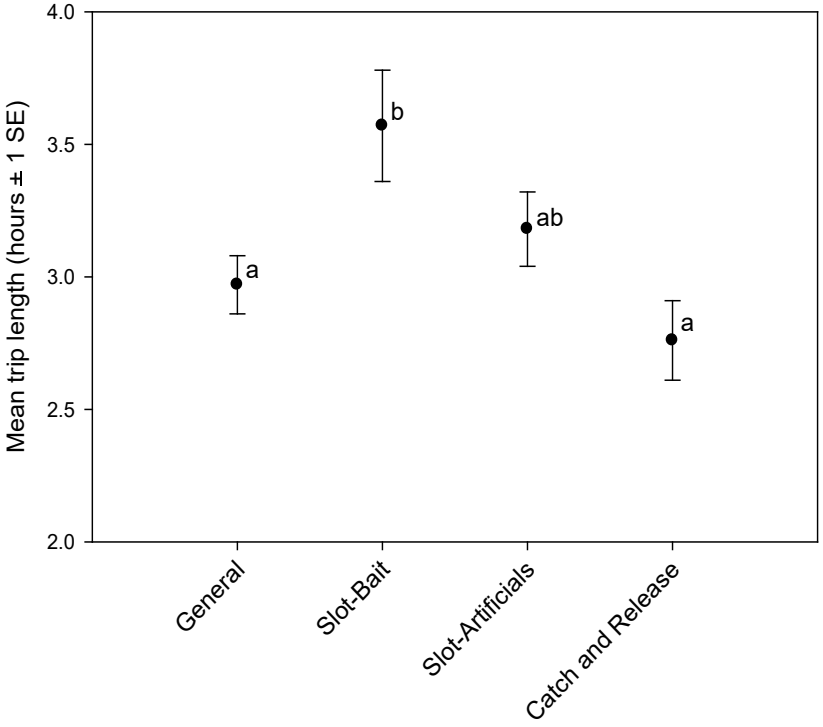

FIGURE 2-3. Comparisons of mean angler trip length among four types of angling regulations in southeast Minnesota, April 1 to September 30, 2013. General regulation streams allowed harvest of five trout (only one > 16 inches) in the daily/possession limit. Slot-bait streams required immediate release of all trout between 12 and 16 inches and allowed all gear types, whereas slot-artificials were the same but only allowed artificial lures and flies. Catch-and-release streams required release of all trout and allow only artificial lures and flies. Means with the same letter were not significantly different ($P < 0.05$).

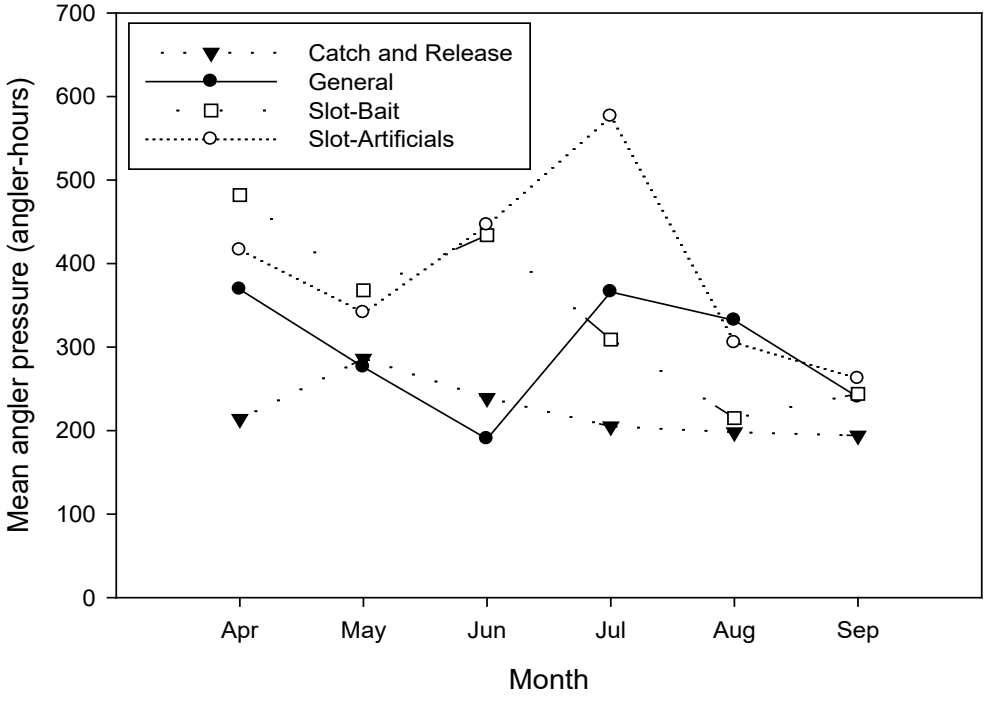

FIGURE 2-4. Monthly mean angler pressure across streams grouped by one of four types of angling regulations in southeast Minnesota, April 1 to September 30, 2013. General regulation streams allowed harvest of five trout (only one > 16 inches) in the daily/possession limit. Slot-bait streams required immediate release of all trout between 12 and 16 inches and allowed all gear types, whereas slot-artificials were the same but only allowed artificial lures and flies. Catch-and-release streams required release of all trout and allow only artificial lures and flies.

Regulations and Fishery Benefits - The nested ANOVA, with individual stream areas nested within regulation groups, allowed an assessment of the overall effect of the regulations as well as testing differences among streams within each regulation group. Catch rates for all trout combined did not differ significantly among the regulations overall (F = 0.79, df = 3, P = 0.51) but did differ among stream areas within the regulations (F = 5.21, df = 20, P = <0.01). Not surprisingly, the overall regulation effect across streams accounted for 0% of the total variation in catch rates, whereas the individual stream areas within each regulation accounted for about 15% of the variation in catch rates. This suggests that the various regulations may have been more effective on some stream areas than others. For example, the catch-and-release regulation may have been more effective on the South Fork Root River (LTM) site where mean catch rate was highest (3.91 trout/hour) (Figure 2-5). Conversely, the catch-and-release regulation may have been least effective on the Middle Branch Whitewater at Quincy bridges because mean catch rate was significantly lower there (0.90 trout/hour) than at the South Fork Root River (LTM) site. Among the five streams with a 12-16 protected slot (artificial lures and flies only) regulation, Trout Run (Lohman's) had the highest mean catch rate (2.65 trout/hour) which was significantly higher than catch rates on Hay Creek (Upper) or Trout Run (Bucksnort) (Figure 2-6). The 12-16 inch protected slot (no gear restrictions) regulation may have been least effective on Forestville Creek because this area had the lowest mean catch rate (0.37 trout/hour), which was significantly different from the mean catch rate on Wisel Creek (Figure 2-7). Mean catch rates among streams with general regulations were more variable, ranging from a low of 0.74 trout/hour on the South Branch Root River (Lanesboro Dam) to a high of 3.62 trout/hour on Crooked Creek (Figure 2-8). Mean catch rate was significantly higher on Crooked Creek than on Hay Creek (State Forest), Mill Creek, and the South Branch Root River (Lanesboro Dam) (Figure 2-8).

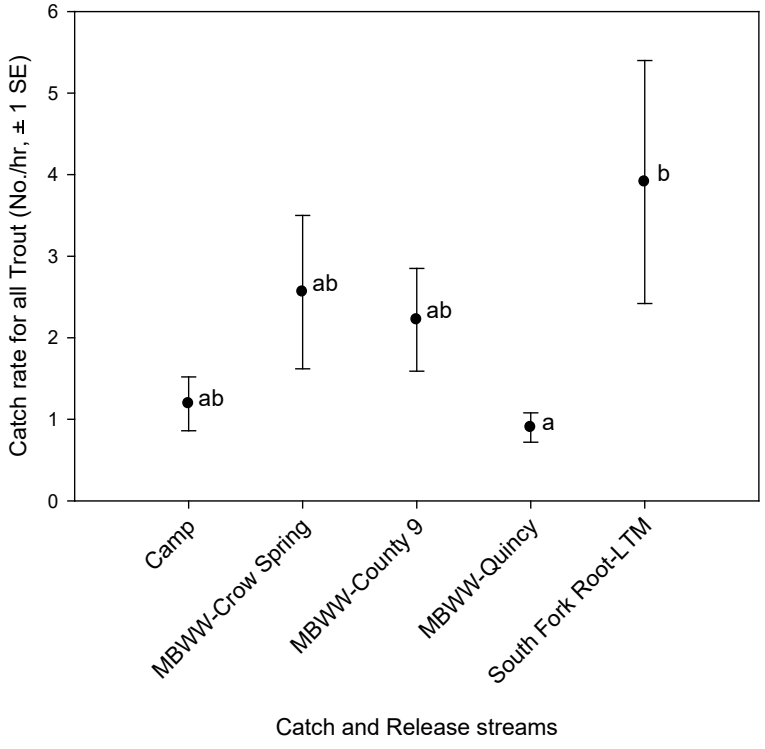

FIGURE 2-5. Comparison of mean angler catch rates for all species (Brown Trout, Brook Trout, Rainbow Trout) and sizes of trout combined among five streams with a catch-and-release regulation taken from a 2013 summer angler survey in southeast Minnesota. Means with the same letter were not significantly different (P < 0.05).

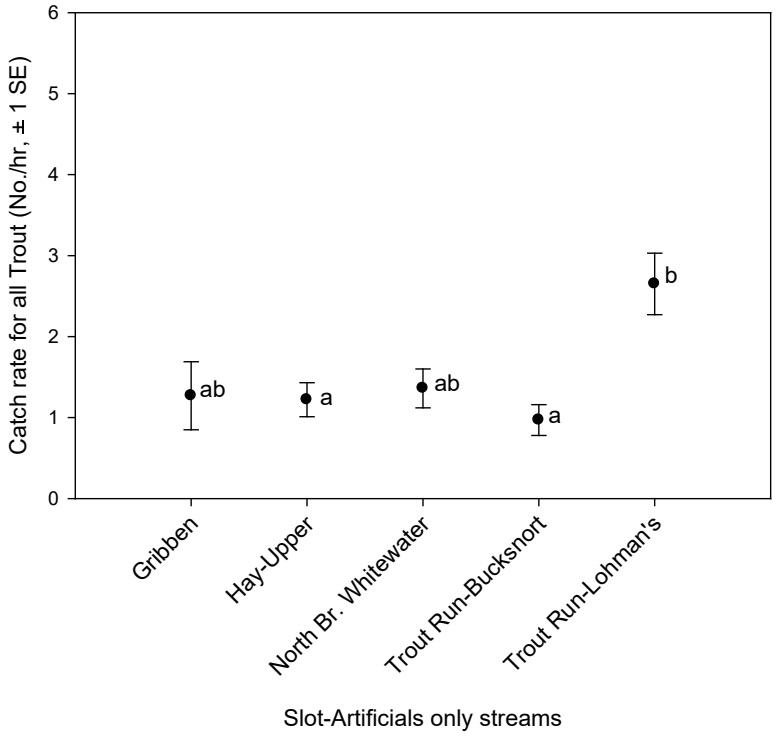

FIGURE 2-6. Comparison of mean angler catch rates for all species (Brown Trout, Brook Trout, Rainbow Trout) and sizes of trout combined among five streams with a 12-16 inch protected slot limit (artificial flies and lures only). Data were from a 2013 summer angler survey in southeast Minnesota. Means with the same letter were not significantly different ($P < 0.05$).

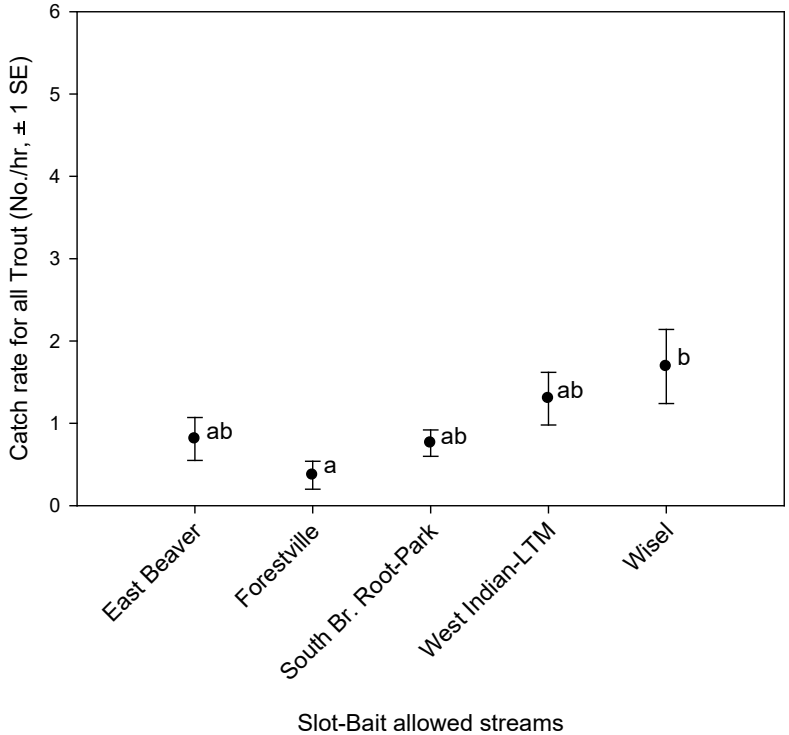

FIGURE 2-7. Comparison of mean angler catch rates for all species (Brown Trout, Brook Trout, Rainbow Trout) and sizes of trout combined among five streams with a 12-16 inch protected slot limit (all gear types allowed). Data were from a 2013 summer angler survey in southeast Minnesota. Means with the same letter were not significantly different ($P < 0.05$).

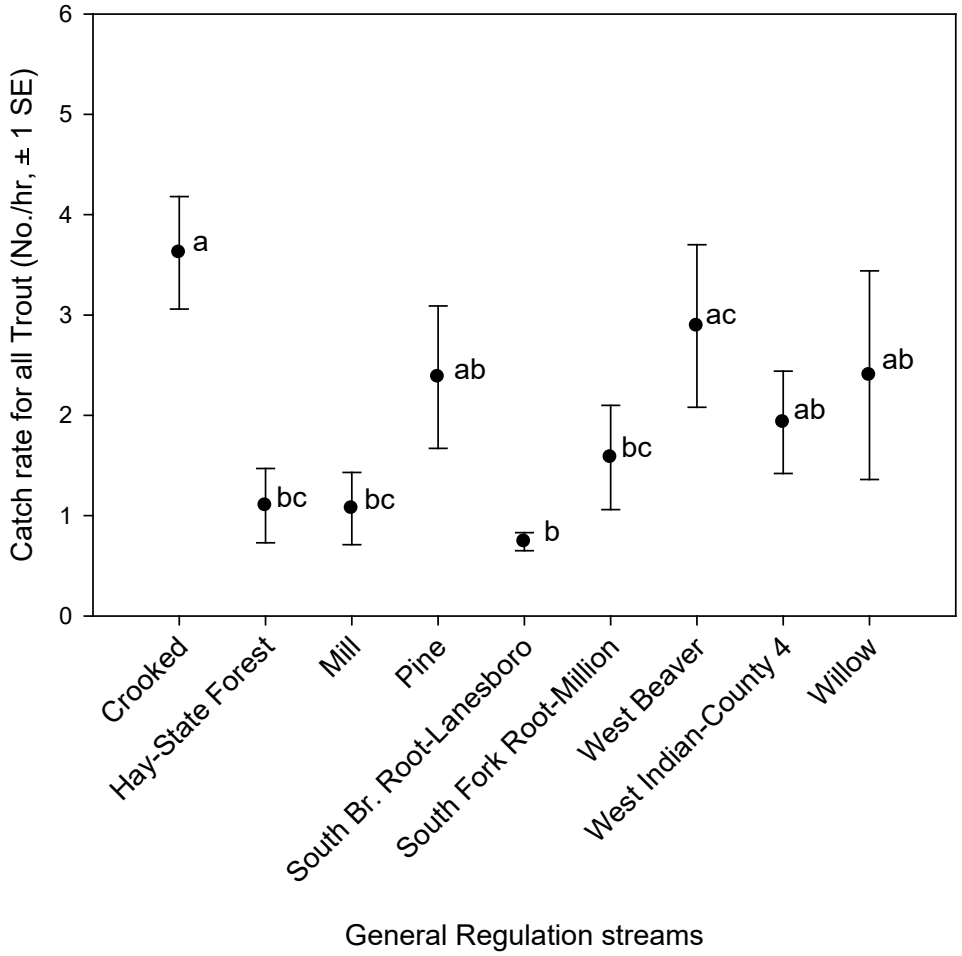

FIGURE 2-8. Comparison of mean angler catch rates for all species (Brown Trout, Brook Trout, Rainbow Trout) and sizes of trout combined among nine streams with general fishing regulations that allowed harvest of five trout (only one > 16 inches) in the daily/possession limit. All angling gear types were allowed. Catch rate data were from an angler survey conducted in southeast Minnesota, April 1 to September 30, 2013. Means with the same letter were not significantly different ($P < 0.05$).

If the more restrictive regulations (i.e., catch-and-release and both types of 12-16 inch protected slots) were accomplishing their desired objective of increasing catch rates of medium- (≥ 12 inch or 12-16 inch) and large-sized (≥ 16 inch) trout, we would have expected higher catch rates for these trout sizes on the regulation stream areas as compared to the stream areas with general angling regulations. However, catch rates for all three size groups of trout did not differ significantly among the regulations, suggesting that the restrictive regulations may not have had success accomplishing this biological objective during summer 2013 (Table 2-8; Figures 2-9, 2-10, 2-11).

When harvest rates were examined by trout stream regulation (catch-and-release seasons and regulations excluded) anglers harvested a higher percentage of their catch on streams with general regulations (17.9%) followed by slot (no gear restrictions) (14.4%) and slot (artificial lures and flies only) (8.1%). This illustrates the implications of applying social regulations to waters which can still result in changes to a fishery.

TABLE 2-8. Kruskal-Wallis non-parametric analysis of variance results comparing catch rates (number/hour) for all trout species combined (Brown Trout, Brook Trout, Rainbow Trout) among four types of angling regulations in streams of southeast Minnesota, April 1 to September 30, 2013. Comparisons were made independently for three size groups of trout (medium trout ≥ 12 inches; medium trout 12-16 inches, and large trout ≥ 16 inches) and two groups of anglers (all anglers and those anglers that caught at least one trout of the designated size group). Anglers had to have fished for at least 0.5 hour to be considered. General regulation streams allowed harvest of five trout (only one > 16 inches) in the daily/possession limit. Slot (no gear restriction) streams required immediate release of all trout between 12 and 16 inches and allowed all gear types, whereas slot (artificial lures and flies only) were the same but only allowed artificial lures and flies. Catch-and-release streams required release of all trout and only allowed artificial lures and flies.

Regulation	Mean catch rate	N	Kruskal-Wallis X^2	df	P
Medium and large trout = ≥ 12 inches, all anglers					
General regulations	0.391	235	5.243	3	0.15
Slot (no gear restrictions)	0.265	126			
Slot (artificial lures and flies only)	0.299	184			
Catch-and-release	0.260	99			
Medium and large trout = ≥ 12 inches, only anglers that caught a trout of this size					
General regulations	1.120	82	2.187	3	0.53
Slot (no gear restrictions)	1.045	32			
Slot (artificial lures and flies only)	0.799	69			
Catch-and-release	0.858	30			
Medium trout = 12-16 inches, all anglers					
General regulations	0.380	235	5.535	3	0.14
Slot (no gear restrictions)	0.254	126			
Slot (artificial lures and flies only)	0.280	184			
Catch-and-release	0.246	99			
Medium trout = 12-16 inches, only anglers that caught a trout of this size					
General regulations	1.088	82	2.263	3	0.52
Slot (no gear restrictions)	1.032	31			
Slot (artificial lures and flies only)	0.778	66			
Catch-and-release	0.871	28			
Large trout = ≥ 16 inches, all anglers					
General regulations	0.011	235	2.975	3	0.40
Slot (no gear restrictions)	0.011	126			
Slot (artificial lures and flies only)	0.020	184			
Catch-and-release	0.014	99			
Large trout = ≥ 16 inches, only anglers that caught a trout of this size					
General regulations	0.322	8	2.292	3	0.51
Slot (no gear restrictions)	0.289	5			
Slot (artificial lures and flies only)	0.304	12			
Catch-and-release	0.453	3			

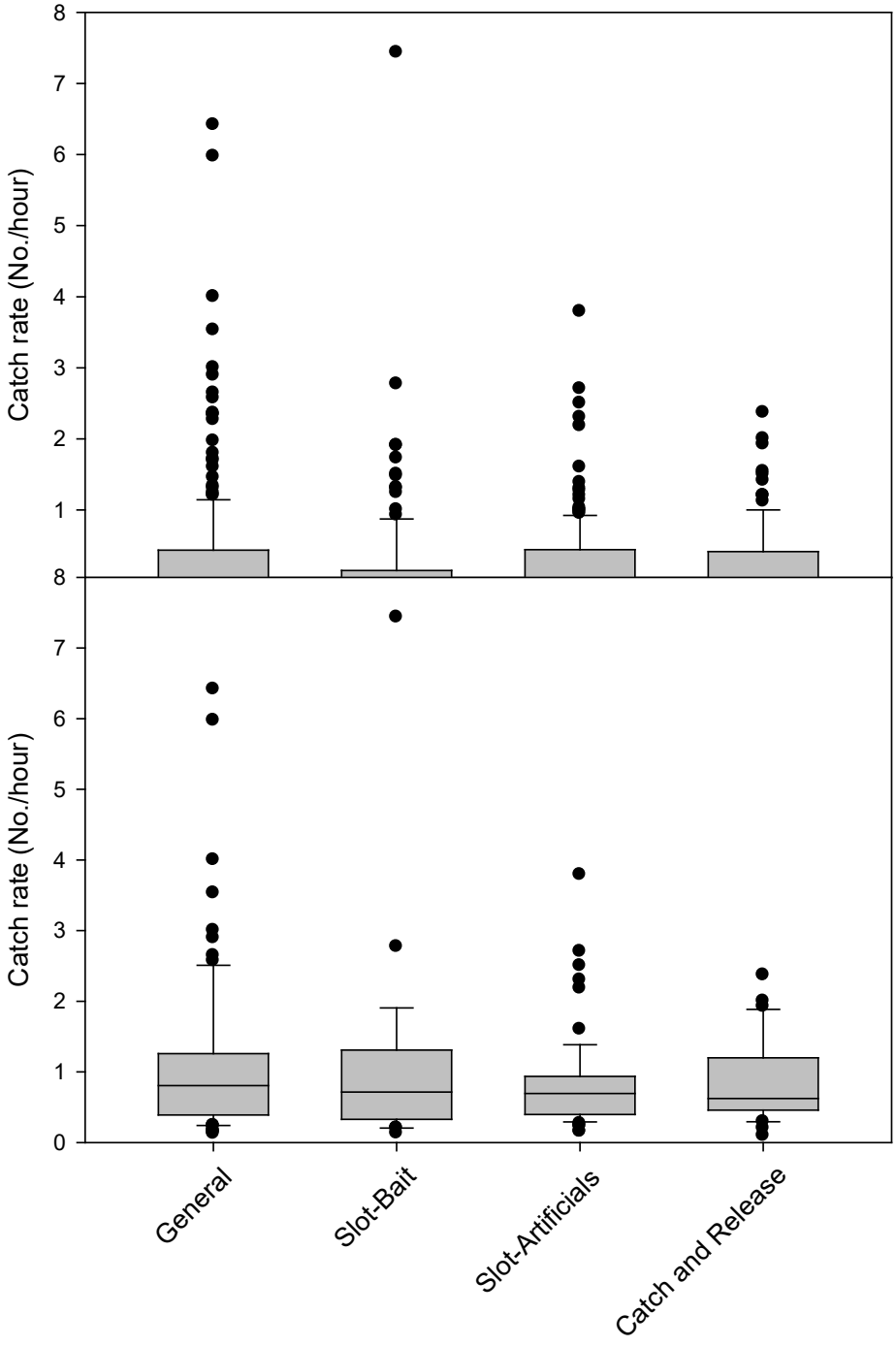

FIGURE 2-9. Box plot depicting differences in catch rates of anglers fishing ≥ 0.5 hr for Brown, Rainbow, and Brook Trout ≥12 in. TL (combined) among four types of angling regulations in southeast Minnesota, April 1 to September 30, 2013. Top figure is all anglers (includes many zeroes). Bottom figure is only anglers that caught at least one trout ≥ 12 in. Box plots depict median catch rates, 25th-75th (box), 10th-90th (whiskers) percentiles and outliers. General regulation streams allowed harvest of five trout daily with only one > 16 in. Slot-bait streams required immediate release of all trout between 12 and 16 in. and allowed all gear types, whereas slot-artificials were the same but only allowed artificial flies and lures. Catch and release streams required release of all trout.

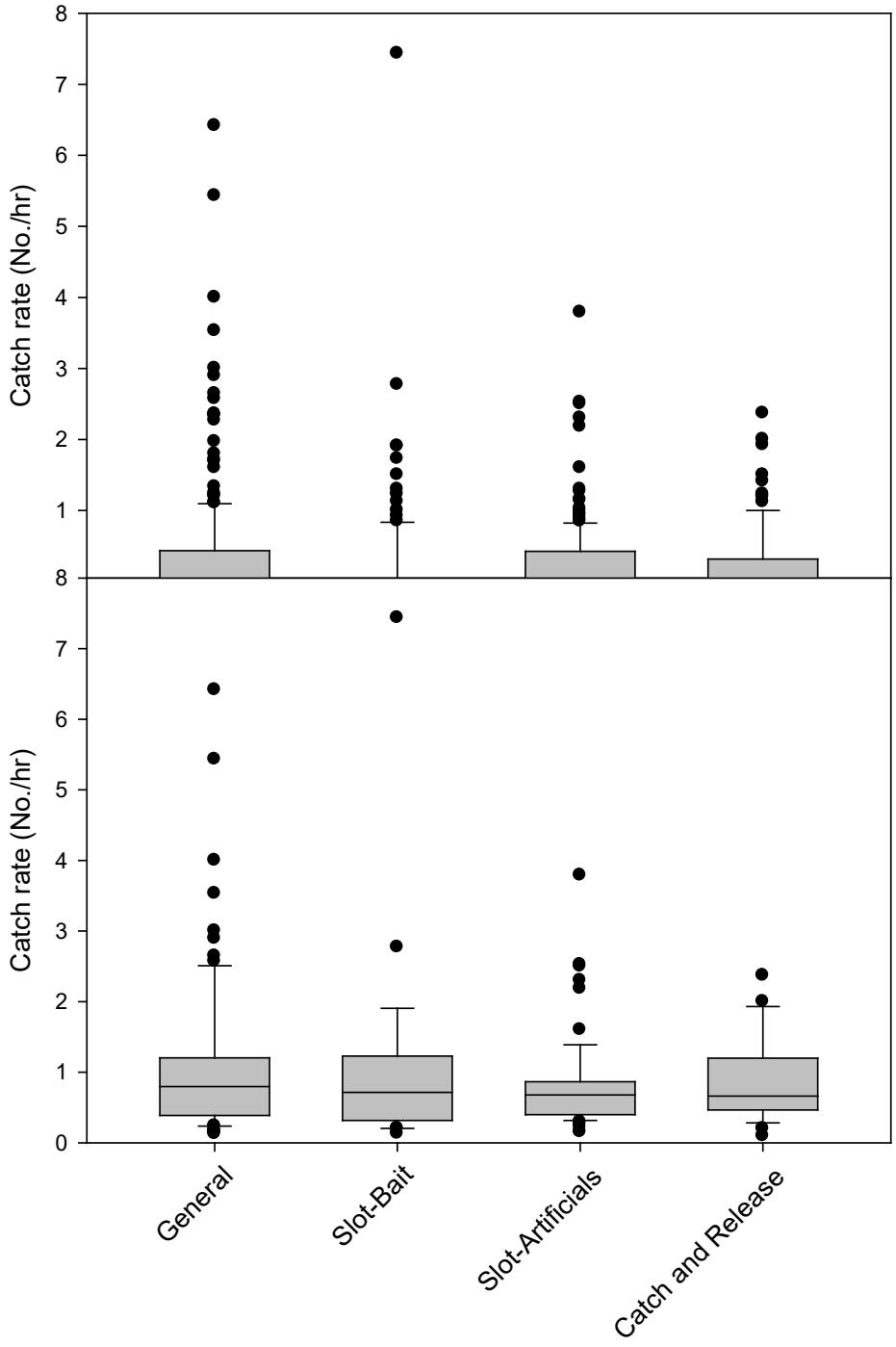

FIGURE 2-10. Box plot depicting differences in catch rates of anglers fishing ≥ 0.5 hr for Brown, Rainbow, and Brook Trout 12-16 in. TL (combined) among four types of angling regulations in southeast Minnesota, April 1 to September 30, 2013. Top figure is all anglers (includes many zeroes). Bottom figure is only anglers that caught at least one trout between 12 and 16 in. Box plots depict median catch rates, 25th-75th (box), 10th-90th (whiskers) percentiles and outliers. General regulation streams allowed harvest of five trout daily with only one > 16 in. Slot-bait streams required immediate release of all trout between 12 and 16 in. and allowed all gear types, whereas slot-artificials were the same but only allowed artificial flies and lures. Catch and release streams required release of all trout.

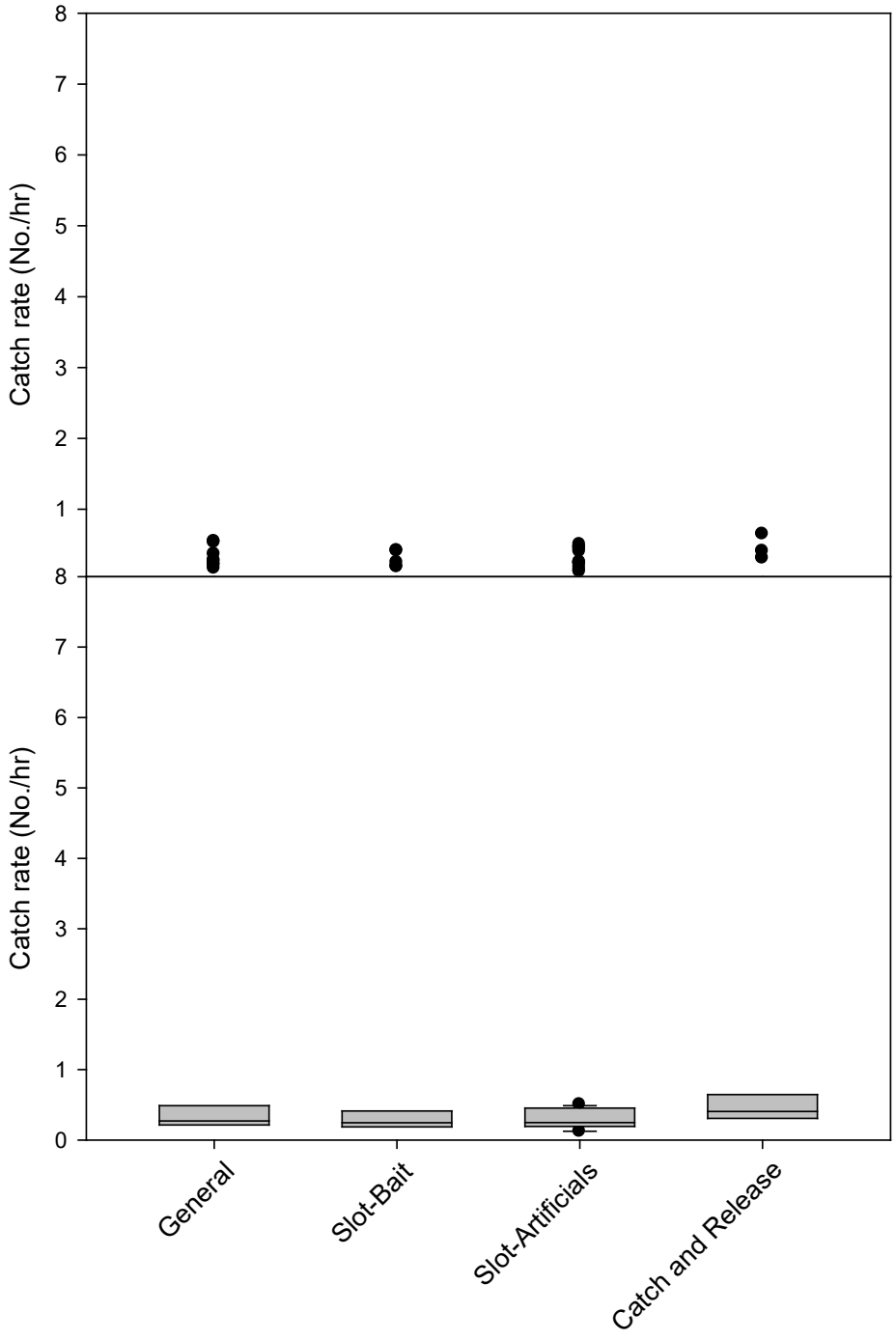

FIGURE 2-11. Box plot depicting differences in catch rates of anglers fishing ≥ 0.5 hr for Brown, Rainbow, and Brook Trout ≥ 16 in. TL (combined) among four types of angling regulations in southeast Minnesota, April 1 to September 30, 2013. Top figure is all anglers (includes many zeroes). Bottom figure is only anglers that caught at least one trout ≥ 16 in. Box plots depict median catch rates, 25th-75th (box), 10th-90th (whiskers) percentiles and outliers. General regulation streams allowed harvest of five trout daily with only one > 16 in. Slot-bait streams required immediate release of all trout between 12 and 16 in. and allowed all gear types, whereas slot-artificials were the same but only allowed artificial flies and lures. Catch and release streams required release of all trout.

Regulations and Angler Satisfaction - When examining satisfaction with the overall fishing experience by trout stream regulation, few differences were apparent (Table 2-9). Regardless of regulation, about 85% or more of anglers were satisfied or very satisfied. No anglers were very dissatisfied with their overall fishing experience on catch-and-release streams, which had the highest percentage of dissatisfied anglers (11.9%).

From a sociological perspective, if regulations were increasing abundance of larger trout then angler satisfaction should be higher on streams with restrictive regulations than on streams with general regulations. However, this was not true. The percentage of anglers that were satisfied or very satisfied with size of trout caught was lowest on the most restrictive regulation areas (catch-and-release = 56%; slot-artificial lures and flies only = 56.8%) and highest on general regulation streams (63.9%) (Table 2-10). The most dissatisfied and very dissatisfied anglers were interviewed fishing the protected slot (no gear restrictions) streams (27.0%).

Similarly, angler satisfaction with numbers of trout caught should be higher on streams with more restrictive regulations if those regulation were working effectively. The highest percentage of satisfied and very satisfied anglers were fishing catch-and-release and slot (no gear restrictions) areas suggesting some support for these social benefits (Table 2-11). However, the lowest percentages were found on stream areas with the slot (artificial lures and flies only) regulation indicating mixed support. The most dissatisfied or very dissatisfied were fishing protected slot (no gear restrictions) streams.

TABLE 2-9. Angler satisfaction (overall fishing experience) by angling regulation of those surveyed fishing selected trout streams in southeast Minnesota, April 1 and September 30, 2013.

Regulation	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
General southeast MN	2.2	4.7	6.9	7.0	86.2	54.6	31.6
Protected slot - all gear	0.6	7.7	11.9	2.6	84.4	50.6	38.5
Protected slot - artificial only	1.6	5.8	8.3	7.9	89.1	62.8	22.0
Catch-and-release	0.0	11.9	7.3	3.7	84.8	49.5	34.9

TABLE 2-10. Angler satisfaction (size of trout caught) by angling regulation of those surveyed fishing selected trout streams in southeast Minnesota, April 1 and September 30, 2013.

Regulation	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
General southeast MN	1.5	15.9	17.4	20.3	63.9	44.3	19.6
Protected slot – all gear	5.7	21.3	27.0	17.7	61.0	34.0	27.0
Protected slot - artificial only	0.0	14.2	14.2	29.0	56.8	48.4	8.4
Catch-and-release	0.0	14.7	14.7	29.4	56.0	36.7	19.3

TABLE 2-11. Angler satisfaction (numbers of trout caught) by angling regulation of those surveyed fishing selected trout streams in southeast Minnesota, April 1 and September 30, 2013.

Regulation	Very Dissatisfied	Dissatisfied	VD + D	Neither	S + VS	Satisfied	Very Satisfied
General southeast MN	1.5	25.1	26.6	18.9	54.6	38.2	16.4
Protected slot – all gear	6.0	26.2	32.2	10.7	57.1	30.9	26.2
Protected slot - artificial only	0.0	20.1	20.1	27.0	52.9	44.4	8.5
Catch-and-release	0.0	23.0	22.9	22.0	55.1	33.9	21.1

DISCUSSION

Angling regulations should only be implemented to achieve some defined pre-regulation management goals and all such regulations should be evaluated (Noble and Jones 1999). Lack of adequate evaluations prohibit determination of whether angling regulations achieve any objectives other than wasting limited public funds. Management goals can include objectives for fish populations (e.g., changes in fish abundance), the general fishery (e.g., angler catch rates), or other sociological benefits (Noble and Jones 1999).

This creel survey was implemented in part to gather information on the fishery and sociological benefits of streams with differing regulations in southeast Minnesota. Development of a formal and comprehensive evaluation plan for these regulations, including treatment and control reaches, was strongly recommended at their inception (MN DNR 2003). However, the expensive and infrequent nature of creel surveys only allowed a modest fishery and sociological evaluation of these regulations.

Few fishery or sociological metrics assessed in this creel survey differed between catch-and-release areas and areas with general regulations. On average, trip lengths and overall pressure were usually lowest on catch-and-release streams (Table 2-7; Figure 2-4). Only 7.8% of anglers fishing catch-and-release areas did so because of the catch-and-release regulation there. This suggests that a minority of anglers actually preferred to fish streams with this special regulation, as suggested in the original coldwater resource plan (MN DNR 2003). Further, the percentage of anglers that were satisfied or very satisfied with the overall fishing experience was similar between catch-and-release (84.8%) and general regulation areas (86.2%) (Table 2-9). From a fishery perspective, overall catch rates for any size grouping of trout were not higher on catch-and-release streams than on general regulation streams, suggesting that the goal of increasing or maintaining presumed higher catch rates of medium and large trout may not have been met. This was also reflected in angler satisfaction responses. A smaller percentage of anglers were satisfied or very satisfied with the size of trout caught in catch-and-release (56.0%) than in general regulation areas (63.9%). Responses were similar for satisfaction with numbers of trout caught as 55.1% of anglers fishing catch-and-release streams were satisfied or very satisfied whereas 54.6% of anglers reported these responses on general regulation streams.

One catch-and-release stream area, the South Fork Root River (LTM) site, had significantly higher catch rates for all trout species and sizes than other stream areas, possibly suggesting that the catch-and-release regulation was increasing trout abundance. Bushong and Anderson (1996) similarly found stream specific responses implemented on Hay Creek in 1985 resulted in increased abundance and angler catch rates of trout ≥12 inches. However, a similar catch-and-release regulation implemented on the Middle Branch Whitewater River failed to increase abundance of trout ≥12 inches. It is also possible, that trout were simply more abundant at the South Fork Root River (LTM) site than at all other sites, but available abundance data suggested that this was not true (Figure 2-1). Still, lack of more complete pre-regulation data from all streams and collected in conjunction with a more definitive before-after-control-treatment design, makes it difficult to verify this.

Most fishery and sociological metrics were similar among stream areas with a 12-16 inch protected slot with or without gear restrictions and general regulation areas. Overall, angler pressure was not greater on protected slot areas than on general regulation areas. Mean trip length also did not differ between protected slot (artificial lures and flies only) areas (3.18 hours) and general regulations (2.97 hours), but anglers did fish slightly longer on protected slot areas that did not have gear restrictions (3.57 hours). The fishery in general did not differ between protected slot and general regulation areas, as catch rates for each trout size group were statistically similar. A higher percentage of anglers were satisfied or very satisfied with their overall angling experience on protected slot (artificial lures and flies only) areas, but a smaller percentage was satisfied with size and numbers of trout caught. Anglers were clearly not fishing longer, catching more or larger sizes of trout, or were more satisfied on stream areas with protected slot regulations than anglers fishing general regulation areas.

Voluntary release rates ranged from 82% on general regulation sites to 92% at sites with a protected slot-artificial-lures-only regulation in 2013. Such high release rates likely influenced regulation performance. If release rates were similarly > 80% prior to implementation of the regulations in 2005, then it was unlikely that fishing mortality due to angler harvest was a critical factor limiting trout abundance and size structure prior to regulation implementation

Simply put, there may not have been sufficient angler harvest initially to protect trout from. Consequently, this could be another explanation for the lack of large differences in fishery metrics among regulation types.

There did not appear to be widely different user groups fishing each regulation type. Anglers fishing general regulation streams tended to include slightly more young (< 19 years old) and old (70-89 year old) age groups and more local anglers from southeast Minnesota than other regulation types. Also, by definition, anglers were more likely to use bait in general regulation and slot (no gear restrictions) areas than catch-and-release and slot (artificial lure and flies only) regulation areas. Streams with general regulations also tended to have a few more lure anglers and equal proportions of new and experienced anglers, whereas anglers fishing the most restrictive catch-and-release regulation had disproportionally more experienced anglers that had been trout fishing for a longer period of time. Similar dichotomies have been noted by conservation officers patrolling western Wisconsin streams, especially parent-children angling parties that are more likely to use bait and fish streams with the least complex angling regulations (Dewald 2001).

Many factors influence satisfaction and satisfaction itself is a function of the disproportionate result between an angler's expectation and what they actually experienced (Decker at el. 2001). Because catch rates were not significantly higher overall on areas with more restrictive regulations, this indicated that the actual experience that anglers received was similar among regulation types. Consequently, the slightly lower satisfaction scores on streams with the most restrictive regulations could have been due to differences between what the anglers expected to catch and what they actually caught at these sites. Future human dimensions survey may need to evaluate angler expectations in addition to just satisfaction to better understand this interaction.

This creel survey represents only current information on the fishery and societal benefits provided by these regulations and should not be over-interpreted. A more comprehensive evaluation that includes biological information on trout population abundance and size structure should be examined as well but was beyond the scope of this report. Such a comprehensive evaluation should also include any existing creel information prior to the implementation of these regulations to enable a more robust before-after-control-impact meta-analysis that includes data from this report. Development of a formal and comprehensive evaluation plan for these regulations, that included identification of control and treatment areas and adequate sample sizes, was recommended by MN DNR (2003) but was never enacted due in part to financial constraints (MN DNR 2010).

MANAGEMENT IMPLICATIONS

1) The present data suggest sociological or fishery-related benefits of these regulations were not sufficient to be detected given the high amount of between stream variability. Future surveys should strive to determine if there are negative consequences of implementing these regulations such as loss of certain user groups including younger or novice anglers using bait. If negative consequences exist, then consideration should be given for removal of these regulations.
2) The present evaluation was hampered by lack of a controlled study design and financial resources. To verify the present conclusions, future sociodemographic and fishery related evaluations of these regulations should collect data from stream areas before and after regulation implementation and on treatment and control areas. Such surveys also need more frequent data collection (more years), perhaps in conjunction with southeast Minnesota's long-term stream monitoring sites which would include fish population and stream habitat data.
3) Trout stream managers need to discuss and decide what appropriate goals for sociodemographic metrics should be. For example, this survey found that fly anglers represented about 19% of anglers fishing general regulation streams. Perhaps this percentage is appropriate. Otherwise, a sociodemographic goal for general regulation streams would need to be something different, such as 50% fly anglers on general regulation streams. Would such a goal be appropriate? Managers need to fully discuss what angler gear use composition might be most appropriate to aid goal setting in management plans such as the LRP (MN DNR 2010). Additional human dimensions surveys might need to be implemented to determine what percentages anglers prefer to see on various regulations.
4) If regulations are failing to increase angler catch rates of larger trout sizes, then this suggests that angler overharvest and/or hooking mortality are not a concern. Voluntary release rates were generally > 80% regardless of regulation. Consequently, biologists need to determine what other factors, such as instream habitat or environmental growth potential (sensu Behnke 1988), may be limiting large trout abundance and angler catch rates.

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CHAPTER 3: Compilation and Initial Evaluation of Baseline Sociodemographic and Fishery-Related Information to Aid Assessment of Instream Habitat Improvement Projects in Southeast Minnesota

Abstract. – Selected sociodemographic and fishery-related information were compiled from creel surveys conducted at 11 stream sites to facilitate evaluations of instream habitat enhancement projects in southeast Minnesota. Data were compiled at seven sites to summarize and establish pre-project baseline conditions prior to habitat projects anticipated to be implemented within the next 10 years (2013-2023). Data summaries included estimates of angler age, gender, gear type, trip length, catch rate, pressure, harvest rate and satisfaction. In addition, prospective power analyses were conducted, given variability in baseline estimates, to facilitate discussion of potential habitat project objectives and sample sizes needed to complete evaluations. Power analyses indicated that increases of about 100% may represent measurable objectives that could be realistically evaluated for several variables. However, angler harvest rates were likely too variable to permit an evaluation. Three other stream sites had received some habitat enhancement project within the past eight years and allowed for initial pre- and post-project evaluations. A fourth site served as a control for one of these habitat projects. There were few conclusive differences in angler demographics, participation, catch rates, or angler satisfaction before and after these projects were implemented with the exception of one habitat project completed on Trout Run Creek in 2007. Overall angler pressure significantly increased by about 200% at this site, from 1,935 angler hours/mile in 2005 to 6,015 hours/mile in 2013. All other comparisons of angler pressure, trip length and catch rate were inconclusive due, in part to small pre-project samples sizes. Future sociodemographic and fishery-related evaluations should benefit from more focused creel surveys to a smaller number of stream sites, such as those surveyed in 2013. The compilation of existing data in this report should thus serve to provide more robust data for evaluations of future habitat projects implemented at the other seven stream sites.

INTRODUCTION

Coldwater streams throughout the upper Midwestern United States have been degraded for over a century by poor land use practices necessitating the expenditure of considerable public funds to restore or enhance habitat for fishes and other aquatic fauna (White 1996). The stream trout fishery in southeast Minnesota was impacted by extensive habitat degradation beginning in the mid-1800s (reviewed in Thorn et al. 1997). Instream habitat enhancement work was initiated by state conservation departments beginning in 1946 and has continued to the present day at varying public costs. For example, between 1958 and 2008, over $380,000 was spent on instream habitat work on Trout Run Creek in Winona, County (MN DNR file data). Since the 1970s, an exceptional recreational stream trout fishery has expanded to more streams, due in part to improved stream habitat. At present this exceptional fishery exists on over 800 stream miles in southeast Minnesota.

A comprehensive long-range trout stream resource plan (Fisheries Long-Range Plan for Trout Stream Resource Management in Southeast Minnesota (LRP)) was developed in 2003 (MN DNR 2003a) and updated in 2010 (MN DNR 2010) to guide management efforts for southeast Minnesota streams. Protection, improvement and restoration of coldwater aquatic habitat was one of the primary goals listed in the LRP [Goal 2.1 Instream Habitat Rehabilitation - Action item 9]. Instream habitat work has traditionally been funded by the sale of trout stamps which are required by any angler, 18 to 65 years old, fishing for trout (anglers purchasing 24-hour and 72-hour fishing licenses are not required to purchase a trout stamp). However, in 2008, Minnesota citizens voted for an allocation of 3/8ths of one percent of state sales taxes (i.e., the Legacy Amendment) to aid funding for environmental and arts/cultural heritage projects across the state. Funds for fish and wildlife habitat protection and enhancement are administered by the Lessard-Sams Outdoor Heritage Council (LSOHC), a group which makes recommendations to the Minnesota Legislature on which projects to fund with Legacy Amendment funds. This has resulted in a substantial increase in funding for instream habitat projects implemented by state agencies (e.g., Minnesota Department of Natural Resources-MN DNR) and private conservation partners, such as the Minnesota State Council of Trout Unlimited. For example, between fiscal year 2010 and 2015, over 10 million dollars were allocated to fund stream habitat projects implemented by Trout Unlimited, at least another 10 million to MN DNR to fund various aquatic habitat projects on lakes and streams across the state, and about 1.8 million to the Lake Superior Steelhead Association, specifically for stream habitat work on the Knife River in northeast Minnesota (LSOHC 2014). By contrast, about 0.4 million was spent annually to improve and protect coldwater stream habitats in southeast Minnesota between 1998-2002 (MN DNR 2003b).

Orth and White (1999) noted the need to establish specific, quantifiable objectives for each stream habitat project initiated. Without specific objectives and good evaluations, identification of project success is impossible to determine and simply results in a waste of public funds without knowing if resource impairments have been corrected. The evaluation of biological benefits, such as increased trout abundance, in stream habitat projects has a long history in the Driftless Area of southwest Wisconsin, northeast Iowa, and southeast Minnesota (e.g., Hunt 1988; Thorn 1988). However, new habitat practices are being implemented that have not received similar biological evaluations. Perhaps more importantly, direct tangible benefits of habitat projects for anglers have been less frequently investigated.

The LRP noted that instream habitat improvement projects should result in maximum benefits to trout and trout anglers. Although not specifically identified, such benefits should likely include a number of factors including increased angler catch rates and satisfaction. Similarly, instream habitat project proposals submitted to the LSOHC have specified vague, unquantified objectives including “improve angler access and participation,” “increase adult trout abundance” or “increase natural reproduction of trout”. Lack of specific, measureable objectives makes proper evaluation difficult. To date, state agencies and conservation partners have rarely attempted to examine sociodemographic benefits or concerns of instream habitat projects in southeast Minnesota, even though millions of public dollars have been expended on this management action over the past five years.

Part of the difficulty with properly assessing sociodemographic and fishery-related benefits of instream habitat projects is because substantial resources are needed to collect these data. Common sociocultural and fishery-related information includes angler age, gear type, pressure, catch rates and satisfaction and these data are usually best collected with a survey, such as an angler creel survey (Knuth and McMullin 1996). Because of their expense, creel surveys have been infrequently conducted on southeast Minnesota trout streams (e.g., Bushong 1996; Weiss 1999; Snook and Dieterman 2006). Also, some past creel surveys covered many streams with low sample sizes on any one stream, resulting in large standard errors. Thus, evaluation of habitat project benefits is difficult on any particular stream.

Funding became available to conduct a creel survey during the 2013 summer angling season. To provide more precise estimates of fishery-related measures, such as angler pressure and catch rates, it was decided that a smaller group of stream areas scheduled for instream habitat projects within the next five years would be targeted for a more intensive angler creel survey. Future creel surveys will be able to compare metrics to this more robust baseline of information. Funding was available to hire four creel clerks, which allowed three additional areas to be surveyed to permit an initial examination of sociodemographic information before and after recent habitat projects. To facilitate these comparisons, data from past creel surveys needed to be compiled as well. Therefore, the goal of this project was to compile historic and current angler creel information to provide a baseline to aid future evaluations of stream habitat projects and where possible to conduct initial evaluations of recent habitat projects. Specific objectives were to:

1. Develop baseline pre-project data by compiling past and current angler information on angler age, gender, residency, gear use, satisfaction, trip length, pressure, catch rate and harvest rate for selected streams scheduled for habitat projects within the next 10 years.
2. Compare angler age, gear use, trip length, pressure, catch rate and satisfaction before and after recent habitat improvement projects for selected stream areas.

METHODS

Several previous creel surveys have been conducted specifically on stream areas either scheduled to receive instream habitat projects within five years or that received habitat projects within the past 10 years (Table 3-1). Seven stream areas were anticipated to receive an instream habitat project within the next 10 years (between 2013 and 2023). The goal is to compile selected sociodemographic information from past creel surveys to characterize the baseline angling constituency that used those areas and to document any pre-project temporal differences. These data were presented in a case-history format to facilitate future pre- and post-project comparisons. Baseline information was compiled in tabular form. Whenever possible, data included presentation of percentages for age groups, gender, residency, gear use, and angler satisfaction with each of three fishery aspects: their overall fishing trip, size of trout caught, and numbers of trout caught. Such percentages can be compared pre- and post-project with a number of tests of proportions (e.g., one-sample proportions test; see Zar 1984 or related statistics books for examples).

Data were also specifically compiled for four other variables: trip length, angler pressure, catch rate and harvest rate. If habitat projects strive to increase angler access and participation as suggested by some LSOHC project proposals, then it is logical that a successful habitat project might have anglers that fish longer on each trip (i.e., increased trip length, expressed in hours fished) or else exhibit higher overall angler pressure (hours/mile). Similarly, habitat projects should result in direct, tangible benefits to anglers that might be reflected in increased catch rates (trout/hour) or harvest rates (trout/mile). Wherever possible, data included the mean (for trip length and catch rate) or estimate (for angler pressure and harvest rate), ± 1 standard error and the sample size (n). These descriptive statistics should allow a basic testing of two samples as described by Zar (1984). An example calculation is provided below to facilitate future pre- and post-project comparisons. Prospective power analyses, assuming a *t* distribution, were also conducted to help identify potential measurable objectives to use for future stream habitat projects and to provide an estimate of potential sample sizes needed. Sample size estimates were the number of anglers fishing longer than 0.5 hours to estimate catch rates, the number of completed angler trips needed to

determine mean trip lengths, and the number of days needed to conduct a creel survey to estimate angler pressure and harvest rates. Prospective power analyses followed suggestions in Rabeni (1996).

Three areas on two streams also recently received instream habitat projects (Table 3-1). Two sites were on the Middle Branch Whitewater River. Historic creel surveys had been conducted on both areas, but not on a separate area that could be considered a "control" site. Thus, only before-and-after comparisons could be made. Both projects were completed by Trout Unlimited and included sloping and stabilizing stream banks, mulching and seeding with native vegetation and installing overhead cover for fishes. A third habitat project site was located on Trout Run Creek in 2007. Another site on Trout Run located about 1.5 miles downstream also contained historic creel information and permitted a more robust before-after-control-impact (BACI) examination. This project was completed by the Hiawatha Chapter of Minnesota Trout Unlimited and also used bank sloping and stabilization, installation of overhead cover, and mulching and seeding.

TABLE 3-1. Creel surveys (by year) completed on selected stream areas on ten coldwater streams in southeast Minnesota that are either scheduled to have an instream habitat project conducted by 2018 or that received a habitat project since 2005 and that have historic angler creel information.

Stream	Area	2013	2005	1998	1995	Additional notes
Hay Creek	State land	X			X	Pre-project (project scheduled 2014)
West Indian Creek	Cty 4 downstream	X				Pre-project
Cold Spring Brook	rmi 0.5, LTM		X	X		Pre-project (project scheduled 2014)
Mill Creek	Chatfield city property	X	X			Pre-project
Willow Creek		X				Pre-project
Wisel Creek	Chickentown	X	X			Pre-project
Crooked Creek		X				Pre-project
M. Br. Whitewater	Quincy bridges	X	X		X	Habitat project completed 2006, before and after comparison
M. Br. Whitewater	County 9, LTM	X	X		X	Habitat project completed 2009, before and after comparison
Trout Run	Lohmans	X	X			Habitat project completed 2007, BACI comparison-Impact area
Trout Run	Bucksnort	X	X			BACI comparison-control area

2013 creel detailed in Chapter 1 in this report; 2005 data from Snook and Dieterman (2006); 1998 data from Weiss (1999); 1995 data from Bushong (1996).

RESULTS

Baseline pre-project information

Hay Creek (State Land) - The Hay Creek site was a 3,500 foot reach located at about river mile 5.5. Since at least 1995, the site has been managed with general angling regulations for southeast trout streams that allowed harvest of five trout daily with only one > 16 inches. Previous angler creel surveys provided pre-project angler data from 1995 (Bushong 1996) and 2013 (Chapter 1 of this report).

No instream habitat projects had previously been implemented in this area. Sociodemographic information was similar to patterns reported in Chapter 1 and showed a mostly resident, male constituency that had aged (Table 3-2). The age group with the largest percentage of anglers was 35-44 in 1995 and 55-64 in 2013. The percentage of anglers using bait was lower in 2013 (30%) than in 1995 (49%), whereas the percentage of anglers using fly fishing gear was higher in 2013 (57%) than in 1995 (24%). Mean catch rates for trout were 0.86 trout/hour in 1995 and 1.10 trout/hour in 2013. Angler pressure and harvest rates were both similar in the two years. More specifically, a worked example of a statistical comparison found that angler pressure was not significantly different between 1995 and 2013 ($t = 0.176$, $df = 43$, $P \geq 0.05$; Table 3-3).

TABLE 3-2. A summary of historical angler creel information for a site on State Forest land on Hay Creek, Goodhue County, Minnesota, collected during 1995 and 2013. All data were collected during the summer angling season (April 1 to September 30). This site was anticipated to receive instream habitat work during summer 2014.

Age group	1995	2013
0-15	3%	0%
16-24	5%	4%
25-34	35%	22%
35-44	38%	17%
45-54	11%	17%
55-64	3%	35%
≥ 65	5%	4%
N =	37	23

Gender	1995	2013
Male	n/a	100%
Female	n/a	0%
N =		23

Residency	1995	2013
Minnesota	97%	96%
Non-resident	3%	4%
N =	37	23

Gear use	1995	2013
Bait	49%	30%
Lure	19%	13%
Fly	24%	57%
Mixed method	8%	0%
N =	37	23

Trip length (hrs)	1995	2013
Mean	n/a	3.42
(± 1 SE)	n/a	(± 0.55)
N =	n/a	6

Catch rate (trout/hr)	1995	2013
Mean	0.86	1.10
(± 1 SE)	(± 0.49)	(± 0.37)
N =	n/a	17

Satisfaction with overall trip	1995	2013
Very satisfied	n/a	58%
Satisfied	n/a	26%
Neither	n/a	16%
Dissatisfied	n/a	0%
Very dissatisfied	n/a	0%
N =		19

Satisfaction with trout size	1995	2013
Very satisfied	n/a	16%
Satisfied	n/a	26%
Neither	n/a	42%
Dissatisfied	n/a	16%
Very dissatisfied	n/a	0%
N =		19

Satisfaction with trout numbers	1995	2013
Very satisfied	n/a	16%
Satisfied	n/a	32%
Neither	n/a	42%
Dissatisfied	n/a	10%
Very dissatisfied	n/a	0%
N =		19

Angler pressure (hrs/mi)	1995	2013
Estimate	1,098	1,002
(± 1 SE)	(± 476)	(±264)
N =	44	67

Harvest rate (trout/mi)	1995	2013
Estimate	344	370
(± 1 SE)	(± 152)	(± 164)
N =	44	67

TABLE 3-3. Worked example to show a simple method for statistically comparing two sample estimates or arithmetic means (e.g., from two different years), such as before and after an instream habitat improvement project. This example would be for a project with a stated objective to increase angler participation (angler-hours) using data from Table 3-2.

	Time periods	
Steps	**1995**	**2013**
Step 1-compile means, standard errors, and sample sizes	Estimate = 1,098 hrs SE_{1995} = 476 n_1 = 44	Estimate = 1,002 hrs SE_{2013} = 264 n_2 = 67
Step 2-calculate the difference between samples	$\lvert estimate(1995) - estimate(2013) \rvert$= 1,098-1,002 = 96 Conclude that there were 96 fewer hours in 2013, but is this significantly fewer?	
Step 2-calculate the standard error for the difference	$SE = \sqrt{SE^2_{2013} + SE^2_{1995}} = 544.31$	
Step 3-calculate *t* statistic	$t = \frac{estimate(1995) - estimate\ (2013)}{SE} = \frac{1{,}098-1{,}002}{544.31} = \frac{96}{544.31} = 0.176$	
Step 4-determine *df*. Simplest method is to take the smallest n and subtract 1	$df = \min(n_1,n_2)-1$ $df = (44)-1 = 43$	
Step 5-consult Critical value of the *t* statistic from a statistical table.	Critical *t* value (at 95% confidence level, $df = 43$) = 2.017	
Step 6-make determination	If *t* calculated (0.176) is greater than Critical *t* value (from table = 2.017) conclude a significant difference at 0.05 probability level. In this example *t* calculated was not higher, so conclude no difference in mean angler hours between 1995 and 2013. Angler pressure was similar in both years.	

Prospective power analyses were conducted to help guide sample size needs and determination of realistic objectives for an instream habitat project on the Hay Creek, State Forest land site (Table 3-4). Mean catch rate in 2013 was 1.10 trout/hour based on completed trip information from 17 anglers. A post-project angler creel survey would need to gather completed trip information from about 20 anglers to be able to detect a 109% change in mean catch rate (Table 3-4). This means that post project, the mean catch rate across 20 anglers would need to more than double to about 2.30 trout/hour, to be able to conclude that the project successfully increased angler catch rates (Table 3-4). If post project only 17 anglers could be contacted again, then you could not conclude that angler catch rates increased even if the mean catch rate doubled from 1.10 to 2.20 because of the inherent variability in this metric.

TABLE 3-4. Prospective power analyses to help guide sample size requirements (number of completed angler trips or days surveyed by creel clerks) or setting of objectives for an instream habitat project on Hay Creek, Goodhue County, Minnesota at a site on State Forest land based on potential pre-project data collected in 2013.

Number of completed angler trips post project	% change that could be detected	Range you could not detect as different from pre-project	Number of days needed to creel	% change that could be detected	Range you could not detect as different from pre-project
	Angler catch rate (trout/hr) (Existing data, n = 17; mean = 1.10 trout/hour)			**Angler pressure (hours/mile)** (Existing data, n = 67; estimate = 1,002 hours/mile)	
5	218	0.00-3.49	5	338	0-4,391
10	154	0.00-2.79	10	239	0-3,399
15	126	0.00-2.48	15	195	0-2,959
20	109	0.00-2.30	20	169	0-2,697
25	97	0.03-2.17	25	151	0-2,518
30	89	0.12-2.08	30	138	0-2,386
40	77	0.25-1.95	40	120	0-2,200
50	69	0.34-1.86	50	107	0-2,074
60	63	0.41-1.79	60	98	24-1,980
70	58	0.46-1.74	70	90	96-1,908
80	54	0.50-1.70	80	85	155-1,849
90	51	0.54-1.66	90	80	203-1,801
100	49	0.56-1.64	100	76	244-1,760
	Angler trip length (hours) (Existing data, n = 6; mean = 3.42 hours)			**Harvest rate (trout/mile)** (Existing data, n = 67; estimate = 370 trout/mile)	
5	62	1.31-5.53	5	569	0-2,475
10	44	1.93-4.91	10	402	0-1,859
15	36	2.20-4.64	15	329	0-1,586
20	31	2.36-4.48	20	285	0-1,423
25	28	2.48-4.36	25	254	0-1,312
30	25	2.56-4.28	30	232	0-1,230
40	22	2.67-4.17	40	201	0-1,114
50	20	2.75-4.09	50	180	0-1,036
60	18	2.81-4.03	60	164	0-978
70	17	2.86-3.98	70	152	0-933
80	15	2.89-3.95	80	142	0-896
90	15	2.92-3.92	90	134	0-866
100	14	2.95-3.89	100	127	0-841

If more completed angler trips could be gathered post project, then a smaller increase in mean catch rate could be detected. For example, if at least 60 anglers that had completed a trip could be contacted, then the project could be considered to have successfully increased catch rates if the post-project mean catch rate increased from 1.10 to 1.79 trout/hour, a 63% increase in catch rates.

Based on prospective power analyses, several objectives for habitat projects could be suggested. A detectable objective for angler pressure might be about a 100% increase from about 1,002 hours/mile in 2013 to over 2,000 hours/mile post project. This could probably be detected with at least 60 days of creel survey effort, but a study design could probably be improved with a more detailed power analysis that incorporates weekend/ holiday versus weekday strata and perhaps for different months as well. However, it is unknown if an objective of a 100% increase is realistically achievable. Very few streams in 2013 had more than 2,000 angler-hours/mile (see Chapter 1). It is unlikely that a meaningful detectable objective could be formulated for harvest rate, as even 100 days of sampling effort, would require mean harvest rate to more than double to be detectable, which seems highly unlikely as well.

West Indian Creek (County 4) - The West Indian Creek site was located downstream of the Wabasha County Highway 4 bridge. Pre-project angler data were only available from 2013, with the stream managed with general angling regulations for southeast trout streams. This site was angled by mostly older males that used flies or lures (Table 3-5). Although most anglers were satisfied with their overall experience fishing this stream in 2013, the modal response for satisfaction with numbers of trout caught was dissatisfied. Habitat project objectives for this site might include increasing the percentage of anglers that were satisfied or very satisfied with the numbers of trout they caught. Angler catch rates averaged 1.93 trout/hour in 2013. A quantifiable objective to increase catch rates by 50-60% may be logistically feasible to evaluate as about 25 to 40 anglers would need to be contacted (Table 3-6). Angler pressure and harvest rate may be more difficult to evaluate because of highly variable pre-project data.

Cold Spring Brook - An instream habitat improvement project has been scheduled to be completed during the summer of 2014. Pre-project angler creel data were available from 1998 (Weiss 1999) and 2005 (Snook and Dieterman 2006), but sociodemographic data were only available from 2005 (Table 3-7). Anglers fishing this stream in 2005 were mostly male and were represented by mostly younger anglers. About 89% of anglers were younger than age 45. The dominant gear type used was bait (44%). Flies were used by one out of every four anglers. Anglers were mostly satisfied with their overall trip and with the numbers of trout caught, but were mostly ambivalent about the size of trout caught (i.e., 50% of anglers answered "neither" to this question). Mean catch rates were 82% lower in 2005 than in 1998. Similarly, the estimate for angler hours fished per mile was 61% lower in 2005 than in 1998. Power analyses indicate that measureable objectives to increase catch rates and angler trip lengths by about 100% (i.e., a doubling) could realistically be detected by sampling 15-20 anglers that had completed an angling trip (Table 3-8). An objective to increase angler pressure by a similar percentage (100%) may be possible but will require a more focused creel survey at this site that includes about 90-100 days of clerk effort. Cold Spring Brook was surveyed on 47 days during the less intensive creel survey conducted in 2005.

Mill Creek - The Mill Creek site was located in the city of Chatfield and has creel survey information from both 2005 (Snook and Dieterman 2006) and 2013 (Chapter 1). The trout population there has been managed with the general angling regulations for southeast trout streams. The site also received annual stockings of yearling Rainbow Trout since at least 1995. Angler ages were broadly distributed in 2005 with many anglers in the 35-44 (34%), 0-15 (28%), and 25-34 (12%) age groups (Table 3-9). However, in 2013, half of the anglers were younger than age 16. Like most streams, anglers were dominated by resident males in both years but the most common method used was bait angling. Mixed method anglers were also more common in 2013. Most anglers have been satisfied or very satisfied with their overall fishing experience and with the size of trout caught, but about one in three anglers has been dissatisfied or very dissatisfied with the numbers of trout caught in 2005 and 2013. Increasing satisfaction with numbers of trout caught might be a good objective for a habitat project at this site. Angler trip lengths and catch rates were consistent in both years. The estimate for angler pressure was higher in 2005 but was more variable, likely because of the fewer number of days sampled (23). Harvest rate was estimated to be 302 trout/mile in 2013 and all harvested trout reported were Rainbow Trout. Identifying measureable objectives, such as 100% increases, for angler catch rate, trip length, and pressure appear possible given historical variability at this site (Table 3-10). However, determination of measureable objectives for harvest rate may be logistically difficult.

TABLE 3-5. A summary of historical angler creel information for a site on West Indian Creek, Wabasha County, Minnesota, collected during 2013. The site was located at the County Road 4 bridge and extended downstream 2,500 feet. All data were collected during the summer angling season (April 1 to September 30). This site was anticipated to receive instream habitat work sometime between 2013 and 2023.

Age group	2013
0-15	6%
16-24	0%
25-34	13%
35-44	13%
45-54	19%
55-64	19%
≥ 65	31%
N =	16

Gender	2013
Male	87%
Female	13%
N =	15

Residency	2013
Minnesota	100%
Non-resident	0%
N =	16

Gear use	2013
Bait	19%
Lure	31%
Fly	50%
Mixed method	0%
N =	16

Trip length (hrs)	2013
Mean	2.32
(± 1 SE)	(± 0.25)
N =	11

Catch rate	2013
Mean	1.93
(± 1 SE)	(± 0.51)
N =	13

Satisfaction with overall trip	2013
Very satisfied	0%
Satisfied	75%
Neither	25%
Dissatisfied	0%
Very dissatisfied	0%
N =	12

Satisfaction with trout size	2013
Very satisfied	7%
Satisfied	31%
Neither	31%
Dissatisfied	31%
Very dissatisfied	0%
N =	13

Satisfaction with trout numbers	2013
Very satisfied	7%
Satisfied	23%
Neither	23%
Dissatisfied	46%
Very dissatisfied	0%
N =	13

Angler pressure (hrs/mi)	2013
Estimate	1,637
(± 1 SE)	(±522)
N =	63

Harvest rate (trout/mi)	2013
Estimate	380
(± 1 SE)	(± 249)
N =	63

TABLE 3-6. Prospective power analyses to help guide sample size requirements (number of completed angler trips or days surveyed by creel clerks) or setting of objectives for an instream habitat project on West Indian Creek, Wabasha County, Minnesota. Values based on potential pre-project data collected in 2013.

Number of completed angler trips post project	% change that could be detected	Range you could not detect as different from pre-project	Number of days needed to creel	% change that could be detected	Range you could not detect as different from pre-project
Angler catch rate (trout/hr) (Existing data, n = 13; mean = 1.93 trout/hour)			**Angler pressure (hours/mile)** (Existing data, n = 63; estimate = 1,637 hours/mile)		
5	149	0.00-4.81	5	397	0-8,135
10	106	0.00-3.97	10	281	0-6,232
15	86	0.26-3.60	15	229	0-5,389
20	75	0.49-3.37	20	198	0-4,886
25	67	0.64-3.22	25	178	0-4,543
30	61	0.75-3.11	30	162	0-4,290
40	53	0.91-2.95	40	140	0-3,935
50	47	1.02-2.84	50	126	0-3,692
60	43	1.10-2.76	60	115	0-3,513
70	40	1.16-2.70	70	106	0-3,374
80	37	1.21-2.65	80	99	12-3,262
90	35	1.25-2.61	90	94	105-3,169
100	33	1.29-2.57	100	89	184-3,090
Angler trip length (hours) (Existing data, n = 11; mean = 2.32 hours)			**Harvest rate (trout/mile)** (Existing data, n = 63; estimate = 380 trout/mile)		
5	56	1.02-3.62	5	816	0-3,480
10	40	1.40-3.24	10	577	0-2,572
15	32	1.57-3.07	15	471	0-2,170
20	28	1.67-2.97	20	408	0-1,930
25	25	1.74-2.90	25	365	0-1,766
30	23	1.79-2.85	30	333	0-1,645
40	20	1.86-2.78	40	288	0-1,476
50	18	1.91-2.73	50	258	0-1,360
60	16	1.94-2.70	60	235	0-1,275
70	15	1.97-2.67	70	218	0-1,208
80	14	1.99-2.65	80	204	0-1,155
90	13	2.01-2.63	90	192	0-1,111
100	13	2.03-2.61	100	182	0-1,073

TABLE 3-7. A summary of historical angler creel information for a site on Cold Spring Brook (rmi 0.5), Wabasha County, Minnesota, collected during 1998 and 2005. All data were collected during the summer angling season (April 1 to September 30). This site was anticipated to receive instream habitat work during summer 2014.

Age group	1998	2005
0-15	n/a	17%
16-24	n/a	11%
25-34	n/a	28%
35-44	n/a	33%
45-54	n/a	11%
55-64	n/a	0%
≥ 65	n/a	0%
N =		18

Gender	1998	2005
Male	n/a	78%
Female	n/a	22%
N =		18

Residency	1998	2005
Minnesota	n/a	89%
Non-resident	n/a	11%
N =		18

Gear use	1998	2005
Bait	n/a	44%
Lure	n/a	17%
Fly	n/a	25%
Mixed method	n/a	11%
N =		16

Trip length (hrs)	1998	2005
Mean	n/a	2.31
(± 1 SE)	n/a	(± 0.22)
N =	n/a	10

Catch rate (trout/hr)	1998	2005
Mean	1.60	0.29
(± 1 SE)	(± 0.45)	(± 0.10)
N =	n/a	11

Satisfaction with overall trip	1998	2005
Very satisfied	n/a	10%
Satisfied	n/a	80%
Neither	n/a	10%
Dissatisfied	n/a	0%
Very dissatisfied	n/a	0%
N =		10

Satisfaction with trout size	1998	2005
Very satisfied	n/a	10%
Satisfied	n/a	30%
Neither	n/a	50%
Dissatisfied	n/a	10%
Very dissatisfied	n/a	0%
N =		10

Satisfaction with trout numbers	1998	2005
Very satisfied	n/a	10%
Satisfied	n/a	40%
Neither	n/a	30%
Dissatisfied	n/a	20%
Very dissatisfied	n/a	0%
N =		10

Angler pressure (hrs/mi)	1998	2005
Estimate	2,785	1,086
(± 1 SE)	(± 387)	(±440)
N =	119	47

Harvest rate (trout/mi)	1998	2005
Estimate	565	n/a
(± 1 SE)	(± 184)	n/a
N =	119	n/a

TABLE 3-8. Prospective power analyses to help guide sample size requirements (number of completed angler trips or days surveyed by creel clerks) or setting of objectives for an instream habitat project on Cold Spring Brook, Wabasha County, Minnesota. Values based on potential pre-project data collected in 2005.

Number of completed angler trips post project	% change that could be detected	Range you could not detect as different from pre-project	Number of days needed to creel	% change that could be detected	Range you could not detect as different from pre-project
	Angler catch rate (trout/hr) (Existing data, n = 11; mean = 0.29 trout/hour)			**Angler pressure (hours/mile)** (Existing data, n = 47; estimate = 1,086 hours/mile)	
5	179	0-0.81	5	436	0-5,817
10	127	0-0.66	10	308	0-4,431
15	104	0-0.59	15	252	0-3,818
20	90	0.03-0.55	20	218	0-3,452
25	80	0.06-0.52	25	195	0-3,202
30	73	0.08-0.50	30	178	0-3,017
40	63	0.11-0.47	40	154	0-2,759
50	57	0.13-0.45	50	138	0-2,582
60	52	0.14-0.44	60	126	0-2,452
70	48	0.15-0.43	70	116	0-2,350
80	45	0.16-0.42	80	109	0-2,269
90	42	0.17-0.41	90	103	0-2,201
100	40	0.17-0.41	100	97	28-2,144
	Angler trip length (hours) (Existing data, n = 10; mean = 2.31 hours)			**Harvest rate (trout/mile)** (Existing data, n = n/a; estimate = n/a)	
5	47	1.22-3.40	5	n/a	n/a
10	33	1.54-3.08	10	n/a	n/a
15	27	1.68-2.94	15	n/a	n/a
20	24	1.76-2.86	20	n/a	n/a
25	21	1.82-2.80	25	n/a	n/a
30	19	1.86-2.76	30	n/a	n/a
40	17	1.92-2.70	40	n/a	n/a
50	15	1.96-2.66	50	n/a	n/a
60	14	2.00-2.62	60	n/a	n/a
70	13	2.02-2.60	70	n/a	n/a
80	12	2.04-2.58	80	n/a	n/a
90	11	2.05-2.57	90	n/a	n/a
100	11	2.07-2.55	100	n/a	n/a

TABLE 3-9. A summary of historical angler creel information for a site on Mill Creek, Fillmore County, Minnesota, collected during 2005 and 2013. All data were collected during the summer angling season (April 1 to September 30). This site was anticipated to receive instream habitat work between 2013 and 2023.

Age group	2005	2013
0-15	28%	50%
16-24	3%	2%
25-34	12%	11%
35-44	34%	11%
45-54	6%	7%
55-64	6%	11%
≥ 65	9%	7%
N =	32	44

Gender	2005	2013
Male	84%	89%
Female	16%	11%
N =	32	44

Residency	2005	2013
Minnesota	97%	100%
Non-resident	3%	0%
N =	32	44

Gear use	2005	2013
Bait	69%	58%
Lure	25%	12%
Fly	0%	5%
Mixed method	6%	24%
N =	32	41

Trip length (hrs)	2005	2013
Mean	2.24	2.27
(± 1 SE)	(± 0.35)	(± 0.35)
N =	14	12

Catch rate (trout/hr)	2005	2013
Mean	1.26	1.07
(± 1 SE)	(± 0.72)	(± 0.36)
N =	23	15

Satisfaction with overall trip	2005	2013
Very satisfied	11%	36%
Satisfied	78%	50%
Neither	0%	7%
Dissatisfied	11%	7%
Very dissatisfied	0%	0%
N =	18	14

Satisfaction with trout size	2005	2013
Very satisfied	0%	36%
Satisfied	44%	21%
Neither	50%	14%
Dissatisfied	6%	21%
Very dissatisfied	0%	7%
N =	18	14

Satisfaction with trout numbers	2005	2013
Very satisfied	0%	14%
Satisfied	22%	43%
Neither	39%	14%
Dissatisfied	39%	21%
Very dissatisfied	0%	7%
N =	18	14

Angler pressure (hrs/mi)	2005	2013
Estimate	3,855	2,130
(± 1 SE)	(± 1,926)	(±406)
N =	23	62

Harvest rate (trout/mi)	2005	2013
Estimate	n/a	302
(± 1 SE)	n/a	(± 152)
N =	n/a	62

TABLE 3-10. Prospective power analyses to help guide sample size requirements (number of completed angler trips or days surveyed by creel clerks) or setting of objectives for an instream habitat project on Mill Creek, Fillmore County, Minnesota. Values based on potential pre-project data collected in 2013.

Number of completed angler trips post project	% change that could be detected	Range you could not detect as different from pre-project	Number of days needed to creel	% change that could be detected	Range you could not detect as different from pre-project
	Angler catch rate (trout/hr) (Existing data, n = 15; mean = 1.07 trout/hour)			**Angler pressure (hours/mile)** (Existing data, n = 62; estimate = 2,130 hours/mile)	
5	204	0-3.26	5	235	0-7,144
10	145	0-2.62	10	166	0-5,675
15	118	0-2.33	15	136	0-5,025
20	102	0-2.16	20	118	0-4,637
25	91	0.09-2.05	25	105	0-4,372
30	83	0.18-1.96	30	96	83-4,177
40	72	0.30-1.84	40	83	357-3,903
50	65	0.38-1.76	50	74	544-3,716
60	59	0.44-1.70	60	68	683-3,577
70	55	0.49-1.65	70	63	790-3,470
80	51	0.52-1.62	80	59	876-3,384
90	48	0.55-1.59	90	55	948-3,312
100	46	0.58-1.56	100	53	1,009-3,251
	Angler trip length (hours) (Existing data, n = 12; mean = 2.27 hours)			**Harvest rate (trout/mile)** (Existing data, n = 62; estimate = 302 trout/mile)	
5	84	0.37-4.17	5	622	0-2,179
10	59	0.93-3.61	10	440	0-1,629
15	48	1.17-3.37	15	359	0-1,386
20	42	1.32-3.22	20	311	0-1,241
25	37	1.42-3.12	25	278	0-1,142
30	34	1.49-3.05	30	254	0-1,068
40	30	1.60-2.94	40	220	0-966
50	26	1.67-2.87	50	197	0-896
60	24	1.72-2.82	60	179	0-844
70	22	1.76-2.78	70	166	0-804
80	21	1.79-2.75	80	155	0-771
90	20	1.82-2.72	90	147	0-744
100	19	1.84-2.70	100	139	0-722

Willow Creek - The Willow Creek site only had historical data from the most recent creel survey in 2013. This site has been managed with general regulations for southeast Minnesota trout streams and has received annual stockings of yearling Rainbow Trout since 2001. Most anglers in 2013 were either between the ages of 16 and 34 or older than 64 (Table 3-11). Like Mill Creek, the most common gear used was bait angling and most anglers were satisfied with their overall fishing experience and the size of trout caught but were mostly dissatisfied with the numbers of trout caught. The harvest rate estimate was 379 trout per mile and all trout harvested were Rainbow Trout. A 100% increase in mean catch rate, from the 2013 estimate of 2.40 to 4.80 trout/hour could be tested with a sample size of about 25 completed angler trips, but evaluation of a more modest objective of a 50% increase (to 3.61 trout/hour) would require about 100 completed angler trips (Table 3-12). A 100% increase in angler pressure from 1,773 hours/mile to about 3,580 hours/mile could be tested with about 70 days of creel surveying. A total of 63 days were surveyed during the more intensive 2013 creel survey.

Wisel Creek (Chickentown area) - The Wisel Creek site had historical creel survey data from 2005 (Snook and Dieterman 2006) and 2013. The trout population at this site has been managed with a 12-16 inch protected slot limit, all gear types allowed, 5 trout daily bag limit with only one trout > 16 inches, since 2005. This site has not received annual Rainbow Trout stockings since 2004. A broad range of angler ages fished this site in both years (Table 3-13). The most common gear used in 2005 was bait (56%) followed by mixed method angling (30%). In 2013, the most common gear used was flies (38%) followed by lure angling (31%). The percentage of anglers that were either satisfied or very satisfied with all three aspects of their fishing trip was higher in 2013 than in 2005 and suggests that most anglers were satisfied with the trout fishery on Wisel Creek. Mean angler trip length and catch rate were both higher in 2013 than in 2005 but differences were probably not statistically significant. The angler pressure estimate was similar, 3,314 hours/ mile in 2005 and 4,298 hours/mile in 2013. Quantifiable and testable objectives for a habitat project could probably be stated for angler catch rate, trip length, and pressure metrics (Table 3-14). However, harvest rate estimates were probably too variable to permit a logistically detectable objective to be stated.

Crooked Creek - The site on Crooked Creek only had data from the most recent creel survey in 2013 (Chapter 1). The trout population in 2013 was managed under the general regulations for southeast Minnesota trout streams and the site received annual stockings of yearling Rainbow Trout since 2001. Anglers in 2013 were from a broad range of age groups, were mostly resident male anglers and mostly used fly fishing and bait gear types (Table 3-15). Over 80% of anglers were either satisfied or very satisfied with their overall angling experience, the size of trout they caught and the numbers of trout they caught in 2013. Consequently, habitat projects probably should not specify objectives to increase angler satisfaction. Instead, objectives to increase angler catch rates, trip lengths, and overall pressure could likely be adequately tested with moderate sample sizes of 25-50 completed angler trips and 60-80 surveyed days (Table 3-16).

TABLE 3-11. A summary of historical angler creel information for a site on Willow Creek, Fillmore County, Minnesota, collected during 2013. All data were collected during the summer angling season (April 1 to September 30). This site was anticipated to receive instream habitat work sometime between 2013 and 2023.

Age group	2013
0-15	4%
16-24	38%
25-34	31%
35-44	0%
45-54	4%
55-64	4%
≥ 65	19%
N =	26

Gender	2013
Male	92%
Female	8%
N =	26

Residency	2013
Minnesota	92%
Non-resident	8%
N =	26

Gear use	2013
Bait	63%
Lure	18%
Fly	7%
Mixed method	11%
N =	27

Trip length (hrs)	2013
Mean	1.52
(± 1 SE)	(± 0.19)
N =	9

Catch rate (trout/hr)	2013
Mean	2.40
(± 1 SE)	(± 1.04)
N =	11

Satisfaction with overall trip	2013
Very satisfied	0%
Satisfied	100%
Neither	0%
Dissatisfied	0%
Very dissatisfied	0%
N =	12

Satisfaction with trout size	2013
Very satisfied	0%
Satisfied	67%
Neither	0%
Dissatisfied	33%
Very dissatisfied	0%
N =	12

Satisfaction with trout numbers	2013
Very satisfied	8%
Satisfied	25%
Neither	0%
Dissatisfied	67%
Very dissatisfied	0%
N =	12

Angler pressure (hrs/mi)	2013
Estimate	1,773
(± 1 SE)	(±543)
N =	63

Harvest rate (trout/mi)	2013
Estimate	379
(± 1 SE)	(± 273)
N =	63

TABLE 3-12. Prospective power analyses to help guide sample size requirements (number of completed angler trips or days surveyed by creel clerks) or setting of objectives for an instream habitat project on Willow Creek, Fillmore County, Minnesota. Values based on potential pre-project data collected in 2013.

Number of completed angler trips post project	% change that could be detected	Range you could not detect as different from pre-project	Number of days needed to creel	% change that could be detected	Range you could not detect as different from pre-project
	Angler catch rate (trout/hr) (Existing data, n = 11; mean = 2.40 trout/hour)			**Angler pressure (hours/mile)** (Existing data, n = 63; estimate = 1,773 hours/mile)	
5	225	0-7.81	5	381	0-8,533
10	159	0-6.23	10	270	0-6,553
15	130	0-5.52	15	220	0-5,676
20	113	0-5.10	20	191	0-5,153
25	101	0-4.82	25	171	0-4,796
30	92	0.19-4.61	30	156	0-4,533
40	80	0.49-4.31	40	135	0-4,163
50	71	0.69-4.11	50	121	0-3,911
60	65	0.84-3.96	60	110	0-3,724
70	60	0.95-3.85	70	102	0-3,580
80	56	1.05-3.75	80	95	83-3,463
90	53	1.12-3.68	90	90	180-3,366
100	50	1.19-3.61	100	85	261-3,285
	Angler trip length (hours) (Existing data, n = 9; mean = 1.52 hours)			**Harvest rate (trout/mile)** (Existing data, n = 63; estimate = 379 trout/mile)	
5	59	0.63-2.41	5	897	0-3,778
10	42	0.89-2.15	10	634	0-2,782
15	34	1.00-2.04	15	518	0-2,341
20	29	1.07-1.97	20	448	0-2,078
25	26	1.12-1.92	25	401	0-1,899
30	24	1.16-1.88	30	366	0-1,766
40	21	1.20-1.84	40	317	0-1,581
50	19	1.24-1.80	50	284	0-1,454
60	17	1.26-1.78	60	259	0-1,360
70	16	1.28-1.76	70	240	0-1,287
80	15	1.30-1.74	80	224	0-1,229
90	14	1.31-1.73	90	211	0-1,180
100	13	1.32-1.72	100	201	0-1,139

TABLE 3-13. A summary of historical angler creel information for a site on Wisel Creek, Fillmore County, Minnesota, collected during 2005 and 2013. All data were collected during the summer angling season (April 1 to September 30). This site was anticipated to receive instream habitat work between 2013 and 2023.

Age group	2005	2013
0-15	9%	1%
16-24	9%	9%
25-34	22%	19%
35-44	17%	12%
45-54	30%	16%
55-64	0%	34%
≥ 65	13%	9%
N =	23	68

Gender	2005	2013
Male	91%	96%
Female	9%	4%
N =	23	68

Residency	2005	2013
Minnesota	82%	93%
Non-resident	17%	7%
N =	22	68

Gear use	2005	2013
Bait	56%	28%
Lure	4%	31%
Fly	9%	38%
Mixed method	30%	3%
N =	23	68

Trip length (hrs)	2005	2013
Mean	3.13	3.64
(± 1 SE)	(± 0.56)	(± 0.34)
N =	20	36

Catch rate (trout/hr)	2005	2013
Mean	1.04	1.69
(± 1 SE)	(± 0.19)	(± 0.45)
N =	21	31

Satisfaction with overall trip	2005	2013
Very satisfied	40%	67%
Satisfied	40%	29%
Neither	10%	2%
Dissatisfied	5%	2%
Very dissatisfied	5%	0%
N =	20	42

Satisfaction with trout size	2005	2013
Very satisfied	10%	67%
Satisfied	45%	31%
Neither	20%	0%
Dissatisfied	20%	3%
Very dissatisfied	5%	0%
N =	20	39

Satisfaction with trout numbers	2005	2013
Very satisfied	10%	74%
Satisfied	40%	18%
Neither	20%	0%
Dissatisfied	20%	8%
Very dissatisfied	10%	0%
N =	20	39

Angler pressure (hrs/mi)	2005	2013
Estimate	3,314	4,298
(± 1 SE)	(± 516)	(±1,011)
N =	24	63

Harvest rate (trout/mi)	2005	2013
Estimate	n/a	241
(± 1 SE)	n/a	(± 198)
N =		63

TABLE 3-14. Prospective power analyses to help guide sample size requirements (number of completed angler trips or days surveyed by creel clerks) or setting of objectives for an instream habitat project on Wisel Creek, Fillmore County, Minnesota. Values based on potential pre-project data collected in 2013.

Number of completed angler trips post project	% change that could be detected	Range you could not detect as different from pre-project	Number of days needed to creel	% change that could be detected	Range you could not detect as different from pre-project
	Angler catch rate (trout/hr) (Existing data, n = 31; mean = 1.69 trout/hour)			**Angler pressure (hours/mile)** (Existing data, n = 63; estimate = 4,298 hours/mile)	
5	233	0-5.62	5	293	0-16,884
10	164	0-4.47	10	207	0-13,198
15	134	0-3.96	15	169	0-11,565
20	116	0-3.65	20	146	0-10,591
25	104	0-3.45	25	131	0-9,927
30	95	0.09-3.29	30	120	0-9,436
40	82	0.30-3.08	40	104	0-8,748
50	74	0.45-2.93	50	93	318-8,278
60	67	0.56-2.82	60	85	665-7,931
70	62	0.64-2.74	70	78	934-7,662
80	58	0.71-2.67	80	73	1,151-7,445
90	55	0.76-2.62	90	69	1,331-7,265
100	52	0.81-2.57	100	65	1,484-7,112
	Angler trip length (hours) (Existing data, n = 36; mean = 3.64 hours)			**Harvest rate (trout/mile)** (Existing data, n = 63; estimate = 241 trout/mile)	
5	88	0.44-6.84	5	1023	0-2,706
10	62	1.38-5.90	10	723	0-1,984
15	51	1.79-5.49	15	591	0-1,664
20	44	2.04-5.24	20	511	0-1,473
25	39	2.21-5.07	25	457	0-1,343
30	36	2.33-4.95	30	418	0-1,247
40	31	2.51-4.77	40	362	0-1,112
50	28	2.63-4.65	50	323	0-1,020
60	25	2.72-4.56	60	295	0-953
70	23	2.78-4.50	70	273	0-900
80	22	2.84-4.44	80	256	0-857
90	21	2.89-4.39	90	241	0-822
100	20	2.92-4.36	100	229	0-792

TABLE 3-15. A summary of historical angler creel information for a site on Crooked Creek, Houston County, Minnesota, collected during 2013. All data were collected during the summer angling season (April 1 to September 30). This site was anticipated to receive instream habitat work sometime between 2013 and 2023.

Age group	2013
0-15	3%
16-24	7%
25-34	45%
35-44	10%
45-54	21%
55-64	14%
≥ 65	0%
N =	29

Gender	2013
Male	90%
Female	10%
N =	29

Residency	2013
Minnesota	93%
Non-resident	7%
N =	29

Gear use	2013
Bait	31%
Lure	17%
Fly	45%
Mixed method	7%
N =	29

Trip length (hrs)	2013
Mean	3.84
(± 1 SE)	(± 0.40)
N =	19

Catch rate (trout/hr)	2013
Mean	3.62
(± 1 SE)	(± 0.56)
N =	22

Satisfaction with overall trip	2013
Very satisfied	55%
Satisfied	38%
Neither	0%
Dissatisfied	0%
Very dissatisfied	7%
N =	29

Satisfaction with trout size	2013
Very satisfied	59%
Satisfied	28%
Neither	3%
Dissatisfied	7%
Very dissatisfied	3%
N =	29

Satisfaction with trout numbers	2013
Very satisfied	38%
Satisfied	41%
Neither	7%
Dissatisfied	10%
Very dissatisfied	3%
N =	29

Angler pressure (hrs/mi)	2013
Estimate	1,697
(± 1 SE)	(±413)
N =	62

Harvest rate (trout/mi)	2013
Estimate	80
(± 1 SE)	(± 62)
N =	62

TABLE 3-16. Prospective power analyses to help guide sample size requirements (number of completed angler trips or days surveyed by creel clerks) or setting of objectives for an instream habitat project on Crooked Creek, Fillmore County, Minnesota. Values based on potential pre-project data collected in 2013.

Number of completed angler trips post project	% change that could be detected	Range you could not detect as different from pre-project	Number of days needed to creel	% change that could be detected	Range you could not detect as different from pre-project
	Angler catch rate (trout/hr) (Existing data, n = 22; mean = 3.62 trout/hour)			**Angler pressure (hours/mile)** (Existing data, n = 62; estimate = 1,697 hours/mile)	
5	114	0-7.74	5	301	0-6798
10	80	0.71-6.53	10	213	0-5304
15	66	1.24-6.00	15	174	0-4642
20	57	1.56-5.68	20	150	0-4247
25	51	1.78-5.46	25	134	0-3978
30	46	1.94-5.30	30	123	0-3779
40	40	2.16-5.08	40	106	0-3500
50	36	2.32-4.92	50	95	84-3310
60	33	2.43-4.81	60	87	225-3169
70	30	2.52-4.72	70	80	334-3060
80	28	2.59-4.65	80	75	422-2972
90	27	2.65-4.59	90	71	495-2899
100	25	2.70-4.54	100	67	556-2838
	Angler trip length (hours) (Existing data, n = 19; mean = 3.84 hours)			**Harvest rate (trout/mile)** (Existing data, n = 62; estimate = 80 trout/mile)	
5	71	1.11-6.57	5	957	0-846
10	50	1.91-5.77	10	677	0-621
15	41	2.26-5.42	15	553	0-522
20	36	2.47-5.21	20	479	0-463
25	32	2.62-5.06	25	428	0-422
30	29	2.72-4.96	30	391	0-393
40	25	2.87-4.81	40	338	0-351
50	23	2.98-4.70	50	303	0-322
60	21	3.05-4.63	60	276	0-301
70	19	3.11-4.57	70	256	0-285
80	18	3.16-4.52	80	239	0-271
90	17	3.20-4.48	90	226	0-260
100	16	3.23-4.45	100	214	0-251

Initial Instream Habitat Project Comparisons

Middle Branch Whitewater River - Two sites on the Middle Branch Whitewater River received an instream habitat improvement project between the 2005 and 2013 creel surveys. A habitat project was completed in 2006 at the Quincy bridges site. There appeared to be little difference in the distributions of angler ages, gender, and gear types used before and after the habitat project (Table 3-17). Both measures of angler participation (angler pressure and trip length), were not significantly higher after the project than before the project was implemented (Table 3-18; Figure 3-1). Similarly, even though mean catch rates showed a 95% increase between before and after the habitat project, they were not significantly different. Lack of differences may have been due in part to low sample sizes in 2005. Angler satisfaction responses were not statistically tested but indicate either no change in the percentage of satisfied or very satisfied anglers or else suggest a decrease in the percentage of these responses. Small sample sizes in 2005 hampered more definitive conclusions.

Another habitat improvement project was completed on the Middle Branch Whitewater River downstream from the Olmsted County Highway 9 road crossing in 2009. The distribution of angler ages shifted to older anglers after the project in 2013 (Table 3-17). For example, anglers aged 55 years or older represented only 17% of anglers before the project, and almost half of all anglers after the project. As with the Quincy bridges site, none of the other sociodemographic and fishery-related metrics showed significant changes following this habitat project, but may have been hampered by low sample sizes in 2005 (Table 3-19; Figure 3-1). Mean values for all three metrics, angler pressure, trip length, and catch rate increased following the project but could not be determined to be statistically different from pre-project estimates. The percentages of anglers that were satisfied or very satisfied with the numbers and sizes of trout caught were higher post-project in 2013 than before the project in 2005, possibly suggesting attainment of an angler satisfaction objective.

TABLE 3-17. Selected sociodemographic information from anglers surveyed before (2005) and after (2013) instream habitat projects completed at two sites on the Middle Branch Whitewater River, Olmsted County, Minnesota. Habitat projects were completed at the Quincy bridges site in 2006 and at the County 9 crossing site in 2009. All data were collected during the summer angling season (April 1 to September 30).

Middle Branch Whitewater-Quincy bridges			**Middle Branch Whitewater-County 9 crossing**		
Age group	2005	2013	Age group	2005	2013
0-15	4%	2%	0-15	0%	7%
16-24	11%	4%	16-24	17%	7%
25-34	22%	20%	25-34	33%	18%
35-44	22%	22%	35-44	17%	7%
45-54	33%	14%	45-54	17%	11%
55-64	4%	29%	55-64	17%	30%
≥ 65	4%	10%	≥ 65	0%	18%
N =	27	51	N =	6	27
Gender			Gender		
Male	89%	92%	Male	100%	93%
Female	11%	8%	Female	0%	7%
N =	27	51	N =	6	27
Gear use			Gear use		
Bait	20%	13%	Bait	0%	0%
Lure	12%	23%	Lure	0%	19%
Fly	68%	61%	Fly	83%	81%
Mixed method	0%	2%	Mixed method	17%	0%
N =	25	52	N =	6	27

TABLE 3-18. Comparison of selected sociodemographic and fishery related metrics before and after an instream habitat improvement project conducted in 2006 on the Middle Branch Whitewater River at the Quincy bridges site, southeast Minnesota. The sample size (n) for angler pressure is the number of days surveyed whereas all other sample sizes were the number of anglers surveyed. Trip lengths were only calculated from completed fishing trips. Catch rates were compiled for all anglers that had fished for at least 0.5 hours.

Potential Objective	Pre-project - 2005	Post-project 2013	Project Result
Increase angler pressure (hrs/mi)	$\bar{x}$ = 2,347 hrs/mi SE = 729 n = 26	$\bar{x}$ = 3,281 hrs/mi SE = 655 n = 63	No significant difference (t = 0.95, df = 25, P > 0.05)
Increase angler trip length (hrs)	$\bar{x}$ = 3.84 hrs SE = 0.943 n = 8	$\bar{x}$ = 2.38 hrs SE = 0.274 n = 50	No significant difference (t = 1.49, df = 7, P > 0.05)
Increase angler catch rate (trout/hr)	$\bar{x}$ = 0.63 trout/hr SE = 0.227 n = 10	$\bar{x}$ = 1.23 trout/hr SE = 0.334 n = 50	No significant difference (t = 1.47, df = 9, P > 0.05)
Increase satisfaction with overall fishing experience	VS & S[a] = 75% Neither =13% VD & D[b] = 13% n = 8	VS & S = 77% Neither =4% VD & D = 20% n = 51	No change in percentage of satisfied anglers, possible increase in percentage of dissatisfied anglers, small 2005 sample
Increase satisfaction with size of trout caught	VS & S[a] = 63% Neither =13% VD & D[b] = 25% n = 8	VS & S = 33% Neither =43% VD & D = 24% n = 51	Decreased percentage of satisfied anglers, increase in the response “Neither”, small 2005 sample
Increase satisfaction with numbers of trout caught	VS & S[a] = 63% Neither =13% VD & D[b] = 25% n = 8	VS & S = 30% Neither =43% VD & D = 27% n = 51	Decreased percentage of satisfied anglers, increase in the response “Neither”, small 2005 sample

[a] The combined percentage of anglers that answered Very Satisfied or Satisfied.
[b] The combined percentage of anglers that answered Very Dissatisfied or Dissatisfied.

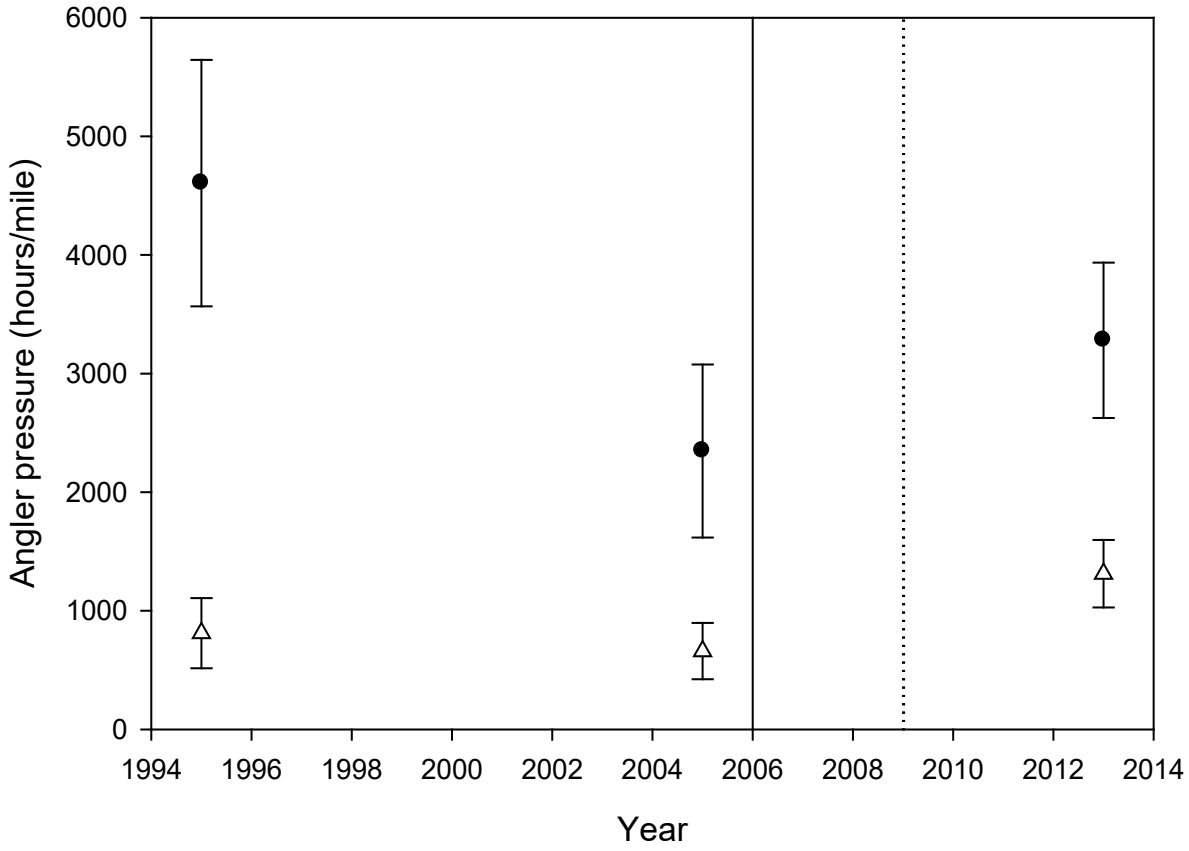

FIGURE 3-1. Angler pressure estimates ($\bar{x}$ ± 1 SE) conducted at two sites on the Middle Branch Whitewater River in southeast Minnesota before and after instream habitat improvement projects. One site was located at the Quincy bridges (filled circles) and the other site was just downstream from the Olmsted County highway 9 crossing (open triangles). Habitat projects were completed at the Quincy bridges site in 2006 (solid vertical line) and at the County highway 9 site in 2009 (dashed vertical line). Pressure estimates were taken from Bushong (1996) for 1995, Snook and Dieterman (2006) for 2005, and Chapter 1 of this report for 2013.

TABLE 3-19. Comparison of selected sociodemographic and fishery related metrics before and after an instream habitat improvement project conducted in 2009 on the Middle Branch Whitewater River at the county highway 9 crossing site, southeast Minnesota. The sample size (n) for angler pressure is the number of days surveyed whereas all other sample sizes were the number of anglers surveyed. Trip lengths were only calculated from completed fishing trips. Catch rates were compiled for all anglers that had fished for at least 0.5 hours.

Potential Objective	Pre-project - 2005	Post-project 2013	Project Result
Increase angler pressure (hrs/mi)	$\bar{x}$ = 660 hrs/mi SE = 238 n = 27	$\bar{x}$ = 1,312 hrs/mi SE = 285 n = 64	No significant difference (t = 1.76, df = 26, P > 0.05)
Increase angler trip length (hrs)	$\bar{x}$ = 2.00 hrs SE = 0.439 n = 4	$\bar{x}$ = 3.18 hrs SE = 0.449 n = 15	No significant difference (t = 1.89, df = 3, P > 0.05)
Increase angler catch rate (trout/hr)	$\bar{x}$ = 0.51 trout/hr SE = 0.387 n = 5	$\bar{x}$ = 2.07 trout/hr SE = 0.560 n = 15	No significant difference (t = 2.29, df = 4, P > 0.05)
Increase satisfaction with overall fishing experience	VS & S[a] = 100% Neither =0% VD & D[b] = 0% n = 6	VS & S = 100% Neither =0% VD & D = 0% n = 15	Maintained high percentage of satisfied anglers, small 2005 sample
Increase satisfaction with size of trout caught	VS & S[a] = 67% Neither =0% VD & D[b] = 33% n = 6	VS & S = 87% Neither =13% VD & D = 0% n = 15	Increased percentage of satisfied anglers, decreased percentage of dissatisfied anglers, small 2005 sample
Increase satisfaction with numbers of trout caught	VS & S[a] = 50% Neither =17% VD & D[b] = 33% n = 6	VS & S = 87% Neither =7% VD & D = 7% n = 15	Increased percentage of satisfied anglers, decreased percentage of dissatisfied anglers, small 2005 sample

[a] The combined percentage of anglers that answered Very Satisfied or Satisfied.
[b] The combined percentage of anglers that answered Very Dissatisfied or Dissatisfied.

Trout Run Creek - A habitat improvement project was completed in 2007 downstream of Lohman's slab bridge on Gun Flint Road on Trout Run. A second site located a short distance downstream at Bucksnort Dam did not receive a habitat project between 2005 and 2013 and consequently served as a control site to provide a better evaluation of the habitat project by identifying whole stream effects on these variables. Before the project, 81% of anglers were between the ages of 35 and 54 years old whereas at the control site, only 46% of anglers were between these ages (Table 3-20). After the project, angler ages were more broadly distributed at both the control site and the site receiving the habitat project suggesting that the habitat work did not contribute to the potential re-distribution of angler ages (Table 3-20). Small sample sizes before the project may account for the slight differences in angler age distributions between the control site and Lohmans' slab bridge site. Angler gender did not change before and after the project, but the habitat project may have retained a greater proportion of fly anglers at the Lohmans' slab bridge site. The percentage of anglers using the different gear types was almost identical before and after the habitat work but changed at the downstream control site. Downstream, the percentage of fly anglers decreased from 62% to 49% between 2005 and 2013, whereas the percentage of lure anglers increased from 31% to almost half of all anglers (48%). No such changes were observed at the site where the habitat work was done.

TABLE 3-20. Selected sociodemographic information from anglers surveyed before (2005) and after (2013) an instream habitat project completed at one site on Trout Run Creek, Winona County, Minnesota. The habitat project was completed at the Lohmans' slab bridge site in 2007 and the Bucksnort dam site on Trout Run Creek represented a statistical "control" to account for whole stream changes independent of the habitat project. All data were collected during the summer angling season (April 1 to September 30).

Trout Run–Impact site (Lohmans' slab bridge)			**Trout Run-Control site (Bucksnort dam)**		
Age group	2005	2013	Age group	2005	2013
0-15	0%	2%	0-15	0%	9%
16-24	0%	9%	16-24	31%	10%
25-34	1%	21%	25-34	7%	14%
35-44	45%	8%	35-44	15%	22%
45-54	36%	7%	45-54	31%	11%
55-64	9%	24%	55-64	7%	19%
≥ 65	0%	29%	≥ 65	7%	13%
N =	11	129	N =	13	105
Gender			Gender		
Male	91%	95%	Male	100%	91%
Female	9%	5%	Female	0%	9%
N =	11	129	N =	13	105
Gear use			Gear use		
Bait	0%	0%	Bait	0%	1%[a]
Lure	27%	30%	Lure	31%	48%
Fly	73%	70%	Fly	62%	49%
Mixed method	0%	0%	Mixed method	7%	1%
N =	11	128	N =	13	105

[a]Illegal gear type, live bait was not allowed on Trout Run Creek.

Angler pressure was significantly higher after the habitat project at the Lohmans' slab bridge site but did not change significantly at the downstream control site (Table 3-21; Figure 3-2). This strongly suggests that the habitat project increased this aspect of angler participation. However, angler trip length and catch rate did not change significantly before and after the habitat project at either the site of the habitat work (Lohman's slab bridge) or the downstream control site (Bucksnort) (Table 3-21; Figure 3-3). The percentage of anglers that were satisfied or very satisfied with their overall angling experience increased at the control site (Bucksnort) but decreased at the site receiving the habitat project (Lohman's slab bridge) (Table 3-22). The percentage of anglers that were satisfied or very satisfied with the size of trout they caught was also lower after the habitat project at both the site receiving the habitat work and at the control site. However, there was a larger decrease at the habitat project site (-11%) than at the control site (-4%). Conversely, the percentage of anglers satisfied with the number of trout they caught increased after the habitat project (+9%) whereas at the control site, this percentage decreased (-17%). As with the other fishery metrics, low sample sizes in 2005 necessitate a tempering of these conclusions.

TABLE 3-21. Before-After-Control-Impact (BACI) comparisons of selected fishery metrics to evaluate an instream habitat project conducted in 2007 at the Lohman's slab bridge site (Impact site) on Trout Run Creek, southeast Minnesota. A site near Bucksnort dam served as a Control site. The sample size (n) for angler pressure is the number of days surveyed whereas all other sample sizes were the number of anglers surveyed. Trip lengths were only calculated from completed fishing trips. Catch rates were compiled for all anglers that had fished for at least 0.5 hours.

Stream site	Before - 2005	After - 2013	Result
Objective-Increase participation (angler pressure-hours/mile)			
Control site - Bucksnort	$\bar{x}$ = 2,149 hrs/mi SE = 749 n = 16	$\bar{x}$ = 3,874 hrs/mi SE = 614 n = 63	No significant difference (t = 1.78, df = 15, P > 0.05)
Impact site – Lohmans' slab bridge	$\bar{x}$ = 1,935 hrs/mi SE = 389 n = 15	$\bar{x}$ = 6,015 hrs/mi SE = 748 n = 63	Significant increase (t = 4.83, df = 14, P < 0.05)
Objective-Increase participation (trip length-hours)			
Control site - Bucksnort	$\bar{x}$ = 2.42 hrs SE = 0.473 n = 8	$\bar{x}$ = 2.90 hrs SE = 0.350 n = 36	No significant difference (t = 0.80, df = 7, P > 0.05)
Impact site – Lohmans' slab bridge	$\bar{x}$ = 1.98 hrs SE = 0.541 n = 4	$\bar{x}$ = 3.26 hrs SE = 0.248 n = 69	No significant difference (t = 2.16, df = 3, P > 0.05)
Objective-Increase angler catch rates (trout/hour)			
Control site - Bucksnort	$\bar{x}$ = 1.02 trout/hr SE = 0.526 n = 9	$\bar{x}$ = 0.87 trout/hr SE = 0.185 n = 53	No significant difference (t = 0.26, df = 8, P > 0.05)
Impact site – Lohmans' slab bridge	$\bar{x}$ = 1.75 trout/hr SE = 0.966 n = 6	$\bar{x}$ = 2.25 trout/hr SE = 0.354 n = 73	No significant difference (t = 0.481, df = 5, P > 0.05)

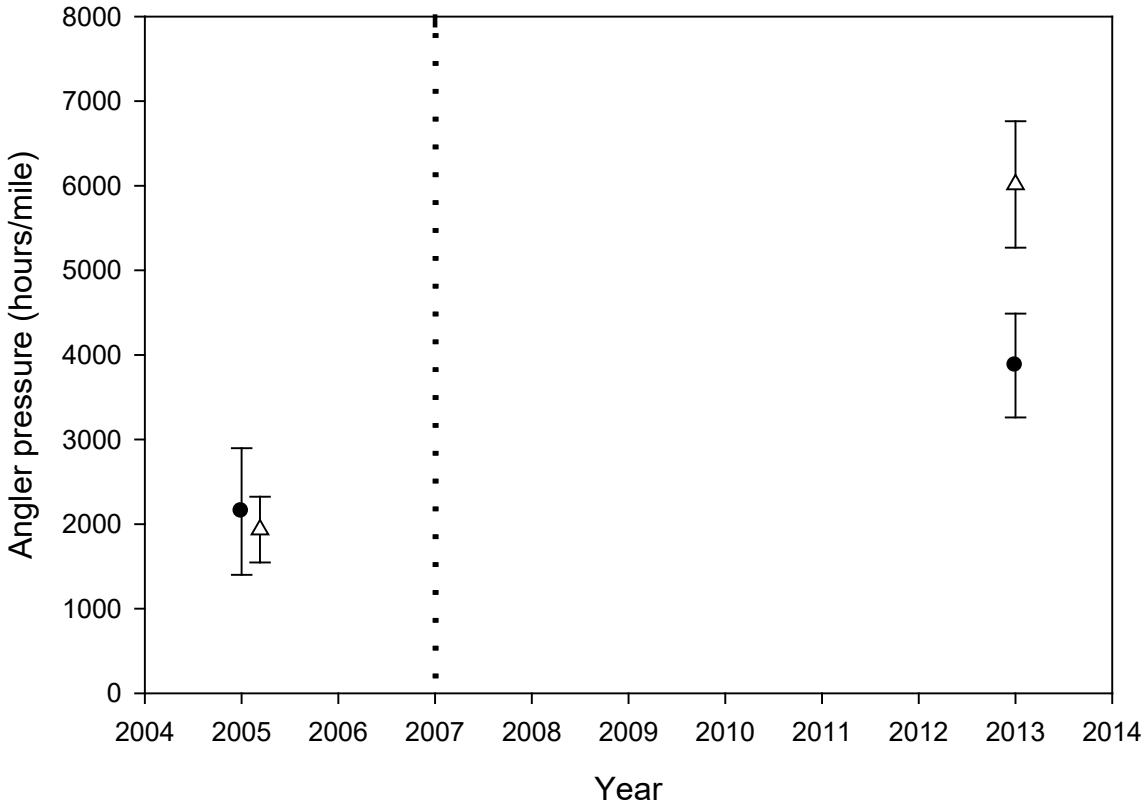

FIGURE 3-2. Angler pressure estimates ($\bar{x}$ ± 1 SE) conducted at two sites on Trout Run Creek in southeast Minnesota to evaluate an instream habitat improvement project using a Before-After-Control-Impact design. The Control site was near Bucksnort Dam (filled circles) and the Impact site that received the habitat work in 2007 (vertical dashed line) was located at the Lohman's slab bridge site (open triangles). Estimates from before the project in 2005 were taken from Snook and Dieterman (2006) and estimates from After the project were taken from Chapter 1 of this report.

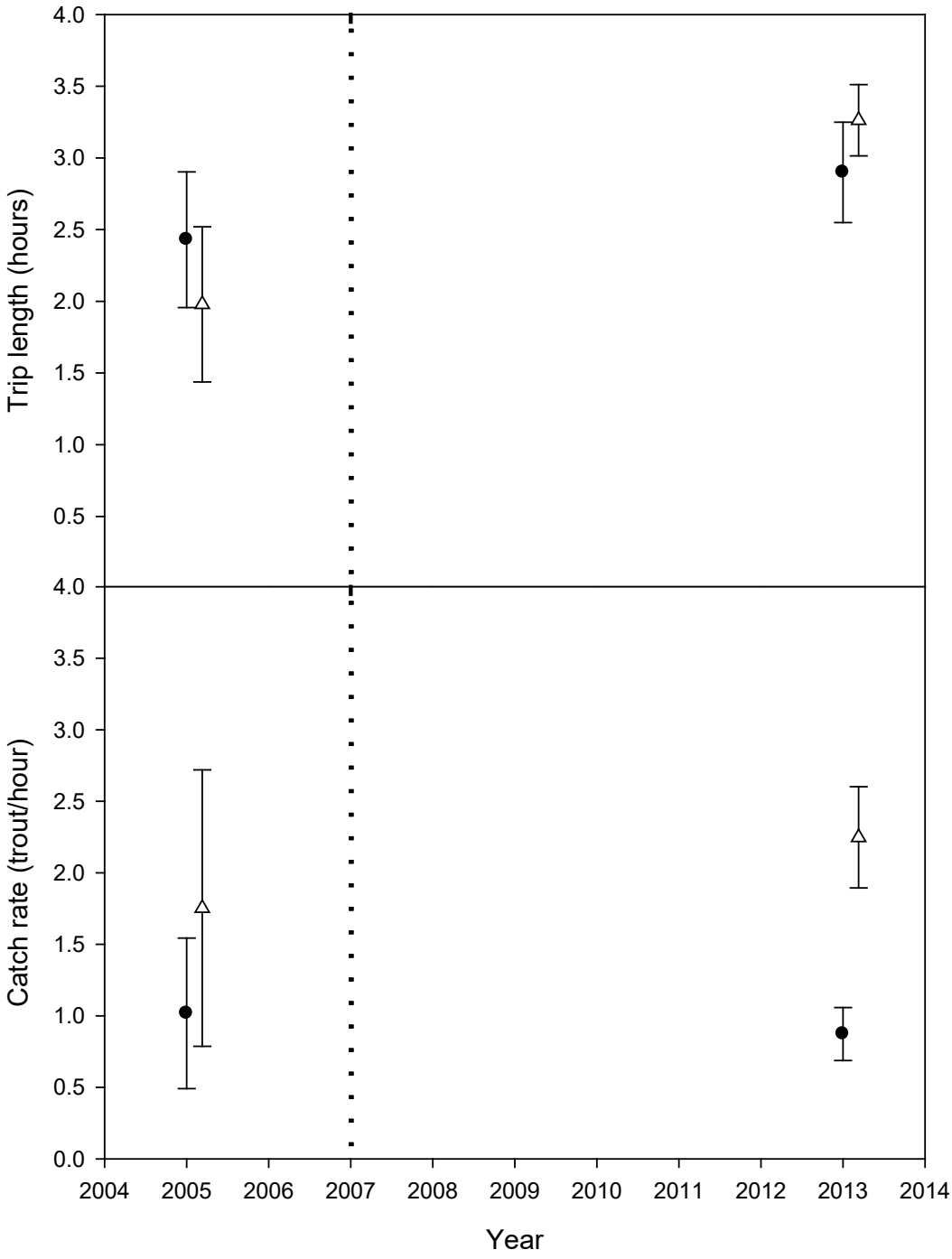

FIGURE 3-3. Estimates ($\bar{x}$ ± 1 SE) for angler trip lengths (top figure) and catch rates (bottom figure) conducted at two sites on Trout Run Creek in southeast Minnesota to evaluate an instream habitat improvement project using a Before-After-Control-Impact design. The Control site was near Bucksnort Dam (filled circles) and the Impact site that received the habitat work in 2007 (vertical dashed line) was located at the Lohman's slab bridge site (open triangles). Estimates from Before the project in 2005 were taken from Snook and Dieterman (2006) and estimates from After the project were taken from Chapter 1 of this report.

TABLE 3-22. Before-After-Control-Impact (BACI) comparisons of angler satisfaction with three fishery aspects used to evaluate an instream habitat project conducted in 2007 at the Lohmans' slab bridge site (Impact site) on Trout Run Creek, southeast Minnesota. A site near Bucksnort dam served as a Control site. The sample sizes (n) were the number of anglers surveyed.

Site	Time	n	Very Satisfied and Satisfied	Neither	Dissatisfied and Very Dissatisfied
Objective-Increase satisfaction with overall angling experience					
Control-Bucksnort	Before (2005)	8	75%	13%	13%
	After (2013)	41	83%	2%	15%
	Change		**+8%**	**-11%**	**+2%**
Impact-Lohman's	Before (2005)	4	100%	0%	0%
	After (2013)	67	93%	1%	6%
	Change		**-7%**	**+1%**	**+6%**
Objective-Increase satisfaction with size of trout caught					
Control-Bucksnort	Before (2005)	8	63%	25%	13%
	After (2013)	41	59%	34%	7%
	Change		**-4%**	**+9%**	**-6%**
Impact-Lohman's	Before (2005)	4	75%	25%	0%
	After (2013)	66	64%	18%	18%
	Change		**-11%**	**-7%**	**+18%**
Objective-Increase satisfaction with numbers of trout caught					
Control-Bucksnort	Before (2005)	8	63%	25%	13%
	After (2013)	41	46%	29%	24%
	Change		**-17%**	**+4%**	**+11%**
Impact-Lohman's	Before (2005)	4	50%	25%	25%
	After (2013)	66	59%	23%	18%
	Change		**+9%**	**-2%**	**-7%**

DISCUSSION

Available angler survey data permitted an initial evaluation of three instream habitat projects in southeast Minnesota. There were few conclusive differences in angler demographics, participation, tangible benefits provided, or angler satisfaction before and after these projects were implemented. The only tentative conclusions that could be made were increases in angler participation (overall angler pressure) and satisfaction with numbers of trout caught, but simultaneously, decreased satisfaction with the overall fishing experience and size of trout caught for one of the three projects (Lohmans' slab bridge on Trout Run Creek). Nothing definitive could be determined for the other two projects on the Middle Branch Whitewater River. Consequently, from a sociodemographic and fishery related perspective, it was difficult to conclude whether these habitat projects met any fishery goals or objectives. The lack of more conclusive findings was hampered by several factors including small sample sizes, especially pre-project in 2005; poor or unspecified project objectives; and poorly planned study designs.

The 2005 creel survey was not specifically designed to collect baseline data before habitat improvement projects. The overall goal of the 2005 creel survey was to broadly characterize angler pressure, catch, harvest and satisfaction across 33 of the more popular trout streams in southeast Minnesota (Snook and Dieterman 2006). Because of the large number of streams targeted in that survey, the actual number of days (or anglers) sampled on any specific stream were modest at best. Pre-project sample sizes in 2005, on sites that ultimately received an instream habitat project, ranged from 23-47 survey days or 4-32 individual anglers or completed angler trips. Conversely, sample sizes during the more focused creel survey in 2013 ranged from 62-67 survey days or 11-50 individual anglers or completed angler trips. Having sufficient sample sizes is critical to allow proper evaluation of environmental management programs (Quinn and Keough 2002; Gerow 2007). The baseline information collected as pre-project data during the 2013 survey should enable a much better evaluation of proposed habitat projects, assuming more specific and measureable objectives are identified.

Prospective power analyses can help determine logistically feasible objectives for habitat projects on some streams. Given 2013 sample sizes, in conjunction with the prospective power analyses, potential objectives to consider for habitat projects might be about 100% changes (i.e., a doubling) of angler trip lengths, catch rates, and overall pressure. This change translates to a sample size of about 15-30 angler trips > 30 minutes to evaluate catch rates, 5-10 completed trips to evaluate trip length, and 50-100 days to evaluate pressure. On average, about 3.1 hours of clerk effort was required to obtain each interview in 2013 (see Chapter 1) and creel clerks were paid about $13.50/hr. Thus, the cost to obtain about 15-30 interviews (assuming interviews were of anglers that fished longer than 30 minutes), would range from about $630 to $1250 to evaluate post-project catch rates. An eight-hour workday for a clerk would cost about $108 (8 hours x $13.50/hour). Thus, the cost to survey 50-100 days could range from $5,400 to $10,800. Substantial variability in harvest rates, possibly due to increased catch-and-release angling probably precludes use of this metric as an objective for habitat projects.

Alternative study designs or approaches may help reduce potential costs of habitat improvement evaluations. Our prospective power analyses assumed simplistic before and after comparisons of each site and should be considered to provide general guidance of sample size needs following implementation of a traditional creel survey. This approach also assumed each individual survey day or angler would be an independent replicate, but conducting power analyses within strata such as weekend/holidays versus weekdays, or different months may reveal a more cost-effective design. Also, the use of "control" sites on each stream should be strongly considered to reduce the influence of other stream-scale factors that might affect the objectives of habitat projects (Quinn and Keough 2002). Such an approach should also allow for other more formal Before-After-Control-Impact analyses (see Smith 2002).

Alternatively, other approaches may be considered to provide a more robust evaluation. For example, angler survey data may be better collected with a mail survey of anglers that purchased trout stamps. Such surveys have been conducted previously for anglers fishing southeast Minnesota trout streams (e.g., Vlaming and Fulton 2003). However, one drawback to such surveys is that they do not consider the youngest or oldest anglers, (those younger than age 18 or older than 64) or resident/non-resident anglers fishing with a 24-hour or 72-hour license, as these angler groups

are not required to purchase a trout stamp. Another potentially useful approach to at least evaluate angler catch rates, would be to randomly select a group of anglers to consistently fish (with the same gear types) randomly selected stream areas (both control and impact sites) on randomly selected days. Such a standardized approach might be the most cost-effective evaluation of whether habitat projects actually increase direct tangible benefits, such as trout catch rates, to anglers.

Finally, habitat project evaluations should include biological assessments to determine if trout populations respond to habitat changes as well. An evaluation coupling trout abundance estimates and angler catch rates would also permit testing an association between these two metrics. If such a link could be established, this would allow habitat evaluations to be based primarily on trout abundance information that would infer direct benefits to anglers.

MANAGEMENT IMPLICATIONS

1. Evaluate all stream habitat projects to ensure that public funds are used appropriately and to maintain public support for aquatic habitat programs and projects.
2. We strongly recommend that managers begin stream habitat projects by following the 12 steps outlined by Orth and White (1999). These steps include stating specific, measurable objectives to be obtained by certain times; selection of appropriate habitat techniques to meet these objectives; and proper evaluation to determine if project objectives were met, and if not, why.
3. Conduct more detailed prospective power analyses within predetermined strata (e.g., months) to refine future study designs.
4. Incorporate sociodemographic objectives such as those examined here, in future evaluations of stream habitat projects to ensure projects provide direct tangible benefits to anglers.
5. Ensure adequate funding is available to evaluate stream habitat projects.
6. Avoid using intermittent angler creel surveys on a large number of streams to evaluate sociodemographic benefits of habitat projects as these creel survey designs rarely provide enough statistical power to assess any changes on specific stream sites.

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APPENDIX 1. Selected trout stream locations surveyed in an angler creel survey in southeast Minnesota with UTM Easting/Northing and length of surveyed route, April 1 to September 30, 2013. LTM = a stream site designated as a long-term monitoring site for other biotic and physical habitat variables.

Stream	UTM's upstream	UTM's downstream	Length of route on stream (feet)
Camp Creek	576,186 – 4,833,694	576,162 – 4,834,416	4,000
Crooked Creek	629,138 – 4,829,623	629,908 – 4,829,486	3,500
East Beaver Creek	614,882 – 4,832,885	614,016 – 4,833,274	3,500
Forestville Creek	562,517 – 4,831,643	562,872 – 4,832,262	3,500
Gribben Creek	587,378 – 4,840,982	587,323 – 4,841,748	3,500
Hay Creek (State)	534,678 – 4,927,400	534,622 – 4,928,115	3,500
Hay Creek (Upper)	532,822 – 4,925,009	532,123 – 4,924,405	4,300
Middle Branch Whitewater River (Crow Springs)	570,075 – 4,872,119	570,445 – 4,872,913	3,200
Middle Branch Whitewater River (County 9)	570,871 – 4,874,544	571,512 – 4,875,064	3,500
Middle Branch Whitewater River (Quincy)	571,618 – 4,876,549	572,096 – 4,876,500	3,500
Mill Creek	564,721 – 4,854,605	565,151 – 4,854,084	3,300
North Branch Whitewater River	574,346 – 4,882,783	575,174 – 4,882,681	3,500
Pine Creek	592,017 – 4,857,747	592,861 – 4,857,495	3,500
South Branch Root River (Lanesboro)	582,252 – 4,840,925	582,387 – 4,841,763	3,500
South Branch Root River (Park)	562,741 – 4,830,295	563,234 – 4,831,051	3,500
South Fork Root River (LTM)	591,587 – 4,830,056	592,383 – 4,830,359	3,500
South Fork Root River (Million Dollar)	595,151 – 4,832,557	595,112 – 4,833,113	3,500
Trout Run (Lohman's)	576,481 – 4,853,839	576,364 – 4,853,230	3,600
Trout Run (Bucksnort)	576,421 – 4,852,322	576,157 – 4,851,823	4,000
West Beaver Creek	611,758 – 4,831,584	612,104 – 4,832,315	3,500
West Indian Creek (LTM)	568,377 – 4,898,499	568,141 – 4,898,960	3,500
West Indian Creek (County 4)	567,787 – 4,899,865	567,082 – 4,900,011	2,500
Willow Creek	572,329 – 4,832,049	572,319 – 4,832,858	2,900
Wisel Creek	595,790 – 4,827,875	595,141 – 4,828,439	3,500

APPENDIX 2. Contact form used to interview anglers in the southeast Minnesota trout stream angler survey, April 1 to September 30, 2013.

STREAM ANGLER CONTACT SHEET

DNR Lanesboro Area Fisheries – (507) 467-2442

Stream/Route _____ Month _____ Day _____ Year _____ Time – AM PM

Area _____ Day – M Tu W Th F Sa Su Holiday – Y N

Interview – Complete Incomplete Refused Lure Type (all that apply) – Bait Lure Fly

---

Good morning/afternoon. I'm doing a survey for the Minnesota Department of Natural Resources and I'd like to ask you some questions about your fishing trip.

Q1. What is your home zip code?_____Q2a. What is your age?_____ Q2b. Gender? M F

Q3. When did you start your fishing trip today? (24-hour clock)_____

Q4. What species are you primarily fishing for? Trout_____BNT_____ BKT_____ RBT_____ Other_____

Q5. How many years have you been fishing for trout?_____

Q6. How many times do you fish this trout stream per year?_____

Q7. How many times do you fish other trout streams per year?_____

Q8. Why did you decide to fish here today? (choose only one)
a. Favorite streamb. live close by c. easy access d. like regulation here
e. dislike regulation elsewhere f. numbers of fish g. size of fish

Have they been fishing for >1 hour (Q3 above)? Continue…

How satisfied or dissatisfied were you with the following:

Q9. The overall fishing experience you had today?
Very dissatisfied Dissatisfied Neither Satisfied Very satisfied

Q10. The size of trout you caught today? Very dissatisfied
Dissatisfied Neither Satisfied Very satisfied

Q11. The number of trout you caught today? Very dissatisfied
Dissatisfied Neither Satisfied Very satisfied

If you caught any fish today do you recall the length or if you kept any would you mind if I measure the catch?

Species	1	2	3	4	5	6	7	8	9	10	11	12	Total #
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Add K (Kept) or R (Released) after measured length

Time interview ended (24-hour clock): _____

Comments (on back if necessary):

APPENDIX 3. Letter survey given to anglers in the southeast Minnesota trout stream angler survey, April 1 to September 30, 2013.

PLEASE COMPLETE AND MAIL EVEN IF YOU WERE NOT FISHING.

Thank you for participating in the Minnesota Department of Natural Resources Fisheries survey. Please answer the following questions and mail this letter in the envelope provided. If you weren't fishing, only answer Question 1.

Q1. Were you fishing for trout when we left this survey? YES NO

Q2. How many anglers total traveled in this vehicle with you to the stream today?_____

Q3. What is your (and passengers) home zip code(s)?_____

Q4. How long was your fishing trip (time you left vehicle until you arrived back at vehicle)?_____

For more information or questions regarding this survey, please contact the Lanesboro Area Fisheries Office at (507) 467-2442.

APPENDIX 4. Survey distribution from clerks by stream with contact type, number of contacts, number of survey letters left with return rates for the southeast Minnesota trout stream creel survey, April 1 to September 30, 2013.

Stream	Interview type	# of Interviews	# of Letters left	# of Letters returned	Overall return rate (%)
Camp Creek	Complete	18			
	Incomplete	30			
	Refused	0			
	Total	48	17	8	47.1
Crooked Creek	Complete	28			
	Incomplete	1			
	Refused	0			
	Total	29	17	13	76.5
East Beaver Creek	Complete	20			
	Incomplete	10			
	Refused	1			
	Total	31	118	51	43.2
Forestville Creek	Complete	16			
	Incomplete	8			
	Refused	0			
	Total	24	12	5	41.7
Gribben Creek	Complete	7			
	Incomplete	10			
	Refused	0			
	Total	17	5	3	60.0
Hay Creek	Complete	57			
	Incomplete	4			
	Refused	0			
	Total	61	65	33	50.8
Middle Branch Whitewater	Complete	76			
	Incomplete	26			
	Refused	1			
	Total	103	57	23	40.4
Mill Creek	Complete	18			
	Incomplete	26			
	Refused	0			
	Total	44	10	3	30.0
North Branch Whitewater	Complete	37			
	Incomplete	18			
	Refused	1			
	Total	56	63	30	47.6
Pine Creek	Complete	20			
	Incomplete	27			
	Refused	0			
	Total	47	20	14	70.0

(Appendix 2 continued on next page)

APPENDIX 4. Continued.

Stream	Interview type	# of Interviews	# of Letters left	# of Letters returned	Overall return rate (%)
South Branch Root River	Complete	166			
	Incomplete	132			
	Refused	19			
	Total	317	77	30	39.0
South Fork Root River	Complete	38			
	Incomplete	31			
	Refused	0			
	Total	69	36	22	61.1
Trout Run	Complete	108			
	Incomplete	126			
	Refused	0			
	Total	234	75	49	65.3
West Beaver Creek	Complete	10			
	Incomplete	10			
	Refused	0			
	Total	20	15	9	60.0
West Indian Creek	Complete	22			
	Incomplete	4			
	Refused	0			
	Total	26	18	11	61.1
Willow Creek	Complete	12			
	Incomplete	14			
	Refused	1			
	Total	27	7	3	42.9
Wisel Creek	Complete	41			
	Incomplete	27			
	Refused	4			
	Total	72	40	25	62.5
Total	Complete	694			
	Incomplete	504			
	Refused	27			
	Total	1,225	652	332	50.9

APPENDIX 5. State and number of interviews and letters given by non-resident anglers fishing selected southeast Minnesota trout streams between April 1 and September 30, 2013.

State	Number of interviews	Number of letters
Iowa	16	7
Illinois	10	0
Wisconsin	10	12
Arizona	6	6
Florida	5	2
South Dakota	5	0
Texas	5	3
Missouri	4	1
North Dakota	4	0
Alaska	3	0
California	3	3
Indiana	3	3
Alabama	2	2
Arkansas	2	0
Colorado	2	0
Kansas	2	0
Nebraska	2	0
New York	2	1
Washington	2	0
Holland (Country)	1	0
Kentucky	1	0
Montana	1	0
North Carolina	1	1
Oklahoma	1	0
Oregon	1	0
Pennsylvania	1	1
Utah	1	0
Virginia	1	0
West Virginia	1	0

APPENDIX 6. Hometown, zip code and number of interviews and letters taken from Minnesota resident anglers fishing selected southeast Minnesota trout streams between April 1 and September 30, 2013.

Town	Zip code	Number of interviews	Number of letters
Rochester	55901, 55902, 55906, 55904, 55905, 55907	219	78
Minneapolis	55406, 55423, 55413, 55417, 55422, 55418, 55419, 55431, 55407, 55408, 55412, 55430, 55403, 55410, 55426, 55436, 55411, 55414, 55416, 55444, 55445, 55448, 55401, 55424, 55428, 55434, 55439, 55447, 55402, 55420, 55425, 55427, 55429, 55435, 55438, 55441, 55443	148	39
St. Paul	55106, 55104, 55119, 55118, 55122, 55105, 55112, 55124, 55103, 55109, 55110, 55120, 55123, 55125, 55117, 55129, 55130, 55102, 55116, 55128, 55108, 55114, 55115	132	37
Chatfield	55923	64	9
Lanesboro	55949	30	10
Austin	55912	26	19
Winona	55987	26	12
St. Charles	55972	23	4
Albert Lea	56007	16	6
Owatonna	55060	15	2
Prior Lake	55372	15	0
Faribault	55021	13	8
Minnetonka	55305, 55345	13	1
Stewartville	55976	13	4
Fountain	55935	12	5
Lakeville	55044	12	2
Mankato	56001, 56003	12	2
Hastings	55033	11	3
Eyota	55934	10	1
Spring Valley	55975	10	1
Plainview	55964	9	6
Cottage Grove	55016	8	0
Elk River	55330	8	0
Rushford	55971	8	5
South St. Paul	55075	8	5
Buffalo	55313	7	3
Farmington	55024	7	5
Houston	55943	7	3
Lake City	55041	7	6
Northfield	55057	7	6
Preston	55956	7	1
Red Wing	55066	7	6
Stillwater	55082	7	2
Caledonia	55921	6	1
Dakota	55925	6	3
Dodge Center	55927	6	1
Excelsior	55331	6	4

(Appendix 6 continued on next page)

APPENDIX 6. Continued.

Town	Zip code	Number of interviews	Number of letters
Dover	55929	5	0
Duluth	55804, 55803, 55807, 55811	5	2
Hayfield	55940	5	1
Hopkins	55343	5	1
Kasson	55944	5	3
Spring Grove	55974	5	4
Blue Earth	56013	4	4
Burnsville	55337	4	0
Byron	55920	4	0
Eden Prairie	55347	4	0
Grand Meadow	55936	4	0
Lewiston	55952	4	1
Little Falls	56345	4	0
Mantorville	55955	4	1
Osseo	55369	4	3
Rogers	55374	4	0
Wabasha	55981	4	3
Waseca	56093	4	0
Brainerd	56401	3	3
Cedar	55011	3	0
Hokah	55941	3	2
Kenyon	55946	3	3
Maple Grove	55311	3	0
Peterson	55962	3	0
Wanamingo	55983	3	0
Zimmerman	55398	3	0
Altura	55910	2	0
Arlington	55307	2	0
Cannon Falls	55009	2	2
Canton	55922	2	0
Chanhassen	55317	2	1
Chaska	55318	2	0
Circle Pines	55014	2	1
Eden Prairie	55344	2	0
Elgin	55932	2	0
Fairmont	56031	2	2
Harmony	55939	2	2
Hutchinson	55350	2	0
Kimball	55353	2	0
LaCrescent	55947	2	1
Lester Prairie	55354	2	0
Litchfield	55355	2	0
Loretto	55357	2	0
Lyle	55953	2	0
Mapleton	56065	2	0
Mazeppa	55956	2	1

(Appendix 6 continued on next page)

APPENDIX 6. Continued.

Town	Zip code	Number of interviews	Number of letters
Minnesota City	55959	2	0
Moorhead	56560	2	0
Mound	55364	2	1
New Prague	56071	2	2
North Branch	55056	2	1
Shakopee	55379	2	0
Waltham	55982	2	0
West Concord	55985	2	0
Willmar	56201	2	2
Worthington	56187	2	0
Wykoff	55092	2	0
Adams	55909	1	3
Alden	56009	1	1
Baxter	56425	1	0
Becker	55308	1	0
Carlton	55718	1	0
Carver	55315	1	0
Champlin	55316	1	2
Claremont	55924	1	0
Clear Lake	55319	1	0
Cloquet	55720	1	0
Cokato	55321	1	0
Dalbo	55017	1	0
Delano	55328	1	0
Dundas	55019	1	0
Eagle Lake	56024	1	0
Elko New Market	55020	1	0
Elkton	55933	1	0
Elmore	56027	1	0
Esko	55733	1	0
Eveleth	55734	1	0
Forest Lake	55025	1	0
Frontenac	55026	1	0
Geneva	56035	1	1
Goodhue	55027	1	0
Grand Marias	55604	1	0
Hamel	55340	1	0
Harris	55032	1	0
Henriette	55036	1	0
Kellogg	55945	1	1
Le Sueur	56058	1	2
Lindstrom	55045	1	0
Mabel	55954	1	2
Maple Lake	55358	1	0
Maple Plain	55359	1	1
Monticello	55362	1	1

(Appendix 6 continued on next page)

Appendix 6. Continued.

Town	Zip code	Number of interviews	Number of letters
Nicollet	56074	1	0
Nisswa	56468	1	0
Ostrander	55961	1	0
Pequot Lakes	56472	1	0
Princeton	55371	1	0
Racine	55967	1	1
Rosemont	55068	1	0
Saint Peter	56082	1	0
Santiago	55377	1	0
Sartell	56377	1	2
Sauk Centre	56378	1	0
Savage	55378	1	0
Shafer	55074	1	0
South Haven	55382	1	0
St Cloud	56304	1	1
St Francis	55070	1	0
St Paul Park	55071	1	1
Stacy	55079	1	0
Staples	56479	1	1
Utica	55979	1	0
Vermillion	55085	1	0
Waconia	55387	1	0
Watertown	55388	1	1
Waterville	56096	1	0
Wayzata	55391	1	2
Webster	55088	1	1
Winsted	55395	1	0
Wyoming	55092	1	1
Oronoco	55960	0	1
Garden City	56034	0	1
Hugo	55038	0	1

APPENDIX 7. Numbers of harvested Brown Trout of two size groups, ≤ 9 and 10-11 inches, from selected southeast Minnesota streams during the 2013 summer angling season.

Stream	Day type	Brown Trout ≤ 9 inches			Brown Trout 10-11 inches		
		Mean harvest/day	Total harvest	SE (±)	Mean harvest/day	Total harvest	SE (±)
Camp Creek			None			None	
Crooked Creek	Early C&R						
	Harvest WD						
	Harvest WEH				0.49	23	23
	Late C&R						
	All					23	23
East Beaver Creek	Early C&R						
	Harvest WD						
	Harvest WEH				0.93	45	45
	Late C&R						
	All					45	45
Forestville Creek	Early C&R						
	Harvest WD						
	Harvest WEH	0.29	14	14	0.40	19	19
	Late C&R						
	All		14	14		19	19
Gribben Creek	Early C&R						
	Harvest WD						
	Harvest WEH	0.35	17	17			
	Late C&R						
	All		17	17			
Hay Creek – State Forest	Early C&R						
	Harvest WD	0.39	42	42			
	Harvest WEH	0.76	36	36	1.45	70	61
	Late C&R						
	All		78	55		70	61
Hay Creek – Upper	Early C&R						
	Harvest WD	0.73	78	78	0.83	89	89
	Harvest WEH	1.00	48	48	1.00	48	48
	Late C&R						
	All		126	92		137	101
Middle Branch Whitewater (Crow)			None			None	
Middle Branch Whitewater (Cty 9)			None			None	
Middle Branch Whitewater (Quincy)			None			None	
Mill Creek			None			None	
North Branch Whitewater	Early C&R						
	Harvest WD				0.81	86	86
	Harvest WEH	1.59	76	55	3.43	165	94
	Late C&R						
	All		76	55		251	128
Pine Creek	Early C&R						
	Harvest WD				0.34	37	37
	Harvest WEH	1.11	53	42	2.80	134	113
	Late C&R						
	All		53	42		171	119
South Branch Root River (Lanesboro)	Early C&R						
	Harvest WD	0.46	50	50	3.24	346	143
	Harvest WEH	1.93	93	64	6.86	329	184
	Late C&R						
	All		143	81		675	233
South Branch Root River (State Park)	Early C&R						
	Harvest WD						
	Harvest WEH	1.13	54	54	1.85	89	89
	Late C&R						
	All		54	54		89	89
South Fork Root River (LTM)			None			None	

(Appendix 7 continued on next page)

APPENDIX 7. Continued.

Stream	Day type	Brown Trout ≤ 9 inches			Brown Trout 10-11 inches		
		Mean harvest/day	Total harvest	SE (±)	Mean harvest/day	Total harvest	SE (±)
South Fork Root River (Million)	Early C&R						
	Harvest WD						
	Harvest WEH				0.43	20	20
	Late C&R						
	All					20	20
Trout Run (Bucksnort)	Early C&R						
	Harvest WD	0.48	52	52	1.64	175	122
	Harvest WEH	1.29	62	62			
	Late C&R						
	All		114	81		175	122
Trout Run (Lohman's)	Early C&R						
	Harvest WD				0.41	44	33
	Harvest WEH	0.86	41	41	2.41	116	105
	Late C&R						
	All		41	41		160	110
West Beaver Creek	Early C&R						
	Harvest WD						
	Harvest WEH				0.45	22	22
	Late C&R						
	All					22	22
West Indian Creek (Cty 4)	Early C&R						
	Harvest WD	0.11	12	12	1.57	168	117
	Harvest WEH						
	Late C&R						
	All		12	12		168	117
West Indian Creek (LTM)	Early C&R						
	Harvest WD	0.57	61	39	1.02	110	61
	Harvest WEH						
	Late C&R						
	All		61	39		110	61
Willow Creek			None			None	
Wisel Creek	Early C&R						
	Harvest WD						
	Harvest WEH	0.15	7	7			
	Late C&R						
	All		7	7			
Total			796	190		2,257	408

APPENDIX 8. Numbers of harvested Brown Trout of two size groups, 12-13 and 14-15 inches, from selected southeast Minnesota streams during the 2013 summer angling season.

Stream	Day type	Brown Trout 12-13 inches			Brown Trout 14-15 inches		
		Mean harvest/day	Total harvest	SE (±)	Mean harvest/day	Total harvest	SE (±)
Camp Creek			None			None	
Crooked Creek	Early C&R						
	Harvest WD						
	Harvest WEH	0.39	19	19			
	Late C&R						
	All		19	19			
East Beaver Creek			None			None	
Forestville Creek	Early C&R						
	Harvest WD						
	Harvest WEH	0.10	5	5			
	Late C&R						
	All		5	5			
Gribben Creek			None			None	
Hay Creek – State Forest	Early C&R						
	Harvest WD	0.58	62	62			
	Harvest WEH	0.72	35	35			
	Late C&R						
	All		97	97			
Hay Creek – Upper	Early C&R						
	Harvest WD				0.36	39	39
	Harvest WEH						
	Late C&R						
	All					39	39
Middle Branch Whitewater (Crow)			None			None	
Middle Branch Whitewater (Cty 9)			None			None	
Middle Branch Whitewater (Quincy)			None			None	
Mill Creek			None			None	
North Branch Whitewater			None			None	
	All						
Pine Creek	Early C&R						
	Harvest WD						
	Harvest WEH				1.17	56	56
	Late C&R						
	All					56	56
South Branch Root River (Lanesboro)	Early C&R						
	Harvest WD	1.06	113	80			
	Harvest WEH	7.48	359	193	7.83	376	296
	Late C&R						
	All		472	209		376	296
South Branch Root River (State Park)			None			None	
South Fork Root River (LTM)			None			None	
South Fork Root River (Million)			None			None	
Trout Run (Bucksnort)			None			None	
Trout Run (Lohman's)			None			None	
West Beaver Creek	Early C&R						
	Harvest WD						
	Harvest WEH	0.69	33	33	0.23	11	11
	Late C&R						
	All		33	33		11	11
West Indian Creek (Cty 4)			None			None	
West Indian Creek (LTM)			None			None	
Willow Creek			None			None	
Wisel Creek			None			None	
Total			715	232		482	304

APPENDIX 9. Numbers of harvested Brown Trout of two size groups, 16-17 and 18-19 inches, from selected southeast Minnesota streams during the 2013 summer angling season.

Stream	Day type	Brown Trout 16-17 inches			Brown Trout 18-19 inches		
		Mean harvest/day	Total harvest	SE (±)	Mean harvest/day	Total harvest	SE (±)
Camp Creek			None			None	
Crooked Creek			None			None	
East Beaver Creek			None			None	
Forestville Creek			None			None	
Gribben Creek			None			None	
Hay Creek – State Forest			None			None	
Hay Creek – Upper			None			None	
Middle Branch Whitewater (Crow)			None			None	
Middle Branch Whitewater (Cty 9)			None			None	
Middle Branch Whitewater (Quincy)			None			None	
Mill Creek			None			None	
North Branch Whitewater			None			None	
Pine Creek			None			None	
South Branch Root River (Lanesboro)			None			None	
South Branch Root River (State Park)			None			None	
South Fork Root River (LTM)			None			None	
South Fork Root River (Million)			None			None	
Trout Run (Bucksnort)			None			None	
Trout Run (Lohman's)	Early C&R Harvest WD Harvest WEH Late C&R				0.32	16	16
	All					16	16
West Beaver Creek			None			None	
West Indian Creek (Cty 4)			None			None	
West Indian Creek (LTM)			None			None	
Willow Creek			None			None	
Wisel Creek			None			None	
Total			0	0		16	16

APPENDIX 10. Numbers of harvested Brook Trout of two size groups, ≤ 9 and ≥ 10 inches, from selected southeast Minnesota streams during the 2013 summer angling season.

Stream	Day type	Brook Trout ≤ 9 inches			Brook Trout ≥ 10 inches		
		Mean harvest/day	Total harvest	SE (±)	Mean harvest/day	Total harvest	SE (±)
Camp Creek			None			None	
Crooked Creek			None			None	
East Beaver Creek			None			None	
Forestville Creek			None			None	
Gribben Creek			None			None	
Hay Creek – State Forest			None			None	
Hay Creek – Upper			None			None	
Middle Branch Whitewater (Crow)			None			None	
Middle Branch Whitewater (Cty 9)			None			None	
Middle Branch Whitewater (Quincy)			None			None	
Mill Creek			None			None	
North Branch Whitewater			None			None	
Pine Creek			None			None	
South Branch Root River (Lanesboro)			None			None	
South Branch Root River (State Park)			None			None	
South Fork Root River (LTM)			None			None	
South Fork Root River (Million)			None			None	
Trout Run (Bucksnort)			None			None	
Trout Run (Lohman's)			None			None	
West Beaver Creek			None			None	
West Indian Creek (Cty 4)			None			None	
West Indian Creek (LTM)	Early C&R Harvest WD Harvest WEH Late C&R	0.39	42	42	0.19	21	21
	All		42	42		21	21
Willow Creek			None			None	
Wisel Creek	Early C&R Harvest WD Harvest WEH Late C&R	0.46	49	49	0.46	49	49
	All		49	49		49	49
Total			91	64		70	53

APPENDIX 11. Numbers of harvested Rainbow Trout of two size groups, ≤ 11 and 12-16 inches (none were harvested > 16 inches), from selected southeast Minnesota streams during the 2013 summer angling season.

Stream	Day type	Rainbow Trout ≤ 11 inches			Rainbow Trout 12-16 inches		
		Mean harvest/day	Total harvest	SE (±)	Mean harvest/day	Total harvest	SE (±)
Camp Creek			None			None	
Crooked Creek	Early C&R						
	Harvest WD						
	Harvest WEH				0.23	11	11
	Late C&R						
	All					11	11
East Beaver Creek			None			None	
Forestville Creek			None			None	
Gribben Creek			None			None	
Hay Creek – State Forest			None			None	
Hay Creek – Upper			None			None	
Middle Branch Whitewater (Crow)			None			None	
Middle Branch Whitewater (Cty 9)			None			None	
Middle Branch Whitewater (Quincy)			None			None	
Mill Creek	Early C&R						
	Harvest WD						
	Harvest WEH	2.22	107	73	1.71	82	61
	Late C&R						
	All		107	73		82	61
North Branch Whitewater	Early C&R						
	Harvest WD	2.83	303	271			
	Harvest WEH	6.69	321	234	1.31	63	63
	Late C&R						
	All		624	358		63	63
Pine Creek			None			None	
South Branch Root River (Lanesboro)	Early C&R						
	Harvest WD	0.77	82	58	0.62	67	41
	Harvest WEH	8.57	412	228	3.5	168	99
	Late C&R						
	All		494	235		235	107
South Branch Root River (State Park)			None			None	
South Fork Root River (LTM)			None			None	
South Fork Root River (Million)			None			None	
Trout Run (Bucksnort)			None			None	
Trout Run (Lohman's)			None			None	
West Beaver Creek			None			None	
West Indian Creek (Cty 4)			None			None	
West Indian Creek (LTM)			None			None	
Willow Creek			None			None	
Wisel Creek			None			None	
Willow Creek	Early C&R						
	Harvest WD	1.16	125	125	0.78	83	83
	Harvest WEH						
	Late C&R						
	All		125	125		83	83
Wisel Creek	Early C&R						
	Harvest WD	0.51	55	55			
	Harvest WEH						
	Late C&R						
	All		55	55			
Total			1,403	455		474	162

APPENDIX 12. Numbers of harvested White Sucker from the South Branch Root River in the town of Lanesboro in southeast Minnesota during three time periods of the 2013 summer angling season. The time periods were Early C&R WD = Catch-and-release April 1-12, 2013 Weekdays; Early C&R WEH = Catch-and-release April 1-12, 2013 Weekends and Holidays; Harvest WD = April 13 – September 14, 2013 Weekdays; Harvest WEH = April 13 – September 14, 2013 Weekends and Holidays; Late C&R WD = Catch-and-release September 15-30, 2013 Weekdays; Late C&R WEH = Catch-and-release September 15-30, 2013 Weekends and Holidays.

Stream	Day type	White Sucker		
		Mean harvest/day	Total harvest	SE (±)
South Branch Root River (Lanesboro)	Early C&R WD	0.00	0	0
	Early C&R WEH	0.00	0	0
	Harvest WD	2.46	263	183
	Harvest WEH	0.00	0	0
	Late C&R WD	0.00	0	0
	Late C&R WEH	0.00	0	0
	All		263	183

APPENDIX 13. Comments from anglers during interviews fishing the trout season in southeast Minnesota, April 1 to September 30, 2013.

Date	Stream	Comment
April-7	Crooked Creek	Spend more money on habitat and less money on stocking
April-12	East Beaver Creek	Recommended by Lanesboro DNR
April-13	Hay Creek	Lost 5 in battle
April-13	West Indian Creek	Thinks the creek could be improved, very few deep holes for fish, lots of shallow slot water
April-13	South Fork Root River	Less crowded here
April-20	West Beaver Creek	Here to try something new
April-21	South Fork Root River	Fishing here because of the good conditions
April-28	South Fork Root River	Said his brother was fishing Nepstad and they were going to meet in the middle
April-28	South Fork Root River	Here because there was a variety of species to catch
April-28	South Fork Root River	Online easements are not up to date
April-28	Wisel Creek	Would love to see bigger fish on Wisel
April-28	Trout Run (Lohman's)	Let kids keep more trout. Thinks there are too many regulations. Like to have slot on all streams. Doesn't think there should be as many artificials only.
April-28	Trout Run (Lohman's)	About Duschee Creek…appalled by the low numbers of fish. Used to see tons of fish and take kids with him. Would like to see slot limit. Said he only saw 5 fish in 1 mile of stream.
May-4	Trout Run (Lohman's)	Would like to see extended season. Like restoration project
May-4	South Fork Root River	Appreciates the catch-and-release regulations because then there are fish and they are good sizes
May-7	Trout Run (Lohman's)	Check corner pool downstream from bridge on north side. Bad erosion.
May-11	Hay Creek	Man with his daughter from Bosnia
May-12	West Indian Creek	Has not fished West Indian Creek for 25 years
May-14	Trout Run (Lohman's)	Angler doesn't like stream restorations. Says he used to catch a lot more fish.
May-16	M. Br. Whitewater River	In town from Salt Lake City, Utah fishing with his dad. Said he fly fishes in Utah 3 days a week
May-17	West Indian Creek	Does not like the habitat rehabilitation project
May-20	East Beaver Creek	Fishes this stream because it stays cool in warm weather and clear after a rain
May-26	Pine Creek	Said he caught a tiger trout on Long Creek
May-31	West Indian Creek	Fished East Indian Creek earlier in the day and caught 8 brook trout
June-2	Camp Creek	Angler wanted to see clerks state ID.
June-3	South Fork Root River	Fishing here because of clear water
June-8	M. Br. Whitewater River	Anglers would like to see website updated more often. They love to see what Vaughn posts.
June-9	South Fork Root River	Here because he heard there was a hatch of mayflies
June-16	Hay Creek	First time fly fishing
June-22	M. Br. Whitewater River	Angler said it just wasn't worth the time because the horrible water quality. Angler left.
June-28	West Indian Creek	Loves the work DNR is doing
June-28	Trout Run (Bucksnort)	Says trout look really healthy
June-30	M. Br. Whitewater River	Angler didn't stay and fish. Went to a stream where he could keep fish (fly angler)
July-7	Gribben Creek	Heard from TU to go here
July-10	Hay Creek	Fishes Beaver Creek often
July-16	Forestville Creek	"Trico hatch?"
July-19	M. Br. Whitewater River	Does not like regulation that you can't keep fish. Said he prefers to fish Iowa streams
July-19	M. Br. Whitewater River	First time fishing (Lure)
July-20	Forestville Creek	"How long have they had slot?" (since 2005)
July-23	Trout Run (Bucksnort)	Anglers first time in southeast Minnesota for fly angling
Aug-1	M. Br. Whitewater River	Angler concerned about holes from cribs at Pine Creek. Said he stepped in one and almost broke his leg.
Aug-3	Hay Creek	First time fly fishing
Aug-3	South Fork Root River	Wants DNR to keep up with habitat projects and to better enforce farming right up to the stream.
Aug-9	M. Br. Whitewater River	Fishes Wisconsin trout streams often
Aug-17	Mill Creek	Anglers want to see less regulations on streams…more bait streams
Aug-22	Wisel Creek	Seems as though the trout are growing up
Aug-24	M. Br. Whitewater River	First time fishing for trout (63 years old)
Aug-24	M. Br. Whitewater River	He said he would like to thank the DNR for doing such good work.
Sept-1	South Fork Root River	The reason angler is here…catch-and-release is not heavily fished
Sept-15	Trout Run (Lohman's)	Angler caught a bluegill at Lohman's yesterday

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