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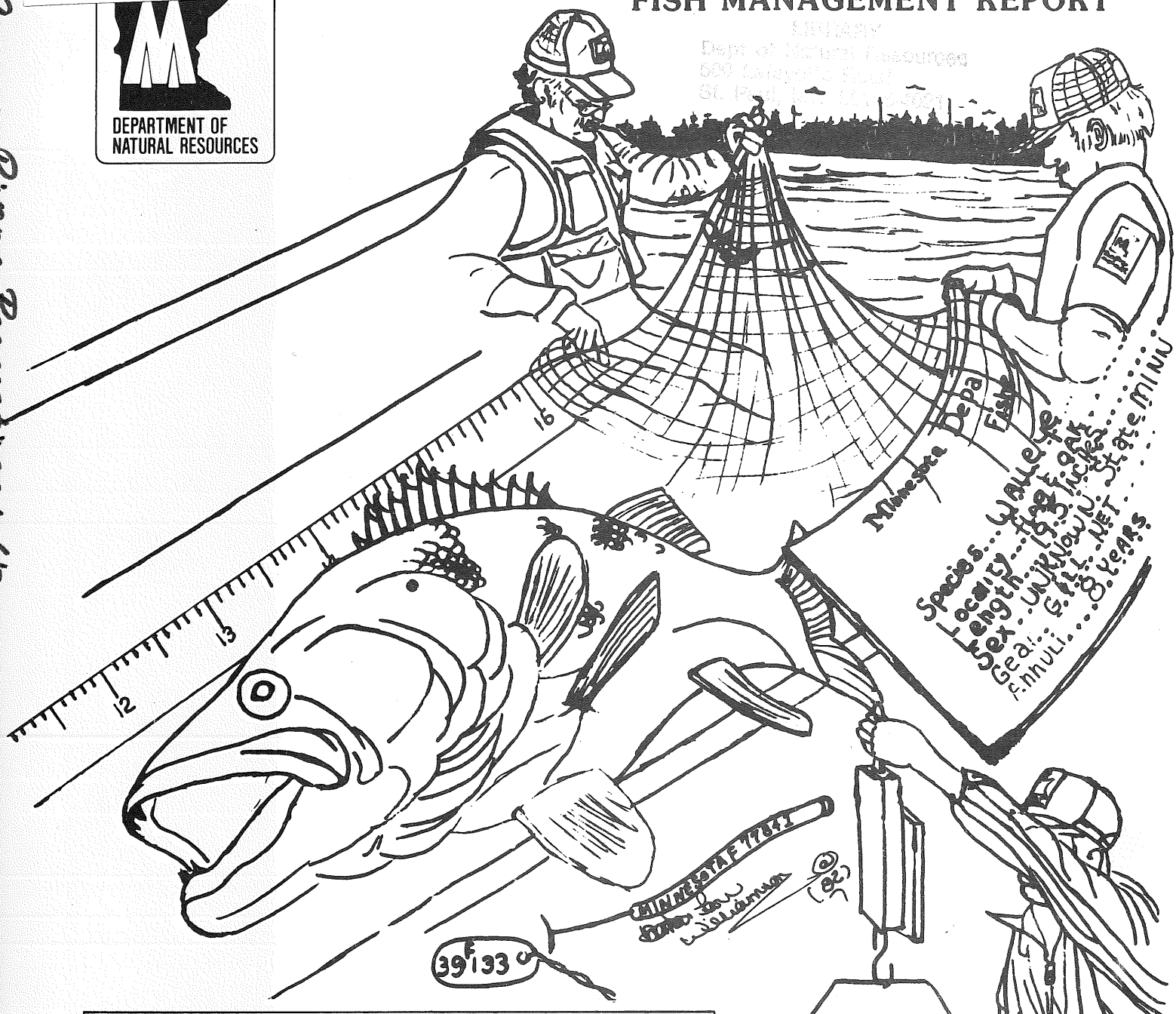

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THE CANNON RIVER: RECREATIONAL USE OF A WARMWATER STREAM

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THE CANNON RIVER: RECREATIONAL USE OF A WARMWATER STREAM[1]

by

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ABSTRACT

The recreational uses of the Cannon River corridor were surveyed from 1 April through 30 September 1984. The Cannon River supported substantial recreational activity including bank angling (116,192 hrs); canoeing (39,720 hrs); and tubing (31,661 hrs). Anglers harvested an estimated 427,800 fish. These included: black bullhead (360,957); black crappie (29,988); carp (11,190); freshwater drum (7,338); and bluegill (4,336). Tailwater sites accounted for 73% of the bank angling pressure and 78% of the harvest. The substantial recreational use that the Cannon River receives has management implications where conflicting uses such as agricultural appropriations, hydroelectric dam flow manipulations, channelization and instream excavations would reduce these benefits.

INTRODUCTION

Warmwater streams throughout Minnesota are being altered by flow manipulation at hydroelectric dams, agricultural appropriations for irrigation, non-point source agricultural pollution, channelization and instream excavation. Many of these streams may receive, or have potential to receive, substantial recreational use. To insure that present recreational use is maintained or potential use attainability is protected, it is necessary to document water based recreation in warmwater stream corridors. These data can be used to determine relative economic values of recreational and non-recreational uses of warmwater streams and appropriate mitigation when conflicts arise over uses of instream water.

The Cannon River, a major tributary of the upper Mississippi River, offers many recreational opportunities to residents of Minnesota and nonresidents from neighboring states. The Cannon River is a designated canoe route from Faribault to the confluence with the Mississippi River and is also included in the Minnesota Wild and Scenic Rivers program. It is classified as recreational from Faribault to Cannon Falls and scenic from Cannon Falls to the mouth. The Cannon River is located in an intensively agricultural and relatively water poor area of Minnesota. It is close to the Twin Cities metropolitan area and several other urban areas. The probability of conflicting uses of instream water is high in the Cannon River corridor; therefore, collection of biological and recreational use data is imperative.

A cooperative recreational use survey of the Cannon River was conducted by the Waterville and Lake City Area Fisheries Stations from 1 April through 30 September 1984. The Trails and Waterways Unit

of the Department of Natural Resources helped fund the project and provided economic questions which were included in the survey. The results of the economic survey are contained in a separate report (Hiller and Kelly 1985). In conjunction with the recreational use survey, a biological survey of the Cannon River was completed in 1984 (Waterville and Lake City Management Files).

STUDY AREA

The Cannon River flows approximately 112 mi from the source at the outlet of Shield's Lake in Rice County to the confluence with the Mississippi River in Goodhue County (Fig. 1). There are nine lakes/impoundments and eight dams along its course. The lowermost 7 mi of stream (below the U.S. Highway 61 bridge) are in the Mississippi River flood plain. Most of the stream (85 mi) flows through a narrow corridor of bottomland hardwood forest with adjacent crop and pasture land. The uppermost 20 mi flow through wetlands. The Cannon River above Tetonka Lake can be intermittent during dry periods.

A wide variety of cool and warmwater fish species are found in the Cannon River (Table 1). The Cannon River watershed has been affected by wetland drainage, headwater stream channelization, and conversion of marginal/erodable land to crop and pasture land. These changes have caused excessive erosion, siltation, fluctuation extremes in discharge and water quality problems that limit game fish abundance. Historically, a major portion of the Cannon River was considered excellent smallmouth bass (Micropterus dolomieui) water; however, populations are presently at extremely low levels. Smallmouth bass numbers had been fairly high in the Cannon River from Welch to Byllesby Reservoir until 1977 (Lake City Management Files). At that

time, Byllesby Reservoir was drained for dam repairs causing increased ammonia and suspended solids along with decreased dissolved oxygen levels downstream. This resulted in an extensive fish kill which severely reduced or extirpated smallmouth bass in the affected reach. The dam at Welch prohibited natural reintroduction of smallmouth bass and reintroduction by stocking has met with limited success.

METHODS

Recreational uses of the Cannon River (excluding lakes and impoundments) were surveyed from the U.S. Highway 61 bridge to the source at Shield's Lake (105 mi). The method employed was a roving instantaneous count angler interview survey using random stratified non-uniform probability sampling as described by Daley and Skrypek (1964) with modifications suggested by Hoenig (MN Department of Natural Resources, personal communication 1984).

The Cannon River was divided into seven sections with a variable number of activity sites (27 total) described for each section (Table 2). Three sections with 10 sites and 4 sections with 17 sites were sampled for the Waterville and Lake City areas, respectively. Sections and sites are referred to using a prefix of W or L for Waterville or Lake City followed by the section letter designation and the site number designation (e.g. W-A-4 is Waterville, Section A, site 4).

Sampling effort consisted of three clerks (two clerks for Lake City and one clerk for Waterville) each working three weekdays and two weekend/holidays per week. Days off were chosen randomly. Data collection and analysis were stratified by weekdays and weekend/holidays. For each workday, one of three possible shifts

was randomly chosen: Waterville area - 0600-1400, 1000-1800 and 1400-2200 hours; Lake City area - 0700-1400, 1030-1730 and 1400-2100 hours.

Recreational use patterns were expected to be different for the Waterville and Lake City areas; therefore, survey methods differed. For the Waterville area, the level of fishing expected at each site was judged from past qualitative observations. Sites were then divided into two groups by use intensity. The frequency and order the clerk visited sites within a group were determined randomly based on the expected fishing level. Four sites were visited daily for two hours each and instantaneous counts were made of all anglers upon arriving at a site. Instantaneous counts of canoeists were not practical because canoe pressure was extremely low; therefore, canoeists were counted during the initial 1.75 hours of the two hour period.

For the Lake City area, sampling effort for each section was determined by the number of activity sites and the expected amount of recreational use. One clerk made two instantaneous counts for an entire section each workday at randomly chosen times. Recreationalists were counted directly except for non-outfitter generated canoeists whose parked cars were counted. (Canoes were generally not visible for counts.) Recreational use generated by two private outfitters (Paul's Landing, Section L-C; and Welch Mills, Section L-D) and within one private campground (Hidden Valley Campground, Section L-C) were not included in the counts. Instead, the private outfitters logged canoe and tube rentals, and the private campground logged the number of visitors.

Interviews were conducted with all anglers and canoeists who

could be contacted excluding those within Hidden Valley Campground. Interviews collected information on trip length, number and length of each fish species harvested, fishing method, number of people per party, gender, age, miles traveled, and residence.

Data analysis methods also differed between the Waterville and Lake City areas. For the Lake City area, data analysis was stratified by time of day: data collected during the early (0700-1030) and late (1730-2100) time periods were analyzed separately from data collected during the middle (1030-1730) time period. For the Waterville area, data analysis was not stratified by time of day. For both areas, bank angling hours were estimated for each site by multiplying the mean number of anglers counted by the available daylight hours for each strata. Anglers who were wading were included as bank anglers.

Canoe angling hours were estimated for Lake City sections by multiplying the proportion of canoeists who were angling (from interviews) by the total number of estimated canoe hours. Canoeists within Hidden Valley Campground were not included in this estimate. For the Waterville area, canoe trips were estimated for each section by multiplying the quotient of the number of canoes counted and the number of hours censused by the available daylight hours for each strata. Each canoe counted was assumed to represent one trip. For the Lake City area, canoeist hours (excluding private outfitters and campground) were estimated for each section, by multiplying the mean number of canoeists' cars counted times the mean number of canoeists per car (from interviews) times the available daylight hours for each strata. Canoeing was assumed to be taking place in the section in which the car(s) were counted. Other recreational pressure was estimated for

each site (excluding Hidden Valley Campground) by multiplying the mean number of other recreationalists counted by the available daylight hours for each strata. Other recreational pressure was separated into specific categories in proportion to what was observed during counts.

Recreational pressure within Hidden Valley Campground was estimated differently because the area receives extremely high use making counts impractical. The campground owners maintained a record of the total number of users and provided voluntary questionnaires to users asking them to identify and quantify each of the activities in which they participated. Pressure estimates for tubing, canoeing, swimming and angling were calculated by multiplying the mean number of hours spent at each activity (from questionnaire) by the total number of visitors to the campground.

Paul's Landing and Welch Mills maintained a daily log of canoeists' and tubers' trip lengths and locations. Hours of pressure from these two sources represent real values rather than estimates.

Harvest rates were calculated for each strata by dividing the number of harvested fish recorded by the number of hours of fishing recorded during angling interviews. Monthly harvest rates were derived for each section and for high use sites within sections by calculating a weighted mean of the strata estimates. Harvest rate data were not collected for angling within Hidden Valley Campground.

Harvest was calculated by multiplying the pressure estimate by the harvest rate for each strata. Monthly harvest was calculated for each section and for high use sites within sections by summing the estimates for each strata. Harvest data were not calculated for angling within Hidden Valley Campground.

RESULTS

Recreational Use

Bank angling accounted for 57% of the recreational uses on the Cannon River (Table 3). Canoeing and tubing accounted for an additional 20% and 16% of the recreational uses, respectively. Combined angling, canoeing and tubing pressure was 187,573 hrs. Seven percent of the dominant recreational use was identified as miscellaneous, of which 77% was picnicking and/or lounging adjacent to the stream.

Bank angling comprised 98% of the total angling pressure (Table 4). Bank angling pressure was highest in May (42,417 hrs) and lowest in September (5,154 hrs) (Table 5). The highest bank angling pressure occurred in Section W-B (29,804 hrs) and Section L-B (21,976 hrs). Tailwaters sites accounted for 73% of the bank angling pressure and had the highest angling use in all sections except L-C (Table 6).

Canoe angling was of very minor importance in the Cannon River fishery. Only 860 hours were estimated for the Lake City area and no hours for the Waterville area (Table 7).

Total estimated canoe use in the Lake City area was 39,611 hrs. Canoe use was very low in the Waterville area (285 trips). Seventy-seven percent of the canoe pressure in the Lake City area occurred in Section C (Table 8). Fifty-nine percent of the canoe usage in the Lake City area was generated by private outfitters. Canoe use was highest in July and lowest in April (Table 9).

Tubing, picnicking/lounging, and swimming were also popular activities on the Cannon River. Total tubing recreation was 31,661 hrs

and was generated exclusively by private outfitters (Table 10). Picnicking/lounging recreation was 12,328 hrs and swimming use was 6,169 hrs (Tables 11 and 12).

Harvest Statistics

Black bullhead (Ictalurus melas) harvest rates were the highest of any species in all Waterville sections while harvest rates in the Lake City sections showed more species variability (Table 13). Species showing the highest harvest rates in Lake City sections were: crappie [99.7% black crappie (Pomoxis nigromaculatus)] in L-A (1.21 fish/hr), black bullhead in L-B (0.36 fish/hr) and L-C (0.32 fish/hr), and carp, (Cyprinus carpio) in L-D (0.10 fish/hr). Black bullhead harvest rates and total harvest rates showed a general decline from upstream sections to downstream sections and were highest in Sections W-B (8.71 and 9.04 fish/hr, respectively) and lowest in Section L-D (0.05 and 0.47 fish/hr, respectively).

The highest estimated total harvest rates among Waterville and Lake City sites were 9.64 fish/hr in W-B-1 and 2.54 fish/hr in L-A-1 (both tailwaters sites) (Tables 14 and 15). Black bullhead harvest rate in W-B-1 was 9.30 fish/hr. Black bullhead and crappie harvest rates in L-A-1 were 1.11 and 1.24 fish/hr, respectively. The highest crappie harvest rate occurred in L-B-5 (1.27 fish/hr).

Total estimated harvest was 354,817 fish in the Waterville area and 72,983 fish in the Lake City area. Waterville harvest was dominated by black bullhead (335,758). Lake City harvest was dominated by black bullhead (25,199), black crappie (20,985), carp (Cyprinus carpio) (10,336) and freshwater drum (Aplodinotus grunniens) (5,890) (Table 16). Other species commonly harvested in the Waterville area

besides black bullhead were: black crappie (9,003), bluegill (Lepomis machrochirus) (3,875), yellow bullhead (Ictalurus natalis) (1,566) and freshwater drum (1,448). Species commonly harvested in the Lake City area included channel catfish (Ictalurus punctatus) (1,479), northern pike (Esox lucius) (1,169), white sucker (Catostomus commersoni) (1,149), shorthead redhorse (Moxostoma macrolepidotum) (1,057) and white bass (Morone chrysops) (1,307).

W-B accounted for 75% of the Waterville harvest and L-A and L-B accounted for 42% and 33% of the Lake City harvest, respectively (Tables 17 and 18). L-C had the lowest estimated harvest of any section (8,851). Black bullhead estimated harvest was highest in W-B (255,936) and black crappie estimated harvest was highest in L-A (14,990).

Seventy-eight percent of the total estimated fish harvest on the Cannon River occurred at tailwaters sites (Tables 16, 19 and 20). Site W-B-1 had the highest harvest of any site (190,929) of which 97% were black bullhead. The largest harvest estimate among Lake City sites was at L-A-1 (30,249) of which 51% were black bullhead and 44% were crappie. The largest estimated harvest for a non-tailwaters site was at W-B-2 (51,659) of which 95% were black bullhead.

User Characteristics

Angler characteristics showed both differences and similarities between the Waterville and Lake City areas. Most anglers fished from shore with live bait in both areas (Table 21). Angler age distribution was also similar between the two areas. The highest percentage age group for both areas were children aged 15 years or younger (Table 22). The Waterville area had a fairly even distribution among remaining age

groups while the Lake City area had a larger percentage of anglers between 35 and 44 years and a somewhat smaller percentage of anglers older than 44 years. Anglers fishing in the Waterville area tended to drive farther and were more likely to be nonresidents than in the Lake City area (Table 23). Ninety-nine percent of the anglers in the Lake City area drove 50 mi or less while 47% of the Waterville area anglers drove more than 50 mi. Thirty-three percent of the Waterville area anglers were nonresidents compared to less than 1% for the Lake City area (Table 23). Twenty-five percent of the Lake City area anglers were southeast Asian immigrants compared to less than 2% for the Waterville area.

Most canoeists in the Lake City area traveled less than 51 mi (86%) and tended to be younger than 35 years (Table 24). Forty percent of the canoeists were between 25 and 34 years of age and 7% were nonresidents. Canoeists usually did not cross study section boundaries.

DISCUSSION

The Cannon River corridor supports a substantial amount of recreation of which bank angling is the most popular. Angling has been found to be the dominant use in other water based recreational use surveys in Minnesota (Watson and Hawkinson 1979; Tureson 1978; Gilbertson 1979, 1980a, 1980b). Canoeing and tubing were also very popular and the distribution of that pressure was affected to some extent by the location of private outfitters. Picnicking/lounging was also found to be a major recreational use of the Cannon River. Hess and Ober (1981) found sightseeing to be the dominant activity on the Flint and Chattahoochee rivers in Georgia. Fleener (1971) also

observed sightseeing, picnicking and other non-consumptive recreational uses as significant activities along the Platte River in Missouri. These types of recreation were likely underestimated for the Cannon River because sampling probabilities reflected fishing and canoeing use. Also, the survey was not designed to make counts in areas such as the Cannon River Wilderness Area (Rice County Park), Carleton College Arboretum at Northfield and Hidden Valley Campground. Aesthetics becomes an important resource consideration where these types of recreation are popular.

The importance of tailwater fisheries was dramatically demonstrated by this survey. Most of the angling pressure was concentrated at tailwaters sites regardless of access. The notably high angling pressure and fish harvest estimates at W-B-1, W-B-2 and L-B-1 are related to lakes that function as reservoirs of fish for these sites. Expressing pressure and harvest statistics as hrs/mi and fish/mi may be less meaningful in the case of the Cannon River than for a stream where pressure is more uniformly distributed or is without lakes or reservoirs along its course.

The principal sport fish harvests along the Cannon River were for species typically classified as commercial fish and generally not regarded as valuable in Minnesota. This may be related to several factors including regional preferences and/or lack of other fisheries resources in the immediate area. The Cannon River bullhead fishery offers local as well as out-of-state anglers opportunities for inexpensive fishing trips with excellent harvest rates and a liberal bag limit. The acceptance of bullhead angling in the Waterville area was high during 1984 where 54% of Cannon River anglers indicated

preference for bullhead and 22% sought "no particular species." This intense utilization of bullhead has resulted in closure of commercial bullhead fishing for social reasons on some Waterville area lakes along the Cannon River. Carp, freshwater drum, white sucker and shorthead redhorse were also acceptable to many anglers in the Lake City area. This was in part due to the large numbers of southeast Asian immigrants who fished Lake City sections of the Cannon River.

Warmwater streams in Minnesota are generally assumed to be underutilized for angling. Results of this survey have described an intensively fished resource that also receives significant canoeing and tubing pressure. Presently, competing recreational uses of the river are spatially separated with anglers concentrated at low-head dams with canoeists and tubers using the intermediate reaches. In the future, more anglers may choose to fish from canoes or the banks of low use reaches between dams. This could eventually become a source of conflict for these groups.

Anglers using the Cannon River were typically younger than 16 years of age. Children are one of many groups that are mobility restricted as far as angling opportunities are concerned. Tailwaters fisheries are frequently located within urban areas and provide convenient, shore-based places to fish. Warmwater streams like the Cannon River provide many of the initial fishing experiences that influence young people to become avid anglers.

Tourism was also a significant factor in the profile of Cannon River users. Within the Waterville area, one-third of the anglers were from out-of-state. Many of these visitors came from relatively "water poor" states and fished the Cannon River with satisfaction. The Lake

City area had few out-of-state visitors (<1%) but many anglers, canoeists and tubers traveled from the Twin Cities metropolitan area (population >2 million) to use the Cannon River for day trips and overnight visits. Hiller and Kelly (1985) estimated that trip expenditures associated with total recreational use of the Cannon River from 1 April through 30 September 1984 were $686,000. This represents a considerable positive economic impact to communities located along the Cannon River.

Improvements of public access along the Cannon River should be of primary concern for communities located near low-head dam sites. Many tailwaters sites had substantial angling pressure but some sites probably would have attracted more anglers if additional shore fishing areas or river access were available (e.g. W-B-1 and W-B-2). Purveyors of food, bait and other amenities also appeared to be less than adequate at some sites. By improving these services, many communities could realize greater local spending based on nearby tailwaters fisheries.

This survey suggests that the Cannon River corridor should be managed primarily for recreation. The Cannon River is faced with many of the problems confronting warmwater streams in agricultural watersheds. Although point source pollution has been largely abated through improvements in wastewater treatment plants, non-point source pollution remains a critical problem for stream water quality. The federal government's Conservation Reserve Program and Minnesota's Reinvest in Minnesota (RIM) program each offer opportunities for water quality improvements through retirement of marginal, erodable lands within the watershed. Siting of RIM acres is specifically targeted for

riparian corridors. Because much of the Cannon River watershed is affected by artificial drainage systems, increased awareness and enforcement of laws related to maintenance of riparian greenbelts along ditches would likely improve water quality and potentially aid in reducing downstream discharge fluctuations. Improved water quality would benefit the fish community and enhance the aesthetics of the stream which is important for persons engaging in non-consumptive forms of recreation.

Development of protected instream flows for the Cannon River will be a critical management issue for the future. Traditional fish management of the Cannon River has been primarily directed to the nine lakes/reservoirs located along the corridor. Substantial sport fisheries are present in these basins and much of this historical effort was justified. Management of discharge from the Cannon River has been and is directed at flood control within the flood plain, maintenance of lake levels for recreational and aesthetic values as well as hydroelectric generation at Byllesby Dam. Recreational values derived from maintaining instream flows typically were not considered.

The economic values associated with recreational uses of the Cannon River suggest that recreational opportunities are providing the greatest public benefit relative to other uses of instream water and the corridor in general. Therefore, appropriation for agricultural irrigation or flow manipulation at hydroelectric sites should not be allowed to an extent where recreation may be negatively impacted. In fact, instream flow regimes could be developed that would possibly increase the recreational value of the river. This may involve storage of water in the lakes/reservoirs with releases during normally dry

months. The result would be extended fishing periods at tailwaters sites that would normally have less than adequate discharge for acceptable angling. Canoeing and tubing recreation would also benefit. Although most of the lakes in the Cannon River chain have histories of infrequent winterkill because of oxygen depletion, protected instream flows could be developed incorporating these concerns. Installation of aeration devices in these lakes may be a cost effective mitigative measure.

LITERATURE CITED

Daley, S.A., and J. Skrypek. 1964. Angler Creel Census of Pools 4 and 5 of the Mississippi River, Goodhue and Wabasha Counties, Minnesota. 1962-63. Minn. Sec. Res. and Plan. Invest. Report No. 277: 50 pp.

Fleener, G.C. 1971. Recreational use of the Platte River, Missouri. Pages 63-78 in E. Schneberger, editor. Stream Channelization, A Symposium. North Cent. Div. Amer. Fish. Soc., Spec. Pub. 2.

Gilbertson, B. 1979. A water surface use study of fifteen metro area lakes, May to September, 1978. Minn. Dept. Nat. Res., Div. Fish. Wildl., Sect. Fish. Mgmt. Rep. No. 16: 55 pp.

Gilbertson, B. 1980a. A creel census and water use study of Waconia Lake, Carver County. Minn. Dept. Nat. Res., Div. Fish Wildl., Sect. Fish. Mgmt. Rep. No. 18: 37 pp.

Gilbertson, B. 1980b. A water surface use study of twenty-one metro area lakes. Minn. Dept. Nat. Res., Div. Fish. Wildl., Sect. Fish. Mgmt. Rep. No. 22: 51 pp.

Hess, T.B., and R.D. Ober. 1981. Recreational use surveys on two Georgia rivers. Pages 14-20 in L.A. Krumholz, editor. Proceedings of a National Symposium on Fisheries Aspects of Warmwater Streams.

Hiller, J., and T. Kelly. 1985. Preliminary Report on 1984 Cannon River Recreation Survey. Minn. Dept. Nat. Res., Office of Planning, Data Section. 37 pp. (Mimeo)

Tureson, F. 1978. A creel census and water surface use study of the Mississippi River from the Coon Rapids Dam to the mouth of the Minnesota River, May 8 to September 30, 1976. Minn. Dept. Nat. Res., Sect. Fish., Fish. Mgmt. Rep. No. 3: 39 pp.

Watson, L.D., and B.W. Hawkinson. 1979. A recreational use survey of Pool 5 Upper Mississippi River, January 1 to December 31, 1978. Minn. Dept. Nat. Res., Div. Fish Wildl., Sect. Fish. Invest. Rep. No. 362: 23 pp.

Table 1. Fish species list for the Cannon River (information from 1970, 1977, 1984 and 1985 sampling).

Bowfin	(Amia calva)
Gizzard shad	(Dorosoma cepedianum)
Mooneye	(Hiodon tergisus)
Brown trout	(Salmo trutta)
Brook trout	(Salvelinus fontinalis)
Northern pike	(Esox lucius)
Central stoneroller	(Campostoma anomalum)
Carp	(Cyprinus carpio)
Brassy minnow	(Hybognathus hankinsoni)
Silver chub	(Hybopsis storeriana)
Hornyhead chub	(Nocomis biguttatus)
Golden shiner	(Notemigonus crysoleucas)
Emerald shiner	(Notropis atherinoides)
Common shiner	(Notropis cornutus)
Bigmouth shiner	(Notropis dorsalis)
Spottail shiner	(Notropis hudsonius)
Spotfin shiner	(Notropis spilopterus)
Sand shiner	(Notropis stramineus)
Mimic shiner	(Notropis volucellus)
Bluntnose minnow	(Pimephales notatus)
Fathead minnow	(Pimephales promelas)
Blacknose dace	(Rhinichthys atratulus)
Longnose dace	(Rhinichthys cataractae)
Creek chub	(Semotilus atromaculatus)
Pearl dace	(Semotilus margarita)
Quillback	(Carpiodes cyprinus)
White sucker	(Catostomus commersoni)
Northern hog sucker	(Hypentelium nigricans)
Bigmouth buffalo	(Ictiobus cyprinellus)
Silver redhorse	(Moxostoma anisurum)
Golden redhorse	(Moxostoma erythrurum)
Shorthead redhorse	(Moxostoma macrolepidotum)
Greater redhorse	(Moxostoma valenciennesi)
Black bullhead	(Ictalurus melas)
Yellow bullhead	(Ictalurus natalis)
Channel catfish	(Ictalurus punctatus)
Stonecat	(Noturus flavus)
Tadpole madtom	(Noturus gyrinus)
Burbot	(Lota lota)
White bass	(Morone chrysops)
Rock bass	(Ambloplites rupestris)
Hybrid sunfish	(Lepomis spp.)
Green sunfish	(Lepomis cyanellus)
Pumpkinseed	(Lepomis gibbosus)
Bluegill	(Lepomis machrochirus)
Smallmouth bass	(Micropterus dolomieui)
Largemouth bass	(Micropterus salmoides)
White crappie	(Pomoxis annularis)

Table 1. Continued.

Black crappie	(Pomoxis nigromaculatus)
Fantail darter	(Etheostoma flabellare)
Johnny darter	(Etheostoma nigrum)
Yellow perch	(Perca flavescens)
Log perch	(Percina caprodes)
Blackside darter	(Percina maculata)
Sauger	(Stizostedion canadense)
Walleye	(Stizostedion vitreum vitreum)
Freshwater drum	(Aplodinotus grunniens)

Table 2. Sections and sites sampled for the Cannon River recreational use survey, 1 April through 30 September 1984.

	Waterville sections (mi)[a]		
Site	A: MN Hwy. 13 to Maiden Rock campground (30.6 mi)	B: Morristown to MN Hwy. 60 (4.4 mi)	C: Kings Mill Dam (1.7 mi)
1	MN Hwy. 13 crossing	Morristown Dam	Kings Mill Dam
2	Gorman Lake Dam	Morristown Park	
3	LeSueur County Hwy. 12 crossing	MN Hwy. 60 wildlife area	
4	Schmidtke Dam	MN Hwy. 60 crossing	
5	Maiden Rock campground		

	Lake City sections (mi)			
Site	A: Faribault to Northfield (16.6 mi)	B: Northfield to Byllesby Dam (10.0 mi)	C: Byllesby Dam to Welch (14.0 mi)	D: Welch to U.S. Hwy. 61 (6.0 mi)
1	Woolen Mills Dam to Straight River	Northfield Dam to Spring Creek	Byllesby Dam tailwaters	Welch Dam tailwaters
2	Rice County Hwy. 29	Northfield water plant and Dakota Hwy. 47 access	MN Hwy. 52 crossing and Cannon Falls	U.S. Hwy. 61 crossing
3	MN Hwy. 3 crossing and Dundas	Waterford crossing	Mouth of Trout Brook	
4	Sechler and Riverside Parks	Alta Ave. crossing and Sciota Trail	Access 0.8 mi above Welch Dam	
5		"Cascades"	Access above Welch Dam	
6		Randolph RR crossing to MN Hwy. 56 crossing		

[a] Indicated mileages are for stream reaches within a section excluding lake/reservoir miles.

Table 3. Estimated hours of pressure for the dominant recreational uses of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Area	Pressure (hrs)			
	Angling	Canoeing	Tubing	Miscellaneous
Waterville	52,233(3,064)	ND[a]	---	---
Lake City	63,959(4,075)	39,720(1,823)	31,661(10,614)	16,071(1,369)
TOTAL	116,192(4,149)	39,720(1,823)	31,661(1,776)	16,071(1,369)[b]

[a] Pressure estimate in hours is not available; estimated number of canoe trips was 285.

[b] Seventy-seven percent of the miscellaneous pressure consisted of picnicking/lounging adjacent to the stream.

Table 4. Estimated hours of angling pressure by angling type on the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Area	Angling type			Total
	Bank	Canoe	Hidden Valley Campground	
Waterville	52,233(3,064)	---	---	52,233(3,064)
Lake City	61,701(2,754)	806(106)	1,452(475)	63,959(2,797)
TOTAL	113,934(4,120)	806(106)	1,452(475)	116,192(4,149)

Table 5. Estimated hours of bank angling pressure[a] by month on the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Month	Section A	Section B	Section C	Section D	Monthly total all sections
		Waterville sections			
April	385(219)	3,203(850)	1,028(485)		
May	4,332(1,268)	12,461(1,456)	4,045(398)		
June	1,082(747)	6,777(1,064)	2,620(452)		
July	1,142(516)	5,741(988)	3,177(657)		
August	545(193)	856(197)	2,326(571)		
September	462(228)	766(231)	1,285(645)		
TOTAL	7,948(1,603)	29,804(2,246)	14,481(1,331)		
TOTAL/mi	260(52)	6,774(510)	8,518(783)		
		Lake City sections			
April	738(134)	2,481(452)	2,059(518)	1,409(561)	11,303(1,387)
May	2,777(549)	10,864(1,052)	2,690(446)	5,248(856)	42,417(2,495)
June	3,757(795)	3,150(600)	2,019(370)	4,204(974)	23,609(1,993)
July	3,371(820)	3,619(588)	1,732(300)	2,754(837)	21,536(1,668)
August	856(220)	1,110(210)	2,133(374)	2,089(432)	9,915(906)
September	319(119)	752(172)	1,171(212)	399(217)	5,154(811)
TOTAL	11,818(1,298)	21,976(1,446)	11,804(938)	16,103(1,711)	113,934(4,119)
TOTAL/mi	712(78)	2,198(145)	843(67)	2,684(285)	1,368(49)

[a] Excludes bank angling pressure in Hidden Valley Campground.

Table 6. Estimated hours of bank angling pressure[a] by site on the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Site	Section A	Section B	Section C	Section D
		Waterville sections		
1	693(693)	20,033(1,440)[a]	14,481(1,331)[a]	
2	4,038(1,029)[a]	8,989(1,696)		
3	977(682)	114(61)		
4	1,707(644)[a]	668(304)		
5	534(388)			
6				
TOTAL	7,948(1,603)	29,804(2,246)	14,481(1,331)	
		Lake City section		
1	10,899(1,278)[a]	12,572(1,159)[a]	3,559(440)[a]	16,103(1,711)[a]
2	53(39)	763(184)	7,511(800)	---
3	233(126)	863(188)	197(71)	
4	633(184)	455(137)	469(201)	
5		1,848(384)	68(34)	
6		5,475(715)		
TOTAL	11,818(1,298)	21,976(1,446)	11,804(938)	16,103(1,711)

[a] Denotes tailwaters site.

Table 7. Canoeist angling hours[a] for Lake City sections[b] of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Section				
A	B	C	D	All
---	135(35)	426(70)	299(72)	860(106)

[a] Excludes canoe angling in Hidden Valley Campground.
[b] Canoe angling was not observed in the Waterville section.

Table 8. Estimated and tabulated canoe usage for the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Month	Waterville sections (trips) A	B	C	All	Lake City sections canoeist (hrs) A	B	C	D	All
Non-outfitter	136	57	92	285	2,574(451)	1,037(226)	7,469(634)	5,097(641)	16,177(1,034)
Paul's Landing & Welch Mills	---	--	--	---	---	120	14,452	149	14,721
Hidden Valley Campground	---	--	--	---			8,713(1,501)	---	8,713(1,501)
Miscellaneous[b]	---	--	--	---	109	---	---	---	109
TOTAL	136	57	92	285	2,683(451)	1,157(226)	30,634(1,629)	5,246(641)	39,611(1,823)
TOTAL/mi	4	13	54	8	162(27)	116(23)	2,188(116)	874(107)	850(39)

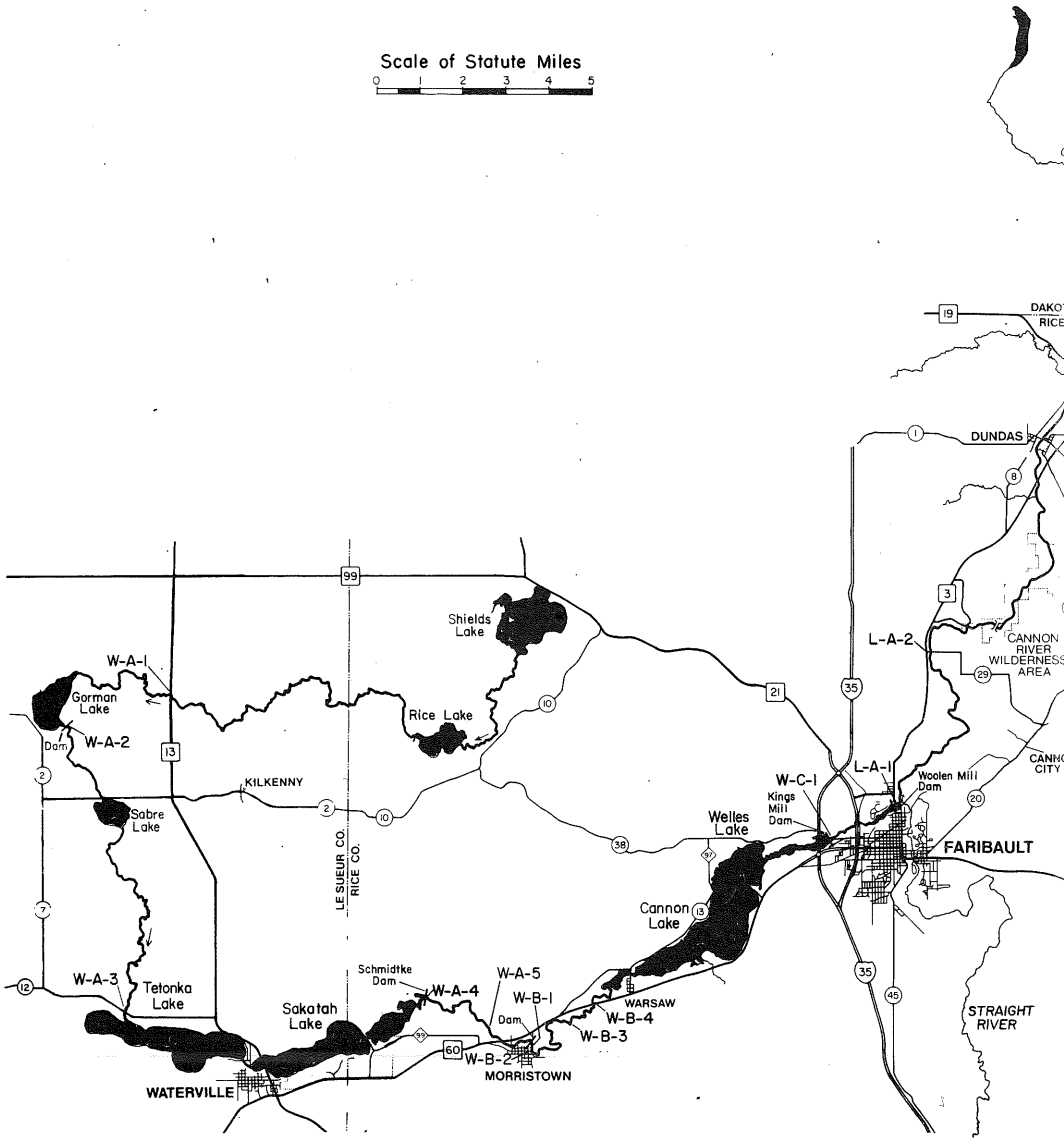
[a] Canoe pressure for Paul's Landing and Welch Mills and the miscellaneous category represent real values.
[b] Includes canoeist hrs for St. Olaf College canoe class and Faribault Heritage Canoe Race.

Table 9. Estimated and tabulated canoe pressure[a] by month for the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Month	Waterville sections (trips)				Lake City sections canoeist (hrs)				
	A	B	C	All	A	B	C	D	All
April	--	--	--	--	227(138)	42(30)	356(130)	---	634(192)
May	76	16	26	118	114(59)	148(66)	1,783(124)	237(148)	2,282(212)
June	--	20	--	20	436(203)	224(142)	3,402(195)	437(190)	4,499(368)
July	29	8	20	57	1,190(309)	415(111)	9,350(438)	173(86)	11,128(554)
August	31	13	46	90	370(131)	196(100)	6,358(347)	34[b]	6,958(384)
September	--	--	--	--	237(165)	132(60)	663(142)	4[b]	1,036(226)
TOTAL	136	57	92	285	2,574(451)	1,157(226)	21,921(634)	885(256)	26,537(850)
TOTAL/mi	4	13	54	8	155(27)	116(23)	1,566(45)	148(43)	569(18)

[a] Includes estimated non-outfitter canoe pressure and tabulated canoe pressure for Paul's Landing and Welch Mills. (Hidden Valley Campground canoe pressure is not included.)

[b] All tabulated hours; no standard deviation.


Scale of Statute Miles
0 1 2 3 4 5
DUNDAS
CANNON RIVER WILDERNESS AREA
FARIBAULT
Woolen Mill Dam
Kings Mill Dam
L-A-1
L-A-2
W-C-1
Welles Lake
Cannon Lake
STRAIGHT RIVER
Shields Lake
Rice Lake
Gorman Lake
Dam
W-A-1
W-A-2
KILKENNY
Sabre Lake
LE SUEUR CO.
RICE CO.
W-A-3
Tetonka Lake
Sakatah Lake
Schmidtke Dam
W-A-4
W-A-5
W-B-1
Dam
WARSAW
W-B-4
W-B-3
W-B-2
MORRISTOWN
WATERVILLE

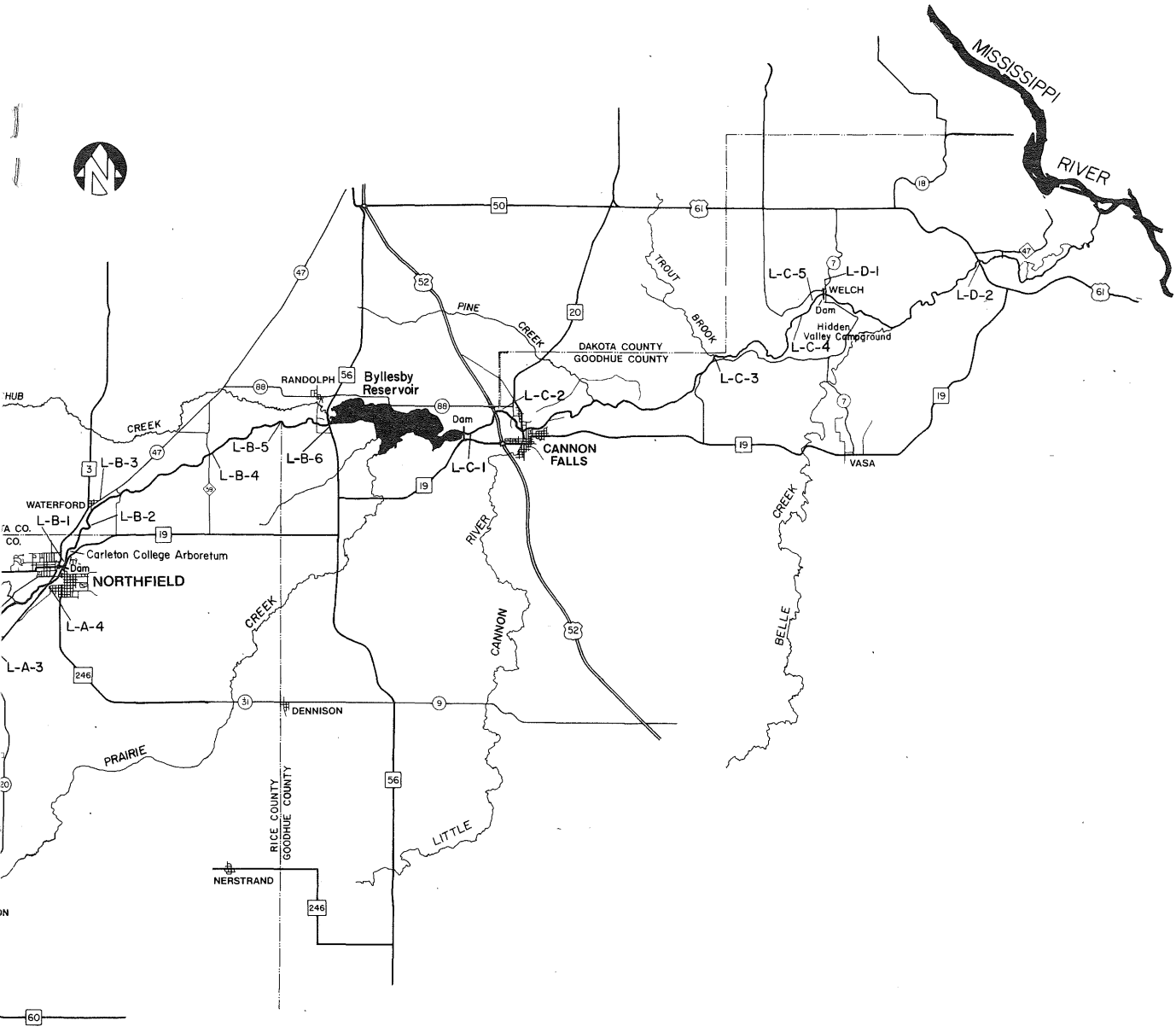


Figure 1. Creel survey sampling sites along the Cannon River, Minnesota (W = Waterville sampling sites; L = Lake City sampling sites; A-D = sample sections; 1-6 = sampling sites within a section).

Table 10. Estimated and tabulated tubing recreation[a] for the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Outfitter			
Paul's Landing	Welch Mills	Hidden Valley Campground	All
9,198	10,845	11,618(1,776)	31,661(1,776)

[a] Values for Paul's Landing and Welch Mills are tabulated; value for Hidden Valley Campground is estimated.

Table 11. Estimated hours of miscellaneous recreational pressure with breakdown of recreation types for Lake City section on the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Recreation type	Sections A	B	C	D	Total
Total	4,445(736)	7,110(818)	2,410(471)	2,106(666)	16,071(1,370)
Picnic/lounge	4,094	6,528	949	757	12,328
Swimming	241	400	601	571	1,813
Camping	tr	tr	798	730	1,528
Spearing	22	37	13	9	81
Horseback riding	22	37	--	--	59
Hiking	44	73	--	--	117
Photography	tr	tr	--	--	tr
Boating	tr	tr	38	27	65
Trapping	--	--	11	12	23
Minnow seining	22	35	--	--	57

Table 12. Recreational use (hrs) in Hidden Valley Campground on the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Type of trip	Trips	Recreational use (hrs) Tubing	Canoeing	Swimming	Angling
Day	772	1,235(289)	926(244)	463(154)	154(77)
Overnight	3,909	6,255(1,463)	4,692(1,236)	2,345(782)	782(391)
Seasonal	2,580	4,128(965)	3,096(816)	1,548(516)	516(258)
TOTAL	7,261	11,618(1,776)	8,713(1,501)	4,356(949)	1,452(475)

Table 13. Harvest rates (fish/hr) for Waterville and Lake City sections of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Section A	Section B	Section C	Section D
		Waterville		
Northern pike	0.02(0.01)	tr	0.01(0.01)	
Carp	0.01(0.01)	0.03(0.01)	---	
Black bullhead	3.19(0.57)	8.71(0.37)	2.89(0.29)	
Yellow bullhead	0.06(0.05)	0.04(0.01)	0.02(0.01)	
White bass	---	0.01(0.01)	0.02(0.01)	
Bluegill	0.14(0.10)	0.03(0.01)	0.08(0.03)	
Black crappie	0.03(0.02)	0.19(0.03)	0.26(0.05)	
Yellow perch	---	---	0.03(0.02)	
Walleye	0.04(0.05)	---	0.03(0.01)	
Freshwater drum	---	0.03(0.01)	0.05(0.03)	
Other[a]	tr	tr	tr	
TOTAL HARVEST RATE	3.48(0.57)	9.04(0.37)	3.39(0.29)	
		Lake City		
Northern pike	0.02(0.01)	0.02(0.01)	0.02(0.01)	0.01(0.01)
Carp	0.03(0.01)	0.29(0.03)	0.12(0.02)	0.10(0.01)
Black bullhead	0.96(0.12)	0.36(0.04)	0.32(0.07)	0.05(0.01)
Channel catfish	tr	0.03(0.01)	0.02(0.01)	0.04(0.01)
White bass	---	0.02(0.01)	0.02(0.01)	0.02(0.01)
Bluegill	0.07(0.03)	tr	tr	---
Smallmouth bass	---	---	0.01(0.01)	0.01(0.01)
Largemouth bass	0.01(0.01)	---	0.01(0.01)	tr
Crappie spp.[b]	1.21(0.11)	0.14(0.03)	0.14(0.02)	0.03(0.01)
Sauger	---	---	---	tr
Walleye	0.02(0.01)	0.01(0.01)	0.03(0.01)	0.01(0.01)
Freshwater drum	0.03(0.01)	0.11(0.01)	0.05(0.01)	0.01(0.01)
Selected panfish[c]	0.02(0.01)	tr	0.03(0.01)	tr
Selected nongame fish[d]	0.01(0.01)	0.06(0.01)	0.04(0.01)	0.09(0.01)
TOTAL HARVEST RATE	2.38(0.17)	1.05(0.07)	0.80(0.07)	0.47(0.03)

[a] Includes: Section A - smallmouth bass; Section B - quillback, bigmouth buffalo, rock bass, largemouth bass and white crappie; Section C - largemouth bass.
[b] Includes white and black crappie.
[c] Includes yellow perch and green sunfish.
[d] Includes: Section A - white sucker and bigmouth buffalo; Section B - quillback, white sucker, northern hog sucker, bigmouth buffalo, golden redhorse, shorthead redhorse and stonecat; Section C - creek chub, white sucker, bigmouth buffalo, golden redhorse and shorthead redhorse; Section D - mooneye, quillback, white sucker, bigmouth buffalo, silver redhorse, golden redhorse and shorthead redhorse.

Table 14. Harvest rates (fish/hr) for selected high use sites[a] in Waterville sections of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Section-site A-2	A-4	B-1	B-2	C-1
Northern pike	0.01(0.01)	0.03(0.03)	tr	tr	0.01(0.01)
Carp	0.02(0.01)	---	0.03(0.01)	tr	---
Black bullhead	3.32(0.75)	3.20(0.94)	9.30(0.43)	5.70(0.59)	2.89(0.29)
Yellow bullhead	---	---	0.03(0.01)	0.02(0.01)	0.02(0.01)
White bass	---	---	0.02(0.03)	---	0.02(0.01)
Bluegill	0.23(0.11)	0.39(0.40)	0.03(0.01)	tr	0.08(0.03)
Black crappie	0.05(0.03)	---	0.19(0.03)	0.27(0.12)	0.26(0.05)
Yellow perch	---	---	tr	---	0.03(0.02)
Walleye	0.06(0.06)	---	tr	0.01(0.01)	0.03(0.01)
Freshwater drum	---	---	0.03(0.01)	0.02(0.02)	0.05(0.03)
Other[b]	---	0.01(0.01)	tr	---	tr
TOTAL HARVEST RATE	3.70(0.77)	3.62(1.02)	9.64(0.43)	6.01(0.61)	3.39(0.29)

[a] All sites are tailwaters except B-2.
[b] Includes: Section A - smallmouth bass; Section B - quillback, bigmouth buffalo, rock bass, largemouth bass and white crappie; Section C - largemouth bass.

Table 15. Harvest rates (fish/hr) for selected high use sites[a] in Lake City sections of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Section-site A-1	B-1	B-5	B-6	C-1	C-2	D-1
Northern pike	0.01(0.01)	0.02(0.01)	0.01(0.01)	tr	0.02(0.01)	0.03(0.01)	0.01(0.01)
Carp	0.01(0.01)	0.48(0.06)	0.01(0.01)	0.13(0.02)	0.19(0.02)	0.10(0.03)	0.10(0.01)
Black bullhead	1.11(0.13)	0.55(0.07)	0.20(0.05)	0.15(0.02)	0.68(0.18)	0.09(0.03)	0.05(0.01)
Channel catfish	tr	0.01(0.01)	---	0.07(0.01)	0.04(0.01)	0.01(0.01)	0.04(0.01)
White bass	tr	0.02(0.01)	0.0(0.01)	0.02(0.01)	0.04(0.01)	tr	0.02(0.01)
Bluegill	0.08(0.03)	0.01(<0.01)	0.02(0.01)	---	tr	---	tr
Smallmouth bass	---	tr	---	---	0.01(0.01)	0.01(0.01)	0.01(0.01)
Largemouth bass	0.01(0.01)	tr	---	---	tr	0.01(0.01)	tr
Crappie[b]	1.24(0.13)	0.07(0.03)	1.27(0.24)	tr	0.18(0.03)	0.12(0.05)	0.03(0.01)
Sauger	---	---	---	---	---	---	tr
Walleye	0.02(0.01)	0.01(0.01)	---	0.01(0.01)	0.07(0.02)	0.01(0.01)	0.01(<0.01)
Freshwater drum	0.03(0.01)	0.13(0.03)	0.02(0.01)	0.16(0.03)	0.11(0.03)	0.02(0.01)	0.11(0.01)
Selected panfish[c]	0.02(0.01)	0.01(0.01)	0.01(0.01)	tr	0.04(0.11)	0.03(0.02)	tr
Selected nongame fish[d]	0.01(0.01)	0.10(0.03)	---	0.10(0.03)	0.02(0.01)	0.06(0.01)	0.09(0.01)
TOTAL HARVEST RATE	2.54(0.19)	1.43(0.11)	1.52(0.25)	0.64(0.05)	1.39(0.19)	0.49(0.10)	0.47(0.03)

[a] Sites A-1, B-1, C-1 and D-1 are tailwaters sites.
[b] Includes white and black crappie.
[c] Includes yellow perch and green sunfish.
[d] Includes: Section A - white sucker and bigmouth buffalo; Section B - quillback, white sucker, northern hog sucker, bigmouth buffalo, golden redhorse, shorthead redhorse and stonecat; Section C - Creek chub, white sucker, bigmouth buffalo, golden redhorse and shorthead redhorse; Section D - mooneye, quillback, white sucker, bigmouth buffalo, silver redhorse, golden redhorse and shorthead redhorse.

Table 16. Total estimated harvest, by species, for the Cannon River, 1 April through 30 September 1984.

Species	Waterville area		Lake City area		Combined	
	No.	No./mi	No.	No./mi	No.	No./mi
Mooneye	--	--	15	tr	15	tr
Northern pike	232	6	1,169	25	1,401	17
Carp	854	23	10,336	222	11,190	134
Creek chub	--	--	205	4	205	2
Quillback	10	tr	81	2	91	1
White sucker	--	--	1,149	25	1,149	14
Northern hog sucker	--	--	17	tr	17	tr
Bigmouth buffalo	42	1	759	16	801	10
Silver redhorse	--	--	15	tr	15	tr
Golden redhorse	--	--	532	11	532	6
Shorthead redhorse	--	--	1,057	23	1,057	13
Black bullhead	335,758	9,149	25,199	541	360,957	4,333
Yellow bullhead	1,566	42	--	--	1,566	19
Channel catfish	--	--	1,479	32	1,479	18
Stonecat	--	--	34	1	34	tr
White bass	728	20	1,037	22	1,765	21
Rock bass	10	tr	--	--	10	tr
Green sunfish	--	--	289	6	289	3
Bluegill	3,875	106	461	10	4,336	52
Smallmouth bass	26	1	237	5	263	3
Largemouth bass	27	1	148	3	175	2
White crappie	16	tr	413	9	429	5
Black crappie	9,003	245	20,985	450	29,988	360
Yellow perch	350	10	545	12	895	11
Sauger	--	--	32	1	32	tr
Walleye	872	24	899	19	1,771	21
Freshwater drum	1,448	39	5,890	126	7,338	88
TOTAL HARVEST	354,817	9,667	72,983	1,565	427,800	5,136

Table 17. Estimated harvest for Waterville sections of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Section A	Section B	Section C	All
Northern pike	71(56)	101(64)	60(32)	232(91)
Carp	97(81)	757(208)	--	854(223)
Black bullhead	25,706(6,842)	255,936(23,144)	54,116(9,656)	335,758(25,994)
Yellow bullhead	647(674)	735(348)	184(141)	1,566(772)
White bass	--	455(184)	273(130)	728(225)
Bluegill	1,493(1,354)	885(260)	1,497(847)	3,875(1,618)
Black crappi3	180(131)	5,325(1,090)	3,498(772)	9,003(1,342)
Yellow perch	--	19(20)	331(226)	350(227)
Walleye	203(234)	189(78)	480(194)	872(314)
Freshwater drum	--	639(236)	809(424)	1,448(485)
Other	26(35)	80(37)	25(18)	131(54)
Quillback	--	10	--	10
Bigmouth buffalo	--	42	--	42
Rock bass	--	10	--	10
Smallmouth bass	26	--	--	26
Largemouth bass	--	2	25	27
White crappie	--	16	--	16
TOTAL HARVEST	28,423(14,026)	265,121(23,177)	61,273(9,740)	354,817(28,788)
HARVEST/mi	929(458)	60,255(757)	36,043(5,729)	9,668(784)

Table 18. Estimated harvest for Lake City sections of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Section A	Section B	Section C	Section D	All
Northern pike	197(70)	542(140)	279(91)	151(64)	1,169(192)
Carp	348(227)	6,230(799)	1,505(250)	2,253(642)	10,336(1,079)
Black bullhead	14,056(3,752)	7,094(854)	3,203(810)	846(214)	25,199(3,938)
Channel catfish	46(28)	579(170)	160(48)	694(160)	1,479(240)
White bass	26(29)	412(55)	191(120)	408(194)	1,037(236)
Bluegill	384(190)	66(30)	4(4)	7(8)	461(193)
Smallmouth bass	---	18(19)	100(37)	119(54)	237(68)
Largemouth bass	32(24)	7(8)	83(56)	26(18)	148(64)
Crappie spp.	15,035(2,898)	4,246(896)	1,633(386)	484(146)	21,398(3,061)
White crappie	45	255	98	15	413
Black crappie	14,990	3,991	1,535	469	20,985
Sauger	---	---	---	32(22)	32(22)
Walleye	202(48)	300(118)	298(83)	99(46)	899(159)
Freshwater drum	280(88)	2,889(428)	426(124)	2,295(650)	5,890(793)
Selected panfish	281(126)	49(22)	414(168)	90(51)	834(217)
Green sunfish	200	10	25	54	289
Yellow perch	81	39	389	36	545
Selected non-game fish	96(43)	1,677(394)	555(82)	1,536(258)	3,864(480)
Mooneye	---	---	---	15	15
Creek chub	---	---	205	---	205
Quillback	---	50	---	31	81
White sucker	83	302	272	492	1,149
Northern hog sucker	---	17	---	---	17
Bigmouth buffalo	13	553	39	154	759
Silver redhorse	---	---	---	15	15
Golden redhorse	---	151	28	353	532
Shorthead redhorse	---	570	11	476	1,057
Stonecat	---	34	---	---	34
TOTAL HARVEST	30,983(4,754)	24,109(1,605)	8,851(978)	9,040(1,021)	72,983(5,213)
HARVEST/mi	1,866(266)	2,411(160)	632(70)	1,507(170)	1,566(112)

Table 19. Harvest for selected high use sites[a] in Waterville sections of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Section-site A-2	A-4	B-1	B-2	C-1
Northern pike	24(28)	17(21)	56(51)	21(24)	60(32)
Carp	104(90)	--	500(131)	--	--
Black bullhead	15,380(6,611)	5,060(3,602)	184,518(15,292)	48,932(12,011)	54,116(9,656)
Yellow bullhead	--	--	462(276)	63(68)	184(141)
White bass	--	--	417(132)	--	273(130)
Bluegill	432(448)	381(524)	710(210)	9(8)	1,497(847)
Black crappie	164(131)	--	3,601(842)	2,348(1,474)	3,498(772)
Yellow perch	--	--	14(15)	--	331(226)
Walleye	118(143)	--	93(47)	39(31)	480(194)
Freshwater drum	--	--	492(164)	247(207)	809(424)
Other[b]	--	10(16)	66(30)	--	25(18)
Combined	16,221(6,630)	5,468(3,640)	190,929(15,322)	51,659(12,103)	61,273(9,740)

[a] All sites are tailwaters except B-2.
[b] Includes: Section A - smallmouth bass; Section B - quillback, bigmouth buffalo, rock bass, largemouth bass and white crappie; Section C - largemouth bass.

Table 20. Harvest for selected high use sites[a] in Lake City sections of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Section-site A-1	B-1	B-5	B-6	C-1	C-2	D-1
Northern pike	144(64)	429(167)	8(8)	5(5)	70(66)	222(102)	151(64)
Carp	27(20)	5,245(852)	20(22)	643(164)	634(289)	1,000(359)	2,253(642)
Black bullhead	15,541(4,675)	4,774(932)	745(388)	974(228)	2,179(854)	948(408)	846(214)
Channel catfish	44(28)	98(89)	--	329(110)	153(64)	27(16)	694(160)
White bass	26(29)	518(352)	10(12)	93(50)	152(70)	8(8)	408(194)
Bluegill	381(190)	48(26)	33(27)	--	5(5)	--	7(8)
Smallmouth bass	--	16(17)	--	--	22(22)	120(58)	119(54)
Largemouth bass	36(27)	13(13)	--	--	3(4)	70(64)	26(18)
Crappie[b]	13,332(5,469)	1,534(430)	3,467(1,270)	51(12)	581(192)	1,303(674)	484(146)
Sauger	--	--	--	--	--	--	32(22)
Walleye	187(68)	189(128)	--	202(18)	184(58)	108(76)	99(46)
Freshwater drum	239(80)	1,211(316)	40(44)	955(178)	221(82)	302(214)	2,295(650)
Selected panfish[c]	198(86)	44(24)	7(8)	8(10)	210(144)	105(86)	90(51)
Selected non-game fish[d]	94(46)	837(272)	--	615(178)	37(19)	610(258)	1,536(258)
Combined	30,249(5,422)	14,956(1,460)	4,330(1,329)	3,875(396)	4,451(944)	4,823(945)	9,040(1,021)

[a] Sites A-1, B-1, C-1 and D-1 are tailwaters sites.
[b] Includes white and black crappie.
[c] Includes yellow perch and green sunfish.
[d] Includes: Section A - white sucker and bigmouth buffalo; Section B - quillback, white sucker, northern hog sucker, bigmouth buffalo, golden redhorse, shorthead redhorse and stonecat; Section C - creek chub, white sucker, bigmouth buffalo, golden redhorse and shorthead redhorse; Section D - mooneye, quillback, white sucker, bigmouth buffalo, silver redhorse, golden redhorse and shorthead redhorse.

Table 21. Percentage of anglers using specified bait types on the Cannon River, 1 April through 30 September 1984.

Bait type	Area	
	Waterville	Lake City
Live	83	71
Artificial	5	15
Mix	11	13
Other	1	1

Table 22. Percentage of anglers in specified age groups on the Cannon River, 1 April through 30 September 1984.

Age group (yrs)	Area	
	Waterville	Lake City
0-15	31	26
16-24	13	17
25-34	13	17
35-44	12	24
45-54	9	7
55-64	10	4
65+	12	5

Table 23. Percentage of anglers traveling specified distances (one way) to fish on the Cannon River, 1 April through 30 September 1984.

Distance traveled (mi)	Area	
	Waterville	Lake City
0-10	24	45
11-25	15	23
26-50	14	31
51-75	11	1
76-150	12	tr
151-300	19	tr
300+	5	tr
Nonresidents	33	tr

Table 24. Percentage of canoeists traveling specified distance (one way) and in specified age groups on Lake City's portion of the Cannon River, 1 April through 30 September 1984.

Distance traveled (mi)	Percentage	Age group (yrs)	Percentage
0-10	25	0-15	15
11-25	20	16-24	19
26-50	41	25-34	40
51-75	8	35-44	19
76-150	2	45-54	6
151-300	2	55-64	1
300+	2	65+	--
Nonresidents	7		

APPENDIX

Table A1. Harvest rates (fish/hr) by month for Waterville Section A of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Grand Mean
	April	May	June	July	August	September	
Northern pike	---	0.02(0.02)	---	---	0.09(0.10)	---	0.02(0.01)
Carp	---	0.02(0.02)	---	---	---	---	0.01(0.01)
Black bullhead	---	2.83(0.69)	4.19(0.95)	4.59(1.93)	3.70(2.96)	3.00(0.92)	3.19(0.57)
Yellow bullhead	---	---	---	---	---	1.40(1.28)	0.06(0.05)
Bluegill	---	0.01(0.01)	0.42(0.49)	0.07(0.10)	---	2.00(2.40)	0.14(0.10)
Smallmouth bass	---	---	---	0.03(0.03)	---	---	tr
Black crappie	---	0.04(0.03)	0.04(0.04)	---	---	---	0.03(0.02)
Walleye	---	0.07(0.10)	---	---	---	---	0.04(0.05)
TOTAL HARVEST RATE	---	2.97(0.69)	4.65(1.07)	4.69(1.93)	3.79(2.96)	6.40(2.87)	3.48(0.57)

Table A2. Harvest rates (fish/hr) by month for Waterville Section B of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Grand Mean
	April	May	June	July	August	September	
Northern pike	---	0.01(0.01)	0.01(0.01)	---	---	---	tr
Carp	0.07(0.04)	0.02(0.01)	0.03(0.01)	---	---	---	0.03(0.01
Black bullhead	1.83(0.53)	8.46(0.56)	10.05(0.83)	9.98(0.97)	15.18(2.04)	7.20(0.97)	8.71(0.37)
Yellow bullhead	---	0.01(0.01)	0.05(0.05)	0.09(0.06)	---	0.41(0.20)	0.04(0.01)
White bass	0.05(0.03)	tr	tr	0.06(0.04)	---	---	0.01(0.01
Bluegill	---	0.05(0.01)	0.02(0.01)	---	---	0.14(0.17)	0.03(0.01)
Black crappie	0.21(0.10)	0.30(0.10)	0.12(0.10)	0.02(0.02)	---	---	0.19(0.03)
Yellow perch	---	---	tr	---	---	---	tr
Walleye	---	---	0.01(0.01)	0.01(0.01)	---	---	tr
Freshwater drum	---	tr	0.02(0.01)	0.05(0.04)	0.24(0.18)	---	0.03(0.01)
Other[a]	---	0.01(<0.01)	0.01(0.01)	---	---	---	tr
TOTAL HARVEST RATE	2.15(0.54)	8.87(0.56)	10.32(0.83)	10.21(0.97)	15.42(2.05)	7.75(1.01)	9.04(0.37)

[a] Includes quillback, bigmouth buffalo, rock bass, largemouth bass and white crappie.

Table A3. Harvest rates (fish/hr) by month for Waterville Section C of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Grand Mean
	April	May	June	July	August	September	
Northern pike	---	0.01(0.01)	---	0.01(<0.01	---	---	0.01(0.01)
Black bullhead	---	0.99(0.20)	3.85(0.64)	4.95(0.91)	5.92(1.19)	7.06(3.38)	2.89(0.29)
Yellow bullhead	---	---	---	0.08(0.06)	---	---	0.02(0.01)
White bass	0.02(0.02)	---	---	0.01(0.01)	0.13(0.10)	0.10(0.05)	0.02(0.01)
Bluegill	---	0.05(0.04)	0.02(0.01)	0.14(0.07)	0.05(0.04)	0.60(0.65)	0.08(0.03)
Largemouth bass	---	tr	---	0.01(0.01)	---	---	tr
Black crappie	0.24(0.10)	0.43(0.10)	0.24(0.10)	0.09(0.04)	0.15(0.10)	0.05(0.05)	0.26(0.05)
Yellow perch	0.22(0.16)	0.02(0.01)	---	---	---	---	0.03(0.02)
Walleye	---	0.04(0.02)	0.03(0.01)	0.01(0.01)	0.08(0.06)	0.10(0.12)	0.03(0.01)
Freshwater drum	---	---	0.03(0.02)	0.08(0.06)	0.34(0.24)	---	0.05(0.03)
TOTAL HARVEST RATE	0.48(0.19)	1.54(0.23)	4.17(0.65)	5.36(0.92)	6.66(1.23)	7.91(3.45)	3.39(0.29)

Table A4. Harvest rates (fish/hr) by month for Lake City Section A of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Grand Mean
	April	May	June	July	August	September	
Northern pike	---	0.06(0.02)	tr	0.01(0.01)	---	---	0.02(0.01)
Carp	0.09(0.09)	0.04(0.02)	---	0.01(0.02)	0.05(0.03)	---	0.03(0.01)
Black bullhead	0.14(0.10)	2.06(0.39)	0.52(0.10)	0.93(0.22)	0.49(0.17)	0.14(0.10)	0.96(0.12)
Channel catfish	---	---	---	0.02(0.01)	0.01(0.01)	---	tr
White bass	---	---	tr	---	---	---	tr
Bluegill	---	0.01(<0.01))	0.02(0.01)	0.02(0.01)	0.48(0.23)	---	0.07(0.03)
Largemouth bass	---	---	0.01(0.01)	---	---	0.04(0.03)	0.01(0.01)
Crappie[a]	---	1.73(0.28)	1.36(0.22)	0.93(0.24)	1.24(0.24)	0.38(0.22)	1.21(0.11)
Walleye	---	0.03(0.02)	0.02(0.01)	0.02(0.01)	0.04(0.03)	0.04(0.04)	0.02(0.01)
Freshwater drum	---	0.03(0.03)	0.02(0.01)	0.06(0.02)	0.04(0.03)	---	0.03(0.01)
Selected panfish[b]	---	---	---	0.08(0.04)	0.02(0.02)	0.10(0.09)	0.02(0.01)
Selected non-game fish[c]	---	---	0.04(0.02)	---	---	---	0.01(0.01)
TOTAL HARVEST RATE	0.23(0.12)	3.96(0.49)	2.01(0.25)	2.07(0.33)	2.36(0.38)	0.69(0.27)	2.38(0.17)

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes white sucker and bigmouth buffalo.

Table A5. Harvest rates (fish/hr) by month for Lake City Section B of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Grand Mean
	April	May	June	July	August	September	
Northern pike	---	0.04(0.01)	tr	0.02(0.01)	0.01(0.01)	0.06(0.03)	0.02(0.01)
Carp	0.16(0.05)	0.43(0.09)	0.30(0.05)	0.19(0.03)	0.63(0.28)	0.02(0.02)	0.29(0.03)
Black bullhead	tr	0.20(0.04)	0.73(0.20)	0.57(0.07)	0.51(0.18)	0.16(0.08)	0.36(0.04)
Channel catfish	---	0.01(0.01)	0.06(0.02)	0.06(0.02)	0.02(0.02)	---	0.03(0.01)
White bass	0.01(0.01)	0.03(0.01)	0.02(0.02)	tr	---	0.02(0.03)	0.02(0.01)
Bluegill	---	0.01(<0.01)	tr	tr	---	---	tr
Smallmouth bass	---	tr	---	---	---	---	tr
Largemouth bass	---	---	tr	---	---	---	tr
Crappie[a]	0.18(0.09)	0.30(0.07)	0.04(0.02)	0.05(0.02)	---	0.01(0.01)	0.14(0.03)
Walleye	0.01(<0.01)	0.01(0.01)	0.01(0.01)	0.01(0.01)	0.02(0.02)	---	0.01(0.01)
Freshwater drum	---	0.02(0.02)	0.30(0.08)	0.21(0.03)	---	0.07(0.03)	0.11(0.01)
Selected panfish[b]	0.01(0.01)	tr	tr	tr	---	---	tr
Selected non-game fish[c]	0.11(0.04)	0.06(0.04)	0.04(0.02)	0.03(0.01)	0.04(0.03)	0.05(0.04)	0.06(0.01)
TOTAL HARVEST RATE	0.49(0.11)	1.12(0.13)	1.50(0.22)	1.16(0.09)	1.23(0.33)	0.39(0.11)	1.05(0.07)

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes quillback, white sucker, northern hog sucker, bigmouth buffalo, golden redhorse, shorthead redhorse and stonecat.

Table A6. Harvest rates (fish/hr) by month for Lake City Section C of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Grand Mean
	April	May	June	July	August	September	
Northern pike	0.01(0.01)	0.03(0.02)	0.04(0.02)	0.02(0.01)	---	0.02(0.01)	0.02(0.01)
Carp	0.29(0.06)	0.04(0.01)	0.26(0.10)	0.09(0.04)	0.14(0.03)	0.04(0.03)	0.12(0.02)
Black bullhead	0.19(0.04)	0.04(0.03)	0.04(0.02)	1.07(0.36)	0.31(0.08)	0.27(0.12)	0.32(0.07)
Channel catfish	---	---	0.04(0.02)	0.06(0.01)	tr	0.02(0.01)	0.02(0.01)
White bass	---	0.01(0.01)	---	0.07(0.04)	---	0.01(0.01)	0.02(0.01)
Bluegill	---	---	---	---	---	0.01(0.01)	tr
Smallmouth bass	---	0.01(0.01)	0.01(0.01)	0.01(0.01)	0.03(0.01)	0.01(0.01)	0.01(0.01)
Largemouth bass	---	---	0.01(0.02)	tr	0.01(<0.01)	0.01(0.01)	0.01(0.01)
Crappie[a]	---	0.08(0.04)	0.14(0.06)	0.31(0.07)	0.21(0.05)	0.09(0.03)	0.14(0.02)
Walleye	---	0.03(0.01)	0.04(0.02)	0.02(0.01)	0.03(0.01)	0.04(0.01)	0.03(0.01)
Freshwater drum	0.01(0.01)	---	---	0.05(0.03)	0.07(0.03)	0.15(0.05)	0.05(0.01)
Selected panfish[b]	---	---	0.01(0.01)	0.01(0.01)	0.20(0.09)	---	0.03(0.01)
Selected non-game fish[c]	0.20(0.06)	0.06(0.02)	---	0.02(0.01)	---	0.01(0.01)	0.04(0.01)
TOTAL HARVEST RATE	0.71(0.10)	0.30(0.06)	0.59(0.13)	1.72(0.37)	0.99(0.14)	0.66(0.14)	0.80(0.07)

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes creek chub, white sucker, bigmouth buffalo, golden redhorse and shorthead redhorse.

Table A7. Harvest rates (fish/hr) by month for Lake City Section D of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Grand Mean
	April	May	June	July	August	September	
Northern pike	---	0.02(0.01)	0.01(0.01)	0.01(0.01)	0.01(0.01)	---	0.01(0.01)
Carp	0.03(0.02)	0.28(0.06)	0.04(0.01)	0.03(0.01)	0.06(0.02)	0.08(0.05)	0.10(0.01)
Black bullhead	---	0.06(0.02)	0.10(0.03)	0.01(0.01)	0.02(0.01)	---	0.05(0.01)
Channel catfish	---	0.02(0.01)	0.04(0.01)	0.09(0.03)	0.11(0.04)	0.01(0.02)	0.04(0.01)
White bass	0.01(0.01)	0.01(0.01)	---	0.01(0.01)	0.14(0.07)	0.01(0.01)	0.02(0.01)
Bluegill	---	---	---	tr	---	---	tr
Smallmouth bass	---	0.01(0.01)	0.01(0.01)	0.01(0.01)	---	---	0.01(0.01)
Largemouth bass	---	0.01(0.01)	---	---	---	tr	tr
Crappie[a]	---	0.05(0.02)	0.02(0.01)	---	0.02(0.01)	0.14(0.08)	0.03(0.01)
Sauger	---	---	---	0.01(0.01)	---	0.01(0.02)	tr
Walleye	---	---	0.01(0.01)	0.01(0.01)	0.01(0.01)	0.01(0.02)	0.01(<0.01)
Freshwater drum	---	0.19(0.04)	0.11(0.03)	0.13(0.06)	0.09(0.05)	0.01(0.01)	0.11(0.01)
Selected panfish[b]	---	---	0.01(0.01)	---	tr	tr	tr
Selected non-game fish[c]	0.24(0.09)	0.11(0.03)	0.04(0.01)	0.06(0.02)	0.07(0.02)	0.06(0.04)	0.09(0.01)
TOTAL HARVEST RATE	0.28(0.09)	0.74(0.09)	0.38(0.05)	0.38(0.07)	0.54(0.11)	0.32(0.11)	0.47(0.03)

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes mooneye, quillback, white sucker, bigmouth buffalo, silver redhorse, golden redhorse and shorthead redhorse.

Table A8. Harvest by month for Waterville Section A of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Month						Total	Total/mi
	April	May	June	July	August	September		
Northern pike	—	42(47)	—	—	30(31)	—	71(56)	2(2)
Carp	—	97(81)	—	—	—	—	97(81)	3(3)
Black bullhead	—	12,710(4,641)	4,536(3,295)	5,293(3,483)	1,781(1,278)	1,386(805)	25,706(6,842)	840(224)
Yellow bullhead	—	—	—	—	—	647(674)	647(674)	21(22)
Bluegill	—	32(30)	458(620)	79(105)	—	924(1,199)	1,493(1,354)	49(44)
Smallmouth bass	—	—	—	26(35)	—	—	26(35)	1(1)
Black crappie	—	138(115)	42(63)	—	—	—	180(131)	6(4)
Walleye	—	203(234)	—	—	—	—	203(234)	7(8)
TOTAL HARVEST	—	13,221(4,650)	5,036(6,707)	5,398(3,484)	1,811(1,278)	2,957(1,594)	28,423(7,013)	
HARVEST/mi		432(152)	165(219)	176(114)	59(42)	97(52)	929(229)	

Table A9. Harvest by month for Waterville Section B of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Month						Total	Total/mi
	April	May	June	July	August	September		
Northern pike	—	63(58)	38(28)	—	—	—	101(64)	23(15)
Carp	189(127)	290(106)	278(126)	—	—	—	757(208)	172(47)
Black bullhead	5,218(2,283)	108,227(4,863)	69,191(3,965)	56,043(3,491)	12,070(3,412)	5,187(1,795)	255,936(23,144)	58,167(5,260)
Yellow bullhead	—	92(48)	236(200)	288(244)	—	119(137)	735(348)	167(79)
White bass	181(121)	7(7)	19(19)	248(138)	—	—	455(184)	103(42)
Bluegill	—	604(188)	149(87)	—	—	132(156)	885(260)	201(59)
Black crappie	724(423)	3,807(926)	719(387)	75(57)	—	—	5,325(1,090)	1,210(248)
Yellow perch	—	—	19(20)	—	—	—	19(20)	4(5)
Walleye	—	28(23)	57(34)	104(67)	—	—	189(78)	43(18)
Freshwater drum	—	90(56)	184(128)	241(162)	124(100)	—	639(236)	145(54)
Other[a]	—	42(24)	38(29)	—	—	—	80(37)	18(8)
TOTAL HARVEST	6,312(2,329)	113,250(15,408)	70,928(12,548)	56,999(11,044)	12,194(3,414)	5,438(1,806)	265,121(23,177)	
HARVEST/mi	1,435(529)	25,739(3,502)	16,120(2,852)	12,954(2,510)	2,771(776)	1,236(410)	60,255(5,268)	

[a] Includes quillback, bigmouth buffalo, rock bass, largemouth bass and white crappie.

Table A10. Harvest by month for Waterville Section C of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Month						Total	Total/mi
	April	May	June	July	August	September		
Northern pike	—	48(29)	—	12(12)	—	—	60(32)	35(19)
Black bullhead	—	3,972(870)	10,311(2,950)	16,652(5,408)	14,170(4,534)	9,011(5,829)	54,116(9,656)	31,833(5,680)
Yellow bullhead	—	—	—	184(141)	—	—	184(141)	108(83)
White bass	17(19)	—	—	12(12)	123(100)	121(79)	273(130)	161(76)
Bluegill	—	220(168)	75(45)	420(178)	53(38)	729(809)	1,479(847)	870(498)
Largemouth bass	—	13(13)	—	12(12)	—	—	25(18)	15(11)
Black crappie	277(207)	1,729(463)	907(507)	384(261)	141(96)	60(73)	3,498(772)	2,058(454)
Yellow perch	260(223)	71(39)	—	—	—	—	331(226)	195(133)
Walleye	—	141(79)	95(69)	52(46)	71(59)	121(146)	480(194)	282(114)
Freshwater drum	—	—	106(91)	168(123)	535(395)	—	809(424)	476(249)
TOTAL HARVEST	554(306)	6,194(1,004)	11,494(2,996)	17,896(5,420)	15,093(4,554)	10,042(5,887)	61,273(9,740)	
HARVEST/mi	326(180)	3,644(591)	6,761(1,762)	10,527(3,188)	8,878(2,679)	5,907(3,463)	36,043(5,729)	

Table A11. Harvest by month for Lake City Section A of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Month						Total	Total/mi
	April	May	June	July	August	September		
Northern pike	—	156(65)	11(11)	30(23)	—	—	197(70)	12(4)
Carp	70(71)	59(37)	—	192(212)	27(19)	—	348(227)	21(14)
Black bullhead	130(47)	4,486(1,362)	2,505(988)	6,561(3,349)	356(160)	45(41)	14,056(3,752)	847(226)
Channel catfish	—	—	—	39(28)	7(7)	—	46(28)	3(2)
White bass	—	—	26(29)	—	—	—	26(29)	2(2)
Bluegill	—	12(10)	65(43)	49(31)	258(182)	—	384(190)	23(11)
Largemouth bass	—	—	21(22)	—	—	11(11)	32(24)	2(1)
Crappie[a]	—	6,592(2,335)	4,803(1,428)	2,413(860)	1,102(397)	125(89)	15,035(2,898)	906(175)
Walleye	—	84(11)	43(27)	39(28)	25(22)	11(12)	202(48)	12(3)
Freshwater drum	—	35(38)	102(55)	101(48)	42(33)	—	280(88)	17(5)
Selected panfish[b]	—	—	22(23)	216(121)	9(10)	34(28)	281(126)	17(8)
Selected non-game fish[c]	—	—	96(43)	—	—	—	96(43)	6(3)
TOTAL HARVEST	173(84)	11,424(2,704)	7,694(1,740)	9,640(3,467)	1,826(913)	226(104	30,983(4,754)	
HARVEST/mi	10(5)	688(163)	463(105)	581(209)	110(55)	14(6)	1,866(286)	

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes white sucker and bigmouth buffalo.

Table A12. Harvest by month for Lake City Section B of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Month						Total	Total/mi
	April	May	June	July	August	September		
Northern pike	—	419(134)	7(8)	63(25)	8(9)	45(28)	542(140)	54(14)
Carp	284(115)	3,894(679)	920(211)	484(129)	629(319)	19(17)	6,230(799)	623(80)
Black bullhead	8(8)	2,604(332)	2,050(639)	1,837(400)	500(217)	95(55)	7,094(854)	709(85)
Channel catfish	—	134(98)	160(67)	274(122)	11(9)	—	579(170)	58(17)
White bass	27(20)	305(26)	36(31)	28(27)	—	16(17)	412(55)	41(6)
Bluegill	—	45(27)	7(7)	14(11)	—	—	66(30)	7(3)
Smallmouth bass	—	18(19)	—	—	—	—	18(19)	2(2)
Largemouth bass	—	—	7(7)	—	—	—	7(8)	1(1)
Crappie[a]	445(232)	3.483(857)	158(104)	155(63)	—	5(5)	4,246(896)	425(90)
Walleye	16(12)	209(114)	15(11)	49(23)	16(18)	—	300(237)	30(24)
Freshwater drum	—	1,312(284)	854(243)	677(208)	—	46(26)	2,889(428)	289(43)
Selected panfish[b]	24(15)	13(14)	7(7)	5(5)	—	—	49(22)	5(2)
Selected non-game fish[c]	255(93)	1,161(376)	95(43)	88(29)	38(25)	40(33)	1,677(394)	168(39)
TOTAL HARVEST	1,059(278)	13,597(1,253)	4,316(728)	3,669(492)	1,202(387)	266(78)	24,109(1,605)	
HARVEST/mi	106(28)	1,360(125)	432(73)	367(49)	120(39)	27(8)	2,411(160)	

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes quillback, white sucker, northern hog sucker, bigmouth buffalo, golden redhorse, shorthead redhorse and stonecat.

Table A13. Harvest by month for Lake City Section C of the Cannon River, 1 April through 30 September 1984. (Standard error in parentheses.)

Species	Month						Total	Total/mi
	April	May	June	July	August	September		
Northern pike	28(22	79(41)	89(65)	36(26)	—	47(35)	279(91)	20(6)
Carp	518(66)	87(37)	334(156)	243(158)	283(85)	40(25)	1,505(250)	180(18)
Black bullhead	388(122)	110(76)	61(29)	1,742(748)	643(242)	259(132)	3,203(810)	229(58)
Channel catfish	—	—	46(31)	87(34)	9(10)	18(12)	160(48)	11(3)
White bass	—	18(14)	—	169(119)	—	4(5)	191(120)	14(9)
Bluegill	—	—	—	—	—	4(5)	4(4)	tr
Smallmouth bass	—	14(11)	11(12)	15(11)	56(31)	4(5)	100(37)	7(3)
Largemouth bass	—	—	38(43)	7(7)	6(4)	32(35)	83(56)	6(4)
Crappie[a]	—	182(108)	340(249)	531(167)	487(214)	93(42)	1,633(386)	117(28)
Walleye	—	66(39)	87(52)	19(13)	71(38)	55(32)	298(83)	21(6)
Freshwater drum	16(18)	—	—	68(41)	179(92)	163(70)	426(124)	30(9)
Selected panfish[b]	—	—	13(14)	22(23)	379(167)	—	414(168)	30(12)
Selected non-game fish[c]	343(36)	159(67)	—	38(26)	—	15(17)	555(82)	40(6)
TOTAL HARVEST	1,293(146)	715(164)	1,019(312)	2,977(795)	2,113(388)	734(170)	8,851(978)	
HARVEST/mi	92(10)	51(12)	73(22)	213(57)	151(28)	52(12)	632(70)	

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes creek chub, white sucker, bigmouth buffalo, golden redhorse and shorthead redhorse.

Table A14. Harvest by month for Lake City Section D of the Cannon River, 1 April through 30 September 1984. (Standard deviation in parentheses.)

Species	Month						Total	Total/mi
	April	May	June	July	August	September		
Northern pike	—	92(57)	23(19)	14(13)	22(17)	—	151(64)	25(11)
Carp	69(52)	1,817(633)	192(72)	74(43)	89(39)	12(14)	2,253(642)	376(107)
Black bullhead	—	301(104)	421(170)	45(58)	34(26)	45(41)	846(214)	141(36)
Channel catfish	—	101(75)	181(66)	241(106)	160(64)	11(13)	694(160)	116(27)
White bass	23(21)	46(35)	—	91(107)	247(156)	1(2)	408(194)	68(32)
Bluegill	—	—	—	7(8)	—	—	7(8)	1(1)
Smallmouth bass	—	61(38)	26(20)	32(33)	—	—	119(54)	20(4)
Largemouth bass	—	15(15)	—	—	—	11(11)	26(18)	81(24)
Crappie[a]	—	223(101)	60(38)	—	45(31)	156(93)	484(146)	5(4)
Sauger	—	—	—	21(17)	—	11(13)	32(22)	16(8)
Walleye	—	—	23(19)	32(34)	22(17)	22(17)	99(46)	382(108)
Freshwater drum	—	1,338(595)	463(169)	344(178)	149(86)	1(2)	2,295(650)	15(8)
Selected panfish[b]	—	—	45(41)	—	11(12)	34(28)	90(51)	256(43)
Selected non-game fish[c]	479(57)	687(232)	130(52)	133(67)	97(43)	10(8)	1,536(258)	
TOTAL HARVEST	571(80)	4,681(917)	1,564(272)	1,034(259)	876(204)	314(110)	9,040(1,021)	
HARVEST/mi	95(13)	780(153)	261(45)	172(43)	146(34)	52(18)		

[a] Includes white and black crappie.
[b] Includes yellow perch and green sunfish.
[c] Includes mooneye, quillback, white sucker, bigmouth buffalo, silver redhorse, golden redhorse and shorthead redhorse.

Table A15. Mean length (in) of harvested fish on the Cannon River, 1 April through 30 September 1984. (Number of fish measured in parentheses.)

Species	Waterville sections			Lake City sections				Grand mean
	A	B	C	A	B	C	D	
Mooneye	—	—	—	—	—	—	12.6(1)	12.6(1)
Northern pike	23.5(2)	19.3(5)	20.0(4)	18.9(3)	21.7(10)	24.0(17)	26.0(9)	22.8(50)
Carp	16.8(3)	19.5(28)	—	10.6(16)	13.0(286)	15.4(141)	20.5(108)	15.2(582)
Creek chub	—	—	—	—	—	5.9(15)	—	5.9(15)
Quillback	—	17.5(1)	—	—	16.9(3)	—	14.6(2)	16.2(6)
White sucker	—	—	—	9.8(5)	13.8(19)	12.2(20)	15.0(21)	13.4(65)
Bigmouth buffalo	—	26.5(1)	—	14.6(1)	20.5(34)	21.3(3)	24.0(10)	21.3(49)
Silver redhorse	—	—	—	—	13.8(4)	—	14.6(1)	14.0(5)
Golden redhorse	—	—	—	—	—	16.9(2)	14.6(22)	14.8(24)
Shorthead redhorse	—	—	—	—	13.4(31)	14.2(1)	15.0(30)	14.2(62)
Black bullhead	8.4(86)	7.9(606)	7.8(409)	7.9(328)	8.3(506)	7.1(420)	8.3(49)	7.9(2,404)
Yellow bullhead	8.7(7)	8.8(45)	9.5(1)	—	—	—	—	8.8(53)
Channel catfish	—	—	—	7.5(3)	11.8(46)	12.2(21)	13.8(34)	12.4(104)
Stonecat	—	—	—	—	5.9(2)	—	—	5.9(2)
White bass	—	8.4(22)	10.4(12)	7.9(1)	10.6(19)	10.2(19)	11.0(29)	10.1(102)
Rock bass	—	8.2(1)	—	—	—	—	—	8.2(1)
Green sunfish	—	—	—	4.7(8)	—	4.7(49)	5.1(3)	4.7(60)
Bluegill	6.9(32)	6.8(73)	5.7(56)	6.7(36)	5.9(5)	6.3(2)	5.9(1)	6.5(205)
Smallmouth bass	11.2(1)	—	—	—	—	11.4(11)	11.4(8)	11.4(20)
Largemouth bass	—	—	10.0(2)	13.4(3)	12.2(1)	10.2(4)	13.8(1)	11.5(11)
White crappie	—	8.7(2)	—	7.9(2)	8.7(8)	8.3(6)	7.1(1)	8.4(19)
Black crappie	8.6(7)	8.1(292)	8.1(178)	7.1(605)	8.3(109)	7.9(138)	7.5(35)	7.6(1,364)
Yellow perch	—	9.2(1)	8.4(14)	7.9(5)	7.9(3)	8.3(1)	7.5(2)	8.2(26)
Sauger	—	—	—	—	—	—	10.2(4)	10.2(4)
Walleye	18.5(5)	14.3(8)	14.6(23)	12.2(9)	16.9(12)	14.6(31)	14.2(6)	14.8(94)
Freshwater drum	—	9.6(9)	10.8(6)	8.7(26)	9.4(184)	10.6(39)	10.6(104)	9.8(368)

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