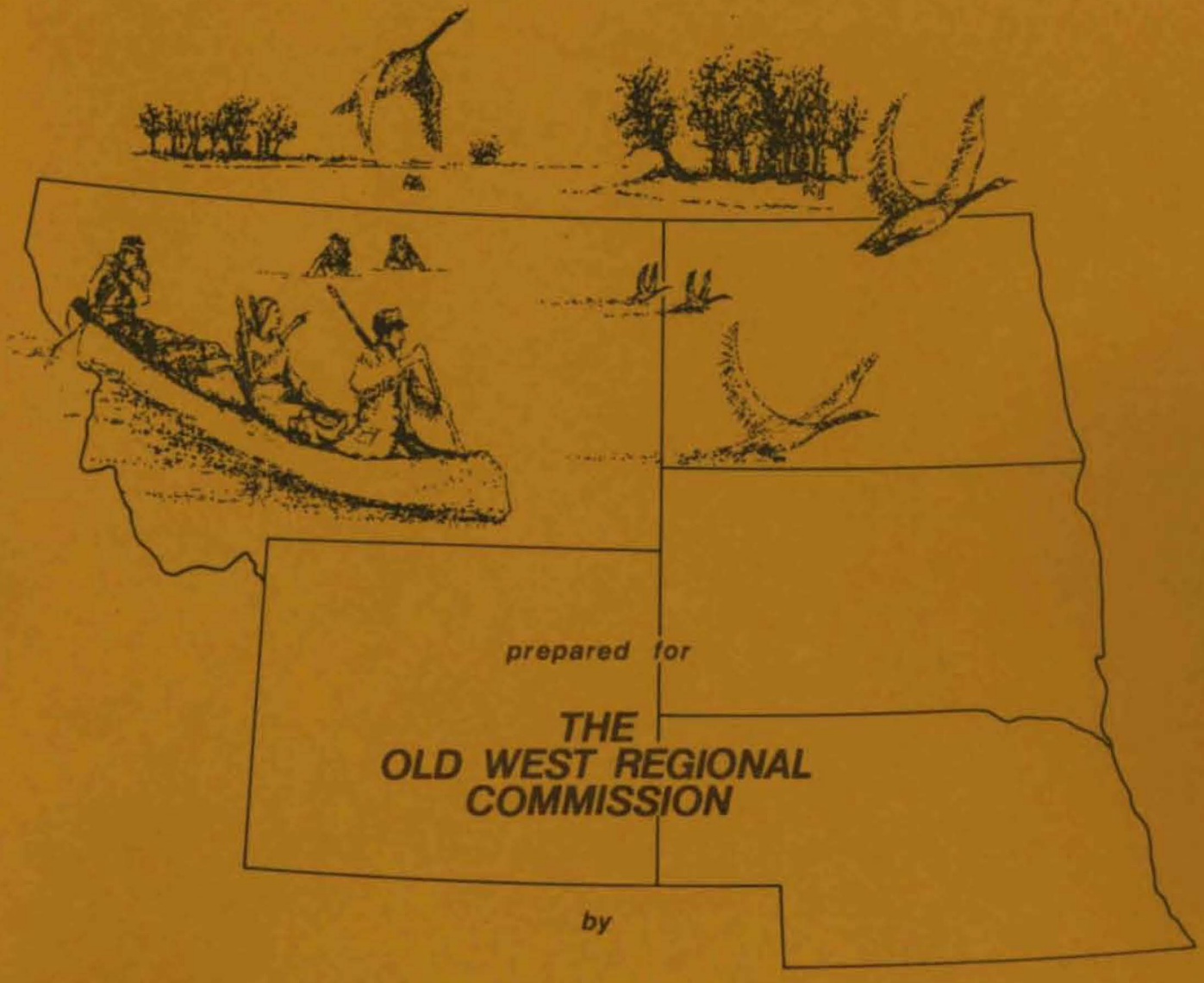
The effect of altered streamflow on water-based recreation in the Yellowstone River Basin, Montana

YELLOWSTONE IMPACT STUDY

TECHNICAL REPORT NO. 10



prepared for

THE
OLD WEST REGIONAL
COMMISSION

by

DNRC WATER RESOURCES DIVISION — JULY 1977
MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

The effect of altered streamflow on water-based recreation in the Yellowstone River Basin, Montana

by

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Recreation Specialist
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conducted by
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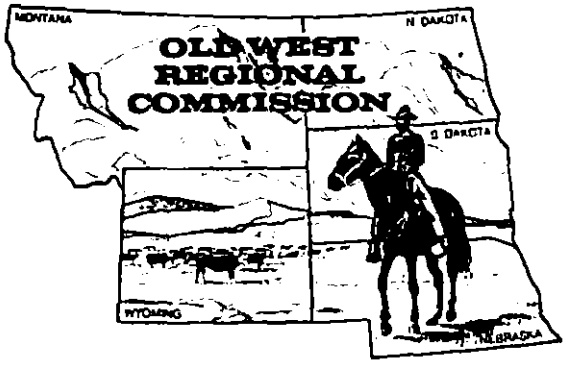

The Old West Regional Commission is a Federal-State partnership designed to solve regional economic problems and stimulate orderly economic growth in the states of Montana, Nebraska, North Dakota, South Dakota and Wyoming. Established in 1972 under the Public Works and Economic Development Act of 1965, it is one of seven identical commissions throughout the country engaged in formulating and carrying out coordinated action plans for regional economic development.

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FOREWORD

The Old West Regional Commission wishes to express its appreciation for this report to the Montana Department of Natural Resources and Conservation, and more specifically to those Department staff members who participated directly in the project and in preparation of various reports, to Dr. Kenneth A. Blackburn of the Commission staff who coordinated the project, and to the subcontractors who also participated. The Yellowstone Impact Study was one of the first major projects funded by the Commission that was directed at investigating the potential environmental impacts relating to energy development. The Commission is pleased to have been a part of this important research.

George D. McCarthy
Federal Cochairman

Contents

Figures

Tables

Abbreviations used in this report

af	acre-feet
b/d	barrels per day
cfs	cubic feet per second
ft	feet
ha	hectares
hm^3/y	cubic hectometers per year
IMN	impact modification number
m	meters
mi	miles
km	kilometers
km^2	square kilometers
mw	megawatts
mmaf/y	million acre-feet per year
mmcfd	million cubic feet per day
mmt/y	million tons per year
SRP	sectional rating preference
t/d	tons per day

Preface

THE RIVER

The Yellowstone River Basin of southeastern Montana, northern Wyoming, and western North Dakota encompasses approximately 180,000 km^2 (71,000 square miles), 92,200 (35,600) of them in Montana. Montana's portion of the basin comprises 24 percent of the state's land; where the river crosses the border into North Dakota, it carries about 8.8 million acre-feet of water per year, 21 percent of the state's average annual outflow. The mainstem of the Yellowstone rises in northwestern Wyoming and flows generally northeast to its confluence with the Missouri River just east of the Montana-North Dakota border; the river flows through Montana for about 550 of its 680 miles. The major tributaries, the Boulder, Stillwater, Clarks Fork, Bighorn, Tongue, and Powder rivers, all flow in a northerly direction. The western part of the basin is part of the middle Rocky Mountains physiographic province; the eastern section is located in the northern Great Plains (Rocky Mountain Association of Geologists 1972).

THE CONFLICT

Historically, agriculture has been Montana's most important industry. In 1975, over 40 percent of the primary employment in Montana was provided by agriculture (Montana Department of Community Affairs 1976). In 1973, a good year for agriculture, the earnings of labor and proprietors involved in agricultural production in the fourteen counties that approximate the Yellowstone Basin were over $141 million, as opposed to $13 million for mining and $55 million for manufacturing. Cash receipts for Montana's agricultural products more than doubled from 1968 to 1973. Since that year, receipts have declined because of unfavorable market conditions; some improvement may be in sight, however. In 1970, over 75 percent of the Yellowstone Basin's land was in agricultural use (State Conservation Needs Committee 1970). Irrigated agriculture is the basin's largest water use, consuming annually about 1.5 million acre-feet (af) of water (Montana DNRC 1977).

There is another industry in the Yellowstone Basin which, though it consumes little water now, may require more in the future, and that is the coal development industry. In 1971, the North Central Power Study (North Central Power Study Coordinating Committee 1971) identified 42 potential power plant sites in the five-state (Montana, North and South Dakota, Wyoming, and Colorado) northern Great Plains region, 21 of them in Montana. These plants, all to be fired by northern Great Plains coal, would generate 200,000 megawatts (mw) of electricity, consume 3.4 million acre-feet per year (mmaf/y) of water, and result in a large population increase. Administrative, economic, legal,

and technological considerations have kept most of these conversion facilities, identified in the North Central Power Study as necessary for 1980, on the drawing board or in the courtroom. There is now no chance of their being completed by that date or even soon after, which will delay and diminish the economic benefits some basin residents had expected as a result of coal development. On the other hand, contracts have been signed for the mining of large amounts of Montana coal, and applications have been approved not only for new and expanded coal mines but also for Colstrip Units 3 and 4, twin 700-mw, coal-fired, electric generating plants.

In 1975, over 22 million tons of coal were mined in the state, up from 14 million in 1974, 11 million in 1973, and 1 million in 1969. By 1980, even if no new contracts are entered, Montana's annual coal production will exceed 40 million tons. Coal reserves, estimated at over 50 billion economically strippable tons (Montana Energy Advisory Council 1976), pose no serious constraint to the levels of development projected by this study, which range from 186.7 to 462.8 million tons stripped in the basin annually by the year 2000. Strip mining itself involves little use of water. How important the energy industry becomes as a water user in the basin will depend on: 1) how much of the coal mined in Montana is exported, and by what means, and 2) by what process and to what end product the remainder is converted within the state. If conversion follows the patterns projected in this study, the energy industry will use from 48,350 to 326,740 af of water annually by the year 2000.

A third consumptive use of water, municipal use, is also bound to increase as the basin population increases in response to increased employment opportunities in agriculture and the energy industry.

Can the Yellowstone River satisfy all of these demands for her water? Perhaps in the mainstem. But the tributary basins, especially the Bighorn, Tongue, and Powder, have much smaller flows, and it is in those basins that much of the increased agricultural and industrial water demand is expected.

Some impacts could occur even in the mainstem. What would happen to water quality after massive depletions? How would a change in water quality affect existing and future agricultural,industrial, and municipal users? What would happen to fish, furbearers, and migratory waterfowl that are dependent on a certain level of instream flow? Would the river be as attractive a place for recreation after dewatering?

One of the first manifestations of Montana's growing concern for water in the Yellowstone Basin and elsewhere in the state was the passage of significant legislation. The Water Use Act of 1973, which, among other things, mandates the adjudication of all existing water rights and makes possible the reservation of water for future beneficial use, was followed by the Water Moratorium Act of 1974, which delayed action on major applications for Yellowstone Basin water for three years. The moratorium, by any standard a bold action, was prompted by a steadily increasing rush of applications and filings for water (mostly for industrial use) which, in two tributary basins to the Yellowstone, exceeded supply. The DNRC's intention during the moratorium was to study the basin's water and related land resources, as well as existing and future need for the basin's water, so that

the state would be able to proceed wisely with the allocation of that water. The study which resulted in this series of reports was one of the fruits of that intention. Several other Yellowstone water studies were undertaken during the moratorium at the state and federal levels. Early in 1977, the 45th Montana Legislature extended the moratorium to allow more time to consider reservations of water for future use in the basin.

THE STUDY

The Yellowstone Impact Study, conducted by the Water Resources Division of the Montana Department of Natural Resources and Conservation and financed by the Old West Regional Commission, was designed to evaluate the potential physical, biological, and water use impacts of water withdrawals and water development on the middle and lower reaches of the Yellowstone River Basin in Montana. The study's plan of operation was to project three possible levels of future agricultural, industrial, and municipal development in the Yellowstone Basin and the streamflow depletions associated with that development. Impacts on river morphology and water quality were then assessed, and, finally, the impacts of altered streamflow, morphology, and water quality on such factors as migratory birds, furbearers, recreation, and existing water users were analyzed.

The study began in the fall of 1974. By its conclusion in December of 1976, the information generated by the study had already been used for a number of moratorium-related projects--the EIS on reservations of water in the Yellowstone Basin, for example (Montana DNRC 1976). The study resulted in a final report summarizing all aspects of the study and in eleven specialized technical reports:

Report No. 1	Future Development Projections and Hydrologic Modeling in the Yellowstone River Basin, Montana.
Report No. 2	The Effect of Altered Streamflow on the Hydrology and Geomorphology of the Yellowstone River Basin, Montana.
Report No. 3	The Effect of Altered Streamflow on the Water Quality of the Yellowstone River Basin, Montana.
Report No. 4	The Adequacy of Montana's Regulatory Framework for Water Quality Control
Report No. 5	Aquatic Invertebrates of the Yellowstone River Basin, Montana.
Report No. 6	The Effect of Altered Streamflow on Furbearing Mammals of the Yellowstone River Basin, Montana.
Report No. 7	The Effect of Altered Streamflow on Migratory Birds of the Yellowstone River Basin, Montana.

Report No. 8	The Effect of Altered Streamflow on Fish of the Yellowstone and Tongue Rivers, Montana.
Report No. 9	The Effect of Altered Streamflow on Existing Municipal and Agricultural Users of the Yellowstone River Basin, Montana.
Report No. 10	The Effect of Altered Streamflow on Water-Based Recreation in the Yellowstone River Basin, Montana.
Report No. 11	The Economics of Altered Streamflow in the Yellowstone River Basin, Montana.

ACKNOWLEDGMENTS

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The author wishes to express his appreciation to the following Montana Department of Fish and Game personnel: Ron Holliday, Administrator of the Parks Division, and Keith Seaburg, Region 7 Supervisor, for their general cooperation; Robert Martinka, Bureau Chief, Baseline Study, for his expertise, advice, and cooperation; Larry Peterman and other members of the Fisheries Division for their assistance and for the use of their equipment; Tom Hinz, Neil Martin, and other members of the Game Management Division for their geographical knowledge of the study area and the use of their equipment; and Becky Grant and Pat Hensley for their diligent work and long hours in the field.

Other DNRC personnel providing assistance were Janet Cawlfield, Lynda Howell, Kris MacIntyre and Barbara Williams, typists. Graphics were performed by Gary Wolf and Gordon Taylor. D.C. Howard designed and drew the cover.

Introduction

PURPOSE

The Yellowstone River, free-flowing in its entire length, provides diverse recreational opportunities. This study was initiated to evaluate present recreational use on the river and determine the potential effects of altered streamflow on existing and future recreational uses. A secondary objective was to evaluate potential recreation sites along the river. The study was initiated in November 1974 and continued until October 1976.

SCOPE

In order to accomplish this study three major techniques have been used to evaluate recreational behavior (Burdge and Field 1972). Two were used in this report. The first was the measurement of demographic, social, and other individual and group characteristics of users of this recreation area. The second was the examination of the resource itself to determine available recreational opportunities. The third, quantification of recreational benefits in terms of dollars, is considered in Report No. 11 of this series.

STUDY AREA

The study area includes the Yellowstone River from Big Timber to the North Dakota border, a distance of approximately 700 river kilometers (436 river miles)(figure 1). Major tributaries include the Boulder, Stillwater, Clarks Fork Yellowstone, Bighorn, Tongue, and Powder rivers, which within Montana have a total combined length of 1,140 km (710 river miles). The boundaries of five major drainages were used to divide the study area into five sections (figure 1).

The upper reaches of the Yellowstone River are considered a cold-water aquatic environment, the lower reaches a warm-water environment, and the river reach between Columbus and Custer a transition zone. These varying environments are characterized in part by a decrease in river gradient; the westernmost section (1) has an average slope of 0.002 (2 m/km, 10 ft/mi); the easternmost section (5) has an average slope of about 0.0004 (0.4 m/km, 2 ft/mi). Differing patterns of recreational activity result from these variations.

Of the counties included in the study area, Yellowstone County has the largest population, 97,400. Other county populations within the study area are much smaller: Custer 12,000, Big Horn 10,900, Dawson 10,400, Richland 9,700, Rosebud 9,578, Carbon 7,700, Stillwater 5,300, Fallon 4,000, Sweet Grass 3,000, Powder River 2,300, Carter 1,900, Prairie 1,900, Wibaux 1,456 and Treasure 1,228. (These figures are 1975 projected estimates based on the 1970 census.)

Water flow in the two years of study differed. In 1975, a year of floods and high runoff, the peak at Miles City of 69,800 cfs occurred on July 9. In 1976 the runoff was much lower and steadier. The peak at Miles City was 45,300 cfs, on June 13.

Yellowstone River Basin

Yellowstone River Study Sections

0 10 20 40 60 80 100 Miles

0 10 20 40 60 80 100 Kilometers

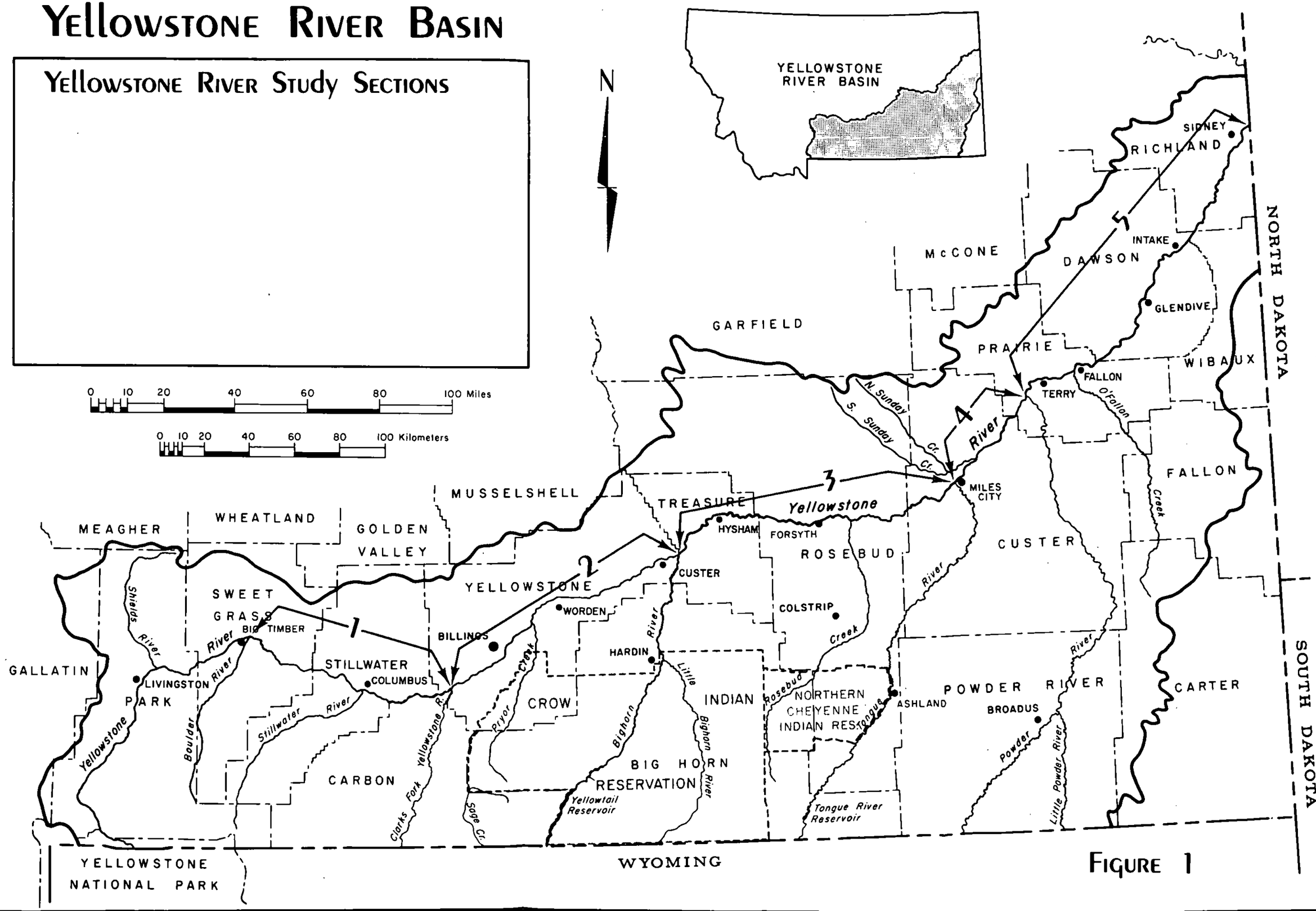


FIGURE 1

AERIAL OBSERVATIONS

From August 8 through December 5, 1975, 29 aerial flights were completed by Region 7 Montana Department of Fish and Game personnel. The average length of these round-trip flights was 2.67 hours, and the average recreationist sighting per flight was 17.3. The majority (27) of the flights were made on weekdays. Each flight was divided into small subsections because of various distances and directions flown. Thus, each flight was counted as one observation of each of several subsections of the river (figure 10). Recreational pursuits were divided into five usually definable categories: fishing, big game or bird hunting, waterfowl hunting, rest and relaxation, and agate hunting (table 11). The number of boats was also recorded. Big game hunting and bird (mostly pheasant) hunting were combined due to the similar, indirect role of the Yellowstone River to these sports.

TABLE 11. Aerial observations of recreational activities, August 8-December 5, 1975.

	Section									
	1	2a	2b	3a	3b	4	5a	5b	5c	Total
	NUMBER OF RECREATIONISTS IN EACH ACTIVITY									
Fishing	2	8	30	6	28	12	5	17	3	111
Big Game Hunting or Bird Hunting	0	1	20	18	40	22	43	40	17	201
Waterfowl Hunting	0	0	14	8	8	3	4	3	3	43
Rest and Relaxation[a]	0	0	8	12	14	0	2	0	2	38
Agate Hunting	0	0	13	2	19	14	25	35	6	114
TOTAL	2	9	85	46	109	51	79	95	31	507
	OBSERVATION DATA									
Number of Observations	3	5	15	14	14	11	9	10	11	92
Number of People per Observation	.66	1.80	5.66	3.28	7.79	3.18	7.22	9.50	2.82	
Number of Boats	0	1	6	3	12	3	5	10	3	43
Number of Persons per Boat[b]	0	9.0	14.2	15.3	9.9	17.0	15.8	9.5	10.3	

[a]Any unidentifiable activity.

[b]This is the ratio of the number of people observed to the number of boats observed. The greater the number, the smaller the relative amount of boating.

TABLE 10. Relative importance of recreational activities and sectional rating preferences (SRP), 1975-1976.

	Section									
	1		2		3		4		5	
	Relative Importance (%)	SRP	Relative Importance (%)	SRP	Relative Importance (%)	SRP	Relative Importance (%)	SRP	Relative Importance (%)	SRP
Swimming	6	2	28	3	3	1	0	1	0	1
Picnicking	18	3	5	1	6	2	0	1	2	1
Rest and Relaxation	23	3	16	3	22	3	47	3	17	3
Boating	15	2	5	2	8	2	28	3	13	2
Horseback Riding	1	1	0	1	0	1	0	1	0	1
Bicycling	1	1	2	1	0	1	0	1	0	1
Motor Biking	2	1	3	1	1	1	1	1	2	1
Driving for Pleasure	1	1	5	1	2	1	0	1	0	1
Playing Outdoor Games	7	1	4	1	6	1	2	1	5	1
Rockhounding	2	1	0	1	0	1	4	1	18	3
Sightseeing	4	1	13	2	6	2	0	1	3	1
Walking for Pleasure	1	1	0	1	0	1	0	1	0	1
Waterskiing	0	1	0	1	0	1	0	1	0	1
Bird Watching	0	1	0	1	0	1	0	1	0	1
Fishing	22	3	19	3	44	3	18	3	40	3
PERCENTAGE OF ALL PEOPLE OBSERVED[a]	31		23		22		13		11	

[a]791 people in section 1, 589 in section 2, 576 in section 3, 332 in section 4, and 279 in section 5, for a total of 2567.

Table 9 shows the relative importance of each section to popular recreational activities. For example, of all the swimming observed during the study period in 1975, 98 percent occurred in section 2. In 1976, only 57 percent occurred in section 2, and 30 percent occurred in section 1. In addition, the fact that section 1 has the largest number of developed sites probably accounts for the largest percentages of picnicking. Table 10 shows the same information for the 1975 and 1976 combined observed use data, and also shows the sectional rating preferences (SRP) assigned for each activity in each section (see discussion of SRP's on page 11).

TABLE 9. Relative importance of each section to popular recreational activities.

Activity	Section				
	1	2	3	4	5
			1975		
Swimming	1	98	0	0	0
Picnicking	77	4	18	0	0
Rest and Relaxation	23	18	10	42	7
Boating and Floating	14	15	13	45	13
Horseback Riding	80	0	20	0	0
Bicycling	31	62	8	0	0
Motor Biking	24	38	7	10	21
Driving for Pleasure	11	56	33	0	0
Playing Outdoor Games	61	9	20	0	11
Rockhounding	25	0	0	25	50
Sightseeing	21	49	24	0	5
Walking for Pleasure	50	17	33	0	0
Waterskiing	0	0	0	0	0
Bird Watching	0	0	0	0	0
Fishing	22	27	24	6	21
			1976		
Swimming	30	57	13	0	0
Picnicking	59	22	16	0	4
Rest and Relaxation	38	13	34	6	9
Boating and Floating	68	2	13	7	10
Horseback Riding	0	100	0	0	0
Bicycling	0	100	0	0	0
Motor Biking	29	53	12	0	6
Driving for Pleasure	50	25	25	0	0
Playing Outdoor Games	29	14	37	8	12
Rockhounding	10	4	4	10	71
Sightseeing	0	83	17	0	0
Walking for Pleasure	100	0	0	0	0
Waterskiing	0	0	0	0	0
Bird Watching	0	0	0	0	0
Fishing	27	9	43	10	12

TABLE 8. Relative importance of activities within each section in 1975 and 1976 (%).

Activity	Section				
	1	2	3	4	5
			1975		
Swimming	1	23	0	0	0
Picnicking	22	1	9	0	0
Rest and Relaxation	24	17	17	56	17
Boating	8	8	12	33	17
Horseback Riding	1	0	1	0	0
Bicycling	1	2	1	0	0
Motor Biking	2	3	1	1	4
Driving for Pleasure	1	6	6	0	0
Playing Outdoor Games	10	1	5	0	4
Rockhounding	2	0	0	3	11
Sightseeing	9	19	16	0	5
Walking for Pleasure	1	0	1	0	0
Waterskiing	0	0	0	0	0
Birdwatching	0	0	0	0	0
Fishing	18	20	31	7	41
PERCENTAGE OF ALL PEOPLE OBSERVED[a]	11	20	16	28	26
			1976		
Swimming	10	37	5	0	0
Picnicking	15	11	5	0	3
Rest and Relaxation	23	16	25	20	17
Boating	20	1	5	11	9
Horseback Riding	0	1	0	0	0
Bicycling	0	4	0	0	0
Motor Biking	1	4	1	0	0
Driving for Pleasure	1	1	1	0	0
Playing Outdoor Games	4	4	6	6	6
Rockhounding	1	1	1	6	25
Sightseeing	0	4	1	0	0
Walking for Pleasure	0	0	0	0	0
Waterskiing	0	0	0	0	0
Birdwatching	0	0	1	0	0
Fishing	26	17	51	56	39
PERCENTAGE OF ALL PEOPLE OBSERVED[b]	36	18	29	6	11

[a]329 people in section 1, 363 in section 2, 202 in section 3, 253 in section 4, 140 in section 5, for a total of 1287.

[b]462 people in section 1, 226 in section 2, 374 in section 3, 79 in section 4, 139 in section 5, for a total of 1280.

TABLE 7. Total observed recreational use for 1975 and 1976.

Activity	1975		1976	
	Number of People	Percentage of Total	Number of People	Percentage of Total
Swimming	86	7	146	11
Picnicking	93	7	115	9
Rest and Relaxation	339	26	272	21
Boating-Floating	188	15	136	11
Horseback Riding	5	-	2	-
Bicycling	13	1	8	1
Motor Biking	29	2	17	1
Driving for Pleasure	36	3	8	1
Playing Outdoor Games	56	4	65	5
Rockhounding	32	3	49	4
Sightseeing	136	11	12	1
Walking for Pleasure	6	1	1	-
Waterskiing	0	0	0	0
Bird Watching	0	0	2	-
Fishing	268	21	447	35
Total number of people observed	1287		1280	
Total number of vehicles observed	558		411	
Estimated number of people per number of vehicles	2.31		3.11	

Figure 9. Swimming in the Yellowstone River near Reedpoint, Montana, 1975.

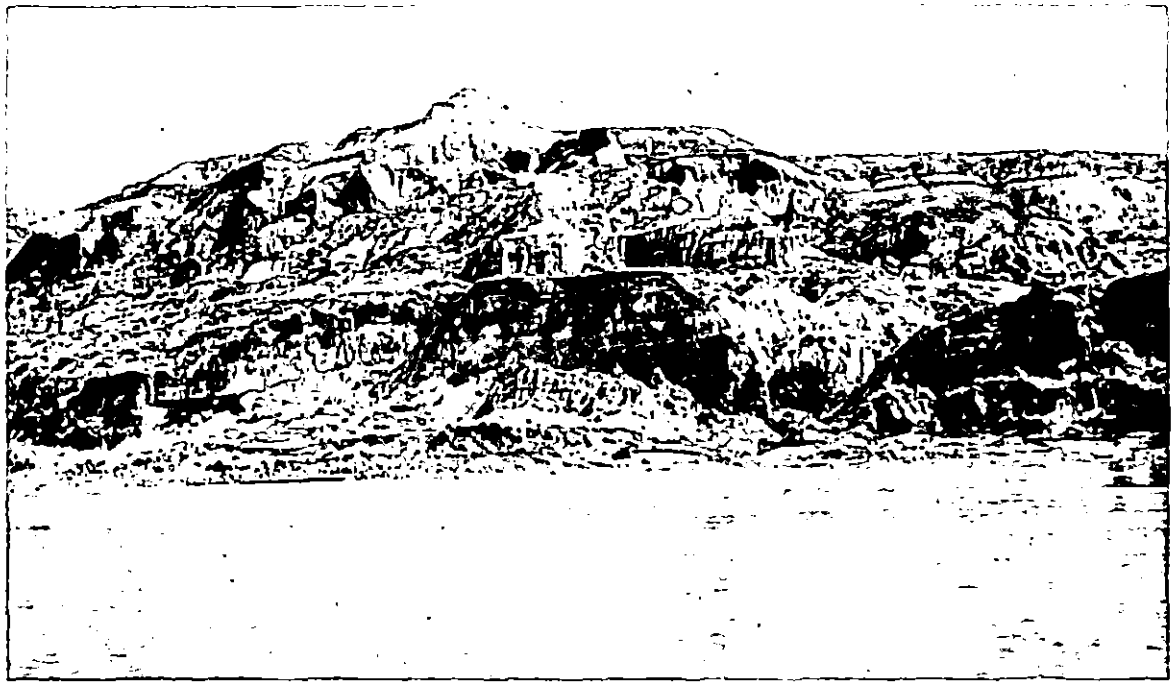


Figure 8. Sightseeing and picnicking along the Yellowstone River offer fine shoreline recreation.

Ling (burbot) fishing has become an extremely popular late winter-early spring recreational activity at the East Rosebud Fishing Access Site (section 3) on the Yellowstone River. Thirty-six fishermen fished a total of 98 hours from February 19 to March 19, 1975 (Haddix 1975). There were 251 burbot taken, a 2.56 average catch per angler hour. From March 1 to June 17, 1975, there were 82 fishermen and 16 people resting and relaxing during 18 observations at this site. Since most observations (13) were not made at night when ling fishing success is at its best, these figures should be considered low. The convenient access and high rate of fishing success greatly appeals to many people, mostly those from Forsyth, Miles City, and Colstrip.

Although no use studies were undertaken during the winter of 1975-76 observations, communications, and common sense were utilized to estimate use. River ice drastically reduces recreational use, and when this condition is coupled with inclement weather the majority of determined outdoor recreationists prefer to engage in off-river forms of recreation such as snowmobiling, predator hunting and trapping, and farm pond ice fishing. River ice began to accumulate in mid-December of 1975. The Yellowstone River within the study area usually is not completely ice-covered, but shoreline ice is dangerous and inhibits access to the river by recreationists. Complete ice breakup usually occurs first on the upper reaches of the study area, with large ice jams often occurring within the Glendive-Sidney segment of the Yellowstone. As the river clears, water-based recreation follows. Fishing pressure and angler success increase with the spawning runs of various species, which, depending upon weather conditions, occurs from midspring through summer.

The analysis of 1975 and 1976 recreational use observed during vehicle trips, by section, is presented below. Table 7 lists the various recreational activities available within the study area and the number and percentage of people participating in each activity for 1975 and 1976. In 1975, rest and relaxation (figure 8) was the most popular activity, 26 percent, followed by fishing, 21 percent. The number of people per vehicle was found to average 2.31. The total number of people observed was 1287.

The 1976 data reveal that fishing was the most frequently pursued activity, 35 percent, followed by rest and relaxation, 21 percent. The number of persons per vehicle was 3, substantially higher than in 1975. Certain areas close to or within towns along the Yellowstone River (e.g., East Rosebud Recreation Area at Forsyth) are within walking or bicycling distance for many recreationists. Access was hindered by residual water more in 1975 than in 1976, perhaps explaining the difference.

Table 8 shows the relative importance of various recreational activities within each section in 1975 and 1976. For example, in section 2, of recreationists observed, 23 percent in 1975 and 37 percent in 1976 were engaged in swimming. Sectional differences are apparent; for example, for both 1975 and 1976, swimming (figure 9) was much more popular in section 2 than in other sections. Also included in table 8 is the percentage of people observed within each section. Section 2, which includes Billings, had the highest percentage (28) in 1975, and section 1 had the highest percentage (36) in 1976. However, in 1976, 63 percent of the people surveyed in section 1 were from Billings.

TABLE 4. Observed recreational use by activity in section 3, March 1-June 17, 1975.

	Myers	Myers to West Rosebud	West Rosebud	East Rosebud	Ft. Keogh	Mouth of Tongue	Below Mouth of Tongue	Total
NUMBER OF OBSERVATIONS	13	13	13	18	18	30	15	
NUMBER OF:								
Fishermen	2	23	6	82	12	64	9	198
Rockhounds		9	1		9	2		30
Sightseers								0
Fishing: Boating								0
Canoeists								0
Rest; Relaxation	4	13	3	16			2	38

TABLE 5. Observed recreational use by activity in section 4, March 1-June 17, 1975.

	Mouth of Powder
NUMBER OF OBSERVATIONS	12
NUMBER OF:	
Fishermen	2
Rockhounds	2
Sightseers	3
Fishing; Boating	
Canoeists	
Rest; Relaxation	

TABLE 6. Observed recreational use by activity in section 5, March 1-June 17, 1975.

	Terry Bridge	Between Terry and Fallon Bridges	Fallon Bridge	Between Fallon Bridge and Glendive	Glendive	Intake	Total
NUMBER OF OBSERVATIONS	10	11	10	11	11	9	
NUMBER OF:							
Fishermen	11	11		32		1023	1077
Rockhounds		2			2		4
Sightseers						2	2
Fishing; Boating					3		3
Canoeists					3		3
Rest; Relaxation				3		53	56

air. Also included in the study were observations made by Montana Department of Fish and Game personnel while working on the river. For each trip, the date and the section of river traveled were noted. Observations from vehicles are not complete due to limited accessibility, but observations from the air are complete. These observations were made from March 1 to June 17, 1975, and from August 8 to December 5, 1976.

ON-GROUND OBSERVATIONS

Recreational visitation frequencies within the defined Yellowstone River sections for the spring 1975 data are presented in tables 2 through 6.

TABLE 2. Observed recreational use by activity in section 1.

	Big Timber	Bratten	Reed Point	Itch-Kep-Pe	Laurel	Total
NUMBER OF OBSERVATIONS	2	2	2	2	3	
NUMBER OF:						
Fishermen			2	3	2	7
Rockhounds						
Sightseers						
Fishing; Boating						
Canoeists						
Rest; Relaxation				4		4

TABLE 3. Observed recreational use by activity in section 2, March 1-June 17, 1975

	Billings	Huntley	Pompeys Pillar	Custer	Custer to Mouth of Bighorn	Total
NUMBER OF OBSERVATIONS	7	6	6	7	7	
NUMBER OF:						
Fishermen		8				8
Rockhounds						
Sightseers						
Fishing; Boating						
Canoeists						
Rest; Relaxation		2			10	12

Cross Tabulation	Valid Responses	Responses
CT-11 (Q. 24a and 24c).	182	The 33 percent that replied they knew of public land near (within 50 miles upstream or downstream) their present site also knew they could obtain information on these lands free of charge. Thirty-one percent did not know the location of proximate public land nor the availability of free information concerning these lands.
CT-12 (Q.17 and 24a).	164	Thirty-five percent of all respondents indicated they knew of the public land along the river near their recreation site but would like to see another site within 30 miles upstream or downstream. Forty-nine percent indicated no knowledge of public lands near their recreational area but would like to see another recreational site within 30 miles.
CT-13 (Q. 23a and 23c).	185	Forty-nine percent indicated that insects were a problem in their area but would return even though the problem persisted. Fifteen percent indicated they would not return.
CT-14 (Q. 23b and 23d).	182	Of the 30 percent who indicated that insects had reduced the amount of recreational time they had spent at the site, 40 percent said that they would not return to the area. Fifty-five percent indicated that insects had not reduced recreational time and that they would return to the area.
CT-15 (Q. 7 and 8b).	144	Thirty-six percent listed their favorite activity as fishing and their length of stay as day use only.

OBSERVED USE

Recreational use along the river was observed in two ways. First, activities were observed at specific sites during the summer study periods of 1975 and 1976. These data were used to determine the nature of current recreational use of the river and to evaluate the impact of such use. Second, activities were observed along the entire mainstem of the Yellowstone River within the study area through visual checks on the ground and from the

Cross Tabulation	Valid Responses	Responses
CT-6 (Q. 15 and 16).	194	Forty percent indicated that the area they were enjoying was just right (concerning crowding) and would like to see more site development. Thirteen percent indicated the area was not used enough but should have more development, and 31 percent thought the area was just right and wanted no more development.
CT-7 (Q. 13 and 18a).	197	Eighty-one percent were Montana residents; forty-five percent of Montanans noted a decrease in the distance traveled to a recreational area due to the increased cost of gasoline, and 36 percent reported no effect.
CT-8 (Q. 14 and 18a).	171	Fifty-four percent of all income categories indicated that the increasing cost of gasoline had reduced the distance traveled to a recreational area; of the remaining 46 percent, some did not answer the cost-of-gasoline question. Only the higher income category, above $16,000 annually, indicated that there was no correlation between the cost of gasoline and the distance traveled for recreation.
CT-9 (Q. 16 and 18a).	193	Fifty-seven percent of the 121 people who indicated that there should be more development at their recreational site replied that the cost of gasoline had decreased their recreational mileage, whereas 43 percent replied that it had not. Of the 72 people who indicated that they wanted no further development for the present site, 46 percent replied that the increasing cost of gasoline had decreased their recreational mileage, and 54 percent answered that it had not.
CT-10 (Q. 13 and 14).	141	Montana residents' income categories were: under $5,000, 16 percent; $6,000-8,000, 11 percent; $8,000-12,000, 29 percent; $12,000-16,000, 28 percent; and over $16,000, 16 percent.

Cross Tabulation	Valid Responses	Responses
CT-1 (Q. 1 and 2)	197	Forty-three percent replied that they were not on vacation and recreation was the primary purpose for the trip. Another 31 percent replied that they were not on vacation and recreation on the Yellowstone was not the primary purpose of their trip. Of the 25 percent who were on vacation, 56 percent replied that recreation on the Yellowstone was the primary purpose and 44 percent replied that it was not.
CT-2 (Q. 4 and 6).	137	Twelve percent replied that since they started using the Yellowstone they had noticed better water quality and their enjoyment of the river had increased. Of the 67 percent who replied water quality had remained the same, 56 percent replied that their enjoyment had increased and 48 percent replied that their enjoyment had stayed the same.
CT-3 (Q. 5 and 6).	129	Sixteen percent reported increased enjoyment regardless of increased litter; 19 percent reported increased enjoyment, with litter about the same as in previous years; 16 percent reported increased enjoyment and noticeably less litter. Replies from 16 percent noted the same general enjoyment in spite of increased litter; 17 percent indicated that enjoyment of the site and on-site litter remained about the same; the 11 percent who reported that litter had decreased said their enjoyment had remained the same.
CT-4 (Q. 18b and 18c)	188	Thirty percent indicated that this year's recreational trip covered a shorter distance than previous years' typical trips, and 62 percent indicated trips within the same mileage categories.
CT-5 (Q. 7 and 18c)	175	Sixty-two percent responded that their stay was for day use only. Sixteen percent of these day users responded that this year's typical recreational trip covered less than 50 miles, 21 percent responded from 50-250 miles, 10 percent from 250-450 miles, and 15 percent over 450 miles.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
14.	28	22	The household income categories were:

	Percentage	
	1975	1976
under $5,000	18	9
$5,000-$8,000	11	14
$8,000-$12,000	32	27
$12,000-$16,000	25	45
over $16,000	14	5

15.	29	29	With respect to crowding, 69 percent of recreationists in 1975 and 70 percent in 1976 thought the area was just right; 14 percent in 1975 and 17 percent in 1976 felt it was too crowded; and 17 percent in 1975 and 13 percent in 1976 thought the area was not used enough.
16.	29	23	Fifty-six percent in 1975 and 78 percent in 1976 thought the site should have more development.
17.	24	18	Seventy percent in 1975 and 61 percent in 1976 would like to see at least one more site within 30 miles of the present recreational site.
24.	28	21	Only 39 percent of recreationists in 1975 and 43 percent in 1976 knew the location of public lands near their recreational site.

Questionnaire Cross Tabulations

Cross tabulations (CT) for 1975 and 1976 questionnaire responses from the entire study area (appendix C) are presented here. Each cross tabulation includes two questions from the questionnaire.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
	15	8	In 1975, sauger/walleye fishing and paddlefishing produced the most success with 40 percent and 27 percent,respectively, of fishermen reporting catches. During 1976, paddlefishing and sauger/walleye fishing success were equal, 37.5 percent, with catfishing third at 25 percent.
10.			Ratings of facilities as exceptional or good were:

	Percentage		Valid Responses	
	1975	1976	1975	1976
picnic facilities	65	74	23	23
rest rooms	59	67	22	21
camping sites	59	67	22	21
weed mowing	57	94	21	20
access roads	54	70	26	20

	19	13	Provision for children's activities was rated only fair or poor by 74 percent in 1975 and 92 percent in 1976.
12.	25	11	In 1975 and 1976, 60 percent and 91 percent, respectively, indicated they liked an alternative site along the Yellowstone as well as the site they were currently enjoying.
13.	29	24	Seventy-six percent in 1975 and 58 percent in 1976 were Montana residents.
	22	14	In 1975, 59 percent of section 5 recreationists were from Glendive, 14 percent from Sidney, and 14 percent from Wibaux. In 1976, 71 percent were from Glendive, 14 percent from Billings, and 7 percent from Sidney.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
1.	29	24	About 69 percent of the respondents in 1975 and 54 percent in 1976 were not on vacation.
2.	28	23	About 68 percent in 1975 and 61 percent in 1976 characterized recreation on the Yellowstone as the main reason for their trip.

3.

Season	Number of Visits	Percentage of Respondents		Valid Responses	
		1975	1976	1975	1976
Spring	1-2	50	54	12	13
Summer	2 or more	75	57	28	24
Fall	1 or none	79	70	18	10
Winter	1 or none	100	100	7	4

4.	26		In 1975, sixty-eight percent reported that water quality had remained the same, 20 percent noted a decrease, and 12 percent perceived an increase.
5.	24	17	Fifty percent in 1975 and 47 percent in 1976 had noticed a decrease in litter.
6.	26		In 1975, sixty-one percent indicated an increase in enjoyment since first association with Yellowstone recreation.
7.	29	24	Sixty-two percent in 1975 and 46 percent in 1976 were day users only.
8.	27	20	Fifty-nine percent in 1975 and 50 percent in 1976 indicated fishing was the favored recreational activity. In 1976, rockhounding was favorite to 35 percent of the respondents.
9.	27	17	Thirty-three percent in 1975 and 20 percent in 1976 indicated that sauger/walleye was the principal fish species sought; 28 percent in 1975 and 50 percent in 1976 sought paddlefish; and 28 percent in 1975 and 21 percent in 1976 sought catfish. Paddlefishing within section 5 decreased from late spring through summer. In the pilot study during late spring in 1975, 84 percent of 63 valid responses listed paddlefish as the main fish sought.

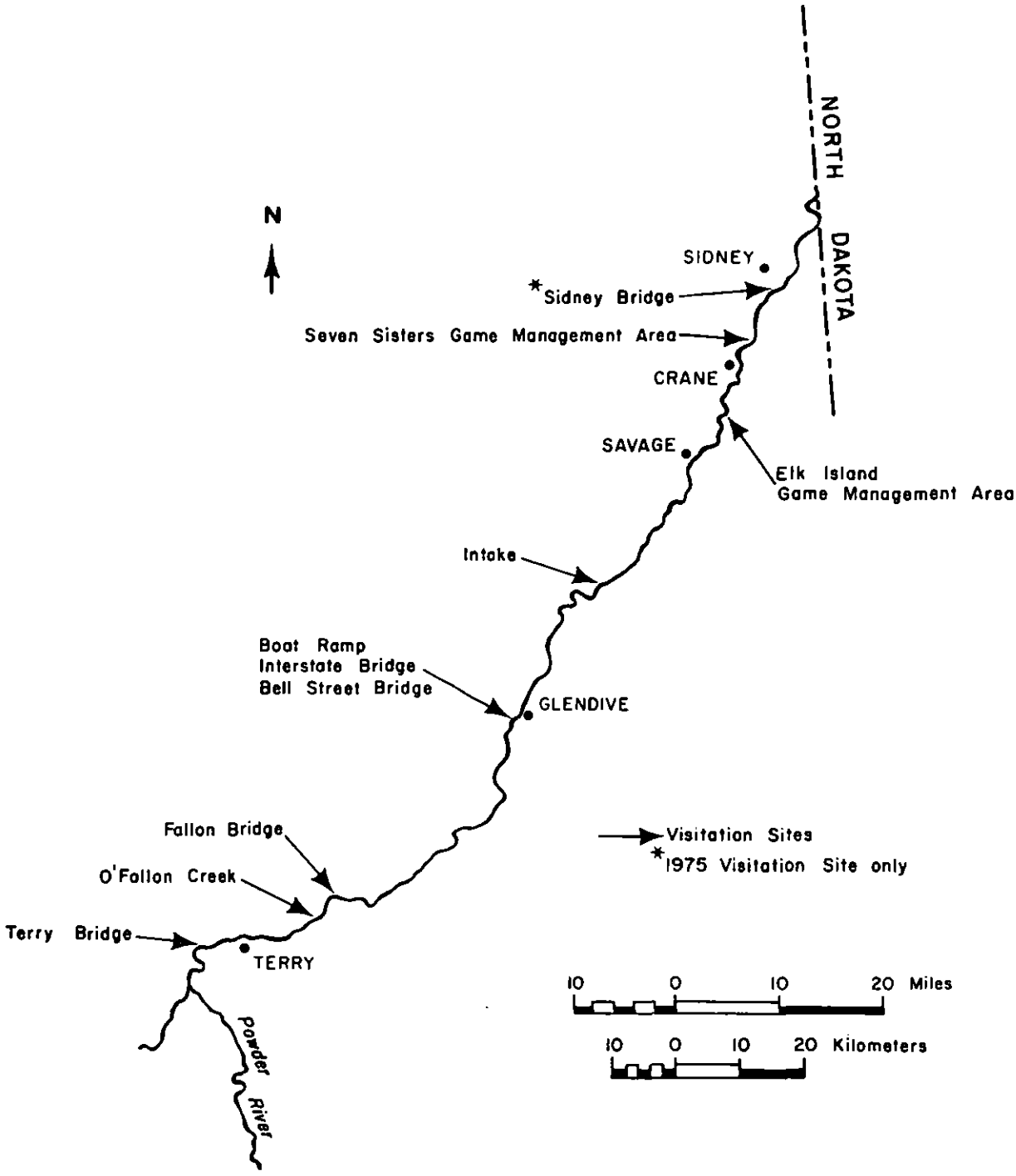


Figure 7. Yellowstone River section 5.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
10.		12	Attitudes toward facilities were generally negative due to the undeveloped nature of all sites. Access roads were rated good or fair by 75 percent of recreationists in 1976.
11.		13	In 1976, 54 percent indicated they did not know where they would go if their present site were not available.
13.	18	13	Eighty-eight percent in 1975 and 92 percent in 1976 were Montana residents.
	18	13	Miles City and Terry residents were the most numerous, with 80 percent in 1975 and 87 percent in 1976.
15.	18	13	With respect to crowding, 88 percent in 1975 and 83 percent in 1976 thought the area was just right.
16.	18	10	In 1975, 67 percent thought their recreational site should be more developed. Only 50 percent replied similarly in 1976.
17.	17	6	Eighty-one percent in 1975 and 67 percent in 1976 would like to see an additional recreational site within 30 miles of their present site.
24.	18	13	Only 36 percent in 1975 and 46 percent in 1976 knew about public lands along the river near their recreational sites.
26.	18	13	Fifty percent in 1975 and 39 percent in 1976 indicated that from two to nine days annually were spent at other recreational sites along the Yellowstone.

Section 5

Section 5 (figure 7) is the most easterly within the study area and stretches 241 river kilometers (149.5 river miles) from the mouth of the Powder River (which is not included) to the Montana-North Dakota state line. The average gradient of the river through section 5 is approximately 0.0004 (0.4 m/km, 2 ft/mi). The largest town in this section is Glendive, population 6,441; the second largest is Sidney, population 4,551. (These figures are projections based on 1970 census). Generally, popular recreational areas occur within each section at nearly every small community along the river, due to some convenient access. A total of 29 questionnaires was collected in section 5 in 1975 and 24 in 1976. Intake is the most popular recreational site of those surveyed within Section 5.

limited within section 4, the heaviest use being received by those areas shown in figure 6. Due to the small number of questionnaires obtained, 18 in 1975 and 13 in 1976, results will be brief. The flood dike along the Yellowstone near Miles City was the most popular recreation site; there are no developed recreational areas within section 4.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
1.	17	12	Seventy-two percent in 1975 and 67 percent in 1976 were not on vacation.
2.	17	12	Sixty-seven percent in 1975 and 58 percent in 1976 indicated recreation on the Yellowstone was the primary purpose of the trip.
3.	17	13	Thirty-five percent in 1975 and 15 percent in 1976 had not previously been to the present site during the summer. The undeveloped local access sites within section 4 seem to be visited mostly by local residents due to their proximity to home.
7.	14	6	Seventy-one percent in 1975 and 89 percent in 1976 were day users only.
8.	18	13	Thirty-nine percent in 1975 responded that they planned to engage in river floating or motorized boating. Thirty-nine percent in 1975 and 31 percent in 1976 indicated that they planned to participate in rockhounding. Agate hunting is a popular recreational activity along the river in sections 3, 4, and 5. In 1975, the Miles City Agate Club had approximately 60 members, 14 of whom reported a total of 49 visits per year between the mouth of the Bighorn River and Terry. These outings average 5-6 hours each. Most agate hunters use boats or rafts in order to reach islands and midchannel bars. Fifty-five percent in 1975 and 69 percent in 1976 were fishing.
	12	12	Fishing was the favorite activity for 50 percent of surveyed recreationists in 1975 and 83 percent in 1976.
9.	9	9	Catfish was the most popular species for 50 percent of the fishermen in 1975 and 67 percent in 1976.

Question No.	Valid Responses 1975	1976	Responses
26.	48	74	Days spent at other sites along the Yellowstone:

	1975 (%)	1976 (%)
No days spent at other sites	42	42
10-15 days	17	12
over 20 days	17	19

Section 4

This section (figure 6) includes 57 river kilometers (35.5 river miles) of the Yellowstone mainstem from the mouth of the Tongue River, which is not included, to the mouth of the Powder River, which is. The river gradient through this section averages 0.00073 (0.7 m/km, 4 ft/mi). Miles City, the only major town, had a 1975 estimated population of 10,029. Access is rather

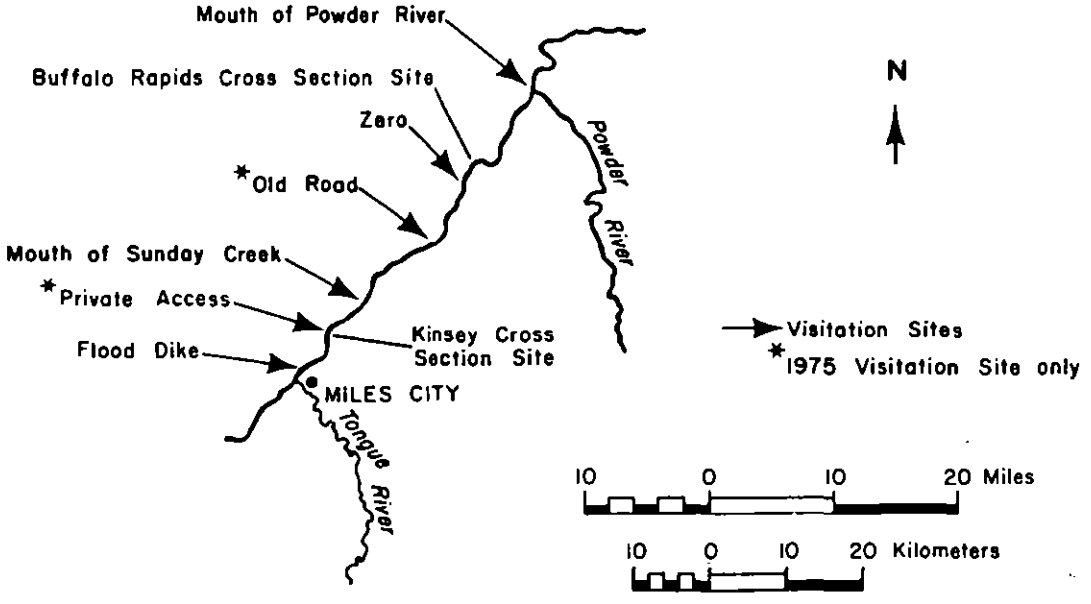


Figure 6. Yellowstone River section 4.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
14.	43	42	Income categories and percentages were as follows:

	Percentage	
	1975	1976
under $5,000	16	19
$5,000-$8,000	12	19
$8,000-$12,000	30	14
$12,000-$16,000	23	19
over $16,000	19	29

15.	49	42	Eighty percent in 1975 and 76 percent in 1976 noted the area was just right; 14 percent in 1975 and 12 percent in 1976 replied that the area was too crowded.
16.	48	41	Sixty-five percent in 1975 and 59 percent in 1976 thought there should be more development at the site.
17.	45	32	In 1975 and 1976, 84 percent and 81 percent, respectively, would like to see another recreation site no more than 30 miles from the present site.
20.	46	43	In 1975 and 1976, 46 and 30 percent, respectively, listed their occupation category as blue collar, possibly a result of coal and energy development near section 3. The next largest category was retired, 20 percent in 1975 and 23 percent in 1976.
23.	45	65	In 1975, 58 percent noted that insects had reduced the time spent enjoying various recreational activities. In 1976, only 32 percent noted reduced time. The amount of standing water in 1976, less than in 1975, probably provided less opportunity for mosquito breeding.
24.	47	45	In 1975 and 1976, 34 and 40 percent, respectively, knew of public land near the sites.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
	23	20	In 1975, 48 percent caught sauger and walleye, and 39 percent caught catfish. Sturgeon, ling, goldeye, suckers, and carp were also caught, but since the latter three species are generally considered trash fish, they were seldom listed by fishermen. In 1976, catfish were most often caught, 55 percent, followed by sauger and walleye, 30 percent.
10.			Facilities were rated as exceptional, good, or fair by the following percentages of respondents:

	Percentage		Valid Responses	
	1975	1976	1975	1976
picnic facilites	91	94	42	35
rest rooms	71	61	34	28
camping sites	85	88	34	32
children's activities	43	64	30	25
weed mowing	39	75	28	39
access roads	85	87	28	38

NOTE: Most sites in section 3 are more developed than those in other sections, which would seem to explain the high percentages in this table.

11.	29	18	In 1975 and in 1976, 69 percent and 72 percent, respectively, indicated they liked an alternative site along the Yellowstone as well as the site they were currently enjoying.
12.	47	47	Eight-seven percent in 1975 and 83 percent in 1976 were Montana residents.
	40	38	Forsyth was the home of 48 percent of recreationists in 1975, followed by Billings, 20 percent, and Miles City, 10 percent. In 1976, Miles City ranked first, 45 percent, followed by Forsyth, 40 percent, and Billings, 8 percent.

Question No.	Valid Responses 1975	1976	Responses
4.	34		Sixty-five percent in 1975 had perceived no change in water quality.
5.	32	38	Fifty-nine percent in 1975 and 76 percent in 1976 indicated that litter had remained the same or decreased.
6.	36		Ninety-five percent in 1975 replied that their enjoyment of the river had remained the same or increased.
7.	40	67	Fifty-three percent in 1975 and 40 percent in 1976 were day users only.
8.	35	33	Seventy-seven percent in 1975 and 58 percent in 1976 indicated that fishing was the favorite recreational activity, followed by rest and relaxation (11 percent) in 1975 and rockhounding (15 percent) in 1976.
9.	32	29	Forty-one percent in 1975 and 52 percent in 1976 listed catfish as the most popular species sought, followed by sauger and walleye (figure 5) (44 percent in 1975 and 35 percent in 1976). Fishermen interchanged the names pike, sauger, and walleye.

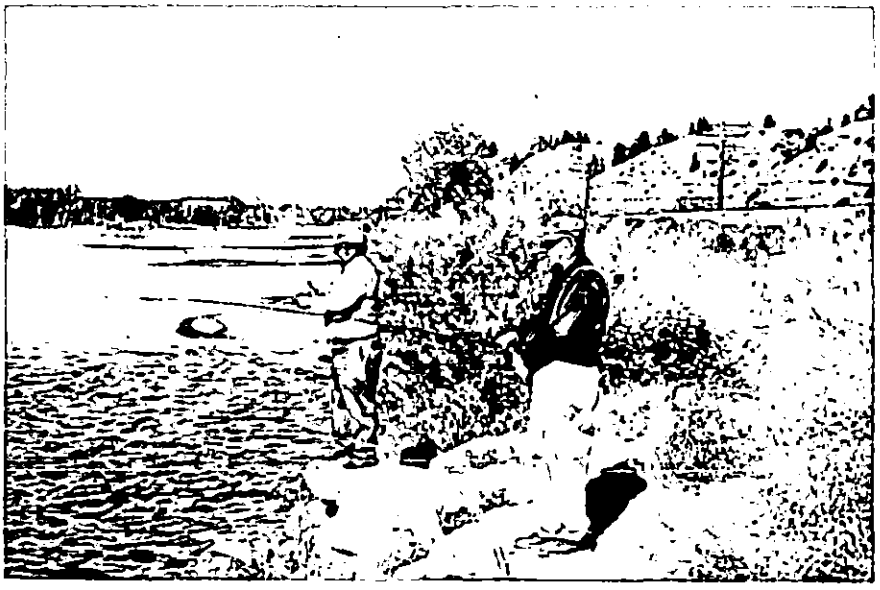


Figure 5. Sauger fishing on the Yellowstone River near Forsyth, Montana, 1976.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
	35	53	Concerning other reasons for a trip, sightseeing and rest and relaxation accounted for 54 percent in 1975 and 40 percent in 1976.

3.

	Percentage of respondents visiting site over 8 times each season		Valid Responses	
	1975	1976	1975	1976
spring	24	38	50	50
summer	44	41	48	49
fall	18	36	50	33
winter	12	37	42	27

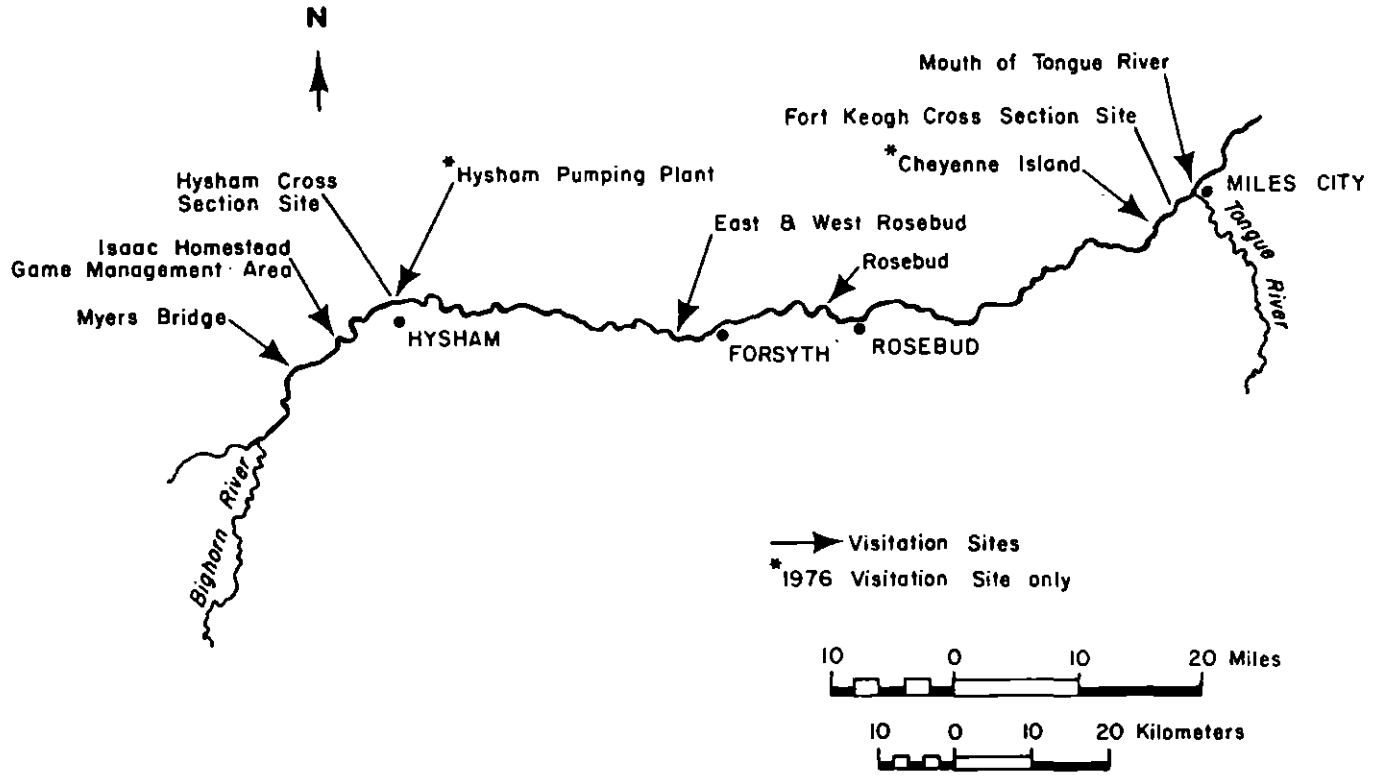


Figure 4. Yellowstone River section 3.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
26.	50	35	Days spent annually at other sites on the Yellowstone:

	1975 (%)	1976 (%)
No days spent at other sites	6	34
2-3 days	12	11
4-5 days	18	11
6-9 days	18	8
10-15 days	16	9
over 20 days	22	14

NOTE: Closure of the gravel pits near Billings in 1976 may account for the increase in the percentage of respondents claiming to spend no days at other sites along the river.

Section 3.

This section (figure 4) includes 178 river kilometers (111 river miles) of the Yellowstone mainstem from the mouth of the Bighorn River, which is not included, to the mouth of the Tongue River, which is. The river gradient averages 0.0006 (0.6 m/km, 3 ft/mi). The largest town within the section is Forsyth, with an estimated 1975 population of 2,449. East Rosebud Fishing Access the most popular recreational site within this section, is located at Forsyth. A total of 51 questionnaires were collected in section 3 in 1975 and 1976.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
1	46	74	Among the respondents, 80 percent in 1975 and 60 percent in 1976 were not on vacation.
2.	46	45	Forty-one percent in 1975 and 56 percent in 1976 indicated recreation on the Yellowstone was the primary purpose of the trip.

Question No.	Valid Response 1975	Valid Response 1976	Responses
15.	48	26	In 1975 and 1976, 27 and 11 percent, respectively, thought the area was too crowded, 58 and 69 percent thought the area was just right, and 15 and 19 percent thought the area was not used enough.
16.	46	23	In 1975 and in 1976, 70 and 57 percent respectively, thought there should be more development at the site.
17.	42	20	In 1975 and in 1976, 88 and 80 percent, respectively, would like to see another recreational site no more than 30 miles from the site.
20.	41	26	The following were the primary occupations listed:

	1975 (%)	1976 (%)
blue collar	42	12
self-employed blue collar	15	
white collar		15
students	17	23
professional		31

23.	47	33	Fifty-one percent in 1975 and 55 percent in 1976 said they thought that insects had reduced the amount of time spent enjoying recreational activities.
24.	48	31	Forty-nine percent in 1975 and 32 percent in 1976 knew of public land near the site.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
10.			Ratings of facilities within acceptable categories (exceptional, good, or fair) were:

	Percentage		Valid Responses	
	1975	1976	1975	1976
picnic facilities	45	50	31	28
rest rooms	17	26	30	15
camping sites	59	64	32	22
children's activities	14	24	28	21
weed mowing	19	29	31	21
access roads	67	76	39	25

12	35	35	Sixty percent in 1975 and 71 percent in 1976 said they liked an alternative site along the Yellowstone as well as the one they were using.
13.	48	30	Ninety-four percent in 1975 and 87 percent in 1976 were Montana residents.
	51	25	Eighty-six percent in 1975 and 96 percent in 1976 resided in Billings.
14.	45	29	The household income categories were:

	Percentage	
	1975	1976
under $5,000	20	17
$5,000-$8,000	18	10
$8,000-$12,000	13	24
$12,000-$16,000	31	31
over $16,000	18	17

Question No.	Valid Responses 1975	1976	Responses
4.	40	--	Eighty-five percent said water quality had remained the same or improved since their first visit to the Yellowstone.
5.	37	37	Fifty-one percent in 1975 noted an increase in litter and 58 percent in 1976 said the problem had remained the same.
6.	37	--	Ninety-five percent said that their enjoyment of the river had increased or remained the same.
7.	46	38	Seventy-six percent in 1975 and 63 percent in 1976 indicated their length of stay as one day only.
8.	42	24	Fishing was the favorite activity of 43 percent of respondents in 1975 and 25 percent in 1976. In 1975, 23 percent identified swimming as their favorite activity; in 1976, 25 percent answered rest and relaxation. Swimming's popularity in 1975 may have been partly due to its popularity at the gravel pits near Billings. The gravel pits were closed in 1976, and swimming dropped to third in popularity (17 percent).
9.	28	12	In 1975, 39 percent indicated that walleye and sauger were the most popular species sought; 17 percent responded suckers and carp, and 13 percent catfish. In 1976, 42 percent rated trout the most popular species sought; 17 percent said catfish, and 17 percent sauger. The news media focused public attention on trout fishing in 1976, possibly explaining the changes in preference.

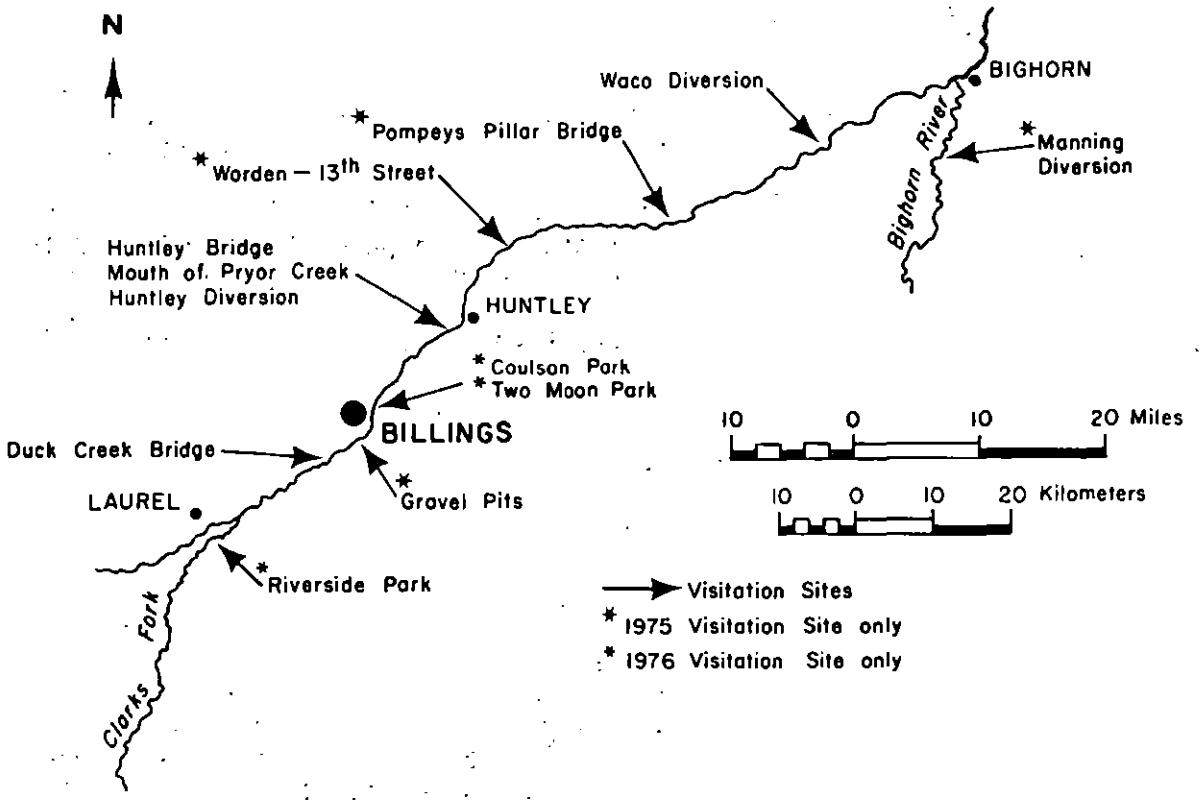


Figure 3. Yellowstone River section 2.

Question No.	Valid Responses 1975	1976	Responses
1.	51	38	Ninety percent in 1975 and 68 percent in 1976 were not on vacation.
2.	47	26	Fifty-seven percent in 1975 and 62 percent in 1976 stated that recreation on the Yellowstone was the main purpose of their trip.

3.

	Percentage of respondents visting site over 8 times each season		Valid Responses	
	1975	1976	1975	1976
spring	32	38	32	21
summer	40	40	45	32
fall	25	25	10	16

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
26.	57	96	Days spent at other sites along the Yellowstone:

	1975 (%)	1976 (%)
No days spent at other sites	16	19
1 day only	14	--
2-3 days	23	19
4-5 days	--	10
6-9 days	10.5	12
10-15 days	12	13
over 20 days	12	22

Section 2

This section (figure 3) extends 135 river kilometers (84 river miles) from the mouth of the Clarks Fork Yellowstone, which is not included, to the mouth of the Bighorn River, which is. The average river gradient through section 4 is about 0.001 (1 m/km, 6 ft/mi). The largest city, Billings, had an estimated 1975 population of 63,729. The most popular recreation area surveyed in 1975 was a series of water-filled gravel pits located on the north bank of the Yellowstone at Billings. This privately owned land is immediately adjacent to the Yellowstone River, and substantial recreational development is planned by private individuals and by the city of Billings. Of the 51 questionnaires collected in section 2 in 1975, 28 were obtained at the gravel pits. During 1976, however, the gravel pits were closed to recreationists, so two additional sites, Two Moon Park and Coulson Park,were surveyed. Manning Diversion on the Bighorn River was also closed in 1976 due to washout of a bridge.

Not included in the study was another privately owned recreational area along the river, Pompeys Pillar, approximately 35 miles east of Billings. Sightseeing is the major attraction at this area, open from June 1 to September 1 each year. Attendance for 1975 was 6,904 adults and 2,146 children, each of whom was charged a fee to view Captain William Clark's name engraved upon the pillar.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
15.	60	93	Concerning crowding, 78 percent in 1975 and 87 percent in 1976 rated the area just right and 22 and 9 percent, respectively, thought the area was not used enough.
16.	58	88	In 1975 and in 1976, 57 and 41 percent, respectively, thought there should be more development at this site.
17.	46	68	In 1975 and in 1976, 83 and 82 percent, respectively, would like another recreational site on the river within 30 miles of the one they were visiting.
20.	59	94	The following are the primary occupations listed:

	1975 (%)	1976 (%)
blue collar	31	23
white collar	19	19
retired	15	14
professional	10	16
housewife	10	--

23.	56	86	In 1975 and 1976, 41 and 38 percent, respectively, noted that insects had reduced the amount of time spent enjoying recreational activities.
24.	58	92	Forty-one percent in 1975 and 36 percent in 1976 knew of public land near the recreational site.

Question No.	Valid Responses 1975	Valid Responses 1976	Responses
9	34	60	Ninety-seven percent in 1975 and 95 percent in 1976 identified trout as the most popular species sought.
10.			Ratings of facilities within acceptable categories (exceptional, good, or fair) were:

	Percentage		Valid Responses	
	1975	1976	1975	1976
picnic facilities	87	89	45	45
rest rooms	64	73	45	77
camping sites	88	99	48	79
children's activities	39	47	26	79
weed mowing	64	51	42	74
access roads	92	85	49	84

12.	42	64	In 1975 and 1976, respectively, 79 and 82 percent indicated that they liked an alternative recreational site along the Yellowstone as well as the one they were currently enjoying.
13.	63	97	Seventy percent in 1975 and 74 percent in 1976 were Montana residents.
	62	71	Of those Montana residents surveyed, 61 percent in 1975 and 63 percent in 1976 resided in Billings; 25 and 24 percent, respectively, lived in Columbus.
14.	47	91	The household income categories were:

	1975 (%)	1976 (%)
under $5,000	4	7
$5,000-$8,000	15	14
$8,000-$12,000	23	24
$12,000-16,000	32	23
over $16,000	26	32

The town of Laurel, at the easternmost edge of section 1, is the largest with a population of 6,459. Reedpoint, population 133, Park City, population 430, Columbus, population 1,322, and Big Timber, population 1,645 are also in the section. (All population figures are 1975 projections based on the 1970 census). The most popular recreation area is Itch-Kep-Pe at Columbus. Sixty-two questionnaires were completed in this section in 1975 and 100 in 1976. From personal observation, recreational use seems more dispersed in this section than in others due to the absence of large towns and to the convenient access at several sites.

Question No.	Valid Responses 1975	1976	Responses
1.	63	99	Sixty percent in 1975 and 70 percent in 1976 were not on vacation.
2.	60	89	In 1975 and 1976, respectively, 50 and 55 percent indicated that recreation on the Yellowstone was the primary purpose of the trip. Twenty-nine percent in 1975 and 27 percent in 1976 were conducting business or visiting relatives.
3.	63	96	Twenty-nine percent in 1975 and 20 percent in 1976 had not been to the site before; 18 and 15 percent, respectively, had been there 2 or 3 times; 11 and 10 percent replied 4 to 6 times; and 24 and 25 percent responded 8 times or more.
4.	40		Ninety-five percent of those surveyed in 1975 said water quality had remained the same or improved since their first visit to the Yellowstone.
5.	39	84	Regarding litter, 33 percent in 1975 and 25 percent in 1976 noted an increase.
6.	40		Ninety-two percent of those surveyed in 1975 indicated that their enjoyment of the river had increased or at least remained the same.
7.	60	95	In 1975 and 1976, 57 and 55 percent, respectively, indicated that their use was for one day only.
8.	43	79	Fifty-six percent in both 1975 and 1976 answered that fishing was their favorite recreational activity, followed by rest and relaxation, 26 and 11 percent in 1975 and 1976, respectively.

is not included in the following tabulations. For that reason, not all response categories listed on the questionnaire are included in the following section, and the percentage responses given for many questions do not add to one hundred percent.

The questionnaires used for the two summers included in the study differed; some questions were used only on the first year's questionnaire, others only on the second. In reporting all of the responses from both years, a numbering system was devised for the questions which is not like the sample 1976 questionnaire in appendix C. The sectional tabulations which follow use this new numbering system as does the rest of this report. A complete list of the questions and their new numbers appears in the cumulative tabulation of results in appendix C.

Section 1

This section (figure 2) includes 124 river kilometers (77 river miles) from the mouth of the Boulder River at Big Timber to the mouth of the Clarks Fork Yellowstone. Access points include the town of Laurel, Itch-Kep-Pe at Columbus, Indian Fort at Reedpoint, Bratten, and the town of Big Timber. The average river gradient through section 1 is approximately 0.002 (2 m/km, 10 ft/mi).

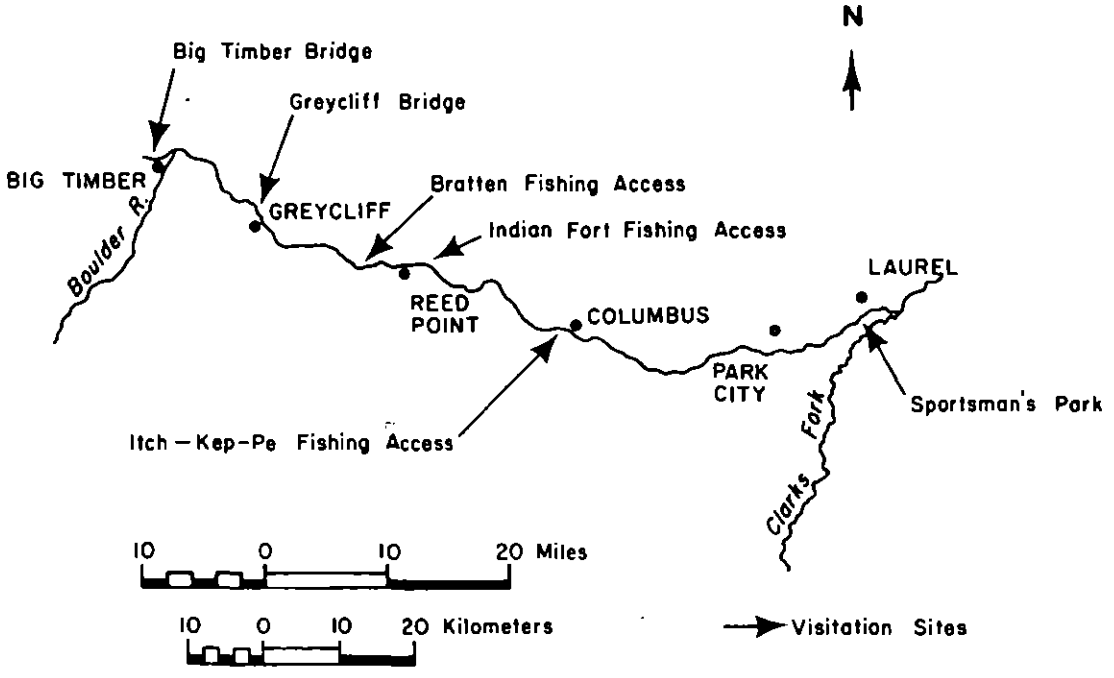


Figure 2. Yellowstone River section 1.

Existing situation

QUESTIONNAIRE RESPONSE

PILOT STUDY

Besides aiding in the development of a questionnaire for the summer recreation seasons, the pilot questionnaire yielded important data about late spring paddlefishing at the Intake Fishing access site, 27 km (17 miles) northeast of Glendive on the Yellowstone River. Eighty-eight questionnaires were returned, 84 percent of them from Intake. The tabulated response is shown in appendix B. Below are listed a number of results from the study.

Fifteen percent of the respondents had perceived a deterioration in water quality since their use of the Yellowstone River for recreation had begun; 29 percent had perceived an increase in litter. About 35 percent indicated that either litter or a deterioration in water quality had affected their enjoyment of the river. Approximately half of the respondents were day users. Only about 16 percent of the respondents reported that they were on their vacation, although almost 70 percent reported that recreation on the Yellowstone River was the primary purpose of the trip. About half replied that they spent one to nine days annually at other sites on the Yellowstone River and its tributaries.

Of the many recreational activities, fishing was the most popular, followed by rest and relaxation. Ninety percent of the respondents reported that this particular site fulfilled recreational demands at least adequately. When asked, "Where would you go to participate in the same activities if this site was not available?" the following alternatives were mentioned: Fort Peck, 20 percent; Fred Robinson Bridge, 18.5 percent; Yellowstone River, 11 percent; stay home, 9 percent; other, 7.5 percent. The remaining replies were scattered among various alternatives. About 60 percent thought the site was too crowded whereas 37 percent thought it was just right. Of those who thought the area was too crowded, most replied that more sites should be available. About two-thirds thought the site they were in should be more fully developed. About 40 percent claimed that the increase in the price of gasoline had decreased the distance traveled for recreation. About 76 percent of the respondents were Montana residents, most from nearby counties.

1975-1976 SUMMER QUESTIONNAIRE AND RESULTS

The characteristic nature and intensity of recreational activities varied among sections due to variations in population, river gradient, and level of water development. Because of these differences, the results of the summer questionnaire are reported below by study section. Appendix C includes a sample copy of the questionnaire and the cumulative tabulation of results from the entire study area.

Because of the relatively small sample size, any category which drew a response of less than five percent of respondents was considered not valid and

TABLE 1. Definition of Sectional Rating Preferences (SRPs)

Sectional Rating Preference	Percentage of Observed Recreationists
1	< 5
2	5-15
3	> 15

For each activity in each section an impact modification number (IMN) was subjectively assigned for each projected level of development. If a particular level of development would have a negative impact on a particular recreational activity in a particular section, then an IMN of minus 1 was assigned. An IMN of 0 indicates no impact, and an IMN of plus 1 a positive impact.

For each level of development, low, medium, and high, and for each recreational activity in each section, the product of the SRP and the IMN determines the overall impact. A series of matrices (tables 19 through 23) shows the impact expected on the activities considered in each section.

Car counters were used in six selected areas to estimate total use. Aerial censuses were undertaken intermittently to further substantiate results. Site visitation varied slightly in 1976 within sections in comparison with 1975 due to limited 1975 data collection and to the closing of some areas.

BOATING DATA

Actual observations of boat use were difficult to obtain. Instead, the number of registered boats in 15 counties of the study area was obtained, and questionnaires (appendix E) were randomly mailed to at least 15 percent of the boat owners of each county. Boat owners were asked where most of their boating occurred, their favorite activities, and the number of boating days per year. If more than one favorite site response was received, each was given an equal preference rating. These data are reported on pages 51 to 54.

RIVER STAGE

During July of 1976, in order to determine the effect of changes in river depth on recreation, channel cross sections were taken at four sites judged to be potentially difficult for navigation (Hinz 1976). Two sites were located in section 2 and two in section 3. At each site, the flow was determined which would provide adequate depth for passage of a 14-foot aluminum boat powered by a 15-to-20-horsepower motor, the most popular combination of boat and motor observed among river boaters. The results are shown in figure 17 on page 67.

IMPACT ASSESSMENT

Recreational use at a particular site depends on a number of factors. For the 1975 data, a multiple regression correlated the total observed number of recreationists with the following independent variables: river section (location), maximum air temperature, discharge, discharge squared, weather conditions, month, date, time of day (one of two time periods), and time of week (weekday or weekend).

For the 1976 data the multiple regression was modified somewhat. Time of day, found to be insignificant from the 1975 analysis, was dropped. Water turbidity, as perceived by the recreationists, was added because turbidity seemed to be inversely related to the number of anglers.

Within each study section, the popularity of each recreation activity was calculated using both 1975 and 1976 observations. For each activity a sectional rating preference (SRP), as explained in table 1, was assigned. For example, if 10 percent of the observed recreationists at a particular site were engaged in a particular activity, then that activity would be given an SRP of two.

USE OF QUESTIONNAIRES

Pilot Questionnaire

To assist in developing an effective and workable questionnaire for the intensive summer studies of 1975 and 1976, a pilot questionnaire was developed and tested. Administered between May 5 and May 27, 1975, at the Intake Fishing Access Site 17 miles northeast of Glendive and elsewhere on the Yellowstone River, the questions were designed to determine the recreationists':

1) age, sex, and residency
2) income
3) length of stay
4) recreation site preference
5) frequency of visits
6) attitudes of fulfillment
7) knowledge of public lands
8) favorite activities
9) problems (crowding, litter, insects, etc.)

The questionnaire was administered to one person from each recreating group. A group, identified intuitively, was defined as a person or persons who had traveled together to the area.

The pilot questionnaire and its results are shown in appendix B.

Summer Questionnaire

After the pilot questionnaire results were evaluated, the questionnaire was revised and prepared for use during the summer. During the summers of 1975 and 1976, the questionnaire was administered at designated popular recreation sites within each of the five study sections. Each section was visited randomly via automobile one day each week, including weekends, from June 22 to September 13, 1975, and from June 28 to September 10, 1976. The time of survey occurred randomly either from 6:00 a.m. to 2:00 p.m. or from 2:00 p.m. to 10:00 p.m. in 1975. During 1976 no survey time periods were used. To reduce bias, sections were visited from west to east one week and from east to west the next; thus, the time of survey was different at each site from week to week.

Statistical analysis of the questionnaire responses was by computer at Montana State University. Summations for each question were tabulated for each of the five river sections (see pages 13 to 34) and in total (appendix C). Cross tabulations of questions were also compiled (see page 34).

SITE COMPARISON DATA

In addition to the questionnaire which was administered at each designated recreational site, an observed use form (appendix D) was also completed by the observer. Observed activities within sections were then compared; it was assumed that percentages of activities not observed were similar to observed percentages.

Methods

Though the literature on recreation is voluminous, research relating changes in recreation behavior to changes in stream environments is almost nonexistent (Andrews et al. 1976). A study made under the auspices of the Pacific Northwest River Basins Commission (1974) investigated the relationship between recreation and streamflow in the Snake River. River flow was controlled by regulating the outflows from dams at five different flows for three days each. The recreational adequacy of a particular site was evaluated for potential by a team of researchers. The Yellowstone Impact Study had a similar objective; however, no flow controls were available because the Yellowstone River is virtually free flowing.

The basic method used in this study was to demonstrate the effect of three projected levels of water development (summarized in appendix A and explained in detail in Report No. 1 of this series) on recreation activities by use of a matrix, similar to that used by Bishop (1972). For each activity, the impact is calculated to be the product of an intensity-of-use factor (Sectional Rating Preference) derived from on-site recreational observation and field data collected by a variety of other methods and a modification factor (Impact Modification Number) subjectively derived through expertise, literature review, and common sense. The methods by which the data were collected which allowed the derivation of these factors is explained in the next few sections.

DATA COLLECTION

Since most recreation use of the Yellowstone River occurred during the summer, most data were collected during that season in both 1975 and 1976. During the other seasons, data were collected more extensively in areas close to Miles City, the headquarters for the study. Such data were largely the result of personal communication and of aerial flights; literature review supplemented these findings.

Interviews and news releases were helpful in identifying places and dates of organized recreation events. At such events, numbers of recreationists, activities pursued, and means of travel were observed.

Due to the vastness of the study area, concentrated efforts to evaluate current recreational use were limited to the Yellowstone River mainstem. For the tributaries, car counter data, personal communication, and literature review were relied upon.

Yellowstone River Basin

Subsections Used in Aerial Observations

1. Big Timber to the mouth of the Clarks Fork
2a. The mouth of the Clarks Fork to Billings
2b. Billings to the mouth of the Bighorn
3a. The mouth of the Bighorn to Forsyth
3b. Forsyth to the mouth of the Tongue River
4. The mouth of the Tongue River to the mouth of the Powder River
5a. The mouth of the Powder River to Glendive
5b. Glendive to the Seven Sisters Game Management Area
5c. Seven Sisters Game Management Area to the North Dakota line

0 10 20 40 60 80 100 Miles

0 10 20 40 60 80 100 Kilometers

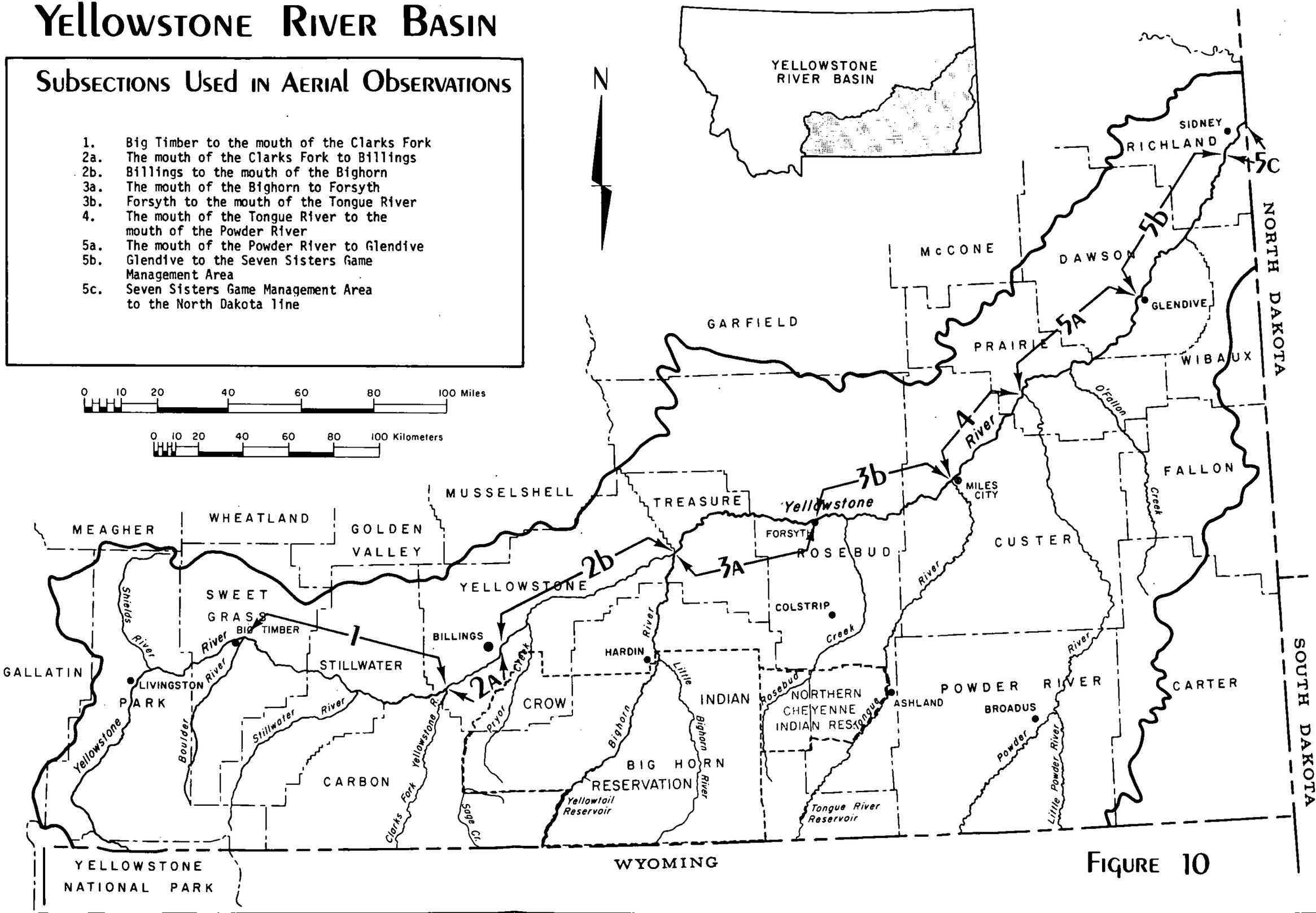


FIGURE 10

In 1975, hunting was the most frequently observed activity in all sections except 1, 2a, and 2b. The period of flight observations included all of the 1975 big game and bird hunting season, which began October 19 and closed November 11. Agate hunting in these same sections was also very popular. Within sections 3, 4, and 5, the low stream gradient and large flood plain create an ideal whitetailed deer and pheasant habitat. In addition, the presence of many large islands increases the chance of success of hunters and rockhounds. Boats are used extensively in these activities, but boat launching opportunities are inadequate in section 4, probably explaining why hunting was relatively less popular there.

Waterfowl hunting data were limited to the flood plain; thus recreationists hunting in fields and along small tributaries were not observed. Waterfowl hunting success, however, is determined not only by the condition of the Yellowstone River itself, but also by other factors, such as the climatic conditions of the region. Migratory waterfowl are more abundant during certain portions of the season than others.

CAR COUNTER DATA

As part of the 1976 study, car counters were placed at six recreational areas in three of the five study sections. Sites surveyed were Indian Fort, Bratten and Itch-Kep-Pe fishing access sites (section 1), East Rosebud Recreation Area and Waco Diversion (section 3), and Intake Fishing Access Site (section 5). All sites were developed and are owned by the Montana Department of Fish and Game, with the exception of Waco Diversion which is privately owned.

Car counter data revealed that some sites were visited much more heavily than others (table 12).

TABLE 12. Tabulation of car counter data, 1976.

Site	Date	Total Cars	Total Use[a]	Number of Days	Average Daily Use[b]
Intake F.A.	5/5/76 to 9/6/76	10,069	31,315	124	253
East Rosebud R.A.	6/25/76 to 9/5/76	8,929	27,769	72	386
Waco Diversion	5/14/76 to 9/9/76	502	1,561	116	14.0
Indian Fort F.A.	7/8/76 to 9/8/76	1,383	4,301	62	69.0
Bratten F.A.	7/8/76 to 9/8/76	1,301	4,046	62	65.0
Itch-Kep-Pe F.A.	7/16/76 to 9/8/76	1,362	4,236	54	78.0

[a]The total number of people using each site was estimated by multiplying the total number of cars by average number of people per car (3.1), obtained from the 1976 observed use data.

[b]The average daily use was obtained by dividing the total use by the number of days of sampling.

Some error resulted from vandalism and mechanical failure of counters. East Rosebud Recreation Area had the largest visitation of a recreation area, but young adults are reported to drive through the area frequently (Bivins 1976), which would give an inaccurate counter reading.

Table 12 shows Itch-Kep-Pe, Indian Fort, and Bratten ranked third, fourth, and fifth, respectively, in use among the sites with car counters. With the exception of the Yellowstone boat float in mid-July, visitation generally increased during the latter part of summer at these areas. Waco Diversion received the least use, probably due to the undeveloped and unpublicized nature of the site. In addition, a completed section of Interstate 10 now bypasses the Waco road turnoff.

Intake Fishing Access ranked second in overall average daily use, but 72.5 percent of the use occurred from May 5 to May 31, 1976. This tremendous pressure is due to paddlefishing during May and early June. Daily use in May at Intake averaged 870 recreation visits.

Extensive data have been compiled concerning recreational activity at the Intake Fishing Access (Rehwinkel 1976) to emphasize the high recreational use there (figure 11). In 1973 and 1974, maximum numbers of recreationists occurred on May 26 and May 28, respectively, both of which fell on a Memorial Day weekend. The high concentrations of fishermen on the Memorial Day weekends of those years and the low daily fishing success known to have occurred on this holiday in 1974 (0.02 fish per hour) suggest that angler concentrations are the result of custom and available time, not high fishing success. The estimated number of fisherman trips was 2,386 in 1973 and 3,363 for 1974 (May 1 to July 1)(Rehwinkel 1975). From May 1 to June 3, 1976, a counter rod registered 3,384 units, depicting another use increase. In addition, table 13 illustrates the results of a subsampling technique (Elser 1975) used to determine representative total hours fished and number of fish caught.

TABLE 13. Numbers of fishermen, hours fished, and numbers of fish caught at Intake during spring, 1975.

Week	Dates	Number Fishermen	Total Hours Fished	Number Fish Caught
		MAY		
1st week	1, 2, 3, 4	59	143.20	0
2nd week	8, 9, 10, 11, 12, 13	75	256.25	25
3rd week	15, 16, 17	42	162.00	29
4th week	22, 23, 25, 29	62	287.00	26
		JUNE		
1st week	1, 2, 3	62	363.25	54
2nd week	11, 12	81	315.50	112

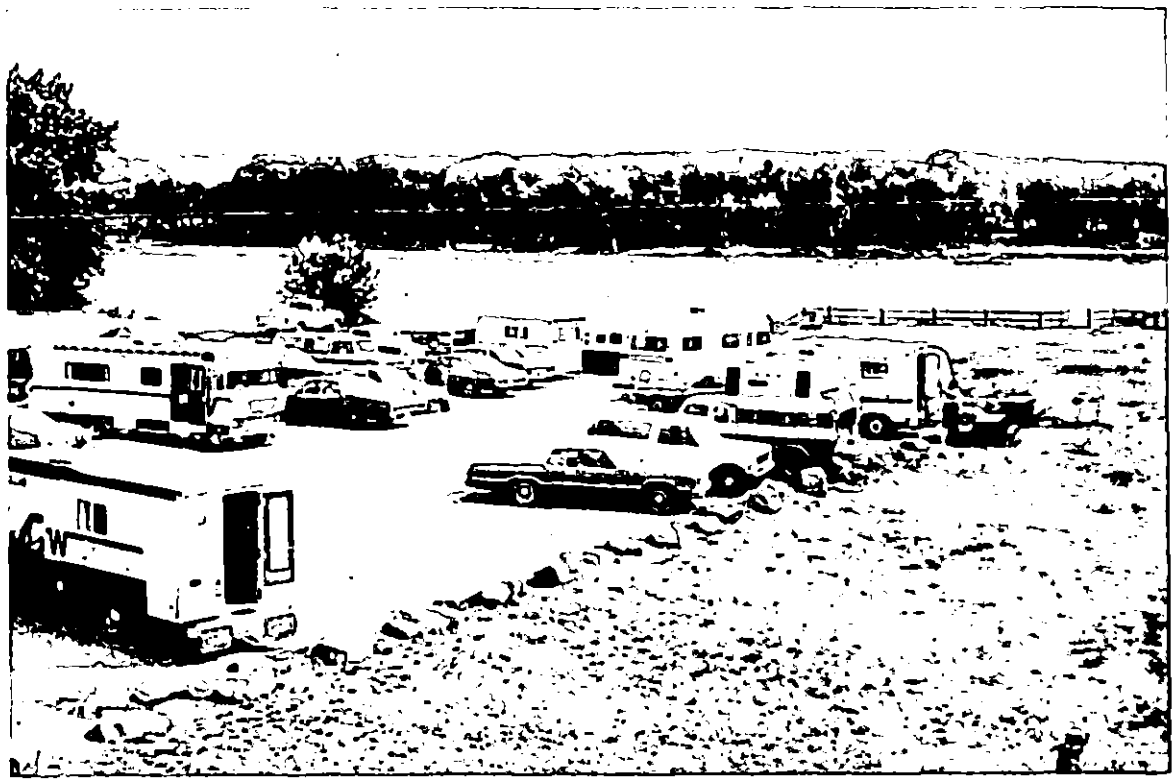


Figure 11. On Memorial Day, 1975 and 1976, large crowds were attracted to Intake Fishing Access for paddlefishing.

BOATING

BOAT REGISTRATION

Montana had seven counties with more than 1,000 registered boats from May 1, 1975, to May 1, 1976: Missoula, 4,549; Flathead, 3,866; Cascade, 2,688; Yellowstone, 2,584; Lake, 1,744; Lewis and Clark, 1,597; and Lincoln, 1,093. Within the Yellowstone study area, Yellowstone County had by far the largest number of registered boats.

BOATING QUESTIONNAIRE

As shown in table 14, at least 15 percent of registered boaters within each of 15 counties were randomly selected for participation in a mail survey (questionnaire in appendix E). Of 688 questionnaires mailed, 510 (74 percent) were returned. The highest percentage of response (93 percent) was from Rosebud County, the lowest (50 percent) from Prairie County.

The "number responses" column in table 14 differs from the "number questionnaires received" column because of incomplete answers to segments of the questionnaire, especially the one pertaining to annual boating days.

TABLE 14. Boating mail survey, 1975.

County	Total Number Registered Boats	Number Questionnaires Mailed	Percentage of Total	Number Questionnaires Received	Percentage Response	Number Responses	Percentage Response of Total Number Of Boat Owners	Sampled Total Boat Days Per Year	Average Boat Days Per Year	Total Boat Days Per Year	Total Person Days of Boating Per Year
Big Horn	265	40	15.1	33	82.5	29	12.5	541	18.6	4,929	10,992
Carbon	177	27	15.3	21	77.8	20	11.9	432	21.6	3,823	8,525
Carter	9	9	100.0	6	66.7	6	66.7	148	24.6	221	493
Custer	222	36	16.2	28	77.8	26	12.6	484	18.6	4,129	9,208
Dawson	314	48	15.3	37	77.1	37	11.8	852	23.0	7,222	16,105
Fallon	67	11	16.4	6	54.5	5	8.9	56	11.2	750	1,673
Powder River	28	8	28.6	6	75.0	5	21.4	67	13.4	375	836
Prairie	37	6	16.2	3	50.0	3	8.1	41	13.7	507	1,131
Richland	214	33	15.4	25	75.8	24	11.7	746	31.1	6,655	14,841
Rosebud	188	29	15.4	27	93.1	24	14.4	547	22.8	4,286	9,558
Stillwater	110	18	16.3	11	61.1	11	10.0	246	22.4	2,255	5,029
Sweet Grass	54	10	18.5	7	70.0	7	13.0	199	28.4	1,193	2,660
Treasure	23	7	30.4	5	71.4	5	21.7	92	18.4	423	943
Wibaux	5	5	100.0	4	80.0	4	80.0	58	14.5	72	161
Yellowstone	2584	401	15.5	292	72.8	282	11.3	5,912	21.0	54,264	121,009
MEANS AND TOTALS	4317	688	15.9	510	74.1	491	11.8	10,421	21.22	93,920	203,164

The average number of boat-days per year was obtained by dividing the "sampled total boat-days per year" by the "number responses"; "total boat-days per year" was then determined by multiplying this average by the total number of registered boats. The total number of person days of boating per year was then estimated by multiplying the total boat days per year by 2.23, the average number of persons per boat observed during the 1976 Yellowstone Boat Float.

Yellowstone County had the largest number of total person days of boating annually, far ahead of Dawson, Richland, and Big Horn counties. The two smallest figures, 161 man days (Wibaux) and 493 man days (Carter), represent 80 percent and 67 percent responses, respectively, from the total number of persons who own registered boats.

Table 15, the results of a mailed-in questionnaire, incorporates favorite activities and visitation sites of the sampled population of the respective counties. Within the activities segment, the "other" category included sunbathing, camping, rest and relaxation, picnicking, sightseeing, trapping, and scuba diving.

Within each county, fishing was the favorite activity, followed usually by water skiing. Agate hunting interest was highest in Richland County (22 percent), and hunting response was highest in Big Horn (12 percent) and Stillwater (9 percent) counties.

Visitational preferences varied widely within counties, but proximity to bodies of water, especially reservoirs, seemed to be the largest factor influencing recreational use. Substantial use of western Montana lakes and rivers indicates willingness to travel.

Nonmotorized boating was not considered in this study. Rubber and wooden rafts and canoes are used extensively for all activities, especially sightseeing, fishing, and hunting. Boat floats are discussed in the following section.

Recent Yellowtail Reservoir and Bighorn River data are listed in table 16.

BOAT FLOATS

A major water-based recreational event along the Yellowstone is the annual three-day, 126-mile (203-km) Yellowstone River boat float, which usually takes place the second weekend in July. The float begins in Livingston and terminates at Billings. Although 97 boats were registered at Livingston in 1975, a count at Columbus on July 12 revealed 60 boats carrying 239 people, seven canoes carrying 14 people, and three kayaks carrying five people. An aerial count on July 13 between Columbus and Billings revealed 37 boats carrying 115 people, seven canoes carrying 14 people, and three kayaks carrying five people. An estimated 1,000 people took part in the float as participants or sightseers.

An aerial census was taken of the 1976 Yellowstone River boat float, which occurred July 8, 9, and 10. From Reedpoint to Columbus, there were 275 boats engaged in river travel, the majority (223) of which were nonmotorized rubber

TABLE 15. Results of mailed-in questionnaire.

County	Favorite Activities (Percentage)					Upper Yellowstone River	Yellowstone River--Sec. 1 Big Timber-Mouth Clarks Fork	Yellowstone River--Sec. 2 Mouth Clarks Fork-Mouth Bighorn	Yellowstone River--Sec. 3 Mouth Bighorn-Mouth Tongue	Yellowstone River--Sec. 4 Mouth Tongue-Mouth Powder	Yellowstone River--Sec. 5 Mouth Powder R.-N. Dak. Line	Bighorn River	Tongue River	Missouri River	Fort Peck	Yellowtail Res.	Tongue River Res.	Cooney Res.	Deadman's and/or Martinsdale	Farm Ponds - *Small Res.	West Mt. Lakes or Rivers	North Dakota	Other[a]
	Fish.	Water Skiing	Hunt.	Agate Hunt.	Other																	
Big Horn	61.8	17.6	11.7	-	8.8	-	-	1.9	-	-	-	33.9	5.7	-	-	47.1	5.7	-	-	3.8	1.9	-	-
Carbon	67.0	14.7	7.3	-	11.1	-	2.4	-	-	-	-	7.1	-	2.4	2.4	26.2	2.4	35.7	7.1	2.4	11.9	-	-
Carter	67.0	33.0	-	-	-	-	-	-	-	-	-	-	-	-	16.7	16.7	-	-	5.6	16.7	22.2	16.7	5.6
Custer	55.6	25.9	7.4	7.4	3.7	-	-	-	13.0	4.3	4.3	-	2.2	-	37.0	13.0	4.3	2.2	-	6.5	4.3	-	10.9
Dawson	60.5	21.0	7.8	5.2	7.8	-	-	-	-	1.7	25.4	1.7	-	1.7	44.1	1.7	1.7	-	-	15.2	-	6.8	1.7
Fallon	80.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-	42.8	14.3	-	-	-	28.6	14.3	-	-
Powder River	80.0	20.0	-	-	-	-	-	-	-	-	-	10.0	10.0	-	10.0	-	20.0	-	-	30.0	10.0	-	10.0
Prairie	50.0	25.0	-	-	25.0	-	-	-	-	33.3	11.1	-	-	11.1	22.2	-	-	-	-	11.1	11.1	-	-
Richland	48.2	18.5	7.4	22.2	3.7	-	-	-	-	4.2	25.0	4.2	-	12.5	31.2	2.1	-	-	-	10.4	2.1	6.3	2.1
Rosebud	60.0	26.7	6.7	3.3	3.3	-	-	2.4	14.3	-	-	7.1	2.4	-	11.9	26.2	21.4	-	-	-	14.3	-	-
Stillwater	54.5	-	9.1	-	36.4	-	-	-	-	3.7	25.9	11.1	3.7	11.1	3.7	22.2	-	3.7	7.4	-	7.4	-	3.7
Sweet Grass	69.2	30.8	-	-	-	6.2	-	-	-	-	-	-	-	12.5	12.5	12.5	18.8	-	18.8	18.8	-	-	-
Treasure	67.0	-	-	-	33.0	-	-	-	37.5	12.5	12.5	-	-	-	-	25.0	-	-	-	-	-	-	-
Wibaux	60.0	-	-	-	40.0	-	25.0	-	-	-	-	-	-	-	25.0	25.0	-	-	-	-	-	25.0	-
Yellowstone	60.0	23.0	-	3.0	9.0	1.4	3.9	2.2	1.0	.3	-	11.1	.5	2.9	3.1	26.5	3.5	13.3	13.0	2.9	12.7	.2	2.0

[a]Powder River, Clarks Fork Yellowstone, Stillwater River, Spotted Eagle Reservoir, Idaho, Wyoming, Canada.

TABLE 16. Yellowtail Reservoir and Bighorn River fishing and boating use.

Location	1970	1971	1972[a]	1973	1974[b]	1975[c]
			FISHERMEN			
Afterbay	636	1,836		4,212	6,239	6,874
River	2,383	4,786		12,513	5,058	10,495
Lake	2,892	2,117		10,356	12,339	29,489
			BOATS			
Afterbay	526	538		614	1,126	973
River	904	809		1,951	364	1,765
Lake	2,912	3,601		6,298	7,399	7,297

[a]Figures not available
[b]River closed to both fishermen and boaters due to litigation (Finch case).
[c]River reopened. Started counting boater fishermen plus boaters in June 1975.

rafts. Eight kayaks, 21 canoes, and 23 motorized rubber rafts were also observed. Six hundred and twelve participants and an estimated 600 sightseers took part in the float. Two hundred and fifty automobiles and trucks and 40 campers, trailers, and mobile homes were present. The average number of people per vessel was 2.23 and the average number of people per car was 4.85, a relatively high figure probably due to the fact that several groups often floated downstream to one car or truck for a ride upstream.

Because of the special nature of the event, the 1975 and 1976 boat float data were not incorporated in total observed use or for regressional comparison of 1975 to 1976 river discharge with recreational use.

Another boat float takes place annually at Terry on July 4. In 1975, 13 crafts carrying 61 people made the trip from the mouth of the Powder River to Terry, 11.9 river miles (19 km). Total observed use was 225 people. The Terry boat float is an example of a specific annual event held regardless of the Yellowstone River discharge. In 1976, 12 rafts and five boats were observed on the Terry boat float. Forty-one people engaged in the float, averaging three to a vessel, and 300 spectators were present.

Another boat float was held on the Powder River on July 4, 1976, from near Broadus to the Powderville Bridge, with 12 vessels and 43 participants.

A popular fishing float trip occurs from the afterbay of Yellowtail Dam 14 miles downstream to the Bighorn Fishing Access Site.

RECENT WATERFOWL HUNTING

Irregular waterfowl hunting pressure is indicated by the results of the 1971-74 Montana Department of Fish and Game waterfowl hunting questionnaire data (table 17). Completed questionnaires were obatained from a sampling of hunters from each of 15 counties in the study area, and the numbers of duck and goose hunters per day were calculated. The number of possible duck and goose hunting days was also listed and divided into the number of duck and goose hunters, respectively, to obtain an average use factor. Counties surveyed were Big Horn, Carbon, Carter, Custer, Dawson, Fallon, Powder River, Prairie, Richland, Rosebud, Stillwater, Sweet Grass, Treasure, Yellowstone, and Wibaux.

TABLE 17. Numbers of duck and goose hunters, days, and average hunters per day.

	Number of Duck Hunters (NDH)	Number of Duck Days (NDD)	$\frac{NDH}{NDD}$	Number of Goose Hunters (NGH)	Number of Goose Days (NGD)	$\frac{NGH}{NGD}$
1971	3180	90	35.3	1439	90	16.0
1972	3758	90	41.8	2182	90	24.2
1973	3596	76	47.3	2107	93	22.7
1974	2965	64	46.3	1953	93	21.0

The number of hunters per day was greatest for ducks in 1973 and for geese in 1972.

Besides flow, factors which affect waterfowl hunting pressure are lengths of seasons, coincidence with other hunting seasons, federal regulations governing bag limits and shooting hours, the amount of leisure time within seasons (the 1974 season had 26 weekend or holiday days, while the 1972 season had only 20), weather conditions, and state regulations. All of these factors may vary annually.

TRIBUTARY RECREATIONAL USE

The major tributaries of the Yellowstone River within the study area (figure 1) are the Powder, Tongue, and Bighorn rivers. These tributaries offer varied recreational opportunities that, with the exception of the upper Bighorn River during spring and early summer, are not extensively utilized.

POWDER RIVER

The Powder River, free flowing in Montana, supports a minimum of recreational use. A boat float which occurred on July 4, 1976, is mentioned above. DFG employees engaged in the Powder River Aquatic Ecology Project

for Utah International, Incorporated, witnessed set line fishing on the river but observed only two sunbathers during the summer of 1976 (Rehwinkel et al 1976), and field work for that study was accomplished daily throughout late spring, summer, and in early fall. Sauger, shovelnose sturgeon, and channel catfish populations were found during the most recently documented capture period, April 5 to July 7, 1976 (Rehwinkel et al. 1976), indicating an underutilized recreational potential related to fish migration.

TONGUE RIVER

The Tongue River (figure 12) receives considerably more recreational use than the Powder River. A 1975 Montana Department of Fish and Game mail survey is summarized in table 18. For the purposes of this study, the Tongue River was divided into sections as follows: section A stretches from the Montana-Wyoming border to the southern tip of the reservoir; section B from the Tongue River Dam to the bridge near Brandenburg; section C stretches from just below the bridge to the mouth of the Tongue River. (Study sections on the tributaries will be identified by capital letters to avoid confusion with Yellowstone mainstem study sections, which are numbered).

TABLE 18. Tongue River recreational use data for 1975 and 1976.

	May 1 - September 30			October 1 - April 30		
	Resident	Nonresident	Total	Resident	Nonresident	Total
Section A	2,644	2,074	4,718	0	0	0
Section B	894	98	992	0	0	0
Section C	4,074	192	4,266	926	244	1,170
Tongur River Reservoir	1,955	3,430	5,385	313	351	664
TOTAL	9,567	5,794	15,361	1,239	595	1,834

SOURCE: Montana Department of Fish and Game 1975-76.

As shown in table 18, nonresident use exceeds resident use on the Tongue River Reservoir, probably due to the greater populations within one-day driving distances in Wyoming than in Montana. Approximately 17,000 total annual visitor days of water-based recreation were recorded for the Tongue River and Reservoir.

BIGHORN RIVER

The Bighorn River (figure 13) is a unique stream which has provided most of the trout fishing within the study area. However, as a result of a decision by the 9th Circuit Court of Appeals in the Finch case, the Crow Indian Tribe has closed to the public that portion of the Yellowstone River that runs through their reservation, as of January, 1977.

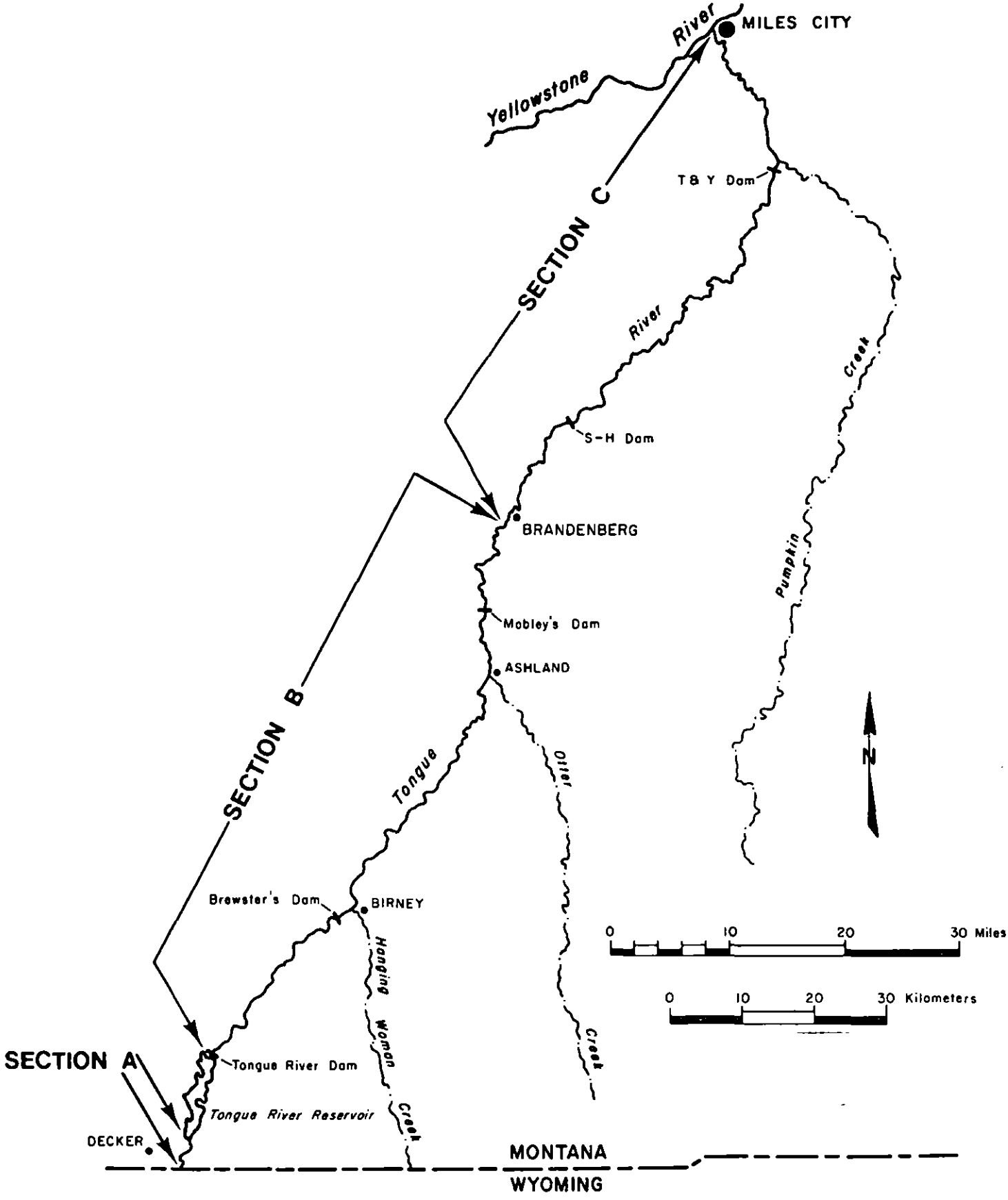


Figure 12. The Tongue River, showing 1975 Montana Department of Fish and Game mail survey fishing pressure sampling sections.

During a study (Stevenson 1975) conducted in 1972 and 1973, the catch of brown, rainbow, and cutthroat trout ranged from 0.00 to 0.07, 0.26 to 0.67, and 0.00 to 0.05 fish per fisherman-hour, respectively. The estimated total number of fisherman-days was 37.4 per surface acre in the afterbay below the dam (section A) and 3,720 and 630 per river mile in sections B and C below the afterbay, respectively.

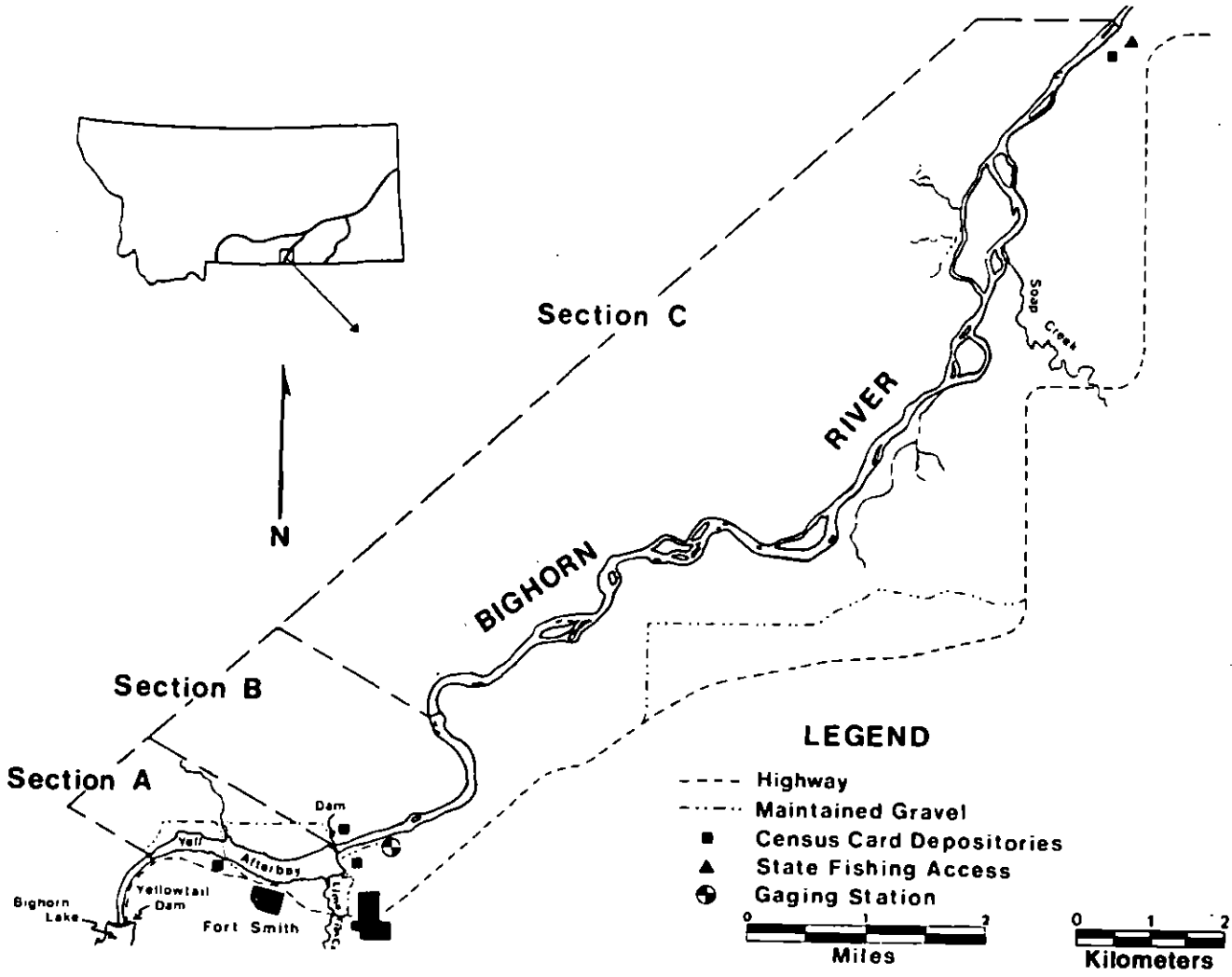


Figure 13. The upper Bighorn River, showing location of study sections A, B, and C (from Stevenson 1975).

The estimated total yield was 37,321 trout caught during 18,648 fisherman-days for an average of 2 fish/fisherman-day. The percentage of rainbow trout in the yield decreased with downstream progression while the percentage of brown and cutthroat trout increased. Although weekend holidays accounted for only 32 percent of the total days in the census period, they made up 58 percent of the fisherman-days. Fishermen from Billings accounted for 81 percent of the Montana residents. In sections A and B, bank fishing made up the greatest part of the fishing pressure; boat fishing provided the greatest portion in section C due to limited access.

Potential recreation sites

Investigations of potential alternative sites have been based on need and feasibility. Summer survey results indicate that most people surveyed (83 percent in 1975 and 87 percent in 1976) would like to see another site within at least 30 miles of the one currently enjoyed. The nature of alternative sites may not allow all recreational interests to be pursued at each, but important access would be provided.

Since most Yellowstone River frontage is privately owned, local property listings and interviews were used to find land with recreational potential. Areas within the 180-km (110-mile) stretch between Forsyth and Fallon were given first priority due to the scarcity of existing sites (figure 14).

After the initial listing, each potential site was visited and evaluated based on the following considerations:

1) Distance to adjacent sites
2) Boat launching potential
3) Proximity to population centers
4) Existing access

Areas which received a high evaluation were appraised and described in detail. Site acquisition preferences were then made based on Montana Department of Fish and Game standards in conformance with Section 26-104.6, R.C.M. 1947.

Currently, the Montana Department of Fish and Game has a plan for siting recreation areas every 20 or 30 miles along the river. Achievement of this goal is difficult; legal problems, inflationary land prices, and landowner unwillingness to sell are current roadblocks.

Along the Yellowstone River, four areas have been investigated:

1) an area north of Rosebud, S16, T6N, R42E;
2) a state-owned section near the mouth of Sunday Creek, S36, T9N, R48E;
3) a section near the mouth of the Powder River, S4, T11N, R50E; and
4) a large area of 14,000 acres near Intake, including part or all of sections 1, 2, 10, 11, 12, 13, 14, 20, 21, 22, 23, 24, 25, 26, 27, 28, and 33 in T18N, R57E and sections 7, 17, 18, 19, and 30 in T18N, R58E.

In addition, other possible Yellowstone River access sites are the Howrey ranch adjacent to the Montana Fish and Game Isaac Homestead Game Management area near Hysham, and the Elmer Winningham ranch 10 miles east of Miles City (figure 15).

Figure 15. Winningham Ranch shoreline, providing valuable access near Miles City and a natural boat landing.

Two major high-priority zones exist on the Yellowstone River. The river segment from Isaac Homestead Game Management Area near Hysham to the Itch-Kep-Pe Fishing Access Site at Columbus, 200.7 km (126 river miles), includes no state-owned developed recreational area. Although there are several newly developed or partially developed privately owned sites within this segment, which contains Billings, the largest city in Montana, more developed recreational sites are needed.

The other high-priority area is the stretch of river from East Rosebud Recreation Area at Forsyth to the newly acquired (1976) boat ramp near Fallon, Montana. This 177.8 km (110.5 river mile) stretch provides local and private access to the Yellowstone River in several places, but no developed sites exist that assuredly would be open to the public. A 2.6-acre area within the city of Miles City which was recently purchased by the Montana Department of Fish and Game will be inexpensive and simple to develop because of the availability of electricity, tap water, gravel fill, and a boat ramp. This recreation area will divide the 110.5-river mile stretch approximately in half.

Yellowstone River Basin

Potential Recreation

High Priority Zones

Potential Recreation Sites

0 10 20 40 60 80 100 Miles

0 10 20 40 60 80 100 Kilometers

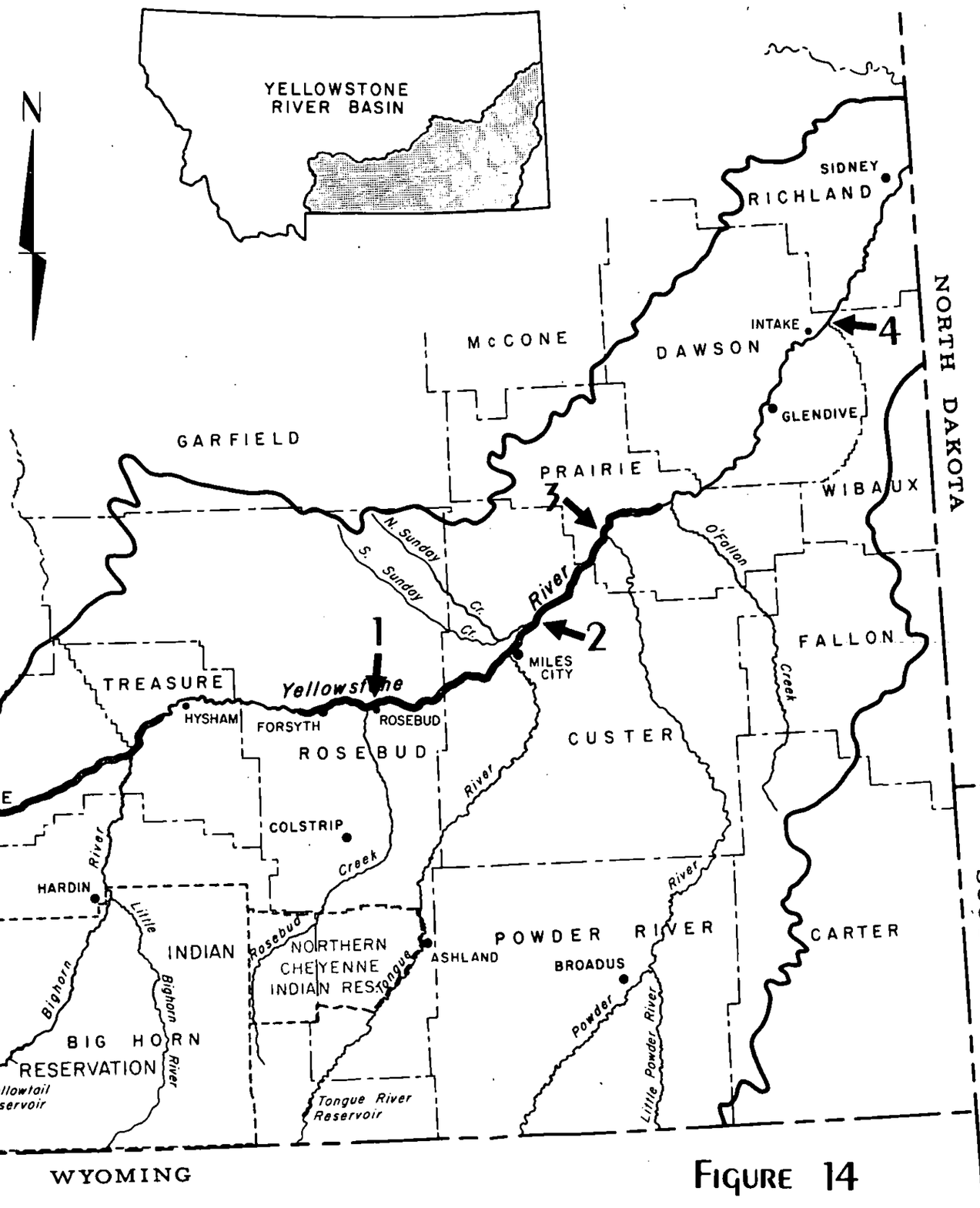


FIGURE 14

Impacts of water withdrawals

PROJECTIONS OF FUTURE USE

In order to adequately and uniformly assess the potential effects of water withdrawals on the many aspects of the present study, it was necessary to make projections of specific levels of future withdrawals. The methodology by which this was done is explained in Report No. 1 in this series, in which also the three projected levels of development, low, intermediate, and high, are explained in more detail. Summarized in appendix A, these three future levels of development were formulated for energy, irrigation, and municipal water use. Annual water depletions associated with the future levels of development were included in the projections. These projected depletions, and the types of development projected, provide a basis for determining the level of impact that would occur if these levels of development were carried through.

To evaluate the impact of these projected levels of development on water-based recreation, associated water flows and depths were determined by the Department of Natural Resources and Conservation (see Report No 1). For most types of recreation, the 50th-percentile flow (that flow which would be exceeded in 50 of 100 years under the particular development level of interest) was used for impact evaluation. One exception is boating, for which the 90th-percentile low flow is important for navigability considerations.

EVALUATION CRITERIA

SHORELINE ACTIVITIES

No changes due to altered streamflow can be foreseen in some activities. Among these are shoreline recreation other than fishing, such as picnicking, rockhounding, rest and relaxation, horseback riding, bicycling, motorbiking, driving for pleasure, outdoor games, sightseeing, walking for pleasure, and birdwatching.

WATER-BASED ACTIVITIES

Included in this category were fishing, boating, water skiing, swimming, and agate hunting from boats.

The effects of increased water demand on fishing in sections 2, 3, and 4 are unknown. Within section 5, the paddlefish spawning run in May and June is in some way related to high flows, turbidity, or both. Thus, in section 5, a -1 IMN value (see explanation of IMN on page 12) is assessed due to the uniqueness of the sport and the possible degradation of the fishery that could result. The other four sections are rated no effect.[1]

---

[1]The author wishes to emphasize that temporary improvements in trout fishing sometimes occur when the river is low and clear. Such a temporary improvement could result from the projected levels of development in section 1.

Water-based rockhounding would probably be adversely (-1) affected by increased water demand. Even though more rocks would be exposed for a few years, agate hunters would soon pick most good agates. If high flows were not sufficient to induce annual erosion, washing, and exposure, long-term quality agate hunting would decrease.

Motorized boating (figure 16) is given a -1 IMN due to the projected loss of the 20-inch water depth necessary for passage. During July and August, the most popular months for motorized boating, 90th-percentile low flows in the Mid-Yellowstone Subbasin are approximately 4,600 and 9,200 cfs, respectively. Increased water demands in July under low and high levels of development range from 2,300 to 3,500 cfs, respectively, and for August from 2,200 to 3,300 cfs, respectively.

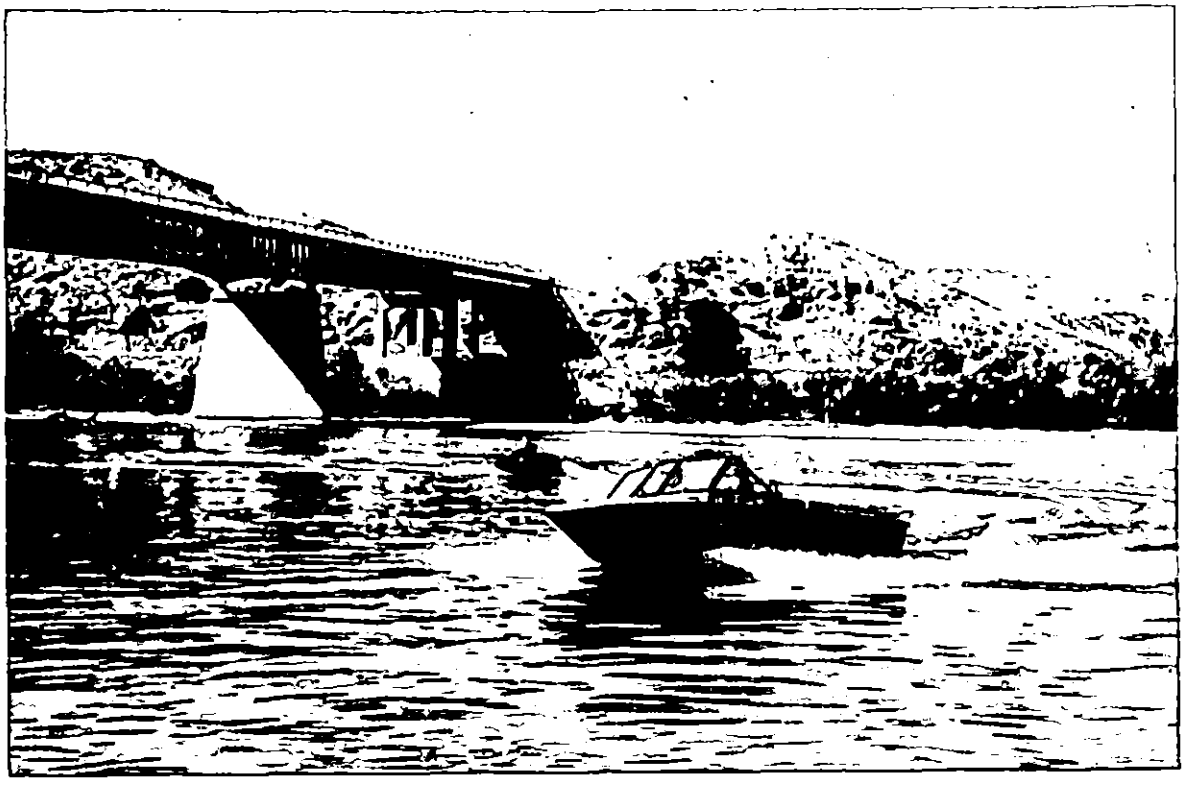


Figure 16. Motorized boating on the Yellowstone River faces severe projected impact.

Figure 17 is a compilation of cross-sectional data taken in 1976 from four Yellowstone River sites near Miles City. From gage height and cross-sectional data, the navigable width of each section was calculated based on a 20-inch navigation depth. The effects of the low, intermediate, and high levels of development on these cross sections and navigable widths are shown in figure 17. The greatest percentage of navigable width loss would occur under the high level of development at the Kinsey and Fort Keogh cross sections. Losses in

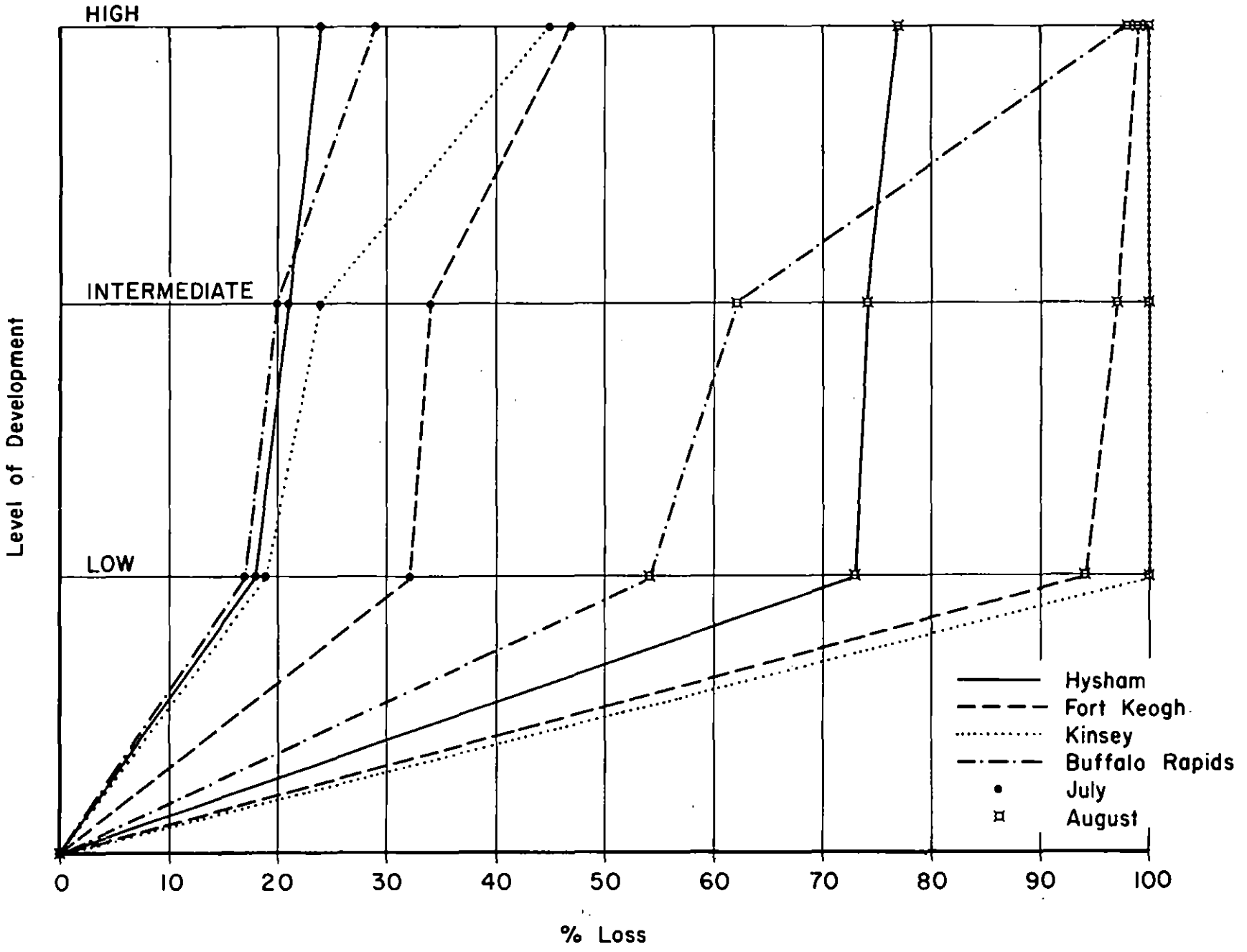


Figure 17. Percentage loss of navigable width in July and August in four sections of the mid-Yellowstone under the low, intermediate, and high levels of development.

excess of 15 percent would occur at all locations under all projections in July and August. The smallest percentage of loss of navigable width would occur in July at the Hysham site. No attempt was made to weigh impacts between sections.

Since passage is presently critical at the 90th-percentile natural low flows for August and September, lower flows would virtually eliminate river travel past critical areas. Waterskiing, obviously associated with boating, is considered only in sections 4 and 5. Lower water levels would increase the present danger situation.

ACCESS

Increased water withdrawal could improve access to recreational sites during what would normally be periods of high runoff. In 1975 several Montana Department of Fish and Game recreational areas were flooded as late as mid-July; bridges were washed out, and some roads were impassable into mid-August (figure 18). There were no such access problems in 1976.

Figure 18. Limited Yellowstone River access near Worden, Montana, in 1975.

PROJECTED IMPACTS

The methods by which the following impact projections were formulated are explained on pages 11 to 12 .

Table 9 on page 44 illustrated that more recreational use was observed in some sections than in others, both in numbers of recreationists and in numbers of recreational activities. Even so, a single recreational experience in one section was assumed equal in importance to an experience in any other section. Even though demand for and withdrawal of Yellowstone River water could affect more person-days of recreation in areas of high use than in areas of low use, the quality of the single experience, regardless of the section in which it occurred, should be considered foremost in evaluating the following tables. In the future, recreational use patterns in the study area may change greatly through the addition of new access and recreational sites.

Tables 19 through 23 list the projected impacts for each activity for each section.

TABLE 19. Impact assessment for section 1.

	Sectional Rating Preference		Impact Modification Numbers: Low Level of Development	Intermediate Level of Development	High Level of Development
Swimming	2	x	-1 = -2	-1 = -2	-1 = -2
Picnicking	3	x	0 = 0	0 = 0	0 = 0
Rest and Relaxation	3	x	0 = 0	0 = 0	0 = 0
Boating	2	x	-1 = -2	-1 = -2	-1 = -2
Floating	3	x	0 = 0	0 = 0	0 = 0
Horseback Riding	1	x	0 = 0	0 = 0	0 = 0
Bicycling	1	x	0 = 0	0 = 0	0 = 0
Motor Biking	1	x	0 = 0	0 = 0	0 = 0
Driving for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Playing Outdoor Games	2	x	0 = 0	0 = 0	0 = 0
Rockhounding	1	x	-1 = -1	-1 = -1	-1 = -1
Sightseeing	1	x	0 = 0	0 = 0	0 = 0
Walking for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Waterskiing	1	x	0 = 0	0 = 0	0 = 0
Birdwatching	1	x	0 = 0	0 = 0	0 = 0
Fishing	3	x	0 = 0	0 = 0	+1 = 0
Access	3	x	+1 = +3	+1 = +3	+1 = +3
TOTALS			-2	-2	-2

TABLE 20. Impact assessment for section 2.

	Sectional Rating Preference		Impact Modification Numbers: Low Level of Development	Intermediate Level of Development	High Level of Development
Swimming	3	x	-1 = -3	-1 = -3	-1 = -3
Picnicking	2	x	0 = 0	0 = 0	0 = 0
Rest and Relaxation	3	x	0 = 0	0 = 0	0 = 0
Boating	2	x	-1 = -2	-1 = -2	-1 = -2
Floating	3	x	0 = 0	0 = 0	0 = 0
Horseback Riding	1	x	0 = 0	0 = 0	0 = 0
Bicycling	1	x	0 = 0	0 = 0	0 = 0
Motor Biking	1	x	0 = 0	0 = 0	0 = 0
Driving for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Playing Outdoor Games	1	x	0 = 0	0 = 0	0 = 0
Rockhounding	1	x	-1 = -1	-1 = -1	-1 = -1
Sightseeing	2	x	0 = 0	0 = 0	0 = 0
Walking for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Waterskiing	1	x	0 = 0	0 = 0	0 = 0
Birdwatching	1	x	0 = 0	0 = 0	0 = 0
Fishing	3	x	0 = 0	0 = 0	0 = 0
Access	3	x	+1 = +3	+1 = +3	+1 = +3
TOTALS			-3	-3	-3

TABLE 21. Impact assessment for section 3.

	Sectional Rating Preference		Impact Modification Numbers: Low Level of Development	Intermediate Level of Development	High Level of Development
Swimming	1	x	0 = 0	0 = 0	0 = 0
Picnicking	2	x	0 = 0	0 = 0	0 = 0
Rest and Relaxation	3	x	0 = 0	0 = 0	0 = 0
Boating	2	x	-1 = -2	-1 = -2	-1 = -2
Floating	1	x	0 = 0	0 = 0	0 = 0
Horseback Riding	1	x	0 = 0	0 = 0	0 = 0
Bicycling	1	x	0 = 0	0 = 0	0 = 0
Motor Biking	1	x	0 = 0	0 = 0	0 = 0
Driving for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Playing Outdoor Games	2	x	0 = 0	0 = 0	0 = 0
Rockhounding	1	x	-1 = -1	-1 = -1	-1 = -1
Sightseeing	2	x	0 = 0	0 = 0	0 = 0
Walking for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Waterskiing	1	x	0 = 0	0 = 0	0 = 0
Birdwatching	1	x	0 = 0	0 = 0	0 = 0
Fishing	3	x	0 = 0	0 = 0	0 = 0
Access	3	x	+1 = +3	+1 = +3	+1 = +3
TOTALS			0	0	0

TABLE 22. Impact assessment for section 4.

	Sectional Rating Preference		Impact Modification Numbers: Low Level of Development	Intermediate Level of Development	High Level of Development
Swimming	1	x	0 = 0	0 = 0	0 = 0
Picnicking	1	x	0 = 0	0 = 0	0 = 0
Rest and Relaxation	3	x	0 = 0	0 = 0	0 = 0
Boating	3	x	-1 = -3	-1 = -3	-1 = -3
Floating	1	x	0 = 0	0 = 0	0 = 0
Horseback Riding	1	x	0 = 0	0 = 0	0 = 0
Bicycling	1	x	0 = 0	0 = 0	0 = 0
Motor Biking	1	x	0 = 0	0 = 0	0 = 0
Driving for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Playing Outdoor Games	1	x	0 = 0	0 = 0	0 = 0
Rockhounding	1	x	-1 = -1	-1 = -1	-1 = -1
Sightseeing	1	x	0 = 0	0 = 0	0 = 0
Walking for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Waterskiing	1	x	-1 = -1	-1 = -1	-1 = -1
Birdwatching	1	x	0 = 0	0 = 0	0 = 0
Fishing	3	x	0 = 0	0 = 0	0 = 0
Access	3	x	+1 = +3	+1 = +3	+1 = +3
TOTALS			-2	-2	-2

TABLE 23. Impact assessment for section 5.

	Sectional Rating Preference		Impact Modification Numbers: Low Level of Development	Intermediate Level of Development	High Level of Development
Swimming	1	x	0 = 0	0 = 0	0 = 0
Picnicking	1	x	0 = 0	0 = 0	0 = 0
Rest and Relaxation	3	x	0 = 0	0 = 0	0 = 0
Boating	2	x	0 = 0	-1 = -2	-1 = -2
Floating	1	x	0 = 0	0 = 0	0 = 0
Horseback Riding	1	x	0 = 0	0 = 0	0 = 0
Bicycling	1	x	0 = 0	0 = 0	0 = 0
Motor Biking	1	x	0 = 0	0 = 0	0 = 0
Driving for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Playing Outdoor Games	1	x	0 = 0	0 = 0	0 = 0
Rockhounding	3	x	-1 = -3	-1 = -3	-1 = -3
Sightseeing	1	x	0 = 0	0 = 0	0 = 0
Walking for Pleasure	1	x	0 = 0	0 = 0	0 = 0
Waterskiing	1	x	0 = 0	0 = 0	0 = 0
Birdwatching	1	x	0 = 0	0 = 0	0 = 0
Fishing	3	x	-1 = -3	-1 = -3	-1 = -3
Access	3	x	+1 = +3	+1 = +3	+1 = +3
TOTALS			-3	-5	-5

Section 5 would be most adversely affected (-5) under the high and intermediate projections. Section 2 would be adversely affected also, to the same extent as section 5 under the low level of development (-3). Sections 1 and 4 would be adversely affected (-2) due to motorized boating loss and associated activities. No impact is foreseen for section 3.

Tables 19 through 23 reflect only two summer study periods, one in 1975 and one in 1976. Hunting was not considered in the tables. Use of a boat for hunting access was considered, but the likelihood of a small increased water demand during hunting season pointed toward no significant impact. Increased irrigation could increase resident waterfowl and pheasant numbers, adding to the recreation potential.

Using the models developed to predict numbers of people on the Yellowstone River as a function of river section, discharge, weather, day of week, temperature, turbidity, and the month of the season, the following relationships were found.

In 1976, discharge and the square of the discharge (to allow for non-linearity) were not strongly correlated with recreational use, accounting for less than 10 percent of the variability in observed use (at $p = 0.1$). The best prediction models for 1976 data correlated recreational use with weekend vs. weekdays, section (location), and turbidity levels, in that order. The best prediction for 1975 data also utilized weekend vs. weekdays and section (location), but discharge ranked third. Turbidity levels were not incorporated in 1975. Turbidity generally decreases towards autumn. Because the paddlefish season occurs during the spring periods of high turbidities, the bulk of the paddlefishing season was not within the summer study periods.

Summary

Recreationists enjoy numerous outdoor pastimes on the Yellowstone River. The cold-water environment of the upper reaches provides trout fishing throughout spring, summer, and fall. The lower reaches offer warm-water fishing--sauger, channel catfish, and, for a short interval, paddlefish. Boating, water skiing, and swimming are popular in these downstream sections of the river and rockhunters favor the areas where moss agates can be found. On shore, picnicking, camping, and sightseeing are popular activities.

This study included two years' investigation of recreational use on the Yellowstone River, by questionnaire and by observed use both on the ground and by aerial survey. Only mainstem use was directly investigated, but a summary of recreational use on the major tributaries, as reported elsewhere, is included. A pilot questionnaire was circulated, and a final questionnaire based on this pilot survey was circulated the following two summers. Questionnaire respondents were asked to relate their activities and length of stay to such variables as available access, facilities, the presence of insects and the cost of recreational travel. The river reaches surveyed proved to have widely varying patterns of recreational use. The principal categories considered were shoreline and water-based activities. Further separation was by type of outdoor pastime engaged in, season of year, number in party, and so on.

Most respondents were day users and were not on vacation. Three-fourths were Montana residents. Fishing was reported as the favorite activity in all study sections, with rest and relaxation second. Ninety percent of those interviewed said the present recreation sites were at least adequate, although adverse conditions such as increased litter and water quality deterioration were cited. Crowding was mentioned as a negative factor.

The study concludes that changes in the Yellowstone River due to altered streamflow would be reflected in recreational uses that depend on a stable riverine environment. Hunters, fishermen, and boaters would all be affected by a lessening in river stage and resultant environmental changes. If streamflows were lessened by the amounts projected in this study, some reaches would become impassable to the motorboats usually used on the Yellowstone. Lowered flows would also decrease the scouring action which uncovers new agates for rockhunters.

Water-based recreation would be most affected by withdrawals, particularly activities such as swimming, boating, and water skiing which are dependent on a sufficient water level. The quality of fishing in the lower Yellowstone would deteriorate as well. Changes in water levels and subsequent altering of river morphology probably would not have a significant effect on shoreline recreation such as picnicking, walking, and sightseeing.

Potential recreation sites will be needed if population projections and increased industrial and commercial activities materialize. Several possible areas are available on or near the mainstem of the Yellowstone. Evaluation

of these sites was based on existing access, boat launching potential, distance to other recreation areas, and proximity to population centers. Patterns of recreational use could be expected to change with establishment of additional access areas.

As withdrawals increase in response to greater demand, the Yellowstone's recreation potential could be permanently affected. Users would then have to adjust their choice of area or activity. Alternative sites for some types of recreation offer one solution.

Appendixes

Appendix A

PROJECTIONS OF FUTURE USE

FIGURES

TABLES

In order to adequately and uniformly assess the potential effects of water withdrawals on the many aspects of the present study, projections of specific levels of future withdrawals were necessary. The methodology by which these projections were done is explained in Report No. 1 in this series, in which also the three projected levels of development, low, intermediate, and high, are explained in more detail. Summarized below, these three future levels of development were formulated for energy, irrigation, and municipal water use for each of the nine subbasins identified in figure A-1.

ENERGY WATER USE

In 1975, over 22 million tons of coal (19 million metric tons) were mined in the state, up from 14 million (13 million metric) in 1974, 11 million (10 million metric) in 1973, and 1 million (.9 million metric) in 1969. By 1980, even if no new contracts are entered, Montana's annual coal production will exceed 40 million tons (36 million metric tons). Coal reserves, estimated at over 50 billion economically strippable tons (45 billion metric tons) (Montana Energy Advisory Council 1976), pose no serious constraint to the levels of development projected, which range from 186.7 (170.3 metric) to 462.8 (419.9 metric) million tons stripped in the basin annually by the year 2000.

Table A-1 shows the amount of coal mined, total conversion production, and associated consumption for six coal development activities expected to take place in the basin by the year 2000. Table A-2 shows water consumption by subbasin for those six activities. Only the Bighorn, Mid-Yellowstone, Tongue, Powder, and Lower Yellowstone subbasins would experience coal mining or associated development in these projections.

IRRIGATION WATER USE

Lands in the basin which are now either fully or partially irrigated total about 263,000 ha (650,000 acres) and consume annually about 1,850 hm^3 (1.5 mmaf) of water. Irrigated agriculture in the Yellowstone Basin has been increasing since 1971 (Montana DNRC 1975). Much of this expansion can be attributed to the introduction of sprinkler irrigation systems.

After evaluating Yellowstone Basin land suitability for irrigation, considering soils, economic viability, and water availability (only the Yellowstone River and its four main tributaries, Clarks Fork, Bighorn, Tongue, and Powder, were considered as water sources), this study concluded that 95,900 ha (237,000 acres) in the basin are financially feasible for irrigation. These acres are identified by county and subbasin in table A-3; table A-4 presents projections of water depletion.

Three levels of development were projected. The lowest includes one-third, the intermediate, two-thirds, and the highest, all of the feasibly irrigable acreage.

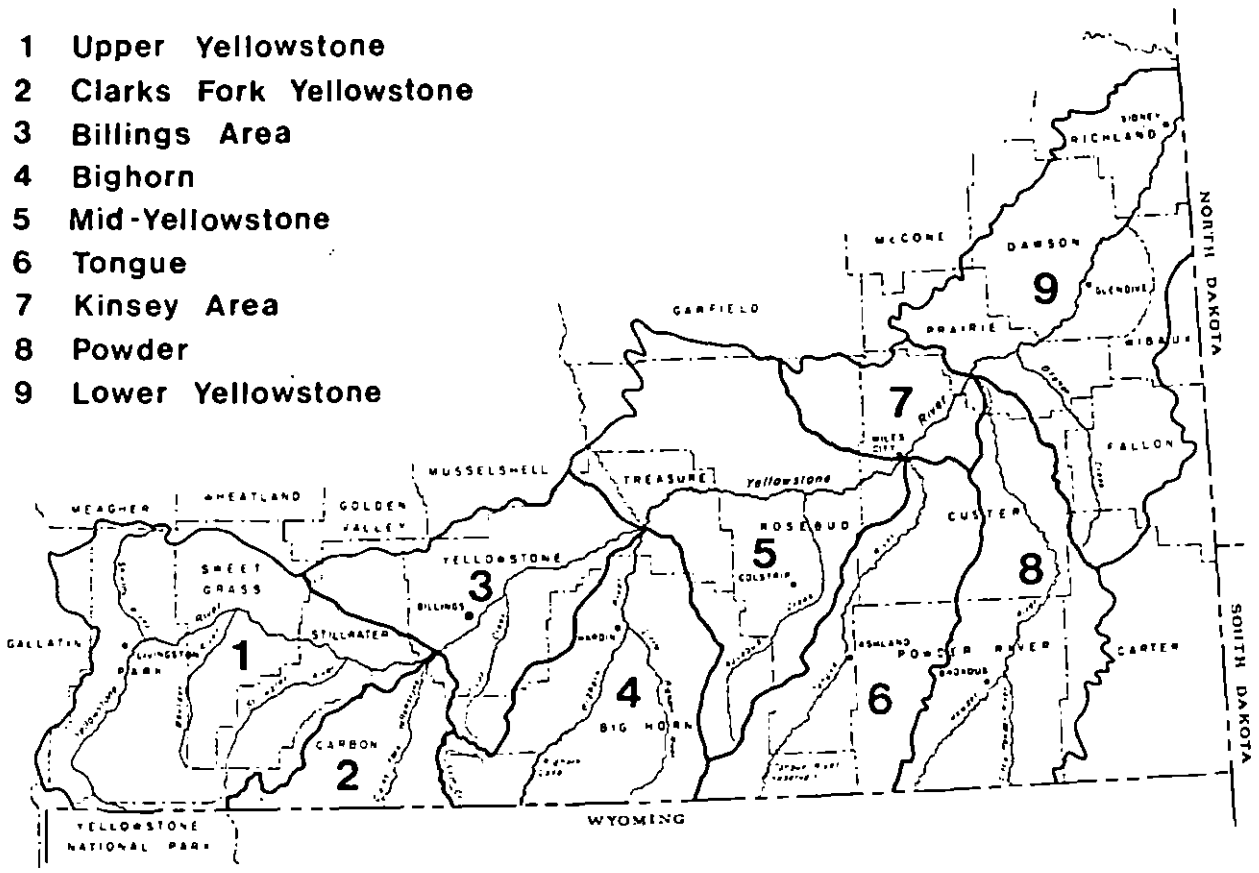


Figure A-1. The nine planning subbasins of the Yellowstone basin.

TABLE A-1. Increased water requirements for coal development in the Yellowstone Basin in 2000.

Level of Development	Coal Development Activity						Total
	Electric Generation	Gasification	Syncrude	Fertilizer	Export	Strip Mining	
			COAL MINED (mmt/y)				
Low	8.0	7.6	0.0	0.0	171.1		186.7
Intermediate	24.0	7.6	0.0	0.0	293.2		324.8
High	32.0	22.8	36.0	3.5	368.5		462.8
			CONVERSION PRODUCTION				
Low	2000 mw	250 mmcfd	0 b/d	0 t/d			
Intermediate	6000 mw	250 mmcfd	0 b/d	0 t/d			
High	8000 mw	750 mmcfd	200,000 b/d	2300 t/d			
			WATER CONSUMPTION (af/y)				
Low	30,000	9,000	0	0	[a]	9,350	48,350
Intermediate	90,000	9,000	0	0	31,910	16,250	147,160
High	120,000	27,000	58,000	13,000	80,210	22,980	321,190

CONVERSIONS: 1 mmt/y (short) = .907 mmt/y (metric)
1 af/y = .00123 hm^3/y

[a]No water consumption is shown for export under the low level of development because, for that development level, it is assumed that all export is by rail, rather than by slurry pipeline.

TABLE A-2. The increase in water depletion for energy by the year 2000 by subbasin.

Subbasin	INCREASE IN DEPLETION (af/y) Elec. Generation	Gasifi-cation	Syn-crude	Ferti-lizer	Export	Strip Mining	Total
LOW LEVEL OF DEVELOPMENT							
Bighorn	0	0	0	0	0	860	860
Mid-Yellowstone	22,500	9,000	0	0	0	3,680	35,180
Tongue	7,500	0	0	0	0	3,950	11,450
Powder	0	0	0	0	0	860	860
Lower Yellowstone	0	0	0	0	0	0	0
Total	30,000	9,000				9,350	48,350
INTERMEDIATE LEVEL OF DEVELOPMENT							
Bighorn	0	0	0	0	4,420	1,470	5,890
Mid-Yellowstone	45,000	9,000	0	0	15,380	6,110	75,490
Tongue	30,000	0	0	0	9,900	7,000	46,900
Powder	15,000	0	0	0	2,210	1,670	18,880
Lower Yellowstone	0	0	0	0	0	0	0
Total	90,000	9,000			31,910	16,250	147,160
HIGH LEVEL OF DEVELOPMENT							
Bighorn	15,000	0	0	0	11,100	2,050	28,150
Mid-Yellowstone	45,000	18,000	29,000	0	38,700	8,710	139,410
Tongue	45,000	9,000	29,000	0	24,860	10,170	118,030
Powder	15,000	0	0	0	5,550	2,050	22,600
Lower Yellowstone	0	0	0	13,000	0	0	13,000
Total	120,000	27,000	58,000	13,000	80,210	22,980	321,190

CONVERSIONS: 1 af/y = .00123 hm^3/y

NOTE: The four subbasins not shown (Upper Yellowstone, Billings Area, Clarks Fork Yellowstone, Kinsey Area) are not expected to experience water depletion associated with coal development.

TABLE A-3. Feasibly irrigable acreage by county and subbasin by 2000, high level of development.

County	Upper Yellowstone	Clarks Fork	Billings Area	Big Horn	Mid Yellowstone	Tongue River	Kinsey Area	Powder River	Lower Yellowstone	County Totals
Park	21,664									21,664
Sweet Grass	10,204									10,204
Stillwater	6,208									6,208
Carbon		2,160								2,160
Yellow-stone			19,412							19,412
Big Horn				13,037		2,185				15,222
Treasure					9,591					9,591
Rosebud					11,408	9,727				21,135
Powder River								46,853		46,853
Custer					4,230	10,035	3,092	26,438		43,795
Prairie							1,644	1,914	8,231	11,789
Dawson									18,355	18,355
Richland									10,421	10,421
Wibaux									633	633
BASIN TOTALS	38,076	2,160	19,412	13,037	25,229	21,947	4,736	75,205	37,670	237,472

CONVERSIONS: 1 acre = .405 ha

NOTE: The number of irrigable acres for the low and intermediate development levels are one-third and two-thirds, respectively, of the numbers given here. This table should not be considered an exhaustive listing of all feasibly irrigable acreage in the Yellowstone Basin; it includes only the acreage identified as feasibly irrigable according to the geographic and economic constraints explained elsewhere in this report.

MUNICIPAL WATER USE

The basin's projected population increase and associated municipal water use depletion for each level of development are shown in table A-5. Even the 13 hm^3/y (10,620 af/y) depletion increase by 2000 shown for the highest development level is not significant compared to the projected depletion increases for irrigation or coal development. Nor is any problem anticipated in the availability of water to satisfy this increase in municipal use.

WATER AVAILABILITY FOR CONSUMPTIVE USE

The average annual yield of the Yellowstone River Basin at Sidney, Montana, at the 1970 level of development, is 10,850 hm^3 (8.8 million af). As shown in table A-6, the additional annual depletions required for the high projected level of development total about 999 hm^3 (812,000 acre-feet). Comparison of these two numbers might lead to the conclusion that there is ample water for such development, and more. That conclusion would be erroneous, however, because of the extreme variation of Yellowstone Basin streamflows from year to year, from month to month, and from place to place. At certain places and at certain times the water supply will be adequate in the foreseeable future. But in some of the tributaries and during low-flow times of many years, water availability problems, even under the low level of development, will be very real and sometimes very serious.

TABLE A-4. The increase in water depletion for irrigated agriculture by 2000 by subbasin.

Subbasin	Acreage Increase	Increase in Depletion (af/y)
HIGH LEVEL OF DEVELOPMENT		
Upper Yellowstone	38,080	76,160
Clarks Fork	2,160	4,320
Billings Area	19,410	38,820
Bighorn	13,040	26,080
Mid-Yellowstone	25,230	50,460
Tongue	21,950	43,900
Kinsey Area	4,740	9,480
Powder	75,200	150,400
Lower Yellowstone	37,670	75,340
TOTAL	237,480	474,960
INTERMEDIATE LEVEL OF DEVELOPMENT		
BASIN TOTAL	158,320	316,640
LOW LEVEL OF DEVELOPMENT		
BASIN TOTAL	79,160	158,320

CONVERSIONS: 1 acre = .405 ha
1 af/y = .00123 hm^3/y

NOTE: The numbers of irrigated acres at the low and intermediate levels of development are not shown by subbasin; however, those numbers are one-third and two-thirds, respectively, of the acres shown for each subbasin at the high level of development.

TABLE A-5. The increase in water depletion for municipal use by 2000.

Level of Development	Population Increase	Increase in Depletion (af/y)
Low	56,858	5,880
Intermediate	62,940	6,960
High	94,150	10,620

CONVERSIONS: 1 af/y = .00123 hm^3/y

TABLE A-6. The increase in water depletion for consumptive use by 2000 by subbasin.

Subbasin	Increase in Depletion (af/y)			
	Irrigation	Energy	Municipal	Total
	LOW LEVEL OF DEVELOPMENT			
Upper Yellowstone	25,380	0	0	25,380
Clarks Fork	1,440	0	0	1,440
Billings Area	12,940	0	3,480	16,420
Bighorn	8,700	860	negligible	9,560
Mid-Yellowstone	16,820	35,180	1,680	53,680
Tongue	14,640	11,450	negligible	26,090
Kinsey Area	3,160	0	0	3,160
Powder	50,140	860	360	51,360
Lower Yellowstone	25,120	0	360	25,480
TOTAL	158,340	48,350	5,880	212,570
	INTERMEDIATE LEVEL OF DEVELOPMENT			
Upper Yellowstone	50,780	0	0	50,780
Clarks Fork	2,880	0	0	2,880
Billings Area	25,880	0	3,540	29,420
Bighorn	17,380	5,890	300	23,570
Mid-Yellowstone	33,640	75,490	1,360	110,990
Tongue	29,260	46,900	300	76,460
Kinsey Area	6,320	0	0	6,320
Powder	100,280	18,380	600	119,760
Lower Yellowstone	50,200	0	360	50,560
TOTAL	316,620	147,160	6,960	470,740
	HIGH LEVEL OF DEVELOPMENT			
Upper Yellowstone	76,160	0	0	76,160
Clarks Fork	4,320	0	0	4,320
Billings Area	38,820	0	3,900	42,720
Bighorn	26,080	28,150	480	54,710
Mid-Yellowstone	50,460	139,410	3,840	193,710
Tongue	43,900	118,030	780	162,710
Kinsey Area	9,480	0	0	9,480
Powder	150,400	22,600	1,140	174,140
Lower Yellowstone	75,340	13,000	480	88,820
TOTAL	474,960	321,190	10,620	806,770

CONVERSIONS: 1 af/y = .00123 hm^3/y

Appendix B

RESULTS OF SPRING 1975 PILOT QUESTIONNAIRE

PILOT STUDY QUESTIONNAIRE

THE following questionnaire has been designed to evaluate the present recreational use of the Yellowstone River and its tributaries. The Old West Regional Commission is funding a study concerning the effect coal and energy related water diversions from the Yellowstone River will have upon the present and future recreational opportunities.

AN accurate reply to the following questions would provide needed information on present recreational use patterns and would aid in fulfilling your future recreational needs. The information you provide is strictly confidential and will be used for no other reason than stated above. You may obtain the results of this summer's survey by writing the Montana Department of Fish and Game, Recreation and Parks Division, Miles City, Montana, as early as November, 1975.

Sincerely,

Max L. Erickson

Max L. Erickson
Recreational Specialist

THANK YOU VERY MUCH FOR YOUR TIME. ENJOY MONTANA.

1/ HAVE YOU NOTICED much deterioration in water quality or increase in litter since you started using the Yellowstone area for recreation?

Decrease in water quality? Yes____ No____
Increase in litter? Yes____ No____

Does it affect your enjoyment of the river? Yes____ No____

2/ LENGTH OF PRESENT STAY: (check one)

Day use only_____ One night_____ Two nights_____ Three nights_____ 4-5 nights_____ 6-8 nights_____ 9-10 nights_____ more than 10 nights_____

3/ PLEASE RECORD the access and/or waterway you are presently enjoying.

_____

Date: _____

4/ ARE YOU PRESENTLY on your vacation? Yes____ No____
Was recreation on the Yellowstone River and/or its tributaries the primary purpose of your trip? Yes____ No____
If no, what is the main reason for your trip?_____

5/ HOW OFTEN do you visit this particular site each year?
NOTE: Spring: March 20-June 20
Summer: June 21-Sept. 22
Fall: Sept. 23-Dec. 20
Winter: Dec. 21-March 19

first time ever_____
once a spring_____
2-3 times a spring_____
4-6 times a spring_____
6-8 times a spring_____
more than 8 times a spring_____

HOW MANY times do you visit this particular site during the
summer?_____
fall?_____
winter?_____

6/ YEARLY, HOW MANY days do you spend enjoying recreational activities at other sites on the Yellowstone River and/or its tributaries?

1_____ 2-3_____ 3-4_____ 4-5_____ 6-9_____ 10-15_____ 16-20_____ More than 20 a year_____

7/ Please mark (X) the activities you have engaged in or plan to engage in while in the immediate area, as well as the number of hours spent doing each.

		No. of Hours
Picnicking	_____	_____
Swimming	_____	_____
Rest and relaxation, as such	_____	_____
Boating - motorized	_____	_____
Boating - non-motorized river floating	_____	_____
Horseback riding	_____	_____
Bicycling	_____	_____
	_____	_____

(continued)

		No. of Hours
Motor biking	______	______
Driving for pleasure	______	______
Playing outdoor games	______	______
Rock hounding	______	______
Sightseeing	______	______
Walking for pleasure	______	______
Water skiing	______	______
Bird watching	______	______
Fishing	______	______

(a) For which species in particular?______________________

(b) Which species, if any, did you catch?__________________

(c) How many of each species?____________________________

What is your FAVORITE activity or activities of this site?________

____

____

8/ HOW DOES this particular site fulfill your recreational demands?

Completely______ Not Adequately______

Adequately______ Poorly____________

If "not adequately" or "poorly", why?

9/ WHERE WOULD you go to participate in the same activities if this site were not available?______________________________

DO YOU like that site as well as this one? Yes_____ No_____

10/ DO YOU think this site presently is: (check one)

Too crowded______ Not used enough______ Just right______

IF YOU think this area is too crowded, would you most prefer MORE sites available? Yes_____ No_____

IF "yes", within how many miles upstream or downstream would you like to see at least one more site?______________________

SHOULD THIS site be more fully developed (more facilities, roads, etc.)? Yes_____ No_____

11/ HAS THE INCREASING cost of gasoline decreased the distance you will travel to enjoy a recreational area? Yes_____ No_____

IF "yes", typical previous years' recreational trip covered approximately ________ miles, while this year's trip covered only _______ miles round trip.

PER PERSON, how much will your trip cost per day? (Include only groceries, automobile gasoline and camping fees, if any).__________

12/ Please check the items of equipment you have with you.

boat_____	car_____	tent_____
canoe_____	pickup_____	motor bike_____
water skiis_____	pickup camper_____	bicycle_____
fishing gear_____	camping trailer_____	hiking gear_____
	motor home_____	sleeping bag_____

Other (list)_____

13/ FOR THIS QUESTION ONLY, you will be answering for your group. Please place an "X" to represent each person in your group, other than yourself. and an "O" to represent yourself.

AGE:	SEX: Male_____	Female_____
1-12_____	_____	_____
13-18_____	_____	_____
19-30_____	_____	_____
31-50_____	_____	_____
50+_____	_____	_____

ARE YOU and your group residents of Montana? Yes_____ No_____
IF YES, which town and county?_____
IF NO, which town, county and state?_____

14/ INDICATE WHICH broad income category your household fits into:

4,999 and under_____	12,000-15,999_____
5,000-7,999_____	16,000-over_____
8,000-11,999_____	

15/ WHAT IS your occupation?_____
If you are married, what is your spouse's occupation?_____

16/ ARE INSECTS a problem to you in this area? Yes_____ No_____
If "yes", have they reduced the time you spend enjoying your favorite activities? Yes_____ No_____

Would you return to this area if the insect problem remains the same? Yes_____ No_____

Would you return to this area if the insect population was reduced by at least one-fourth? Yes_____ No_____

17/ ARE YOU AWARE of the location of public (Bureau of Land Management) lands near (50 miles upstream and 50 miles downstream) this area?
Yes_____ No_____

Are you aware of the location of public lands near your home if this area is not near your home (50 miles in any direction)?
Yes_____ No_____

Are you aware that literature is available at any Bureau of Land Management Office providing information and location of these areas, free of charge? Yes_____ No_____

Within the past year, have you used any of these areas adjacent to the Yellowstone River for recreational purposes? Yes_____ No_____

If "yes", for what main activity?

18/ WHAT OTHER kinds of recreation would you like to see at this particular site? _____

_____

_____

COMMENTS CONCERNING ANYTHING ASSOCIATED WITH THIS QUESTIONNAIRE:

THANK YOU VERY MUCH

PILOT QUESTIONNAIRE RESULTS

Questionnaires completed during the May 1975 pilot study were mostly (84.1 percent) from recreationists at Intake Fishing Access Site 17 miles northeast of Glendive on the Yellowstone River, where paddlefishing is the major recreational attraction in late spring. Catching of 50-to 65-pound fish is not uncommon.

The summations of 88 questionnaires are listed here. Questions to which the response was less than 10 percent (9 people) will not be discussed.

1. *Have you noticed much deterioration in water quality or increase in litter since you started using the Yellowstone for recreation?*

Decrease in water quality?

Number of valid responses	Yes	No
80	15%	85%

Through personal communication, it was determined that the interviewees defined water quality as the color of the water. Clear, blue water would be good water quality, as opposed to the murky, brown water of the Yellowstone at the survey sites.

Increase in litter?

Number of valid responses	Yes	No
82	29%	71%

Does it affect your enjoyment of the river?

Number of valid responses	Yes	No
82	35%	65%

In a survey done in southern Saskatchewan (Parkes 1975), over two-thirds of 560 recreationists indicated that they were willing to pay between 49 and 61 cents each per use-day, over and above the additional expenses to which recreationists are subject, for improved water quality.

2. *Length of present stay (check one)*

Number of valid responses	Length of stay	Percentage of respondents
83	Day use only	53
	One night	11
	Two nights	11
	Three nights	13
	4-5 nights	0
	6-8 nights	2
	9-10 nights	0
	Over ten nights	4

3. *Please record the access and/or waterway you are presently enjoying.*

Number of valid responses
88

The five access sites from which questionnaires were received are listed below, followed by the percentage of respondents at each.

Intake Fishing Access Site	84
East Rosebud Fishing Access Site	11
Twelve Mile Dam (Tongue River)	1
Mouth of the Tongue River	2
Pumpkin Creek Bridge (near Twelve Mile Dam)	1

4. *Are you presently on your vacation?*

Number of valid responses	Yes	No
85	17%	84%

Was recreation on the Yellowstone River and/or tributaries the primary purpose of your trip?

Number of valid responses	Yes	No
75	69%	31%

If no, what is the reason for your trip?

Number of valid responses		Percentage of Respondents
22		
	Visiting relatives and/or friends	27
	Sightseeing	9
	Enjoyment and/or rest and relaxation	9
	Business or work-related activities	14

5. *How often do you visit this particular site each year?*

NOTE: Spring: March 20 - June 20
Summer: June 21 - September 22
Fall: September 23 - December 20
Winter: December 20 - March 19

	Number of Valid Responses	Number of Visits	Percentage of Respondents
Spring	84	First time	18
		One time	16
		2-3 times	20
		4-6 times	10
		6-8 times	5
		Over 8 times	32
Summer	45	One time	22
		2-3 times	20
		4-6 times	7
		7 or 8 times	2
		Over 8 times	49
Fall	17	Over 8 times	41
Winter[a]	7		

[a]The receipt of only seven valid responses indicates light winter recreational use.

6. *Yearly, how many days do you spend enjoying recreational activities on the Yellowstone River and/or its tributaries?*

Number of valid responses	Days Spent	Percentage of Respondents
73	1-9 days	49
	10-15 days	16
	16-20 days	6
	Over 20 days	29

7. *Please mark (x) the activities you have engaged in or plan to engage in, in the immediate area, as well as the number of hours spent doing each.*

For this question, a nonresponse was considered a definite "no" rather than a missing answer.

Number of valid responses		Percentage of Respondents
88	Picnicking[a]	52
	Swimming	16
	Rest and relaxation[b]	49
	Boating--motorized	16
	Rockhounding[c]	17
	Sightseeing[d]	17
	Walking for pleasure	16
	Fishing[e]	75

NOTE: Insignificant response was received for questionnaire recreation categories boating--motorized, horseback riding, bicycling, motorbiking, driving for pleasure, and playing outdoor games. For categories water skiing and birdwatching, the data were not valid.

[a]The most commonly reported picnic duration was two hours.

[b]Rest and relaxation entails no definite outdoor recreational activity such as fishing or picknicking. It can be closely related with sightseeing, but generally is defined as enjoying an area with no specific purpose in mind.

[c]A 2-3 hour rock hunt was indicated by 46 percent of the rockhounds.

[d]A 2-3 hour sightseeing trip was indicated by 80 percent of those who responded positively. From personal communication, people who were visiting the area for the first time were most likely to consider themselves sightseers.

[e]Of the fishermen, 22 percent said they spent 2-5 hours fishing.

Fishermen were asked to complete the following three questions:

a) For what species in particular?

Number of valid responses	Species sought	Percentage of Respondents
63	Paddlefish	84

b) Which species, if any, did you catch?

Number of valid responses	Species sought	Percentage of Respondents
25	Paddlefish	60

c) How many of each species?

Number of valid responses	Number caught	Percentage of Respondents
20	2	85

What is your FAVORITE activity or activities of this site?

Number of valid responses	Favorite activity	Percentage of Respondents
65	Fishing	85

8. How does this particular site fulfill your recreational demands?

Number of valid responses		Percentage of Respondents
83	Completely	23
	Adequately	68
	Inadequately	10

If "not adequately" or "poorly", why?

Number of valid responses		Percentage of Respondents
10	Too crowded	50

From personal observation, Intake Fishing Access received the highest annual use on the Memorial Day weekend in 1975 and 1976.

9. *Where would you go to participate in the same activities if this site were not available?*

Alternative Site	Number of Responses	Percentage of 54 Responses
Twelve Mile Dam	1	2
East Rosebud	1	2
Don't Know	1	2
Yellowtail	2	4
Ft. Peck	11	20
Stay Home	5	9
Spotted Eagle	3	6
Yellowstone River	6	11
Powder River	2	4
Fred Robinson	10	19
North Dakota	3	6
South Side Intake	2	4
South Dakota	1	2
Fairview	1	2
Gartside	1	2
Other	4	8
TOTAL	54	

Do you like that site as well as this one?

Number of valid responses	Yes	No
45	67%	33%

From personal communication, people indicated that in many cases a second choice of site was enjoyed as much as, or even more than, the present area, but time, money, and distance precluded their visiting it.

10. *Do you think this site presently is too crowded, not used enough, or just right?*

Number of valid responses		Percentage of Respondents
84	Too crowded	61
	Not used enough	2
	Just right	37

If you think this area is too crowded, would you prefer more sites available?

Number of valid responses	Yes	No
63	83%	17%

If "yes", within how many miles upstream or downstream would you like to see at least one more site?

Number of valid responses		Percentage of Respondents
40	Within 1 mile	18
	1-2 miles	15
	3-5 miles	15
	6-10 miles	18
	11-20 miles	10
	20-50 miles	23
	Over 50 miles	3

Should this site be more fully developed (more facilities, roads, etc.)?

Number of valid responses	Yes	No
78	67%	33%

11. *Has the increasing cost of gasoline decreased the distance you will travel to enjoy a recreational area?*

Number of valid responses	Yes	No
83	40%	60%

If yes, typical previous years' recreational trip covered approximately _____ miles, while this year's trip covered only _____ miles round trip.

	Number of Valid Responses	Percentage of Respondents	
		Trips over 450 miles	Trips less than 50 miles
Previous years' trip	23	48	17
This years' trip	22	23	46

Per person, how much will your trip cost per day? (Include only groceries, automobile gasoline and camping fees, if any).

Number of valid responses	Trip cost	Percentage of Respondents
55	Under $5	22
	$6-10	20
	$21-25	13
	$26-35	2
	Over $35	13

12. *Please check items of equipment you have with you.*

Number of valid responses	Equipment Items	Percentage of Respondents
88	Boat[a]	15
	Water skis	2
	Fishing gear	78
	Car	42
	Pickup	44
	Pickup camper	27
	Camping trailer	13
	Motor home	6
	Tent	8
	Motor bike	6
	Bicycle	2
	Hiking gear	6
	Sleeping bag	34

[a]There were no canoes.

13. *FOR THIS QUESTION ONLY, you will be answering for your group. Please place an "X" to represent each person in group, other than yourself, and an "O" to represent yourself.*

Number of valid responses
88

Age and sex of people in each of 88 groups:

Age	Sex		Total
	Male	Female	
1-12	47	23	70
13-18	33	14	47
19-30	61	25	86
30-50	41	23	64
50+	24	13	37
TOTAL	206	98	304

NOTE: The reason that the most frequently reported age category was 19-30 years could be related generally to the physical strength needed for paddlefishing.

Are you and your group residents of Montana?

Number of valid responses	Yes	No
56	78%	22%

If YES, which town and county? (The towns were not considered for the pilot study).

Number of valid responses	County	Percentage of Respondents
56	Dawson	38
	Rosebud	13
	Richland	11
	Yellowstone	9
	Sheridan	7
	Custer	7

If NO, which town, county and state?

Number of valid responses	State	Percentage of Respondents
15	North Dakota	53
	Wyoming	33
	Washington	7
	Canada	7

14. *Indicate which broad income category your household fits into:*

Number of valid responses	Income	Percentage of Respondents
78	$5,000 and under	5
	$5,000-8,000	9
	$8,000-12,000	32
	$12,000-16,000	27
	Over $16,000	26

15. *What is your occupation? If you are married, what is your spouse's occupation?*

Occupational Category	Interviewee's Occupation[a] (%)	Spouse's Occupation[b] (%)
Professional	9	15
Student	6	4
Housewife	5	54
Self employed white collar	2	7
Self employed blue collar	2	0
Employed white collar	11	7
Employed blue collar	49	9
Agriculture	11	4
Retired	5	0

[a]85 valid observations
[b]46 valid observations

Thus, the most common occupation (49 percent) among those interviewed was blue-collar work in which the interviewee had no ownership of his employer's company or holdings. The most common occupation for the spouse was housewife (54 percent).

16. *Are insects a problem to you in this area?*

Number of valid responses	Yes	No
80	31%	69%

If "yes", have they reduced the time you spend enjoying your favorite activities?

Number of valid responses	Yes	No
30	37%	63%

Would you return to this area if the insect problem remains the same?

Number of valid responses	Yes	No
88	72%	28%

Would you return to this area if the insect population was reduced by at least one-fourth?

Number of valid responses	Yes	No
88	60%	40%

17. *Are you aware of the location of public (Bureau of Land Management) lands near (50 miles upstream and 50 miles downstream) this area?*

Number of valid responses	Yes	No
78	35%	65%

Are you aware of the location of public lands near your home if this area is not near your home (50 miles in any direction)?

Number of valid responses	Yes	No
70	61%	39%

Are you aware that literature is available at any Bureau of Land Management office providing information and location of these areas, free of charge?

Number of valid responses	Yes	No
76	64%	36%

Within the past year, have you used any of these areas adjacent to the Yellowstone River for recreational purposes?

Number of valid responses	Yes	No
75	52%	48%

If "yes", for what main activity?

Number of valid responses	Activity	Percentage of Respondents
32	Fishing	69
	Rockhounding	6
	Rest and Relaxation	6

18. What other kinds of recreation would you like to see at this particular site?

Number of valid responses	Activity	Percentage of Respondents
11	Play equipment for children	36

CROSS TABULATIONS

The second aspect of the pilot study entails use of cross tabulations (CT) to establish certain pertinent relationships. Only those tabulations thought to be most important and valid are included here. Because of the small sample size, only the most obvious relationships within each cross tabulation are mentioned.

Pilot Study Questionnaire Cross Tabulations	Valid Responses	Responses
CT-1	74	Fifty-eight percent indicated that recreation on the Yellowstone River was the primary purpose of their trip but were not on their vacation.
CT-2	75	Sixty-five percent indicated that no decrease in water quality had been noted and that the enjoyment one derives from the site had not been affected.
CT-3	76	Sixty percent indicated that no increase in litter had been noticed and that the enjoyment potential of the site had not been affected.
CT-4	21	Forty-three percent of Montana residents traveled 50 miles or less (round trip) on a typical recreational outing.
CT-5	75	Forty-nine percent indicated that insects were not a problem in the area and that the site adequately met all recreational needs.

Pilot Study Questionnaire Cross Tabulations	Valid Responses	Responses
CT-6	62	Sixty-six percent indicated that the site was too crowded but met the desired recreational needs adequately.
CT-7	73	Forty-five percent of Montanans indicated that the increasing cost of gasoline had reduced the distance they would drive on a typical recreational outing; 55 percent replied that it had not. Nonresidents indicated 24 percent and 76 percent, respectively. Recreational use in terms of activities and places of visitation could change at some point in the future, depending generally on the nation's economy.
CT-8	74	Fifty-eight percent of all income categories thought the increasing cost of gasoline had not decreased the distance of travel for recreational outings.
CT-9	76	Forty-two percent indicated a desire for more site development and reported that the increasing cost of gasoline had no effect upon the distance traveled for a recreational outing.
CT-10	78	Thirty-four percent of households surveyed indicated an income of $8,000 to $12,000. In this income bracket, 71 percent were Montana households and 29 percent were not.
CT-11	23	Fifty-two percent reported that fishing was the most preferred activity and the main activity engaged in upon public land.
CT-12	60	Sixty-two percent indicated that insects were not a problem presently but could prevent a return trip if numbers increased.

Appendix C

1975-76
SUMMER QUESTIONNAIRE
AND RESULTS

SUMMER QUESTIONNAIRE

The following questionaire has been developed to evaluate the present recreational use of the Yellowstone River and its tributaries. The Old West Regional Commission is funding a study concerning the effect of coal and energy related water diversions from the Yellowstone River upon the present and future recreational opportunities.

An accurate reply to the following questions will provide needed information on present recreational use patterns and will aid in fulfilling your future recreational needs. The information you provide is strictly confidential and will be used for no other reason than stated above. You may obtain the results of this summer's survey by writing the Montana Department of Fish and Game, Recreation and Parks Division, Miles City, Montana, as early as November, 1976.

Thank You Very Much For Your Time, ENJOY MONTANA Sincerely, Max L. Erickson

Max L. Erickson, Recreational Specialist

1 Are you presently on your vacation? ( )Yes, ( )No.

2 Was recreation on the Yellowstone River and/or its tributaries the primary purpose of your trip? ( )Yes, ( )No.

If not, what is the main reason for your trip? ( )Visit relatives-friends, ( )Sightseeing, ( )Enjoyment, Rest, Relaxation, ( )Business or Work, ( )Other reasons.

3 How often do you visit this particular site each summer (June 21 - Sept 22) ?
( )Never before, ( )1 time, ( )2-3 times, ( )4-6 times, ( )7-8 times, ( )more than 8 times

How many times do you visit this particular site during the
Spring (March 20 - June 20) ? - ( )1-2 times, ( )3-6 times, ( )7-8, ( )more than 8 times
Fall (Sept 23 - Dec 20) ? - - - ( )1-2 times, ( )3-6 times, ( )7-8, ( )more than 8 times
Winter (Dec 21 - March 19) ? - -( )1-2 times, ( )3-6 times, ( )7-8, ( )more than 8 times

4 Since you started using the Yellowstone for recreation, has the amount of litter
( )Increased ( )Stayed the same ( )Decreased ?

5 What is the length of your present stay? ( )Day use only, ( )1 night, ( )2 nights
( )3 nights, ( )4-5 nights, ( )6-8 nights, ( )9-10 nights, ( )more than 10 nights.

6 For each activity you have engaged in or plan to engage in while in this immediate area, indicate the number of hours per day spent in that way.

( )Picnicking	( )Horseback Riding	( )Bicycling	( )Playing Games
( )Swimming	( )Water Skiing	( )Motor Biking	( )Motor Boating
( )Rest,Relaxation	( )Sightseeing	( )Walking,Hiking	( )River Floating
( )Bird Watching	( )Rock Hunting	( )Pleasure Driving	( )Fishing

Which of these is your favorite activity _____

7 If you fished in this area, for which species?_____
Which species did you catch, and how many?_____,)_____,)

8 Rate each of the following at this location.

	Exceptional	Good	Fair	Poor
Picnic Facilities - - - - - - - -	( )	( )	( )	( )
Rest rooms - - - - - - - - - -	( )	( )	( )	( )
Camping sites - - - - - - - - -	( )	( )	( )	( )
Childrens activities, equip. - -	( )	( )	( )	( )
Weed mowing - - - - - - - - - -	( )	( )	( )	( )
Access Roads - - - - - - - - -	( )	( )	( )	( )

9 Where would you go for the same activities if this site was not available? ( )Don't know,
Specify: _____.

10 Do you like that site as well as this one? ( )Yes, ( )No.

11 What is your state of residence?_____, County or town _____.

12 Check the broad income category your combined household fits into:
( )Under 5000, ( )5000-7999, ( )8000-11999, ( )12000-15999, ( )16000 and over.

OVER PLEASE

13 Do you think this site presently is: ( )Too crowded, ( )Just right, ( )Not used enough.

14 Should this site be more fully developed (more facilities, roads, etc.)? ( )Yes, ( )No.

15 Do you want more recreation sites along the Yellowstone River? ( )Yes, ( )No.
If you answered YES, within how many miles from this site?
( )0-5miles, ( )5-15miles, ( )15-30miles, ( )Over 30 miles.

16 Has the increasing cost of gasoline decreased the distance you travel to a recreational area?
( )Yes, ( )No.

Check the miles covered in a typical previous years' recreation trip.
( )0 - 50 miles, ( )50 - 250 miles, ( )250 - 450 miles, ( )over 450 miles.

Check the miles covered in a typical recreation trip this year.
( )0 - 50 miles, ( )50 - 250 miles, ( )250 - 450 miles, ( )over 450 miles.

17 Check your occupation
( )Self employed White collar ( )Professional, Technical
( )Self employed Blue collar ( )Student
( )Employed White collar ( )Housewife
( )Employed Blue collar ( )Agriculture, Ranching
( )Unemployed ( )Retired

What is your spouse's occupation?_____

18 Check your sex, ( )Female, ( )Male.
Check your age, ( )1-12 yrs, ( )13-18 yrs, ( )19-30 yrs, ( )31-50 yrs, ( )over 50 yrs.

19 Enter the number of other persons in each category from your group.
Females - ( )1-12 yrs, ( )13-18 yrs, ( )19-30 yrs, ( )31-50 yrs, ( )over 50 years.
Males - - ( )1-12 yrs, ( )13-18 yrs, ( )19-30 yrs, ( )31-50 yrs, ( )over 50 years.

20 Are insects a problem to you in this area? ( )Yes, ( )No.
Have they reduced the time you spend enjoying your favorite activities? ( )Yes, ( )No.
Would you return to this area if the insect problem remains the same? ( )Yes, ( )No.

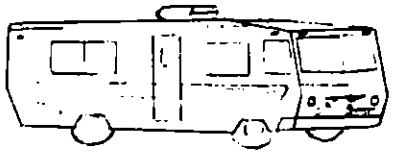
21 Are you aware of the location of public (Bureau of Land Management) lands along the river near (50 miles upstream or downstream) this area? ( )Yes, ( )No.

Are you aware of the location of public lands near your home if this area is not near your home (50 miles in any direction)? ( )Yes, ( )No.

Do you know that literature is available at any Bureau of Land Management Office providing information and the location of these areas, free of charge? ( )Yes, ( )No.

22 Within the past year, which of the following activities have you participated in on these public lands adjacent to the Yellowstone River?
( ) None, ( )Fishing, ( )Boating, ( )Picnicking,
( ) Camping, ( )Hunting, ( )Other,specify _____

23 Yearly, how many days do you spend at other sites on the Yellowstone River and its tributaries?
( )none, ( )1 day, ( )2-3 days, ( )4-5 days, ( )6-9, ( )10-15, ( )16-20, ( )over 20.



TOTAL SUMMER QUESTIONNAIRE RESPONSE, 1975 and 1976

In 1975, 212 questionnaires were completed in the entire study area; in 1976, 257 questionnaires were completed. The questionnaire form was modified between the two sampling seasons. Some questions were dropped, others were added, and, accordingly, the numbering of the questions differed on the two forms. For that reason, the numbering of the questions in the following discussion does not correspond to the question numbers on the sample 1976 questionnaire (pages 106 and 107).

Each response represents a group of recreationists. Fewer than 10 percent of the responses were deemed not valid for questions one through six. All totals may not equal 100 percent due to rounding.

The results for each individual study section are given in the main report on pages 13 to 34. Cross tabulations for the entire study area are given on pages 34 to 37.

1. *Are you presently on your vacation?*

	Number of valid responses	Yes	No
1975	210	24%	76%
1976	250	36%	64%

2. *Was recreation on the Yellowstone River and/or its tributaries the primary purpose of your trip?*

	Number of valid responses	Yes	No
1975	198	54%	46%
1976	184	57%	54%

If not, what is the main reason for your trip?

	Percentage of valid responses[a] 1975	1976
Enjoyment, rest, and relaxation[b]	43	42
Visiting relatives and/or friends	12	42
Sightseeing[b]	12	
Business or work	12	

[a]129 valid responses in 1975, 167 in 1976.

[b]Those who answered either "sightseeing" or "enjoyment, rest and relaxation" apparently did not consider those activities to be recreation.

3. *How often do you visit this particular site each summer (June 21-Sept. 22)?*

Number of visits	Percentage of valid responses[a] 1975	1976
Never before	23	27
2-3 times	--	19
4-6 times	11	11
8 times or more	30	26

[a] 199 valid responses in 1975, 200 in 1976.

How many times do you visit this particular site during the 1) spring (March 20-June 20), 2) fall (Sept. 23-Dec. 20), 3) winter (Dec. 21-March 19)?

Number of visits	Percentage of valid responses[a] 1975	1976
Spring[a]		
1-2 times	38	53
3-6 times	28	15
More than 8 times	27	25
Fall[b]		
1-2 times	20	57
3-6 times	31	14
7-8 times	12	--
More than 8 times	27	25
Winter[c]		
1-2 times	49	66
3-6 times	15	--
More than 8 times	26	30

[a] 122 valid responses in 1975, 200 in 1976.
[b] 100 valid responses in 1975, 70 in 1976.
[c] 53 valid responses in 1975, 70 in 1976.

A note may be made that the fewest valid responses for 1975 and 1976 occurred during the winter portion, and the most occurred within the summer portion. One may surmise that these data reflect seasonal use patterns, summer having the greatest use and winter the least.

4. *Have you noticed a change in water quality since you started to use the Yellowstone River area for recreation?*

	Percentage of valid responses[a]
Water quality had increased	23
About the same	65
Water quality had decreased	12

[a] 155 valid responses in 1975 only.

From personal communication, water quality, to the interviewees, was defined as the color of the water. Blue, clear water would be of good quality, as opposed to murky, brown water.

5. *Since you started using the Yellowstone River area for recreation, has the amount of litter increased, stayed the same, or decreased?*

	Percentage of valid responses[a]	
	1975	1976
Increased	36	29
Stayed the same	37	48
Decreased	27	22

[a] 142 valid responses in 1975, 170 in 1976.

6. *Has your enjoyment of the river increased, decreased, or stayed the same?*

	Percentage of valid responses[a]
Increased	51
Decreased	--
Stayed the same	44

[a] 154 valid responses in 1975 only.

7. *What is the length of your present stay?*

	Percentage of valid responses[a]	
	1975	1976
Day use	62	47
One night	10	12
Over 10 nights	12	13

[a] 189 valid responses in 1975, 236 in 1976.

From personal communication, nonresidents and vacationers constituted the majority of those staying over ten nights and responded not necessarily with their present location in mind but rather with respect to the total duration of their trip.

8. *For each activity you have engaged in or plan to engage in while in this immediate area, indicate the number of hours per day spent in that way.*

See table C-1 on page 112 for response.

Which of these is your favorite activity?

Activities	Percentages of valid responses[a] 1975	1976
Picnicking	1	3
Swimming	8	8
Rest and Relaxation	15	10
Water Skiing	1	1
Sightseeing	4	0
Rockhounding	4	9
Bicycling	0	1
Motor Biking	1	2
Walking and Hiking	3	3
Motor Boating	2	1
Floating	4	5
Fishing	57	58

[a] 159 valid responses in 1975, 156 in 1976.

The responses given to question 8 indicate that fishing and rest and relaxation were the recreational activities most engaged in and most preferred during the survey periods.

9. *If you fished in this area, for which species?*

Species	Percentages of valid responses[a] 1975	1976
Sauger, walleye	47	16
Paddlefish	8	6
Catfish	24	20
Sturgeon	1	3
Ling	2	3
Sucker, carp	5	1
Trout	30	51
Bass	3	0
Bullhead	0	1

[a] 181 valid responses in 1975, 120 in 1976.

TABLE C-1. Percentage of people spending between 1 and 8 hours per day in recreational pursuits in the Yellowstone River Basin, 1975-76.

Activity	Hours per day														Not Valid[a]		Number non-responses[b]	
	1		2		3		4		5		6		8					
	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976
Picnicking	42	57	40	23	0	13	0	0	0	0	0	0	0	0	24	0	167	187
Swimming	42	69	26	19	0	0	0	0	0	0	0	0	0	0	11	0	193	221
Rest & relaxation	24	45	20	14	0	0	13	0	0	0	0	0	0	0	0	0	137	153
Bird watching	33	50	33	25	0	17	0	0	0	0	0	0	17	0	17	0	206	245
Horseback riding	25	100	25	0	0	0	0	0	0	0	0	0	50	0	0	0	208	255
Water skiing	25	100	0	0	25	0	0	0	0	0	25	0	25	0	0	0	208	254
Sightseeing	40	48	40	19	0	0	0	14	0	0	0	0	10	0	0	0	192	205
Rockhounding	50	46	19	22	0	14	0	12	0	0	0	0	12	0	0	0	186	207
Bicycling	38	50	25	50	13	0	13	0	0	0	0	0	13	0	0	0	204	253
Motor biking	14	91	14	0	14	0	0	0	43	0	0	0	14	0	0	0	205	246
Walking, hiking	31	59	0	25	0	0	19	0	13	0	19	0	0	0	0	0	196	213
Pleasure driving	58	53	17	27	0	0	0	0	0	0	0	0	0	0	0	0	200	223
Playing outdoor games	40	44	10	25	20	0	10	19	0	0	0	0	10	0	10	0	202	241
Motor boating	47	60	35	0	0	0	0	0	0	0	0	20	12	0	0	0	195	252
Fishing	16	37	15	0	0	12	21	15	0	0	17	0	0	0	0	0	111	126

NOTE: Response less than 10 percent is shown only as zero (0).

[a]Not-valid responses were those which defied common sense--e.g., 24 hours of water skiing per day.

[b]Nonresponses are categories which were not answered. The author assumes that the vast majority of these nonresponses did not engage in the respective recreational activity.

Which species did you catch, and how many?

Species	Percentages of valid responses[a] 1975	1976
Sauger, walleye	29	16
Paddlefish[b]	6	4
Catfish	27	22
Sturgeon	5	1
Ling	3	1
Sucker, carp	5	7
Trout	13	45
Bass	2	0
Bullhead	2	1
Goldeye	8	1
Whitefish	2	1

[a] 31 valid responses in 1975, 76 in 1976.
[b] The study period did not cover the peak paddlefishing period.

The actual number of fish caught by the 17 percent in 1975 and the 42 percent in 1976 of successful fishermen varied. Without regard to species, 81 percent (31 valid responses) and 71 percent (76 valid responses) caught from one to six fish.

10. *Rate each of the following at this location.*

	Number of Valid Responses	Percentage of Valid Responses Exceptional	Good	Fair	Poor[a]
	1975				
Picnic Facilities	150	11	40	24	25
Rest Rooms	138	8	25	21	46
Camping Sites	145	10	36	32	22
Children's Activities, Equipment	111	3	14	16	67
Weed Mowing	130	5	21	21	55
Access Roads	165	12	33	33	19
	1976				
Picnic Facilities	165	9	49	28	15
Rest Rooms	148	3	39	24	34
Camping Sites	156	7	53	29	12
Children's Activities, Equipment	119	3	14	27	56
Weed Mowing	141	3	28	28	42
Access Roads	167	9	41	32	17

[a] The "poor" category includes responses concerning privately owned lands where certain activities and/or conditions were not present.

11. *Where would you go for the same activities if this site was not available?*

The data collected in 1975 were not valid. In 1976, 54 percent replied that they did not know where they would go.

12. *Do you like that site as well as this one?*

	Number of valid responses	Yes	No
1975	145	68%	32%
1976	92	80%	20%

13. *What is your state of residence?*

	Number of valid responses	Montanans
1975	205	82%
1976	195	77%

County or town?

Town of residence	Percentage of valid responses[a] 1975	1976
Billings	49	42
Forsyth	12	10
Miles City	--	18
Columbus	--	12
All others	13	19

[a] 165 valid responses in 1975, 151 in 1976.

14. *Check the broad income category your combined household fits into.*

Income	Percentage of valid responses[a] 1975	1976
Under $5,000	14	12
$5,000-$8,000	13	15
$8,000-$12,000	26	22
$12,000-$16,000	28	26
Over $16,000	20	26

[a] 203 valid responses in 1975, 180 in 1976.

15. *Do you think this site presently is too crowded, just right, or not used enough?*

Site criteria	Percentages of valid responses[a] 1975	1976
Too crowded	13	10
Just right	72	81
Not used enough	15	9

[a] In 1975, 203 valid responses, in 1976, 183.

16. *Should this site be more fully developed (more facilities, roads, etc.)?*

	Number of valid responses	Yes	No
1975	197	63%	38%
1976	175	51%	49%

17. *Do you want more recreation sites along the Yellowstone River?*

	Number of valid responses	Yes	No
1976 only	175	81%	19%

If you answered YES, within how many miles from this site?

Miles distant	Percentage of valid responses[a] 1975	1976
Less than 5	29	11
5-15	32	35
15-30	23	31
Over 30	16	24

[a] 173 valid responses in 1975, 136 in 1976.

18. *Has the increasing cost of gasoline decreased the distance you travel to a recreational area?*

	Number of valid responses	Yes	No
1975	203	58%	46%
1976	182	40%	60%

Check the miles covered in a typical previous year's recreation trip.

Number of miles	Percentage of valid responses[a] 1975	1976
Under 50	14	4
50-250	26	31
250-450	16	19
Over 450	44	47

[a] 190 valid responses in 1975, 164 in 1976.

Check the miles covered in a typical recreation trip this year.

Number of miles	Percentage of valid responses[a] 1975	1976
Under 50	21	13
50-250	32	32
250-450	16	14
Over 450	31	41

[a] 195 valid responses in 1975, 166 in 1976.

The percentage of trips over 450 miles decreased significantly in 1975 and 1976 while shorter recreational trips increased.

19. *Check the type of vehicle you arrived in.*

Vehicle	Percentage of valid responses[a]
Car	50
Pickup	23
Pickup with camper	13
Other models	15

[a] 1975 only, 204 valid responses.

Check the items of equipment you have with you.

Equipment	Percentage of valid responses[a]
Boats	17
Tents	11
Fishing gear	57
Sleeping bags	23
Firearms	14

[a] 212 valid responses, 1975 only.

20. *Check your occupation. What is your spouse's occupation?*

Occupation	Interviewee[a] 1975	1976	Spouse of Interviewee[b] 1975	1976
Self-employed White Collar	6	4	6	3
Self-employed Blue Collar	7	6	3	3
Employed White Collar	10	9	15	12
Employed Blue Collar	35	25	19	23
Professional	11	5	0	8
Student	8	10	0	1
Housewife	8	6	50	41
Agriculture	4	3	2	0
Retired	12	19	7	9

[a] 192 valid responses in 1975, 187 in 1976.
[b] 122 valid responses in 1975, 116 in 1976.

For both years, "employed blue collar" was the most common form of employment of the interviewee, and "housewife" was the most common occupation of spouses. This corresponds with the larger number of males than females interviewed in 1975 and 1976.

21. *Check your sex.*

	Number of valid responses	Male	Female
1975	204	68%	32%
1976	186	76%	24%

Check your age.

Age	Percentage of valid responses[a] 1975	1976
Under 18	11	11
19-30	28	23
31-50	37	38
Over 50	24	29

[a] 197 valid responses in 1975, 136 in 1976.

22. *Enter the number of other persons in each category from your group.*

Age Group	Males Number of Valid Responses[a]	%	Females Number of Valid Responses[b]	%
1-12	29	26	14	13
13-18	24	22	12	11
19-30	23	21	32	29
30-50	19	17	36	33
Over 50	16	14	16	15

NOTE: The numbers of valid responses in this table are the numbers of respondents who answered that their group contained people in the indicated age-sex category--they do not indicate the number of recreationists in that category. Likewise, the percentage figures show the percentage of respondents claiming to have males or females of the given age category in their group. The results from question 22 were not valid for showing the total number of recreationists in each age-sex category.

[a] In 1975 only, 111 valid responses
[b] In 1975 only, 110 valid responses.

23. *Are insects a problem to you in this area?*

Results not valid.

Have they reduced the time you spend enjoying your favorite activities?

	Number of valid responses	Yes	No
1975	191	42%	58%
1976	223	39%	61%

Would you return to this area if the insect problem remains the same?

	Number of valid responses	Yes	No
1975	188	85%	15%
1976	224	65%	35%

Would you return to this area if the insect problem was reduced?

	Number of valid responses	Yes	No
1975 only	184	92%	9%

24. *Are you aware of the location of public (Bureau of Land Management) lands along the river near (50 miles upstream or downstream) this area?*

	Number of valid responses	Yes	No
1975	192	41%	59%
1976	212	46%	54%

Are you aware of the location of public lands near your home if this area is not near your home (50 miles in any direction)?

	Number of valid responses	Yes	No
1975	155	57%	43%
1976	216	46%	54%

Do you know that literature is available at any Bureau of Land Management Office providing information and the location of those areas, free of charge?

	Number of valid responses	Yes	No
1975	191	64%	36%
1976	245	49%	51%

25. *Within the past year, which of the following activities have you participated in on these public lands adjacent to the Yellowstone River?*

Activity	Percentage of valid responses[a] 1975	1976
None	16	28
Fishing	56	65
Boating	25	40
Picnicking	34	46
Camping	29	52
Hunting	28	30
Other	10	30

[a] 212 valid responses in 1975, 257 in 1976.

26. *Yearly, how many days do you spend at other sites on the Yellowstone River and its tributaries?*

Number of days spent at other sites	Percentage of valid responses[a] 1975	1976
None	20	35
1	9	2
2-3	15	11
4-5	10	11
6-9	11	9
10-15	16	10
16-20	4	4
Over 20	16	18

[a] 199 valid responses in 1975, 125 in 1976.

Appendix D

OBSERVED USE FORM

DATE _____

SEC _____

WEATHER _____

TIME PERIOD _____

	SWIMMING	PICNICKERS	REST & RELAXATION	BOATING-FLOATING	HORSEBACK RIDING	BICYCLING	MOTOR BIKING	DRIVING FOR PLEASURE	PLAYING OUTDOOR GAMES	ROCK HOUNDING	SIGHTSEEING	WALKING FOR PLEASURE	WATER SKIING	BIRD WATCHING	FISHING	VEHICLES	H_2O LINE

Appendix E

1975

MAIL SURVEY BOATING

QUESTIONNAIRE

1975 MAIL SURVEY BOATING QUESTIONNAIRE

Dear Boater:

Your name has been selected by the Montana Department of Fish and Game to evaluate boating use in southcentral and southeastern Montana. A prompt and accurate reply to the questions concerning your favorite boating site, favorite activities, number of days spent boating in 1975 would help greatly toward evaluation of new facility proposals.

Thank you very much.

My favorite boating site was (check one):

Fort Peck Reservoir _____

Yellowtail Reservoir _____

Tongue River Reservoir _____

Yellowstone River:

No. Dakota Line-Mouth Powder River _____

Mouth Powder-Mouth Tongue _____

Mouth Tongue-Mouth Bighorn _____

Mouth Bighorn-Mouth Clarksfork _____

Mouth Clarks Fork-Big Timber _____

Big Horn River _____

Tongue River _____

Powder River _____

Missouri River _____

Clarks Fork River _____

Stillwater River _____

Other _____

Favorite Activities _____

Number of total days spent boating _____

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YELLOWSTONE IMPACT STUDY

Recreation

10

MONTANA

DEPARTMENT OF NATURAL RESOURCES

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