FISHERIES MANAGEMENT PLAN

for

Mountain Lakes in the Rock Creek Drainage

Montana and Wyoming

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Introduction

Absaroka-Beartooth Wilderness Lakes

The Absaroka-Beartooth Wilderness Area (A-B) established in 1978 encompasses 930,584 acres and contains more area over 10,000 feet in elevation than any other area in the U.S. It rates as one of the top four or five wilderness areas in the country, receiving about 320,000 visitor-days of use each year. For comparison, the Bob Marshall Wilderness Area receives about 150,000 visitor-days use yearly. The Absaroka-Beartooth Wilderness Area and lands immediately adjacent contain 948 high mountain lakes, 318 of which contain fish and 630 that are barren. Approximately 204 of these lakes have self-sustaining fisheries and 114 are stocked. Stocking schedules vary from annually in some of the more heavily used areas to once every six to ten years in the lakes managed for trophy fisheries.

Pat Marcuson, during the time he worked for the Montana Department of Fish, Wildlife and Parks (MDFWP) out of Red Lodge, gathered a tremendous amount of information on the A-B lakes and created a massive database. In 1980 he developed fisheries management plans for each major drainage. Since that time, a computer database containing the latest information on the lakes with fisheries has also been developed. This database is located at the MDFWP Regional Headquarters in Billings. Additional information about individual lakes can be obtained from that office.

The purpose of this document is to update the 1980 lake management plan with the latest fisheries information available for the mountain lakes in the Rock Creek Drainage.

Methods

Mountain lake information is collected primarily by a lake survey team consisting of two temporary employees who spend about eight weeks backpacking into the remote lakes of the A-B Mountains. Lakes scheduled for sampling are selected based on length of time since last survey, questions about the status of fish introductions, impending scheduled fish plants, and angler reports. Fish populations are monitored with lightweight experimental nylon gill nets, hook and line, and visual surveys. Additional information gathered includes lake access, pH, air and surface water temperatures, availability of firewood and campsites, and extent of recreational use. Observations are also made of aquatic invertebrates, cruising and rising fish, fish fry, and suitability of substrate for spawning. Inlet and outlet streams are visually surveyed for fish and spawning activity or potential.

Fish collected are weighed and measured, and scales are taken for later age determination. Live fish are released, dead fish are dissected to check for parasites and general health and condition; stomachs are examined for food organisms.

Spot creel checks are conducted by enforcement and fisheries personnel to determine catch rates and angler satisfaction with regulations. Additional angler use information was gathered during 1988 and 1989 with a voluntary trailhead creel information survey implemented at the major access points to the A-B Wilderness Area. The purpose of this survey was to address a proposed new three-fish limit, estimate harvest and catch rates, solicit public comments, and gather additional fisheries information. Supplemental fisheries information is also obtained from guides and outfitters, Wilderness Rangers and other Forest Service personnel, as well as reports from other wilderness users.

Information gathered from all sources is summarized and analyzed to make fish management decisions for the mountain lakes. Regulations are adjusted as necessary to help achieve desired fish population levels. Stocking rates and individual lake management strategies are adjusted as necessary to maintain desired angler catch rates, fish growth rates, and species distribution. Summarized information is used to update the computer database for each mountain lake sampled.

DESCRIPTION

Location and numbers of lakes

Rock Creek has a drainage area of approximately 623 square miles of which 412 square miles are outside the Forest boundary, 196 square miles are in Beartooth Ranger District of the Custer National Forest in Carbon County, Montana and 15 square miles are in Clarks Fork Ranger District of the Shoshone National Forest in Park County, Wyoming. These National Forests have 91 waters in the Rock Creek drainage area defined as lakes in this report. Twenty-six lakes are in Wyoming, 63 lakes are in Montana, and 2 lakes are shared by both states (Figure 1 and Table 1). Seven Montana lakes and all 25 Wyoming lakes are outside the Absaroka-Beartooth Wilderness Area. All 91 lakes are in the Beartooth Mountain Range. Red Lodge, Montana is the nearest town to the lakes in the Rock Creek Drainage.

Lake areas and depths

Lakes in the drainage cover 1,092.4 surface acres and range from 0.6 to 176.7 acres (Marcuson 1969; Marcuson & Bishop 1970, 1971, 1973, 1974). The percentage of total lake area to forest land area is 0.8%. Glacier Lake covers the largest area. Only one lake exceeds 200 feet of depth, 4 exceed 100 feet, 31 are between 16 and 100 feet and the remaining 54 lakes are under 15 feet deep. The deepest lakes are Sliderock at 245 feet, Black Canyon at 185 feet, Glacier at 180 feet, Emerald at 150 feet, and Marker at 115 feet.

Lake elevations

Frosty Lake is the highest named lake in the drainage at 11,020 feet above sea level; however, two unnamed lakes occur at 11,180 and 11,100 feet. There are 42 lakes in the 10,000 to 11,000 foot range, 38 lakes exist between 9,000 and 10,000 feet, 5 lakes are between 8,000 and 9,000 feet, 2 lakes are between 7,000 and 8,000 feet and the lowest lake in the drainage is Wild Bill at 6,719 feet. The majority of the waters (45) occupy the Subalpine ecological zone, followed by 32 in the Alpine, 9 in the Canadian and 4 in the Transition Zone.

Accessibility

Wild Bill and Greenough lakes are the only lakes of the 91 accessible by road. The majority of the lakes are accessible by trail. Some lakes, like those in the Hell Roaring chain and those in the Twin Lake cirque, are short cross-country hikes from roadways. Even though all the lakes are reasonably close to trails, there are 30 lakes accessible by foot travel only. All trailheads are on public lands and have unrestricted egress.

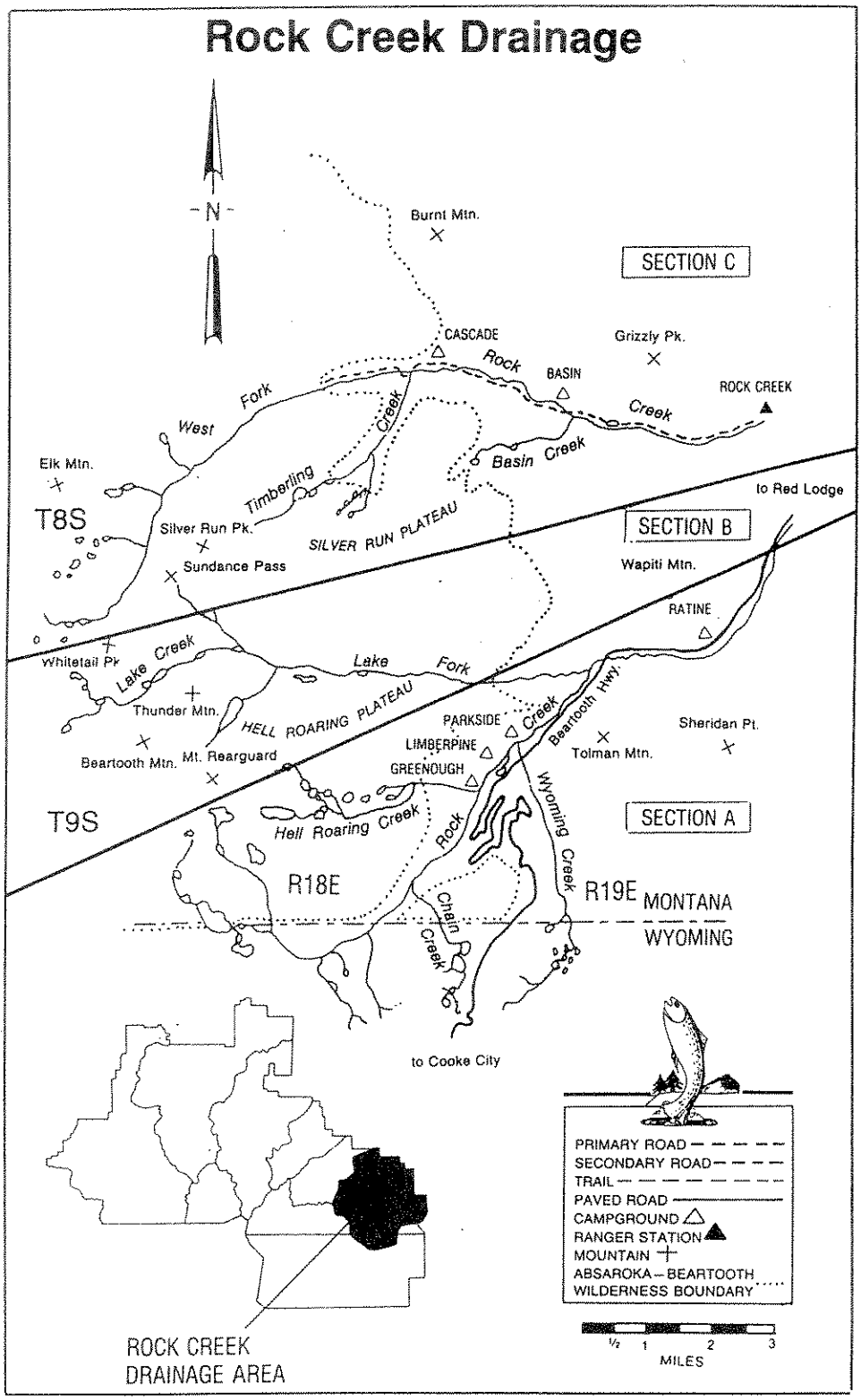

Figure 1. Location of lakes in the Rock Creek Drainage.

Source: Marcuson, P. 1985. The Beartooth fishing guide. Falcon Press Publishing Co., Inc. Billings and Helena, Montana.

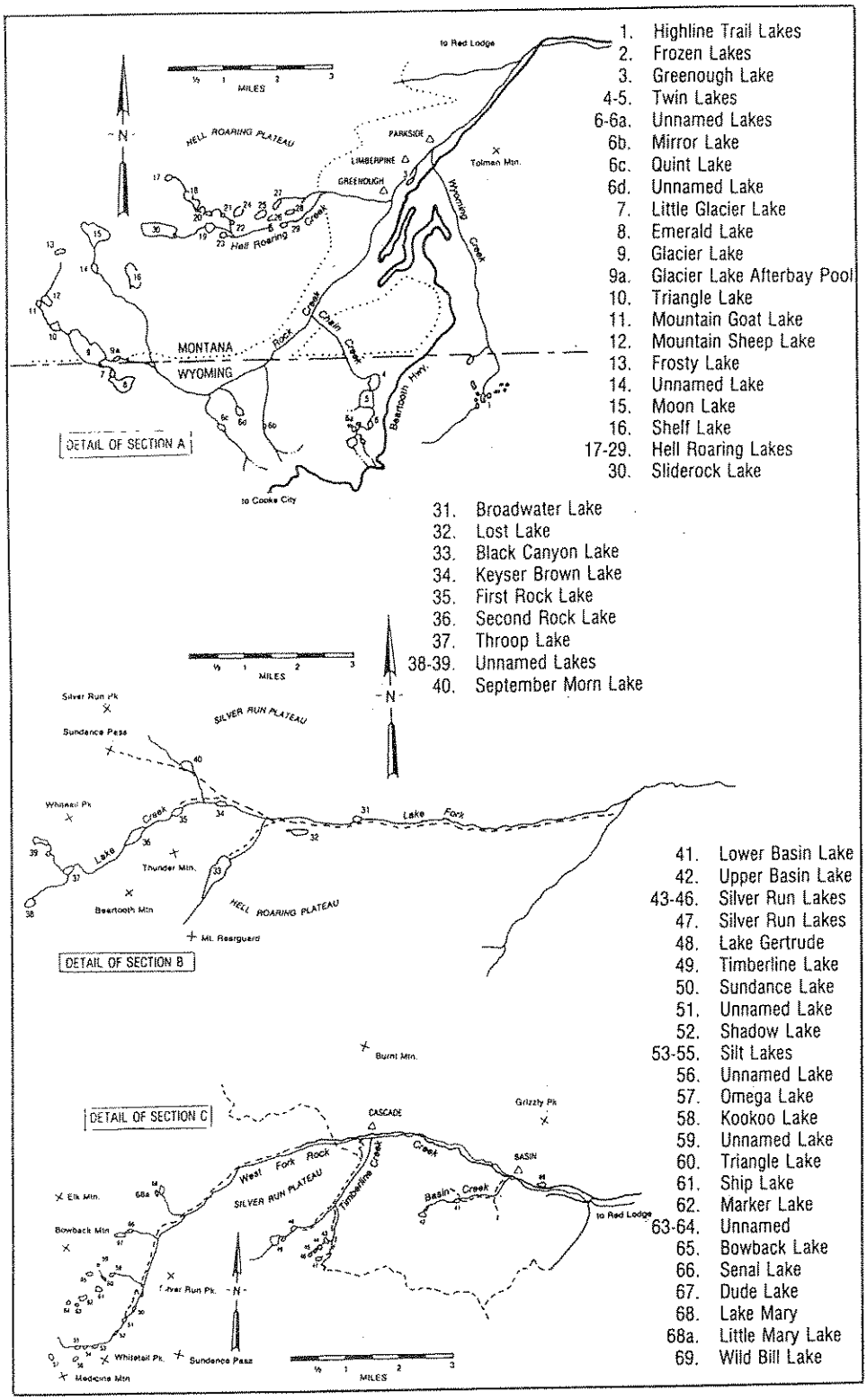

Figure 1. Location of lakes in the Rock Creek Drainage (continued).

Table 1. Summary of locations, physical features and fisheries information for lakes in the Rock Creek Drainage of the Beartooth Mountain Range.

Location code [1]	Name of lake W = Lakes located in Wyoming	County [2]	Forest [3]	Elevation in feet	Area in acres t=total	Maximum depth in feet	Shoal (% of lake less than 15 ft. deep)	Ecological zone [4]	Fish species [5]	Fish population type [6]	Fish management [7]
	ROCK CREEK										
1	Highline Trail Lake (10) (W)	P	S	10,000±	20.0t	15	100	4	B		3
2	Frozen (W)	P	S	9,700	4.6	4	100	4	B		3
3	Greenough	10	C	7,280	0.8	9	100	1	RB 2 EB 1		2 1
4	Lower Twin (W)	P	S	9,970	31.1	55	51	3	EB 1		1
5	Upper Twin (W)	P	S	9,975	44.3	75	32	3	EB 1		1
6	Unnamed (8) (W)	P	S	10,000±	14.2t	14	100	3	B		3
6a	Unnamed (W)	P	S	10,000±	12.7	98	31	3	EB 1		1
6b	Mirror (W)	P	S	9,150	4.0	14	100	2	B		3
6c	Quint (W)	P	S	9,075	3.2	10	100	2	B		3
6d	Unnamed (W)	P	S	9,820	1.9	1	100	2	B		3
7	Little Glacier (W)	P	S	9,812	11.0	30	70	3	EB 1		1
8	Emerald (W)	P	S	9,750	39.2	150	27	3	CT 2		2
9	Glacier	10	C	9,702	176.7	180	21	3	EB 1 CT 2		1 2
9a	Afterbay Pool	10	C	9,518	2.4	8	100	2	EB 1		1
10	Triangle	10	C	9,730	7.9	35	60	3	CT 2		2
11	Mountain Goat	10	C	10,040	12.5	60	26	4	CT 2		2
12	Mountain Sheep	10	C	9,985	7.3	18	40	4	CT 2		7
13	Frosty	10	C	11,020	1.0	<15	100	4	B		3
14	Unanmed	10	C	10,318	15.5	<15	100	4	B		3

Table 1. Summary of locations, physical features and fisheries information for lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake W = Lakes located in Wyoming	County [2]	Forest [3]	Elevation in feet	Area in acres t=total	Maximum depth in feet	Shoal (% of lake less than 15 ft. deep)	Ecological zone [4]	Fish species [5]	Fish population type [6]	Fish management [7]
15	Moon	10	C	10,400	82.2	115	4	4	CT	2	2
16	Shelf	10	C	10,120	51.0	55	30	4	EB	1	1
17	Hell Roaring #1	10	C	10,900	5.2	77	20	4	B		1
18	Hell Roaring #2	10	C	10,160	32.9	65	48	4	EB CT	1 2	1 2
19	Hell Roaring #3	10	C	10,040	18.8	40	43	3	EB	1	1
20	Hell Roaring #4	10	C	10,100	2.6	4	100	3	EB	1	1
21	Hell Roaring #5	10	C	10,060	2.7	10	100	3	EB	1	1
22	Hell Roaring #6	10	C	9,990	1.1	3	100	3	B		3
23	Hell Roaring #7	10	C	9,900	2.0	4	100	3	B		3
24	Hell Roaring #8	10	C	10,000	13.6	42	25	3	EB	1	1
25	Hell Roaring #9	10	C	9,660	7.9	30	64	3	EB	1	1
26	Hell Roaring #10	10	C	9,580	4.6	4	100	3	CT	1	1
27	Hell Roaring #11	10	C	9,670	7.4	40	32	3	EB	1	1
28	Hell Roaring #12	10	C	9,510	3.0	2	100	3	EB CT	1 1	1 1
29	Hell Roaring #13	10	C	9,600	1.2	2	100	3	B		3
30	Sliderock	10	C	10,480	81.0	245	5	4	EB	1	1
31	LAKE FORK Broadwater	10	C	7,990	1.0	3	100	1	EB	1	1
32	Lost	10	C	8,520	11.3	25	63	2	CT	2	5
33	Black Canyon	10	C	9,280	82.4	185	8	3	CT	2	2
34	Keyser Brown	10	C	8,720	9.5	8	100	2	EB CT	1 1	1 1

Table 1. Summary of locations, physical features and fisheries information for lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake W = Lakes located in Wyoming	County [2]	Forest [3]	Elevation in feet	Area in acres t=total	Maximum depth in feet	Shoal (% of lake less than 15 ft. deep)	Ecological zone [4]	Fish species [5]	Fish population type [6]	Fish management [7]
35	First Rock	10	C	8,870	17.5	36	60	2	CT 1 EB 1		1 1
36	Second Rock	10	C	9,110	25.9	50	39	3	EB 1		1
37	Throop	10	C	9,690	8.5	6	100	3	B		3
38	Unnamed	10	C	10,520	10.3	23	75	4	B		1
39	Unnamed	10	C	10,160	12.6			4	B		3
40	September Morn	10	C	9,696	11.3	75	20	3	EB 1		1
41	WEST FORK Lower Basin Creek	10	C	8,360	2.5	21	98	1	B		3
42	Upper Basin	10	C	8,960	6.7	5	100	2	GR 2a EB 1		6 4
43	Silver Run	10	C	9,600+	3.6	4	100	3	B		3
44	Silver Run (Fig.4)	10	C	9,600+	2.3	4	100	3	B		3
45	Silver Run "	10	C	9,600+	0.8	2	100	3	B		3
46	Silver Run "	10	C	9,600+	1.2	4	100	3	B		3
47	Silver Run "	10	C	9,580	2.5	10	100	3	EB 1		1
48	Lake Gertrude	10	C	9,550	6.1	11	100	2	EB 1		1
49	Timberline	10	C	9,660	31.4	85	44	3	EB 1		1
50	Sundance	10	C	9,370	2.9	17	90	3	CT 2		2
51	Unnamed	10	C	9,560	2.4	4	100	3	B		6
52	Shadow	10	C	9,580	3.6	6	100	3	CT 2		2
53	Silt	10	C	9,780	0.6	4	100	3	B		6
54	Silt	10	C	9,800	4.4	10	100	3	CT 2		2
55	Silt	10	C	9,820	3.2	7	100	3	CT 2		2

Table 1. Summary of locations, physical features and fisheries information for lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake W = Lakes located in Wyoming	County [2]	Forest [3]	Elevation in feet	Area in acres t=total	Maximum depth in feet	Shoal (% of lake less than 15 ft. deep)	Ecological zone [4]	Fish species [5]	Fish population type [6]	Fish management [7]
56	Unnamed	10	C	10,400	1.3		100	4	B		3
57	Omega	10	C	10,940	1.5	Iced	100	4	B		3
58	Kookoo	10	C	10,200	6.1	30	60	3	CT	2a	6
59	Unnamed	10	C	10,420	1.6	8	100	4	B		3
60	Triangle	10	C	10,440	6.3	35	38	4	CT	2	2
61	Ship	10	C	10,480	28.9	55	25	4	EB	1	1
62	Marker	10	C	10,870	15.5	115	10	4	CT	2	2
63	Unnamed	10	C	11,180	1.6	4	100	4	B		3
64	Unnamed	10	C	11,100	2.8	6	100	4	B		3
65	Bowback	10	C	10,380	6.4	40	30	4	CT	2	2
66	Senal	10	C	10,140	3.1	10	100	3	EB	1	1
67	Dude	10	C	10,180	12.2	20	40	4	CT	2	2
68	Lake Mary	10	C	9,930	8.0	50	43	3	EB	1	1
68a	Little Mary	10	C	9,925	1.9	11	100	3	B		3
69	Wild Bill	10	C	6,719	3.2	8	100	1	RB EB	2 1	2 1

1/ See Figure 1 for locations.

2/ 10 = Carbon; P = Park County, Wyoming

3/ C = Custer National Forest; S = Shoshone National Forest

4/ 1 = Transition; 2 = Canadian; 3 = Sub-alpine; 4 = Alpine

5/ RB = Rainbow trout; CT = Cutthroat trout; EB = Brook trout; B = Barren of fish.

6/ 1 = Self-sustaining; 2 = Stocked; 2a = Stocked but may become self-sustaining.

7/ 1 = No management necessary; 2 = Stock at intervals; 3 = No fisheries potential; 4 = Rehabilitate and stock new species; 5 = Stock new species after present fisheries die out; 6 = Stock to establish self-sustaining population; 7 = Inhabit from upstream source.

Water chemistry

According to surveys during the 1970's, chemical attributes of 58 of the 91 lakes in the Rock Creek Drainage (Table 2) were near neutral acidity with a mean pH of 6.4 and a range of 6.1 to 6.8. Conductivities, an important biological parameter, ranged from 9 to 199 mhos with a mean for the drainage of 29.8 mhos. Conductivities were typically greater in lower elevation waters. Conductivities measured on August 4, 1977 in the West Fork of Rock Creek from Shadow Lake to Red Lodge are demonstrated below:

Location	Time (military)	Temp (°F.)	Conductivity (mhos)
Shadow Lake	1600	41	17
Sundance Lake	1630	41	19
Lower Quinnebaugh	1645	50	20
Bridge near Bot Sots	1730	50	27
Bridge near Silver Run Cr.	1800	50	32
Highway 212 Bridge	1830	52	46
Rock Creek at Red Lodge	1845	54	48

Mean chemical parameters important to biological communities arranged by geographic areas within the drainage follow:

Geographic Area	Number Waters	Conductivity (mhos)	Alkalinity ($CaCO_3$ ppm)
Headwaters in Wyoming	6	38	28
Glacial Lake group	8	15	8
Hell Roaring group	4	10	10
Lakes in Lake Fork	10	23	14
Ship Lake group	5	27	10
Basin-Timberline group	6	24	11

Thermal

Surface temperatures of lake water from 21 July to 6 August 1977 ranged from 40 to 60°F. The coldest waters were in the headwater lakes of the West Fork Rock Creek. Ice cover prevails over ice-free days. Lakes ranged from 90 to 168 days of ice-free cover for the observation period of 10 years between 1968 to 1978.

Water clarity

Waters were mostly clear and no turbidity values were recorded for most of the waters tested. Some of the lakes at higher

Table 2. Chemical attributes of lakes in the Rock Creek Drainage of the Beartooth Mountain Range.

Location code [1]	Name of lake	pH	Conductivity (mhos)	Alkalinity (ppm)	Total hardness (ppm)	Silica (ppm)	Iron (ppm)	Total phosphate (P) t = trace (no units)
1	Highline Tr. Lakes	6.3	50	90	25	2.7	0	.10
2	Frozen	6.6	50					
3	Greenough	6.3	199	290	100	3.0	0	.10
4	Lower Twin	7.2	30	31	50	.6	.06	.03
5	Upper Twin	7.2	30	31	50	.6	.06	.03
6	Unnamed	6.5	32	20	5	1.9	0	0
6a	Unnamed	7.7	25	15	50	.5	.08	.06
6b	Mirror	6.5	40	5	15		0	.10
6c	Quint	6.2	23	10	10		.05	.05
6d	Unnamed	6.8	32	15	10		.05	.05
7	Little Glacier	6.4	9	5	5		0	0
8	Emerald	6.4	17	9	5	.9	0	t
9	Glacier	6.8	16	10	5		0	.10
10	Triangle	6.2	19	5	5		.05	0
11	Mountain Goat	6.4	12	5	5		0	.10
12	Mountain Sheep	6.4	17	9	5	1.1	0	0
14	Unnamed	6.5		10	5		0	0
15	Moon	6.4		10	5		0	.05
16	Shelf	6.3		10	5		0	0
18	Hellroaring #2	6.4	10	10	5		0	0
19	Hellroaring #3	6.4	14	20	5	.4	.02	
20	Hellroaring #4	5.9		0	5	.6	.2	.10
21	Hellroaring #5	6.4	12	10	5	.6	0	0

Table 2. Chemical attributes of lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake	pH	Conductivity (mhos)	Alkalinity (ppm)	Total hardness (ppm)	Silica (ppm)	Iron (ppm)	Total phosphate (P) t = trace (no units)
24	Hellroaring #8	6.5	14	10	5		0	0
25	Hellroaring #9	6.4	15	15	5	1.2	.30	.07
26	Hellroaring #10	6.3	16	23	7	1.2	.03	
27	Hellroaring #11	6.3	15	9	6	1.5	.15	.04
28	Hellroaring #12	6.3	15	18	8	1.0	.14	
30	Sliderock	6.6		15	5		0	.05
31	Broadwater	6.3	29	10	15	1.8	0	0
32	Lost	6.3	48	15	20	2.2	0	.05
33	Black Canyon	6.3	14	30	20	1.2	0	.05
34	Keyser Brown	6.1	25	10	10	1.2		.05
35	First Rock	6.3	20	15	10	1.3	0	0
36	Second Rock	6.2	20	10	10	1.0	0	0
37	Throop	6.3	20	15	5	1.1	0	0
38	Unnamed	6.4	12	10	5	.7	0	.21
39	Unnamed	6.3		15	10	.9		
40	September Morn	6.4	18	5	10	1.2	.03	
41	Lower Basin	6.4	30	12	10	3.0	.1	.02
42	Upper Basin	6.8	20	11	10	4.8	0	.03
44	Silver Run	6.8	30	10	10		0	.1
47	Silver Run	6.8	20	15	10		0	.1
48	Lake Gertrude	6.4	22	10	10		0	.05
49	Timberline	6.3	22	10	10		0	0
50	Sundance	6.3	19	10	10	1.0	0	0
51	Unnamed	4.8	21	0	10	1.6	.05	.07

Table 2. Chemical attributes of lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code 1/	Name of lake	pH	Conductivity (mhos)	Alkalinity (ppm)	Total hardness (ppm)	Silica (ppm)	Iron (ppm)	Total phosphate (P) t = trace (no units)
52	Shadow	6.4	17	10	10	.8	0	0
53	Silt Lakes	4.9	23	10	10	1.0	.03	.07
58	Kookoo	6.2	35	12	10	2.4	0	t
60	Triangle	6.3	13	10	10	.6	0	.02
61	Ship	6.3	25	10	5	.9	0	.08
62	Marker	6.2	20	10	5	1.3	.05	.05
65	Bowback	6.4	14	10	5	.7	0	.1
66	Senal	6.4	30	8	5	2.0	0	t
67	Dude	6.3	30	7	5	2.2	0	.1
68	Lake Mary	6.3		10	10		0	.2
69	Wild Bill	6.4	52	60	25	.9	.05	.15

1/ See Figure 1 for locations.

elevation like Emerald, the Silt Lakes and those in the headwaters of the Lake Fork of Rock Creek have considerable glacial silt. Maximum visibility was 15 feet and less for many of these lakes.

Plankton

Plankton samples were collected from 49 mountain lakes in the Rock Creek Drainage (Table 3). The volumetric measurement cc/m^3 represents everything in the tow sample such as algae and rotifers, while numbers per cubic meter reflect only zooplankton and large zooplankters commonly consumed by trout. Zooplankton larger than 2.2 mm were represented by three species Diaptomus shoshone, Daphnia middendorffiana and Daphnia pulex. These forms were found in 22 of the 49 lakes sampled. Seventeen of these 22 lakes had fish populations.

Fisheries

Distributions and sizes of trout in mountain lakes were only semi-static due to stocking rates, winter kills and longevity of non-reproducing fish populations. None of the fisheries in the drainage were indigenous; all were stocked by man. The "fish population type" column in Table 1 depicts the 31 self-sustaining fisheries in the drainage. These are lakes which support naturally reproducing trout populations and are waters which most likely will always have fish unless poisoned by man or become victim to total winterkill. The 31 self-sustaining fisheries were dominated by 23 brook trout waters and two mixed populations of brook and rainbow trout. Most of these fisheries were composed of fish smaller than 11 inches.

Five lakes have sustaining cutthroat trout living in co-existence with brook trout. Two of these cutthroat populations, Hell Roaring lakes #10 and 12, are very low density. Continued survival of this remnant population of cutthroat trout is unlikely due to competition from brook trout. Kookoo Lake may have the only self-sustaining cutthroat trout population living without sharing its environment with another species.

Slightly fewer than half (44) of the 91 lakes in the drainage were fishless (Table 1, "Fish species" column). Some lakes are recognized as having little or no fisheries potential. The status of the fishery of six lakes and the stream from Sundance to Upper Silt lakes in the West Fork of Rock Creek is not certain at this time. An introductory plant of 450 cutthroat was made in 1976. These fish were not located in 1977 or sampled in 1978. The object of the plant was to create a stream-lake fishery in an area extensively used by backcountry recreationists.

Table 1 also shows 18 lakes currently managed with cutthroat trout of hatchery origin. These cutthroat populations represent the fluctuating fisheries within the drainage. If stocking was discontinued, these 12 lakes would become fishless in a few years.

Table 3. Plankton samples from lakes in the Rock Creek Drainage of the Beartooth Mountain Range.

Location code [1]	Name of lake	Sample date	Volume of plankton cc/m^3	Number/m^3 of zooplankton	Number/m^3 of large zooplankton	Species of large zooplankton
3	Greenough	3/9/78	29.97	298		
4	Lower Twin	7/18/79	.72	1,221		
5	Upper Twin	7/18/79	.54	754		
6a	Unnamed	7/18/79	.18	144		
6b	Mirror	7/26/77	1.60	348	84 42	D. shoshone D. middendorffiana
6d	Unnamed	7/26/77	.24	96		
7	Little Glacier	7/21/77	1.40	431	287	D. shoshone
8	Emerald	8/4/76 7/21/77	1.20 .36	1,654 1,436		
9	Glacier	7/21/77 8/7/79	1.80 .03	718 0	628 90	D. shoshone D. middendorffiana
10	Triangle	8/4/76 7/21/77 8/7/79	.39 .72 .18	0 0 0		
12	Mountain Sheep	8/4/76 7/21/77 8/7/79	.51 .48 .14	0 0 1		
14	Unnamed	7/26/77	2.20	129	129	D. middendorffiana
15	Moon	7/26/77	.22	29	29	D. middendorffiana
16	Shelf	7/26/77	5.70	72	14	D. middendorffiana
18	Hellroaring #2	7/22/77 8/30/79	.36 .04	18 169	18 106	D. shoshone D. middendorffiana
19	Hellroaring #3	7/22/77	.54	514		
21	Hellroaring #5	7/22/77	.57	431		
24	Hellroaring #8	7/22/77	1.10	18	18	D. middendorffiana
26	Hellroaring #10	8/30/79	1.5	239		

Table 3. Plankton samples from lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code 1/	Name of lake	Sample date	Volume of plankton cc/m^3	Number/m^3 of zooplankton	Number/m^3 of large zooplankton	Species of large zooplankton
27	Hellroaring #11	8/30/79	.04	0		
28	Hellroaring #12	8/30/79	1.08	0		
30	Sliderock	7/22/77	.18	0		
31	Broadwater	8/2/77	.28	0		
32	Lost	8/2/77	.48	479	392	Daphnia pulex
33	Black Canyon	8/2/77	.31	0		
		7/13/78	.48	48		
		8/3/79	.03	0		
34	Keyser Brown	8/2/77	.36	251	72	Daphnia pulex
35	First Rock	8/3/77	.21	0		Daphnia pulex
36	Second Rock	8/3/77	.28	115		Daphnia pulex
38	Unnamed	8/3/77	.60	180	180	D. shoshone
40	September Morn	8/3/77	.40	239		
41	Lower Basin	8/2/77	3.30	5,166	339	D. shoshone
					405	Daphnia pulex
42	Upper Basin	7/10/76	19.30	385		
		8/2/77	12.80	6,525	6,525	D. shoshone
44	Silver Run	7/27/77	2.99	703		
47	Silver Run	7/27/77	5.10	1,231		
48	Gertrude	7/27/77	4.60	201		
49	Timberline	7/27/77	2.20	0		
50	Sundance	8/4/77	.60	0		
51	Unnamed	8/10/79	.36	120		
52	Shadow	8/4/77	.65	0		
		7/11/78	.24	0		

Table 3. Plankton samples from lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code 1/	Name of lake	Sample date	Volume of plankton cc/m^3	Number/m^3 of zooplankton	Number/m^3 of large zooplankton	Species of large zooplankton
53	Silt	8/9/79	2.0	319		
58	Kookoo	8/2/77	.20	0		
60	Triangle	7/28/76	.50	0		
		8/2/77	4.50	1,221	1,203	D. shoshone
					18	D. middendorffiana
61	Ship	7/28/76	.04	0		
		8/3/77	1.00	164	41	D. shoshone
62	Marker	7/28/76	.20	0		
		8/3/77	.42	42	42	D. shoshone
65	Bowback	8/2/77	.36	0		
66	Senal	8/6/76	.60	0		
		7/27/77	10.80	2,800	72	D. shoshone
					2,728	D. middendorffiana
67	Dude	8/6/76	4.30	1,654	1,654	D. shoshone
		7/27/77	.36	3,071		
		9/5/79	.41	82	82	D. shoshone
68	Lake Mary	7/28/77	11.50	37,623	86	D. middendorffiana
69	Wild Bill	3/10/78	29.97	1,798		

1/ See Figure 1 for locations.

Greenough and Wild Bill lakes, located near campgrounds and developed roads, both receive heavy use. Catchable-sized rainbow trout are stocked into both lakes at four week intervals throughout the summer. These fish provide a put-and-take fishery with limited carry-over from year to year.

Modern stocking histories of lakes planted by the State of Montana Department of Fish, Wildlife & Parks show the dominant use of cutthroat trout (Table 4). Initial fish plants were mostly brook trout (not recorded in Table 4) and were stocked by individuals not employed by a Fish and Wildlife agency (Marcuson 1976). Brook trout were first supplied by the National Fish Hatchery in Bozeman and later by the Department of Fish, Wildlife & Parks. Holding areas were located at the site of the old Richel Lodge and at the present site of the Big Sky Historical Museum. These fish were allocated to individuals and to Red Lodge Rod and Gun Club members for distribution of their choice. Records of these plants were misplaced by the Rod and Gun Club. Information on specific plants was searched out by Pat Marcuson through numerous contacts with early residents. The latest fish distribution and lake survey information is included in Table 5.

Creel censuses were conducted by Waples, Marcuson and crew, National Outdoor Leadership School, and selected individuals during the period 1965-1978. Fishermen were interviewed at 28 lakes. The overall catch per hour for cutthroat trout was .95 and for brook trout was .98. Those anglers using flies had a catch rate of 2.92 fish/hour compared to .67 and .78 fish/hour for bait and lures, respectively.

During 1988 and 1989 (Poore & Frazer 1990), a voluntary trailhead creel information survey was implemented at the major access points to the Absaroka-Beartooth Wilderness Area (A-B). That study showed, in spite of liberal fish limits for the A-B mountains, anglers kept only 26% of their catch in 1988 and 27% in 1989. Anglers release three out of four fish they presently catch without being required to by restrictive regulations. By a four to one majority, those fishermen responding to the survey wanted to see the present liberal fish limits retained in the A-B.

A-B anglers kept 35% of the brook trout they caught, 24% of the rainbows and 22% of the cutthroat. The average catch per hour for each fish species was; 0.94 for cutthroat trout, 0.72 for rainbow trout, and 1.27 for brook trout. Catch rates for 1988 and 1989 were identical with 2.6 fish per hour on lakes, 4.3 fish per hour on streams, and 2.4 fish per hour for people fishing both lakes and streams.

Table 4. Fish planted by the State of Montana in lakes in the Rock Creek Drainage of the Beartooth Mountain Range.

Location code [1]	Name of lake	Number of fish	Species and strain [2]	Number/acre	Date planted
3	Greenough	1,000-8,780/yr	RB		1966-1969
		4,743 avg/yr	RB		1970-1990
8	Glacier	21,000	CT'M	119	8/18/88
		19,348	CT'M	109	7/22/85
		13,258	CT'M	75	8/19/82
		31,975	CT'M	181	8/7/81
		6,159	CT'M	34	8/17/79
		9,000	CT'M	51	8/24/78
		9,048	CT'M	51	7/26/71
		7,600	CT'Y	43	9/11/53
		2,000	EB	11	8/1/40
		11,400	EB	64	7/30/37
		23,119	EB	131	7/23/36
		9,600	EB	54	7/26/33
10	Triangle	2,070	CT'M	262	7/22/85
		790	CT'M	100	8/17/77
		2,070	CT'Y	262	8/11/69
11	Mountain Goat	1,000	CT'M	80	8/13/90
		1,050	CT'M	84	7/29/86
		1,012	CT'M	80	7/28/82
		1,620	CT'M	221	8/10/76
		2,430	CT'M	194	8/1/69
12	Mountain Sheep	1,500	CT'M	205	8/10/76
		2,430	CT'M	332	8/1/69
15	Moon	8,197	CT'M	98	8/13/90
		8,220	CT'M	99	8/13/87
		8,220	CT'M	99	8/18/84
		8,217	CT'M	99	8/5/81
		10,000	CT'M	120	8/10/75
		5,230	CT'Y	63	8/9/72
		10,000	CT'Y	120	8/1/69
		26,400	CT'Y	318	8/25/55
		4,700	CT'Y	57	9/11/53
		1,040	EB	12	8/26/38
18	Hellroaring #2	1,629	CT'M	49	8/13/90
		1,620	CT'M	49	7/28/82
		1,650	CT'M	50	8/17/77
		6,123	CT'Y	186	7/29/71
		2,000	CT'Y	60	8/4/67
		12,000	EB	364	8/6/33

Table 4. Fish planted by the State of Montana in lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake	Number of fish	Species and strain [2]	Number/acre	Date planted
	Hellroaring #24, 25, 26, 27, 28	59,000	EB		1931 & 1933
	Hellroaring #25, 26	20,000	CT'Y		8/3/32
30	Sliderock	1,560	EB	19	8/26/38
		13,600	EB	167	8/7/33
32	Lost	1,000	GR	88	8/18/84
		1,500	CT'M	132	8/10/75
		1,003	CT'Y	88	7/29/71
		5,000	CT'Y	442	8/2/65
		4,956	CT'Y	438	8/21/61
		4,830	CT'Y	427	8/4/60
33	Black Canyon	8,245	CT'M	100	8/13/87
		8,290	CT'M	100	8/2/83
		8,248	CT'Y	100	8/17/79
		8,060	CT'Y	97	8/10/75
		7,000	CT'Y	84	8/27/70
		4,000	CT'Y	48	8/4/67
		3,080	EB	37	7/22/41
34	Keyser Brown	11,000	EB	1,157	8/15/33
35	First Rock	4,700	CT'Y	269	9/11/53
		20,000	EB	772	7/7/31
36	Second Rock	6,000	EB	231	8/19/33
		18,000	EB	694	8/18/33
		18,000	EB	694	8/16/33
37	Throop	15,000	GR	Eggs	7/20/55
		7,180	EB	844	8/6/37
40	September Morn	7,000	EB	1,044	8/15/33
		25,000	CT'Y	2,212	9/12/31
42	Upper Basin	200	GR	29	8/5/85
		3,000	CT'Y	447	9/10/58
		3,325	CT'Y	496	9/11/53
		1,560	EB	232	8/24/38
48	Lake Gertrude	5,600	EB	918	7/07/34
		5,600	EB	918	7/01/34
		10,000	EB	1,639	8/23/33
		6,000	EB	983	7/13/32

Table 4. Fish planted by the State of Montana in lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake	Number of fish	Species and strain [2]	Number/acre	Date planted
49	Timberline	5,600	EB	178	7/2/34
		5,600	EB	178	6/26/34
		12,000	EB	382	8/24/33
		12,000	EB	382	8/23/33
		6,000	EB	191	7/14/32
50	Sundance	1,168	CT'M	402	8/3/88
		300	CT'M	103	8/18/84
		825	CT'M	284	8/7/80
		5,600	EB	1,931	7/9/34
		5,600	EB	1,931	7/3/34
		12,000	EB	4,137	8/27/33
52	Shadow	334	CT'M	92	8/7/80
54	Silt Lake #2	315	CT'M	71	8/3/88
		300	CT'M	68	8/14/84
		334	CT'M	75	8/7/80
		450	CT'M	102	8/10/76
55	Silt Lake #3	442	CT'M	138	8/3/88
		450	CT'M	140	8/18/84
		334	CT'M	104	8/7/80
58	Kookoo	872	CT'M	142	7/22/85
		1,760	CT'Y	288	8/9/72
60	Triangle	654	CT'M	103	7/22/85
		630	CT'M	100	8/17/77
		660	CT'Y	104	8/5/71
61	Ship	5,600	EB	193	7/8/34
		5,600	EB	193	6/30/34
		6,000	EB	207	7/13/32
62	Marker	3,080	CT'M	198	7/25/86
		2,000	CT'M	129	8/24/78
		3,080	CT'Y	198	8/9/72
		3,600	CT'Y	232	7/24/50
65	Bowback	663	CT'M	103	8/3/88
		640	CT'M	100	8/7/80
		1,125	CT'Y	175	8/12/71
		1,540	CT'Y	240	8/27/68

Table 4. Fish planted by the State of Montana in lakes in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake	Number of fish	Species and strain [2]	Number/acre	Date planted
67	Dude	2,445	CT'M	200	8/2/83
		2,500	CT'M	204	8/10/75
		2,500	CT'Y	204	7/23/68
		1,000	CT'Y	81	8/4/67
		2,600	EB	213	8/23/38
		25,000	EB	2,049	6/18/31
68	Lake Mary	2,600	EB	325	8/23/38
		5,600	EB	700	7/5/34
		5,600	EB	700	6/29/34
		8,000	EB	1,000	8/24/33
69	Wild Bill	4,798 avg/yr	RB	1,499	1964-1990
		30,000 (F)	CT'Y	9,375	8/6/34

1/ See Figure 1 for locations.

2/ RB = Rainbow trout; EB = Brook trout; GR = Arctic grayling; CT'Y = Yellowstone cutthroat trout; CT'M = McBride cutthroat trout.

Table 5. Species distribution, species, catch/net, average length, population status and latest survey date for lakes located in the Rock Creek Drainage of the Beartooth Mountain Range.

Location code [1]	Name of lake	Fish species [2]	Average catch/net	Average length (inches)	Sustaining population	Stocked population	Survey date
3	Greenough	RB	We stock catchables				Never surveyed
		EB			X		
4	Lower Twin	EB	Located in Wyoming		X		No survey info
5	Upper Twin	EB	Located in Wyoming		X		No survey info
6a	Unnamed	EB	Located in Wyoming		X		No survey info
7	Little Glacier	EB	18	9.4	X		7/31/68
8	Emerald	CT'M	16	10.0		X	8/10/81
9	Glacier	CT'M	25	10.0		X	
		EB	5	8.0	X		8/9/84
10	Triangle	CT'M	6	12.9		X	7/31/90
11	Mountain Goat	CT'M	9	12.3		X	7/31/90
12	Mountain Sheep	CT'M	16	13.7		X	7/31/90
15	Moon	CT'M	7	12.4		X	7/22/81
16	Shelf				-	-	8/29/90
		EB	20	11.0	X		8/17/69
18	Hellroaring #2 (Hairpin)	CT'M	17	11.9		X	8/16/90
19	Hellroaring #3 (Snowbank)	EB	3	8.9	X		8/16/90
21	Hellroaring #5 (Elk)	EB	16	10.0	X		10/1/70
24	Hellroaring #8 (Crescent)	EB	9	8.6	X		8/15/90
25	Hellroaring #9	EB	17	7.7	X		8/14/90
		CT	7	8.3	X		
26	Hellroaring #10 (Smethurst)	CT	13	8.5	X		8/14/90
		EB	3	7.7	X		
27	Hellroaring #11 (Daly)	EB	4	8.9	X		8/15/90
30	Sliderock	EB	17	11.2	X		8/14/70

Table 5. Species distribution, species, catch/net, average length, population status and latest survey date for lakes located in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code [1]	Name of lake	Fish species [2]	Average catch/net	Average length (inches)	Sustaining population	Stocked population	Survey date
32	Lost	CT'M GR	9	15.4	X		6/19/88
33	Black Canyon	CT'M	71	10.0		X	8/21/90
34	Keyser Brown	EB CT	38 3	7.5 6.8	X X		8/10/71
35	First Rock	CT'Y EB	31	9.5	X X		7/12/71 7/12/71
36	Second Rock	EB	29	8.9	X		8/11/71
40	September Morn	EB	33	9.8	X		8/11/71
42	Upper Basin	EB	13	9.6	X		6/21/71
47	Silver Run	EB	3	10.5	X		7/27/77
48	Lake Gertrude	EB	37	7.4	X		6/29/71
49	Timberline	EB	19	7.6	X		6/30/71
50	Sundance	CT'M	1	13.5 (1983)		X	7/10/90 (No fish)
52	Shadow	CT'M	3	14.2		X	7/20/90
54	Silt #2	CT'M	10	9.6		X	7/20/90
55	Silt #3	CT'M	14	8.4		X	7/20/90
58	Kookoo	CT'M	19	12.2		X	7/19/90
60	Triangle	CT'M	12	16.1		X	7/19/90
61	Ship	EB	16	9.0	X		8/15/80
62	Marker	CT'M	20	13.7		X	7/18/90
65	Bowback	CT'M	10	10.9		X	7/19/90
66	Senal	EB	5	13.9	X		7/27/77

Table 5. Species distribution, species, catch/net, average length, population status and latest survey date for lakes located in the Rock Creek Drainage of the Beartooth Mountain Range (continued).

Location code 1/	Name of lake	Fish species 2/	Average catch/net	Average length (inches)	Sustaining population	Stocked population	Survey date
67	Dude	CT'M	3	13.7		X	7/17/90
68	Lake Mary	EB	10	10.6	X		7/28/77
69	Wild Bill	RB	We stock catchables			Never surveyed	

1/ See Figure 1 for locations.

2/ RB = Rainbow trout; CT'M = Mc Bride cutthroat trout; EB = Brook trout; CT'Y = Yellowstone cutthroat trout; GR = Arctic grayling.

MANAGEMENT RECOMMENDATIONS FOR LAKES IN ROCK CREEK DRAINAGE

Lakes in the Rock Creek Drainage are typical of numerous mountain areas in the western United States, in that all lakes capable of supporting a fishery have fish. This is not the case with lakes in the rest of the Absaroka-Beartooth Study Area. Responses to a questionnaire mailed to each ranger district in the western United States and numerous state agencies showed that stocking mountain lakes involved a multitude of fish. Even though fish stocking policies were common between state agencies and the forest managers, it was evident that few areas had active field investigations substantiating reasonings or results of the plants. Lack of adequate manpower and the need to work on more pressing aquatic problems were cited as the reasoning for the small amount of effort expended on inaccessible waters. These reasonings are understandable. Unfortunately, lack of research on alpine waters has led to numerous management errors. These errors include overstocking, utilizing the wrong species, elimination of a successful fish species through stocking without adequate knowledge of the water or watershed being stocked and aerial drops into unscheduled waters. The usual result of these errors is creation of many small sized fish populations with little appeal to anglers. The need for fishless lakes is also a recognizable management alternative and has its justification (Marcuson 1976). Many opportunities for this "fishless" approach are available in other drainage units of the Absaroka-Beartooth Study Area.

Investigations of the numerous lakes in the Absaroka-Beartooth Mountains has revealed the importance of the densities of fish populations in relation to seasonal availability of food organisms. For this reason, stocking recommendations (Table 6) for lakes in the Rock Creek Drainage reflect results of numerous studies in these mountains. Stocking frequencies also include a fallow period for many of the lakes in order to prevent overutilization of critical foods. The drainage has adequate fisheries to allow this type of management. Unfortunately, this style of management leaves some anglers with empty creels at a lake which provided excellent fishing years before. It does, however, provide quality fishing during good years. Most important, it allows for changes in management direction should the fishery suffer from a poor decision.

Backcountry lakes in the Rock Creek Drainage have cutthroat and brook trout. Two lakes accessible by car have rainbow trout. No other species occupy drainage water. Two lakes, Lost and Upper Basin, were previously identified as potential arctic grayling habitats (Marcuson 1974). Additional studies at Lost Lake indicate inadequate spawning opportunities for grayling. For this reason, the lake was dropped from consideration as a grayling water and will be maintained with cutthroat trout. Lost Lake's food supply was seriously depleted by brook trout and has not regained since

Table 6. Fish stocking proposed for lakes in the Rock Creek Drainage of the Beartooth Mountains.

Location code [1]	Name of lake	Next stocking year	Stocking frequency	Fish species [2]	Number of fish	Number of fish/acre	Comments
3	Greenough	1991	1	RB	6,000	7,500	5 plants of 1200 fish early May then every 4 weeks
8	Emerald	1995	9	CT'M	2,900	150	
9	Glacier	1991	3	CT'M	21,000	119	
10	Triangle	1993	8	CT'M	800	100	
11	Mountain Goat	1994	4	CT'M	1,000	80	
15	Moon	1993	3	CT'M	8,220	100	
18	Hellroaring #2	1998	8	CT'M	1,600	50	
32	Lost	1992	6	CT'M	565	50	
33	Black Canyon	1995	6	CT'M	8,240	100	
42	Upper Basin	When available	0	GR	1,500	224	
50	Sundance	1992	8	CT'M	300	100	
52	Shadow	1991	6	CT'M	360	100	
53	Silt #2	1992	4	CT'M	300	420	
54	Silt #3	1992	4	CT'M	300	68	
58	Kookoo	1993	8	CT'M	610	100	
60	Triangle	1993	8	CT'M	630	100	
62	Marker	1994	8	CT'M	3,100	200	
65	Bowback	1996	8	CT'M	640	100	
67	Dude	1991	8	CT'M	2,440	200	
69	Wild Bill	1991	1	RB	6,000	1,875	5 plants of 1200 fish early May then every 4 weeks

1/ See Figure 1 for location.

2/ GR - Arctic grayling; CT'M - McBride cutthroat trout; RB - Rainbow trout.

rehabilitation in 1964. Continued plants of cutthroat trout at densities less than 150 fish per acre may allow the food base to rebuild and become a reasonable producer of trout.

Upper Basin Lake has an ideal grayling habitat and 200 juvenile fish were planted in 1985. The lake also sustains brook trout. The inlet stream should provide an excellent spawning area for grayling. Chemical rehabilitation would eliminate the brook trout; however, chemical treatment is not recommended because Basin Lake's outflows eventually enter the City of Red Lodge's supply of water. It may take several introductions of grayling to establish a sustaining population. Increased fish densities are expected to induce some winterkill since partial kills were common in the past. It is recommended that an additional 500 juvenile grayling be stocked as soon as fish are available. The presence of grayling would provide opportunity to harvest a unique fish on a day's hike experience.

Implementation of more restrictive regulations throughout the entire A-B Wilderness at this time is not warranted because: 1) Use is restricted by difficult access and the large number of lakes containing fisheries. Maintained trails lead to less than half the lakes with fish. 2) Many A-B lakes need more harvest because they contain overabundant populations of brook trout and (in some lakes) Yellowstone cutthroat. 3) Unlike most wilderness lakes many A-B lakes are uniquely fertile and productive. Even with liberal limits, optimum harvest has not been reached. 4) Our trailhead creel survey indicates people are regulating their own harvest and prefer this to being required to follow unnecessarily stringent regulations.

Several areas along major trails (especially where horses are allowed) are showing signs of overuse and may require some type of special management. Most A-B Wilderness users, however, are satisfied with present management and the resource is in excellent shape.

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LIST OF LAKES WITH MORE THAN ONE NAME

Lake Code Number	Lake Name	2nd Lake Name
18	Hellroaring #2	Hairpin (Ralph Saunders map) Also Cliff or Bay Lake
19	Hellroaring #3	Snowbank Lake (Saunders map)
21	Hellroaring #5	Elk Lake or Wapiti
24	Hellroaring #8	Crescent Lake (Saunders map)
25	Hellroaring #9	Hellroaring (Proper)
26	Hellroaring #10	Smethurst
27	Hellroaring #11	Daly (Saunders map)
28	Hellroaring #12	Rydberg Lake
34	Keyser Brown	First Rock Creek Lake
35	First Rock Lake	Second Rock Lake
36	Second Rock Lake	Third Rock Creek Lake Saunders maps list: Keyser Brown (Downstream Lake) First Rock Lake- Second Rock Lake (Upstream Lake)