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BIG HOLE RIVER ARCTIC GRAYLING RECOVERY PROJECT:

ANNUAL MONITORING REPORT 1995

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ABSTRACT

Water temperatures, discharge, and fish populations of the upper Big Hole River are monitored annually with respect to the Arctic grayling population. Stream flows of the upper Big Hole were ample after above-normal snow pack and intermittent summer rains. Neither discharge nor water temperatures reached critical levels in 1995. Analysis of water temperature gradients revealed reaches where substantial increases in water temperature occur and where riparian or stream channel rehabilitation may be necessary. Sampling of spawning fluvial Arctic grayling indicated continued balance in the age distribution of the population. Recruitment in 1995 appeared to be moderately successful. Fall population surveys indicated slight increases in the fluvial Artic grayling population to 70 Age 1+ per mile in the Wisdom section with a balanced age structure. Brook and rainbow trout populations underwent slight declines, probably due to drought conditions in 1994.

INTRODUCTION

Fluvial Arctic grayling (Thymallus arcticus) were historically distributed throughout the upper Missouri River drainage in Montana, but are presently restricted to the Big Hole River (Vincent 1962, Kaya 1992). This population declined in abundance by approximately 75% during the mid-1980's. In response to the decline, Montana Fish, Wildlife, and Parks (MFWP) initiated the inter-agency Arctic Grayling Recovery Program in 1991 to coordinate research and restoration efforts. The program sponsored investigations of population status, life history, and limiting factors and developed a brood reserve and reintroduction program. Reports documenting these efforts have been compiled annually since 1991 (Byorth 1991, 1993, 1994, 1995, Magee and Byorth 1994). Objectives for activities from April 1 to October 31, 1995 were:

A. Monitor water temperatures and discharge in the upper Big Hole River and tributaries,

B. Maintain minimum instream flows by promoting water conservation among Big Hole basin water users,

C. Monitor abundance and distribution of grayling and potential competitors in the upper Big Hole basin,

D. Monitor the reserve stock of grayling at Axolotl Lakes and collect gametes,

E. Investigate competitive interactions between Arctic grayling, and rainbow and brown trout.

Results of investigations under objective E will be reported separately.

METHODS

Discharge and Water Temperature

A U.S. Geological Service (USGS) gaging station recorded discharge and water temperatures of the upper Big Hole River at Wisdom. USGS provided provisional data used in this report. We have monitored water temperatures annually at 4 sites since 1992 (Figure 1). At each of these stations, Omnidata DP-212 thermographs recorded temperatures at 120 minute intervals from early April through November. We installed 6 additional water temperature monitoring stations. A DP-212 thermograph was installed near Tom Clemow Lane at the head of the McDowell sampling section. Five stations contained "Hobotemp" thermographs recording at 144 minute intervals: in Steel Creek; in the North Fork Big Hole River at its mouth; in Deep Creek; and in the Big Hole River near the mouth of Pintlar Creek. A single "Stowaway" thermograph recorded water temperatures at 36 minute intervals in the North Fork Big Hole River at the bridge crossing of the Upper North Fork Road. Hobotemp and Stowaway are produced by Onset Instruments (Pocasset, MA).

Data from DP-212 memory chips were downloaded to DBase files and analyzed with DBase IV programs (Ashton-Tate, Scotts Valley, CA). We downloaded Onset Instruments thermographs using Boxcar or LogBook programs and exported data into Lotus 1-2-3 and DBase files for analysis. We calculated daily maximum, minimum, and mean temperatures for each station and compared them between adjacent stations with pairwise T-tests on Statistix 4.1

(Analytical Software, Tallahassee, FL).

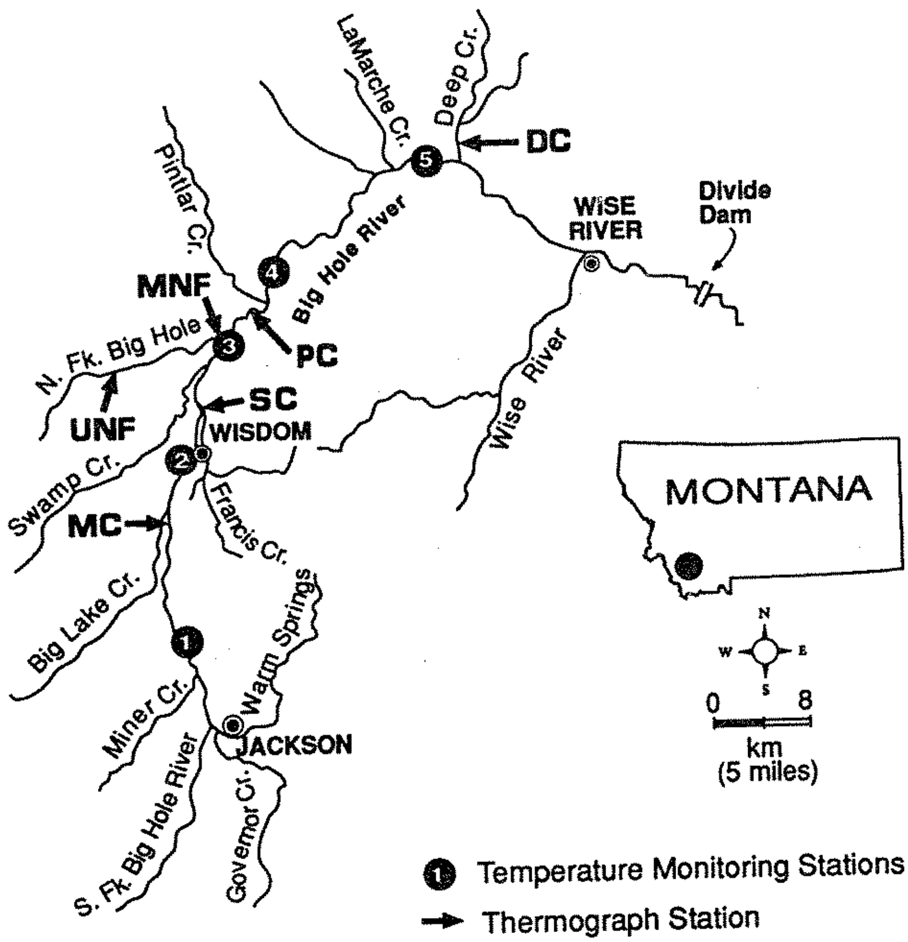

Figure 1. Map of the upper Big Hole River temperature monitoring stations. Stations are: 1 = Peterson Bridge, MC = McDowell Section, 2 = USGS gage at Wisdom, SC = Steel Creek, 3 = Buffalo Ranch, MNF = mouth of North Fork Big Hole River, UNF = Upper North Fork Big Hole River, PC = mouth of Pintlar Creek, 4 = Christianson Ranch, 5 = Sportsmans Park, DC = Deep Creek.

Population Monitoring

The Arctic grayling population is monitored twice annually, in spring and fall, to document abundance, age class composition, and relative recruitment success. We used a mobile-anode electrofishing system mounted on either a drift boat or Coleman Crawdad with a 4,000 watt generator and a Coffelt Mark XXII-M rectifying unit. Arctic grayling, trout, and burbot (Lota lota) were netted and held in a live well. For processing, fish were anesthetized in a tricaine methanesulfonate (MS-222) bath, measured (to 0.1 inches) and weighed (to 0.01 lb). We notched a fin as a temporary mark and implanted a VI tag (visible implant, Northwest Marine Technology, Inc.) in an adipose eyelid of each grayling. Scale samples were collected from grayling and rainbow trout (Oncorhynchus mykiss) for age analysis.

We electrofished to characterize the spawning population of Arctic grayling in the McDowell, Wisdom East and West, North Fork, Pintlar-Squaw, and Deep Creek sections between April 13 and 24, 1995. We discontinued surveys when ripe female grayling were captured, to minimize any impacts electrofishing may have on spawning success.

Fall population estimates have been used as an index of grayling abundance in the upper Big Hole River since 1983 in the McDowell and Wisdom sections. We attempted to decrease bias in these sections by conducting two marking runs. We marked grayling and brook trout (Salvelinus fontinalis) on September 6, 7, and 8, 1995 and September 20, 21, and 22 and recaptured on

October 3, 4, and 5. We also conducted a mark-recapture experiment in the Sawlog-Sportsmans and Sportsmans-Eastbank sections to monitor the grayling population and to collect baseline data on the rainbow trout population. Fish were marked September 11 - 18, 1995 and recaptured September 26 and 28. We analyzed electrofishing data using Mark/Recapture Version 4.0 (MFWP 1994). We calculated population estimates with Modified Peterson or Log-Likelihood methods. Catch per effort of young-of-the-year grayling (YOY) was calculated per sampling section as an index of recruitment.

To investigate reports of anglers catching grayling in the North Fork Big Hole River, we electrofished a 1.8 mile section at the Big Hole Battlefield National Monument. We marked fish on September 13, 1995 using the Coleman Crawdad system and recaptured fish using the drift boat mounted system on September 22.

Axolotl Lake Brood

Progeny of the Big Hole grayling brood reserve were planted into "Cutthroat Lake" of the Axolotl Lake chain in 1989. A second plant occurred in 1992. Gametes have been gathered annually to supplement the brood stock and provide grayling for reintroductions. We sampled the lake during May 1995 using fyke nets and hook-and-line. Grayling were processed as described above and released to facilitate mark/recapture estimates of abundance. As grayling entered spawning condition they were sorted by sex and held in live cars. Personnel from U.S. Fish and Wildlife Service (USFWS) Ennis National Fish Hatchery spawned grayling. Eggs were stripped from ripe females and pooled with eggs of other females. An aspirator was used to collect and pool milt from up to five males. Eggs were fertilized, rinsed, and packaged for transport to USFWS Fish Technology Center in Bozeman, MT where they were hatched and reared. We collected samples of ovarian fluid, fecal matter, and tissue of spawned grayling for disease testing. Remaining grayling were released into the lake after processing. We calculated population estimates for different cohorts using a Modified Peterson estimator.

RESULTS AND DISCUSSION

Discharge and Water Temperatures

Water supply was ample during 1995 in the upper Big Hole basin. In stark contrast to 1994, early May snowpack was 210% of 1994 levels and 123% of long-term averages (1961-1990) (National Resource Conservation Service Snow Survey files). The hydrograph depicted a more typical pattern of runoff, similar to that of 1993 but in contrast to severe drought in 1994 (Figure 2). Lowland runoff peaked in early May 1995 at over 1500 cfs. Peak mean daily flow in 1995 was 3060 cfs at Wisdom on June 6, 1995. On that date, point estimates of discharge exceeded 4000 cfs, the limits of the ratings table of the gaging station. In 1994, runoff peaked in early May at low levels relative to 1995.

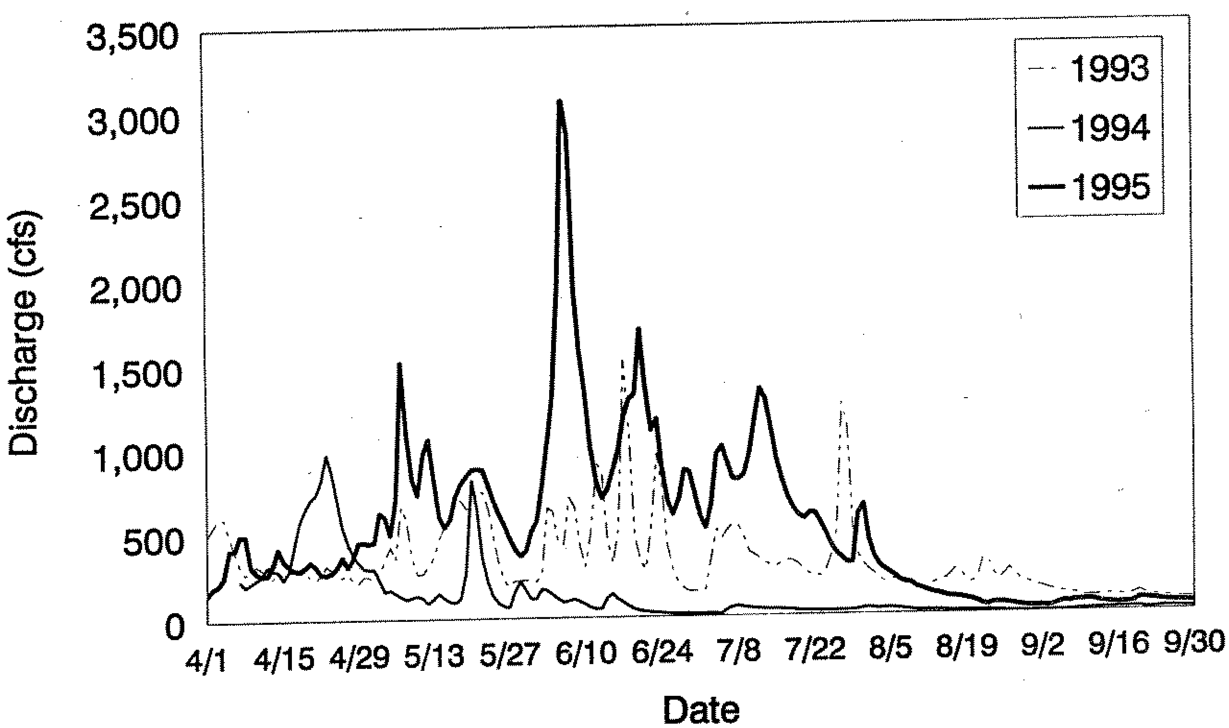

Figure 2. Hydrograph of the Big Hole River measured at the USGS gage at Wisdom, 1993 - 1995.

Timing and pattern of runoff were similar in 1993 and 1995, but the magnitude of peaks were greater in 1995. However, late summer flows fell below 60 cfs for 25 days in 1995 (Figure 2). Throughout Summer 1993, the Big Hole River flowed at or near 60 cfs and fell below that level on only 6 days. Minimum mean daily flow was 31 cfs on September 3, 1995 versus a low of 55 cfs in October of 1995 (Table 1). August-September 1995 water yield was 6 times greater than that of 1994, but only 64% of 1993 water yield.

Table 1. Comparisons of Big Hole River discharge parameters measured at the USGS gage at Wisdom, 1988 to 1995. Yield is the total volume of water passing the Wisdom gage during August and September.

Year	# Days less than 20 cfs		Max Flow (cfs)	Min Flow (cfs)	Dates at Min	Yield Aug-Sept (ac-ft)
	Apr-June	July-Sept				
1988	0	78	1080	0	8/27-9/21	213
1989	0	4	978	12	8/20	3790
1990	1	0	667	18	5/23	5820
1991	0	16	4300	10	9/4	3690
1992	18	32	479	3.3	5/26	2760
1993	0	0	1700	55	10/5	17490
1994	11	55	976	1.9	8/30	1821
1995	0	0	3060	31	9/3	11150

It is apparent that mid-summer flows in the upper Big Hole can be expected to fall below the 60 cfs "absolute minimum" flow granted as an instream flow reservation (MFWP 1989, Montana

Department of Natural Resource Conservation 1992). Even in normal moisture years, water conservation efforts will be necessary. To protect instream flows, MFWP and USFWS Partners for Wildlife Program developed groundwater wells to provide an alternative to diverting river water for stock. Four wells were drilled in 1995 and will be developed Spring 1996. Several additional developments are being planned. We estimate that 12-15 cfs will be conserved by using wells instead of diversion canals. The goal of water conservation efforts should be to maintain flows at the Wisdom gage between 40 and 60 cfs, even in drought years.

Maintaining flows at suitable levels should alleviate excessive water temperatures. Prolonged runoff and persistent stream flows resulted in moderate water temperatures through 1995. Temperatures did not reach or exceed lethal limits at any monitoring station (Table 2). The highest temperature was recorded in Steel Creek near its confluence with the Big Hole River: 73.2°F on August 5, 1995. The highest mean daily temperature was 67.8°F near the mouth of Pintlar Creek on August 6, 1995.

Analysis of differences in water temperatures between adjacent monitoring stations revealed reaches where significant heating or cooling occurred (Table 3). Mean daily temperature averaged over 1°F higher at the McDowell station (MC) than at Peterson Bridge (Figure 1). Maximum daily temperature averaged over 2°F higher and mean daily temperature averaged 1.6°F higher at Wisdom Bridge than at MC. Slight, but statistically significant differences also occurred between Steel Creek (SC) and Buffalo Ranch (3) stations. While maximum daily temperatures are lower on average at station 3, average mean daily temperature was greater there than at SC.

Table 2. Maximum daily (T_{max}) and maximum mean daily water temperature at thermograph stations in the Big Hole River 1995. Stations are: 1 = Peterson Bridge, MC = McDowell Section, 2 = USGS gage at Wisdom, SC = Steel Creek, 3 = Buffalo Ranch, MNF = mouth of North Fork Big Hole River, UNF = Upper North Fork Big Hole River, PC = mouth of Pintlar Creek, 4 = Christianson Ranch, 5 = Sportsmans Park, DC = Deep Creek.

Station	T_{max} (°F)	Max T_{mean} (°F)
1	68.9	62.8
MC	70.7	63.8
2	71.6	66.2
SC	73.2	66.1
3	72.5	66.4
MNF	72.6	65.9
UNF	69.6	63.3
PC	72.9	67.8
4	72.5	67.1
5	68.9	63.6
DC	69.6	63.9

The North Fork Big Hole River warms by over 2°F between stations at the Upper North Fork Road (UNF) and at its mouth (MNF) (Figure 1, Table 3). At their confluence, mean daily temperature of the North Fork averaged 1°F cooler than the Big Hole River. Significant increases in water temperature occurred in both major channels between station 3 and MNF and Pintlar Creek. The Pintlar Creek station consistently recorded the highest water temperatures in the upper Big Hole River. Below Pintlar Creek, temperatures cooled moderately to station 4. Temperatures were as much as 4°F lower at Sportsmans Park than at station 4.

Table 3. Average difference in water temperatures (°F) between adjacent thermograph station by mean daily and maximum daily temperatures. Significant differences at α=0.05 are denoted by Y, nonsignificant differences are indicated by N. Stations are: 1 = Peterson Bridge, MC = McDowell Section, 2 = USGS gage at Wisdom, SC = Steel Creek, 3 = Buffalo Ranch, MNF = mouth of North Fork Big Hole River, UNF = Upper North Fork Road, PC = near mouth of Pintlar Creek, 4 = Christianson Ranch, 5 = Sportsmans Park.

Reach (Down - upstream)	Reach Length (miles)	Mean Difference		Significance (α=0.05)	
		Max	Mean	Max	Mean
MC - 1	12.0	-0.12	1.032	n	y
2 - MC	4.9	2.04	1.64	y	y
SC - 2	4.0	0.06	-0.37	n	y
3 - 2	12.0	-0.16	0.09	n	n
3 - SC	11.0	-0.22	0.46	y	y
MNF - 3	0.25	0.27	-1.06	n	y
MNF - UNF	9.0	2.43	1.26	y	y
PC - 3	6.9	0.58	0.36	y	y
PC - MNF	6.9	0.31	1.41	y	y
4 - PC	2.0	-0.76	-0.28	y	y
5 - 4	14.5	-3.46	-4.01	y	y

Reaches with elevated temperatures may reflect degraded riparian vegetation or channel geomorphology. These reaches will be further analyzed through a habitat inventory to identify problem areas and potential rehabilitation projects (OEA Research, Inc. 1995). Maintaining adequate minimum flows and enhancing bank and channel stability should alleviate extreme water temperatures.

Population Monitoring

Spawning and Recruitment

During spring electrofishing surveys we captured a total of 182 grayling. We sampled prior to the onset of spawning to minimize potential impacts. Sex ratio of the sample was 1.8 males per female, which was typical before peak spawning. Surveys were discontinued on April 24 when 6 ripe female grayling were captured. Peak spawning activity probably occurred between April 24 and 30. The timing of peak spawning was similar to that noted in past years (Byorth 1993, 1994, 1995). However, water temperatures were cooler during spawning than in recent years, ranging between 36.5 and 50°F. Discharge averaged 362 cfs during spawning and ranged from 266 to 452 cfs (USGS provisional files).

The age composition of the spawning population was dominated by age 3 and older grayling (Table 4). Prior to 1992, the spawning population was comprised of a large proportion of age 2 grayling: 46% in 1990 and 44% in 1991. In North America, Arctic grayling do not become fully mature until reaching lengths of 11.4 to 12 inches (Armstrong 1986). In the Big Hole, age 2 grayling rarely exceed 11 inches during spawning periods. Hence, the effective spawning population was limited in 1990 and 1991.

From 1992, as the population stabilized, a more balanced age distribution was realized in the spawning population. Since 1992, age 3 to age 6 grayling comprised over 80% of spawners, except in 1994 (Table 4). Byorth (1995) erroneously reported age composition and length frequency for 1994. The corrected data are included in Table 4 and Figure 3.

Table 4. Percent composition by age class of Arctic grayling captured during spawning surveys in the upper Big Hole River, 1989 - 1995.

Year	N	% by Age Class				
		2	3	4	5	6
1989	143	25	63	6	6	1
1990	150	46	20	32	1	1
1991	144	44	35	13	8	0
1992	120	19	53	28	0	0
1993	122	12	39	42	6	0
1994	80	30	26	26	16	1
1995	145	15	39	27	15	2

In 1995, a total of 12 YOY grayling were captured in 3 sampling runs in the McDowell Section, while 97 were captured in both channels of the Wisdom Section in three passes (Table 5). Catch rates were low in the McDowell Section and similar to 1991 and 1993 through 1995. Catch rates in the Wisdom section are comparable to the last several years. Post-hatch flow patterns should have been beneficial to survival of YOY grayling. Based on estimated degree-days, larvae hatched and emerged between May 10 and 19, 1995. Peak flows occurred approximately 3 weeks thereafter, which is sufficient time for larvae to fully develop fins and move to secure rearing habitat (Lee 1985, Clark 1992).

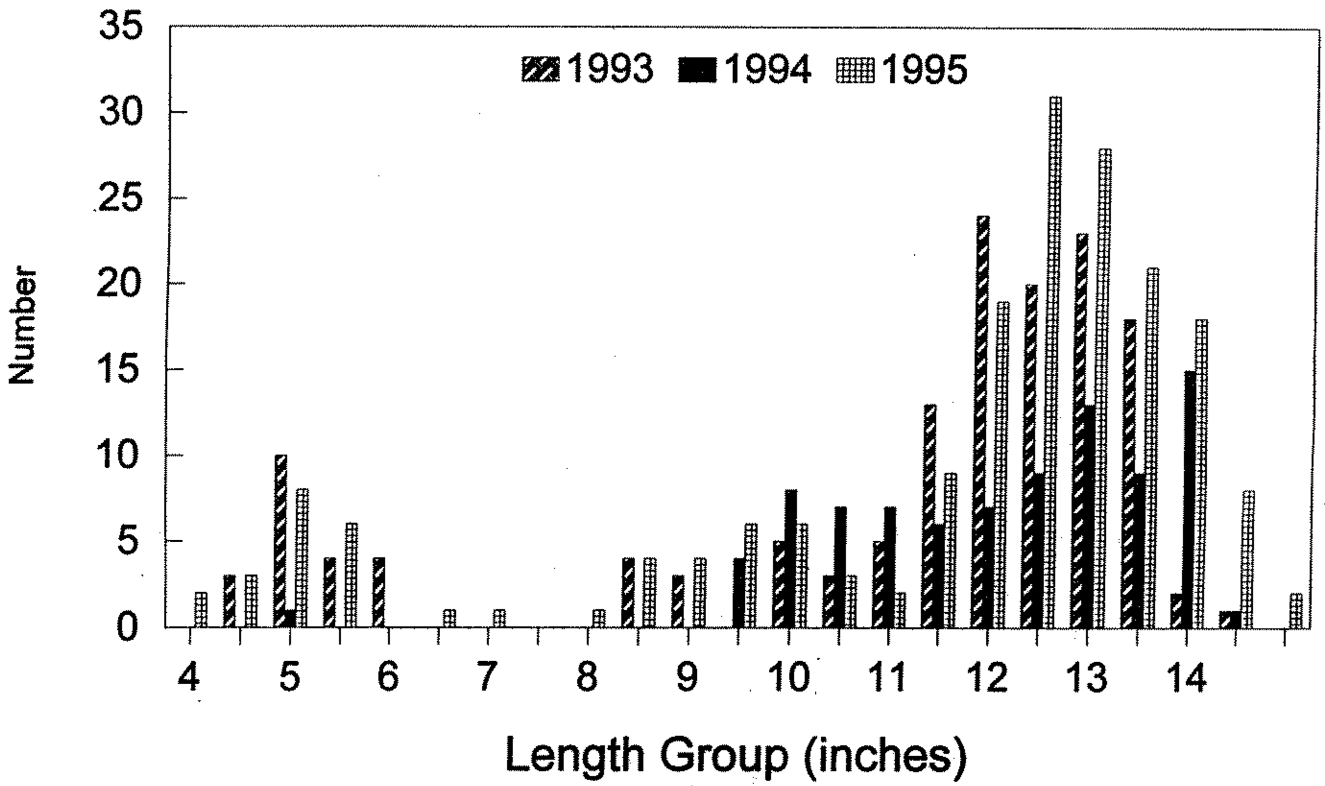

Figure 3. Length-frequency histogram of Arctic grayling captured during Big Hole River spawning surveys, 1993 - 1995.

Fall Population Surveys

Arctic grayling are difficult to census due to their migratory tendencies and low densities (Armstrong 1986). Problems associated with conducting mark/recapture experiments to estimate population abundance in the Big Hole River are described by Byorth (1993). We attempted to decrease bias and increase sample size by conducting 2 marking runs at least 10 days apart followed in 10 days by a single recapture run. Grayling moved substantially between sampling passes. In the McDowell - Wisdom combined section, we marked a total of 78 grayling, captured 25, and recaptured only 4 grayling, 1 of which was a YOY.

Table 5. Catch rates (catch-per-effort (CPE)) of young-of-the-year (YOY) grayling captured in the McDowell and Wisdom sections of the Big Hole River, 1983 - 1995.

Year	McDowell Section			Wisdom Section		
	# YOY	# Runs	CPE	#YOY	# Runs	CPE
1983	---	---	---	2	6	0.33
1984	---	---	---	5	7	0.71
1985	0	3	0	0	3	0
1986	145	4	38.2	---	---	---
1987	3	1	3.0	0	1	0
1988	---	---	---	---	---	---
1989	178	2	89.0	90	2	45.0
1990	58	2	29.0	98	4	24.5
1991	10	2	5.0	41	2	20.5
1992	42	2	21.0	83	4	20.75
1993	2	2	1.0	31	4	7.75
1994	---	---	---	39	2	17.5
1995	12	3	4.0	97	6	16.2

No marked grayling were recaptured in the McDowell section; therefore, a Log-likelihood estimate for the combined McDowell-Wisdom section of 88 Age 1+ grayling per mile is probably invalid. If grayling captured in the McDowell Section are omitted, a Log-likelihood estimate for the Wisdom Section is 97 per mile. However, the Log-likelihood estimate relies on modeling electrofishing efficiency based on length groups. A sufficient number of recaptures was achieved only for 12 - 14.9 inch grayling. No age 1 grayling (≤11.0 inches) were recaptured.

A less-biased Modified Peterson estimate for the Wisdom Section is 70 (± 62) age 1+ grayling per mile (Vincent 1971). In 1994, the same method estimated 65 (± 50) age 1+ grayling per mile in the Wisdom section (Byorth 1995). Parameters of 1995 estimates are listed in Table 6.

Table 6. Parameters and population estimates by size group of Arctic grayling abundance in the Wisdom and McDowell Sections of the Big Hole River, Fall 1995. Recapture efficiency was too low to calculate an estimate for McDowell section.

Wisdom (inches)	M	C	R	Ñ	Ñ/mi ± 95% CI
4.0 - 6.9	69	21	1	769	156.9 ± 83.7
8.0 - 12.9	55	17	2	335	68.4 ± 61.2
13.0 - 14.9	4	2	1	7	1.4 ± 0.9
Total Age 1+				342	70 ± 62
McDowell (inches)	M	C	R	Ñ	Ñ/mi ± 95% CI
4.0 - 6.9	9	4	0	-	-
8.0 - 12.9	11	6	0	-	-
13.0 - 14.9	0	1	0	-	-

A similar situation resulted from attempts to estimate grayling populations in the Sawlog-Sportmans and Sportmans-Eastbank sections. A Modified Peterson estimate of age 1+ grayling abundance in the Sawlog-Sportsmans Section was 44 (±41; M=34, C=22, R=2) age 1+ grayling per mile. In the Sportmans-Eastbank section, the age 1+ population was estimated to be 37 (± 33; M=33, C=19, R=2) per mile. If parameters from these sections are combined, the estimated population is 37 (±33) age 1+ grayling per mile. Sampling in these sections in 1993 resulted in an estimate of 31 (± 26) per mile (Byorth 1994).

In Deep Creek, efficient sampling enabled calculation of a relatively robust population estimate. Approximately 68 (±36) age 1+ grayling were in Deep Creek during October. However, a fall migration of grayling into Deep Creek has been observed and may have biased this estimate upward (Byorth 1994).

Apparently the grayling population is stable to increasing in each sampling reach. Length-frequency analysis of all grayling sampled during Fall 1995 reveals a balanced age structure (Figure 4). While the McDowell and Wisdom sections tend to be biased toward younger age classes, the Sportsmans to Eastbank reaches support greater proportions of older age classes. Pooling grayling captured in both reaches provided a clearer picture of the age structure of the population. This analysis confirms observations made during sampling of the spawning population. A balanced age structure will enable the population to compensate for stochastic factors such as drought or poor rearing conditions due to flooding. This balanced structure has developed over the last three years and will add a measure of stability to the population and facilitate increases in abundance.

We also sampled brook and rainbow trout populations during fall electrofishing. Brook trout underwent a 33% decline in the McDowell-Wisdom section. The population of ≥ 7 inch brook trout was 165 (±70) per mile, a decrease from 249 (±69) per mile in 1994. In the Sawlog to Sportsmans Park section, we calculated a estimate of 232 (±180) ≥ 6 inch brook trout per mile. Because of extensive spawning movements, no estimate could be calculated in the Sportsmans Park - Eastbank section. This reach of the upper Big Hole River represents a transitional area where rainbow trout become predominant over brook trout. Rainbow trout density has remained low in the McDowell-Wisdom section (approximately 4 per mile) and decreased in lower reaches. The density

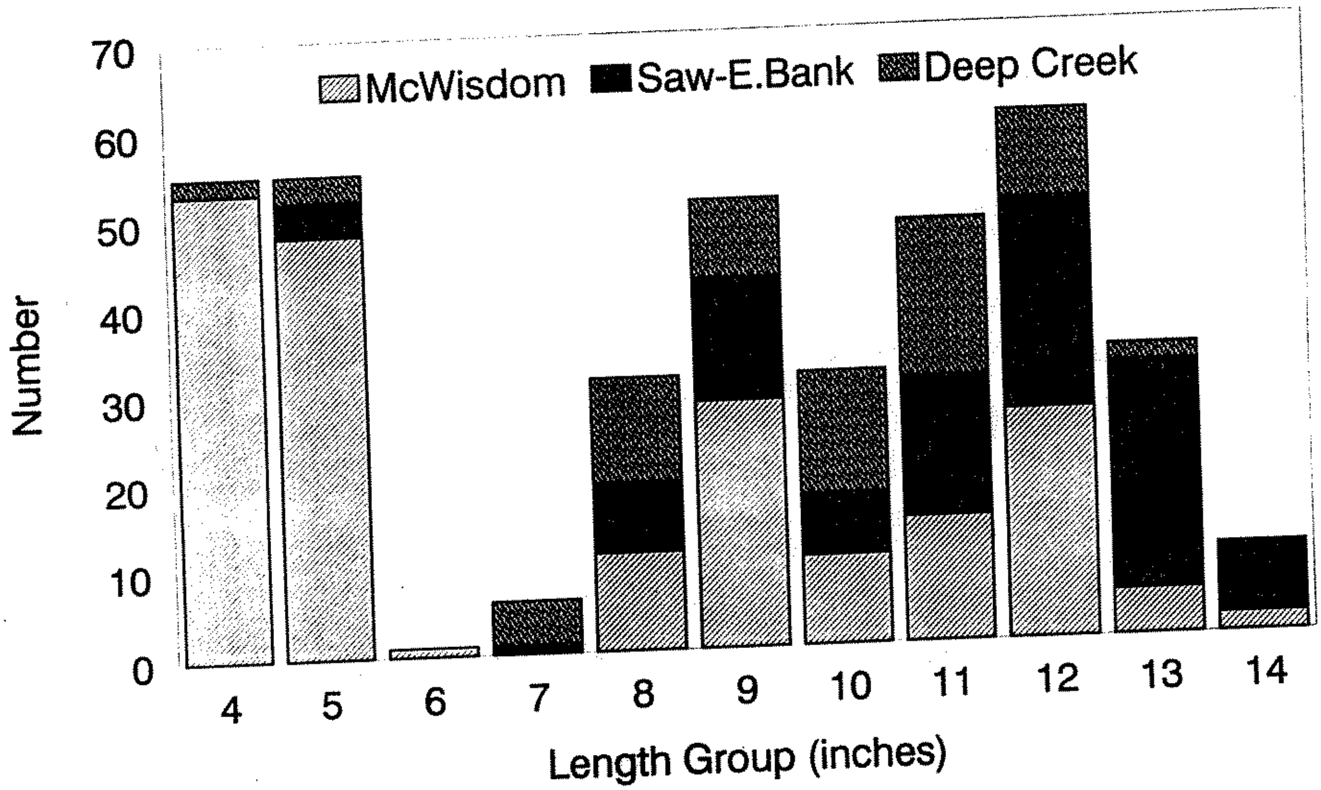

Figure 4. Length-frequency histogram of Arctic grayling captured in Fall population surveys in Big Hole River and Deep Creek sampling sections, 1995.

of rainbow trout ≥ 5.0 inches was 186 (±174) per mile in the Sawlog-Sportsmans Park section in 1995 versus 230 (±331) in 1993. We estimated 391 (±244) rainbow trout ≥ 5.0 inches per mile in the Sportsmans - Eastbank section in 1995 versus 257 (± 234) in

1993. Apparently the drought of 1994 had a greater impact on brook and rainbow trout than on grayling. In Deep Creek, rainbow trout density was estimated to be 409 (±126) ≥ 4.0 inches per mile, while brook trout estimates were 470 (±220) per mile ≥ 5.0 inches. The habitat quality of Deep Creek appears to be capable of supporting much higher densities of salmonids than the much larger Big Hole River, especially for rearing.

No grayling were captured during a survey of the North Fork Big Hole River through the Big Hole Battlefield National Monument. Suitable habitat and reliable angler reports indicate that grayling may use this reach seasonally. Resident populations of brook trout (257 ± 78 per mile > 5 inches) and mountain whitefish (58 ± 30 per mile > 10 inches) were present. Other species sampled included burbot, mottled sculpin (Cottus bairdi), and longnose dace (Rhinichthys cataractae). Habitat suitability and low densities of resident fishes make this reach an excellent candidate for supplementation or reintroductions.

Axolotl Lake Brood

We sampled the brood reserve stock at Axolotl Lakes to monitor the status of the 1988 and 1992 cohorts and to collect gametes for experimental reintroductions. A mark-recapture experiment indicated that 175 (± 167) age 7 grayling remained in the population. Their average length, unchanged from 1994, was 13.5 inches (range: 11.5-14.4 inches). Sex ratio of the 1988 cohort was 1.2 males per female. A majority of these grayling did not produce gametes and are reaching senescence.

Of approximately 3,000 grayling planted in 1993, approximately 687 remain: approximately 104 (± 90) of F_1 Axolotl (AX) origin and 583 (±560) F_1 Big Hole River (BHR) origin. Sex ratio of age 3 grayling was 1.6 females per male. Mortality rates were 72% for the F_1 AX and 30% for F_1 BHR grayling. Higher mortality of F_1 AX grayling may be a result of pelvic fin clips. Growth rates did not differ between age 3 lots: average length was 9.5 inches (range: 8.1 - 11.0). However, growth rate of the 1993 cohort was considerably slower than the 1988 cohort. At age 2 the 1988 cohort averaged 10.4 inches (range: 9.5 - 11.3) and were 12.4 inches by age 3 (range: 10.9 - 13.3). Apparently, the stocking rate surpassed the productivity of the lake. Length of grayling is known to affect fecundity (Armstrong 1986). Slow growth rates and subsequent late maturation resulted in low egg viability and fertilization rate of eggs from the 1993 cohort. In the future, this population should be maintained through lower stocking rates.

We collected eggs from 35 age 3 and 4 age 7 female grayling. Milt of 108 age 3 and 18 age 7 males fertilized the eggs. Because of low fecundity in age 3 females, eggs from several females were pooled. Approximately 75% of males contributed gametes and an average of 3.2 males were used per female.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Water Conservation

In spite of ample snowpack and mid-summer precipitation, the Big Hole River at Wisdom fell below 60 cfs for 25 days. Discharge did not reach critical levels. Apparently 60 cfs, the "absolute minimum flow", is attainable in only the wettest years. Minimum instream flows should be identified, by reach, to confirm biologically and hydrologically necessary levels. Water conservation efforts should be continued until adequate minimum flows can be assured. Stream reaches have been identified that make significant contributions to elevated water temperatures. These reaches should be analyzed for potential habitat restoration projects to minimize loading.

Population Status

We encountered difficulties in deriving population estimates. However, each index of population status suggests that the grayling population has stabilized and is increasing in abundance. The age structure of the population is balanced with a full representation of all age classes. The current status of the population will provide a foundation for continued recovery and a measure of protection against stochastic events.

In light of the difficulty in obtaining statistically valid population estimates it is important to characterize the population with a broad range of censuses. Monitoring during spawning provides a comprehensive sample of the adult grayling population because a majority of spawning occurs in the Wisdom area. Electrofishing will continue prior to the onset of spawning to minimize negative impacts.

Fall grayling population estimates are muddled by fall migrations. In 1995, we failed to improve sampling by conducting dual marking runs 10 days apart. To decrease bias in the future, we will conduct marking runs on consecutive days followed by recapture runs within 7 to 10 days.

Disparities exist between the age structure of grayling in the Wisdom area versus the Sportmans Park sections. While age 1 and 2 grayling predominate in the Wisdom area, age 3+ grayling are more abundant in lower reaches. To accurately characterize the population, both reaches should be sampled annually. Furthermore, the sampling the Sportsmans - Eastbank section will enable monitoring of the rainbow trout population as an index of encroachment of rainbow trout into the upper river.

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