FISHERIES INVESTIGATIONS IN THE YELLOWSTONE AND SHIELDS RIVER BASINS, PARK COUNTY, MONTANA

ANNUAL REPORT FOR 2001

Federal Aid Project F-113-R- 1

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Table of Contents

Table of Contents (continued)

List of Tables

Table of Contents (continued)

List of Figures

Table of Contents (continued)

Table of Contents (continued)

List of Photographs

ABSTRACT

Estimates of rainbow, brown, and cutthroat trout abundance in the Corwin Springs, Mill Creek Bridge, and Springdale sections of the Yellowstone River were generally similar in 2001 to estimates from previous years. Rainbow trout larger than seven inches were significantly more abundant in the Mill Creek Bridge section this year (536 fish/mile), compared to previous surveys (typically 200 fish/mile). This increase coincides with a tendency for spring spawning trout throughout the upper river to be more abundant in recent years, than previously.

Estimated abundance of mountain whitefish larger than seven inches this spring was 11,500 fish/mile in the Mill Creek Bridge section of the Yellowstone River, and 6,000 fish/mile near Springdale. In the Shields River, whitefish abundance was 4,600 fish/mile near its confluence with the Yellowstone River, 1,000 fish/mlle near Clyde Park, and 300 fish/mile above Wilsall.

The average size of rainbow trout in spring gillnet catches at Dailey Lake was 17.4 inches this year. Walleye averaged 11.8 inches. Average length of yellow perch was 8.5 inches, similar to their average length last year.

OBJECTIVES

Funds for this project are provided by grants from the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777k) supporting the Montana Statewide Fisheries Management Program. This program consists of two elements: Fisheries Management in Montana, and Statewide Program Coordination. The Fisheries Management element includes four activities, each with associated objectives:

State Program Activities and Objectives

1. Survey and Inventory
To survey and monitor the characteristics and trends of fish populations, angler harvest and preferences, and to assess habitat conditions in selected waters.

2. Fish Population Management
To implement fish stocking programs and/or fish eradication actions to maintain fish populations at levels consistent with habitat conditions and other limiting factors.

3. Technical Guidance
To review projects by government agencies and private parties which have the potential to affect fisheries resources, provide technical advice or decisions to mitigate effects on these resources, and provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources.

4. Aquatic Education
To enhance the public's understanding, awareness and support of the state's fishery and aquatic resources and to assist young people to develop angling skills and to appreciate the aquatic environment.

Statewide activities and objectives are addressed locally by ongoing fisheries investigations and management activities intended to enhance aquatic habitats and recreational fisheries in the upper Yellowstone and Shields River basins.

Local Project Objectives

In fiscal year 2001 (July 1, 2000 to June 30, 2001), project objectives for state project number 3350 (the Yellowstone and Shields drainage areas) were identical to the statewide objectives listed above. Project objectives are intended to guide continuing efforts to maintain and enhance local fisheries. In support of these efforts, the following data collections, compilations, and analyses are reported here under separate headings:

A. Estimates of trout abundance in three sections of the Yellowstone River based on spring sampling in 2001.

B. Estimates of mountain whitefish abundance in two sections of the Yellowstone River based on spring sampling in 2001.

C. Estimates of fish abundance in three sections of the Shields River based on spring sampling in 2001.

D. Genetic test results for Yellowstone cutthroat trout collected from the Shields River and some of its tributaries in 1999.

E. Summary of year 2001 spring gillnet catches at Dailey lake.

State survey, inventory, and fish population management objectives are addressed under headings A through E. Technical guidance and aquatic education objectives are addressed on an ongoing basis by meetings with various angler groups, school groups, journalists, and the public. In fiscal year 2001 these meetings included participation in a Governor's task force investigating management issues affecting the upper Yellowstone river, work supporting the Upper Shields Watershed Association, educational seminars for local school children, and meetings with local angling groups to discuss a variety of fisheries topics. Landowner contacts and consultations occurred routinely each month in conjunction with administration of the Montana Natural Streambed and Land Preservation Act and the Montana Stream Protection Act.

PROCEDURES

A. Estimates of trout abundance in three sections of the Yellowstone River based on spring sampling in 2000.

This spring we sampled trout abundance in three sections of the Yellowstone River (Table1; Figure1) normally examined as part of routine fisheries surveys (e.g., Tohtz 1996a; Tohtz 2001).

Table 1. Survey sections where trout abundance was sampled from the Yellowstone River in 2001.

Section name	Survey date	Length (ft)	Approximate location [1]		
Corwin Springs	04/17/00	12,100	Upper Boundary	North West	45 06′ 30″ 110 47′ 22″
			Lower Boundary	North West	45 09′ 14″ 110 50′ 14″
Mill Creek Bridge	04/10/00	26,700	Upper Boundary	North West	45 39′ 17″ 110 33′ 01″
			Lower Boundary	North West	45 40′ 44″ 110 32′ 06″
Springdale	04/07/00	15,600	Upper Boundary	North West	45 41′ 42″ 110 16′ 49″
			Lower Boundary	North West	45 43′ 44″ 110 14′ 20″

1. Latitude and longitude (degrees, minutes, seconds).

Fish were sampled with electrofishing gear mounted on an aluminum-hulled jet boat. This gear included a 5,000-watt generator and a Coffelt Model VVP-15 rectifying unit. Anodes were metal hoops with stainless steel droppers suspended from twin booms at the bow of the boat. The boat hull served as the cathode.

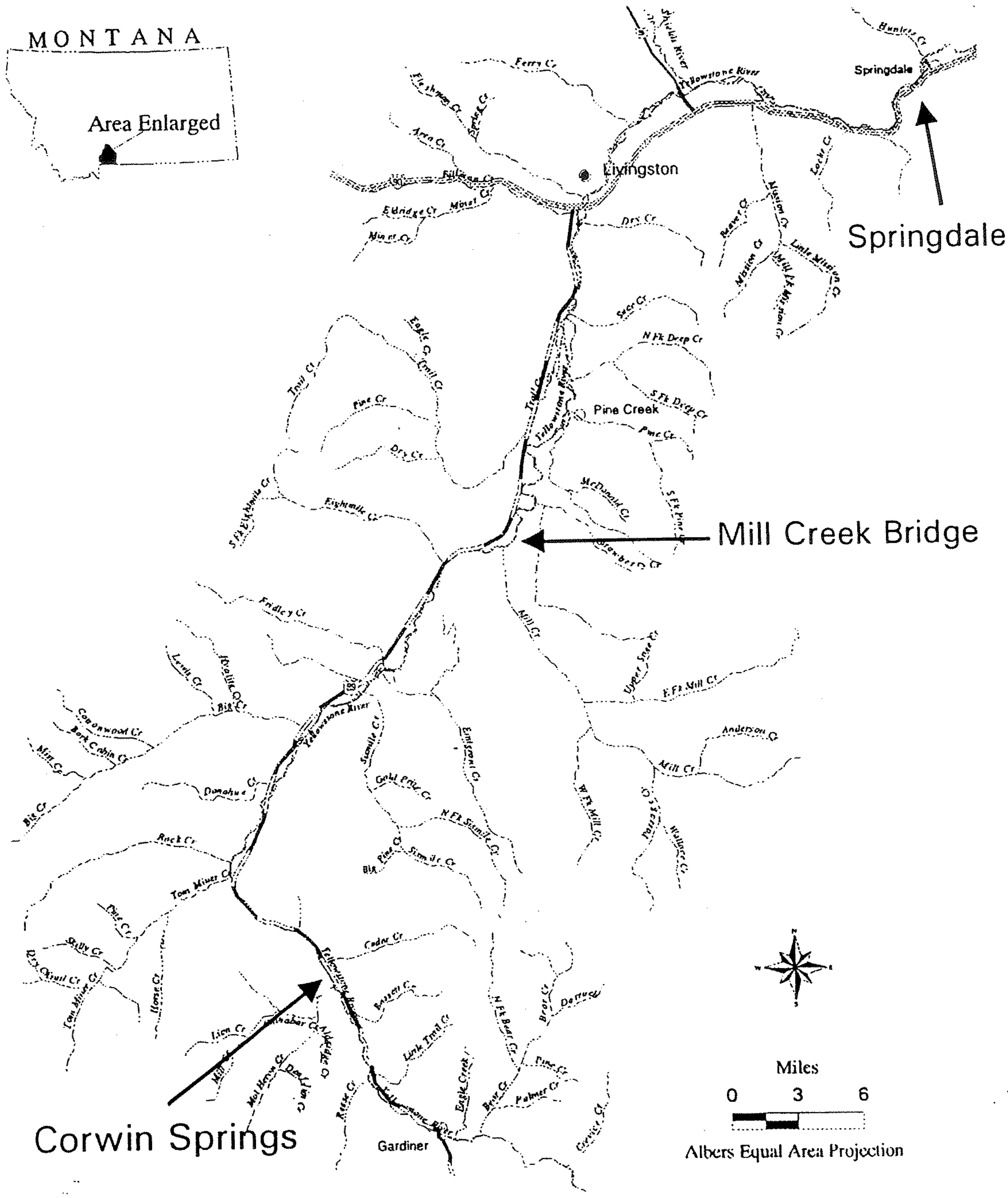

Figure 1. Upper Yellowstone drainage showing three areas where fish abundance was sampled from the Yellowstone River in spring 2001.

Fish were collected in live cars, identified[1], measured to the nearest 0.1 inch[2], and weighed to the nearest 0.01 pound. Trout were marked with fin clips and returned to the river after marking. Recapture sampling occurred about two weeks later in each section.

Fish abundance was estimated using a log-likelihood model available in software from Montana Fish, Wildlife and Parks (FWP; Anon. 1994). Estimates were evaluated for reliability at alpha = 0.05. Fish were separated into one-inch length groups for all abundance analyses.

B. Estimates of mountain whitefish abundance in two sections of the Yellowstone River based on spring sampling in 2001.

This spring we sampled mountain whitefish abundance in two sections of the Yellowstone River (Table 2) where we also sampled trout abundance (see part A, above). Fish handling and marking procedures were identical

Table 2. Survey sections where mountain whitefish abundance was sampled from the Yellowstone River in 2001.

Section name	Survey date	Length (ft)	Approximate location [1]		
Mill Creek Bridge	04/10/00	3,168	Upper Boundary	North West	45 39′ 17″ 110 33′ 01″
			Lower Boundary	North West	45 40′ 44″ 110 32′ 06″
Springdale	04/07/00	4,554	Upper Boundary	North West	45 41′ 42″ 110 16′ 49″
			Lower Boundary	North West	45 43′ 44″ 110 14′ 12″

1. Latitude and longitude (degrees, minutes, seconds).

to those used to sample trout. Fish were sampled with electrofishing gear mounted on an aluminum-hulled jet boat. This gear included a 5,000-watt generator and a Coffelt Model VVP-15 rectifying unit. Anodes were metal hoops with stainless steel droppers suspended from twin booms at the bow of the boat. The boat hull served as the cathode.

1. Common names are used in this report. Scientific names are listed in Appendix A.

2. All fish lengths are total lengths (TL).

Fish were collected in live cars, identified, measured to the nearest 0.1 inch, and weighed to the nearest 0.01 pound. Trout were marked with fin clips and returned to the river after marking. Recapture sampling occurred about two weeks later in each section.

Fish abundance was estimated using a log-likelihood model available in software from Montana Fish, Wildlife and Parks (FWP; Anon. 1994). Estimates were evaluated for reliability at alpha = 0.05. Fish were separated into one-inch length groups for all abundance analyses.

C. Estimates of fish abundance in three sections of the Shields River based on spring sampling in 2001.

This spring we sampled fish abundance in the Convict Grade, Todd, and Tomschin sections of the Shields River (Figure 2). These sections

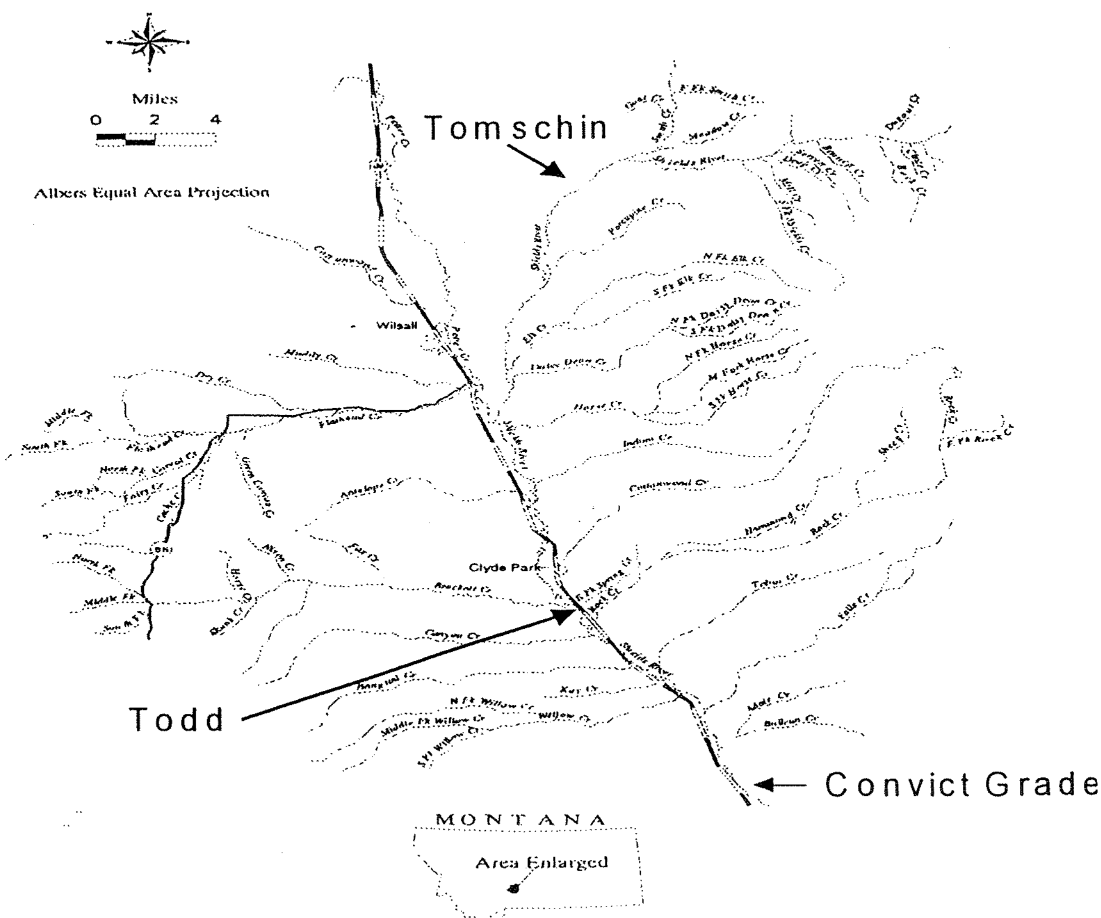

Figure 2. Shields River drainage showing locations of the Convict Grade, Todd, and Tomschin sections sampled in spring 2001.

are part of a series of locations we have sampled periodically to monitor fish abundance in the mainstem Shields River (e.g., Tohtz 1996a; Tohtz 1999; Tohtz 2001; Table 3).

Table 3. Shields River sections where fish were sampled in spring 2001.

Section name	Section length (ft)	Location\[1]
Tomschin	1,000	T4N, R9E, S29
Todd	7,500	T2N, R9E, S33
Convict Grade	7,725	T1S, R10E, S22, 23

1. Township, Range, Section

Fish were sampled in the Convict Grade and Todd sections with electrofishing gear mounted on a small drift boat. This gear included a 4,5000-watt generator and a Leach direct current rectifying unit. The cathode was a steel plate attached to the bottom of the drift boat; the anode was a single hand held (mobile) electrode connected to the power source by about 30 feet of cable.

Fish were sampled in the Tomschin section with electrofishing gear mounted on a small utility boat. This gear included a 4,500-watt generator and a Leach direct current rectifying unit. The cathode was a steel mesh attached to the side of the boat; the anode was a single hand held (mobile) electrode connected to the power source by about 30 feet of cable.

In all cases, fish were collected in live cars, identified, measured to the nearest 0.1 inch, and weighed to the nearest 0.01 pound. Trout and mountain whitefish were marked with fin clips and returned to the stream. Recapture sampling was conducted about two weeks later in each section.

Data were processed using MR4, a computer program developed by FWP for processing electrofishing records (Anon. 1994). Fish numbers were estimated using the log-likelihood model.

D. Genetic tests of Yellowstone cutthroat trout collected from the Shields River and several of its tributaries in 1999.

In 1999 we collected Yellowstone cutthroat trout from the Shields River and several of its tributaries during a larger fish inventory effort (Tohtz 1999). Our work at that time was concentrated in an area of the drainage where aerial reconnaissance of stream conditions had been completed in support of a local watershed association. Although our specific sampling objectives varied, depending on location (Table 4), one of our intentions was to test Yellowstone cutthroat trout for possible hybridization with rainbow trout. We were especially interested in cutthroat trout collected from areas that had not been sampled before. Test results for those fish are finally available, and are reported here for the first time.

Table 4. Fisheries investigations in the Shields River drainage in 1999.

Stream name	Location\[1]	Survey date	Type of survey/ procedure	Number of fish for genetics tests \[2]
Shields River	T2N, R09E, S33	03/15/99	Mark-recapture estimate	13
Shields River	T4N, R09E, S04	03/23/99	Removal estimate	5
Shields River	T4N, R09E, S29	03/16/99	Removal estimate	3
Shields River	T4N, R09E, S25	03/18/99	Qualitative inventory	2
Porcupine Creek	T4N, R09E, S11	05/05/99	Removal estimate	34
N.F. Elk Creek\[3]	T4N, R09E, S33	07/06/99	Qualitative inventory	44
S.F. Elk Creek	T4N, R09E, S25	07/06/99	Removal estimate	29
Daisy Dean Creek\[3]	T3N, R09E, S11	10/21/99	Qualitative inventory	25
Horse Creek\[3]	T2N, R09E, S23	10/13/99	Removal estimate	30
Cottonwood Creek	T2N, R10E, S07	03/22/99	Removal estimate	32

1. Township, Range, Section
2. Yellowstone cutthroat trout.
3. Locations of these samples were incorrectly reported in Tohtz 1999. The correct locations are contained in this table.

E. Summary of spring gillnet sampling at Dailey Lake in spring, 2001.

Gillnet sampling in year 2001 mimicked previous spring sampling (e.g., Tohtz 1999). A single overnight set using two sinking and two floating experimental gillnets (Shepard 1993) determined the entire sample. Results in 2001 are compared to samples from several previous years.

RESULTS AND DISCUSSION

A. Estimates of rainbow, brown, and cutthroat trout abundance in three sections of the Yellowstone river based on spring sampling in 2001.

Most of our data for rainbow, brown, and cutthroat trout from each of the sections sampled in 2001 fit the log-likelihood model well (Table 5). Pooled data[3] for brown trout captured in the Mill Creek Bridge section modeled at a probability value less than 0.05. Unusually low flow conditions early in the spring, and cool weather followed by several hot days, contributed to much better success catching fish during the recapture survey than we could achieve when marking the fish. We have encountered this seasonal sampling problem in the Mill Creek Bridge section before (e.g., Tohtz 1998).

Table 5. Trout/mile in three sections of the Yellowstone River based on spring sampling in 2001. Estimates are for fish seven inches (TL) or longer.

Section (mark date):			Overall model			Pooled model		
Fish species	N	SD	DF	Chi-square	P	DF	Chi-square	P /1
Corwin Springs (April 27):								
Rainbow trout	631	72	6	3.13	0.79	5	2.65	0.75
Brown trout	331	95	5	6.76	0.24	1	2.18	0.14
Cutthroat trout	740	116	5	1.18	0.95	5	1.18	0.95
Mill Creek (April 20):								
Rainbow trout	536	88	7	7.96	0.34	6	7.30	0.29
Brown trout	241	46	10	17.40	0.07	8	16.62	0.03
Cutthroat trout	243	54	5	11.30	0.05	4	4.52	0.34
Springdale (April 7):								
Rainbow trout	611	130	7	8.18	0.32	3	1.52	0.68
Brown trout	241	156	5	8.03	0.15	3	7.15	0.07
Cutthroat trout	128	35	5	4.32	0.50	1	1.01	0.31

1. N = estimated number; SD = standard deviation; DF = degrees of freedom; P = probability value.

3. Our analyses include a procedure that combines one-inch length groups of fish (data are "pooled") into new groups that contain at least three recaptured fish. Results of this analysis are reported in Table 5 as outputs of the pooled model.

Corwin Springs Section

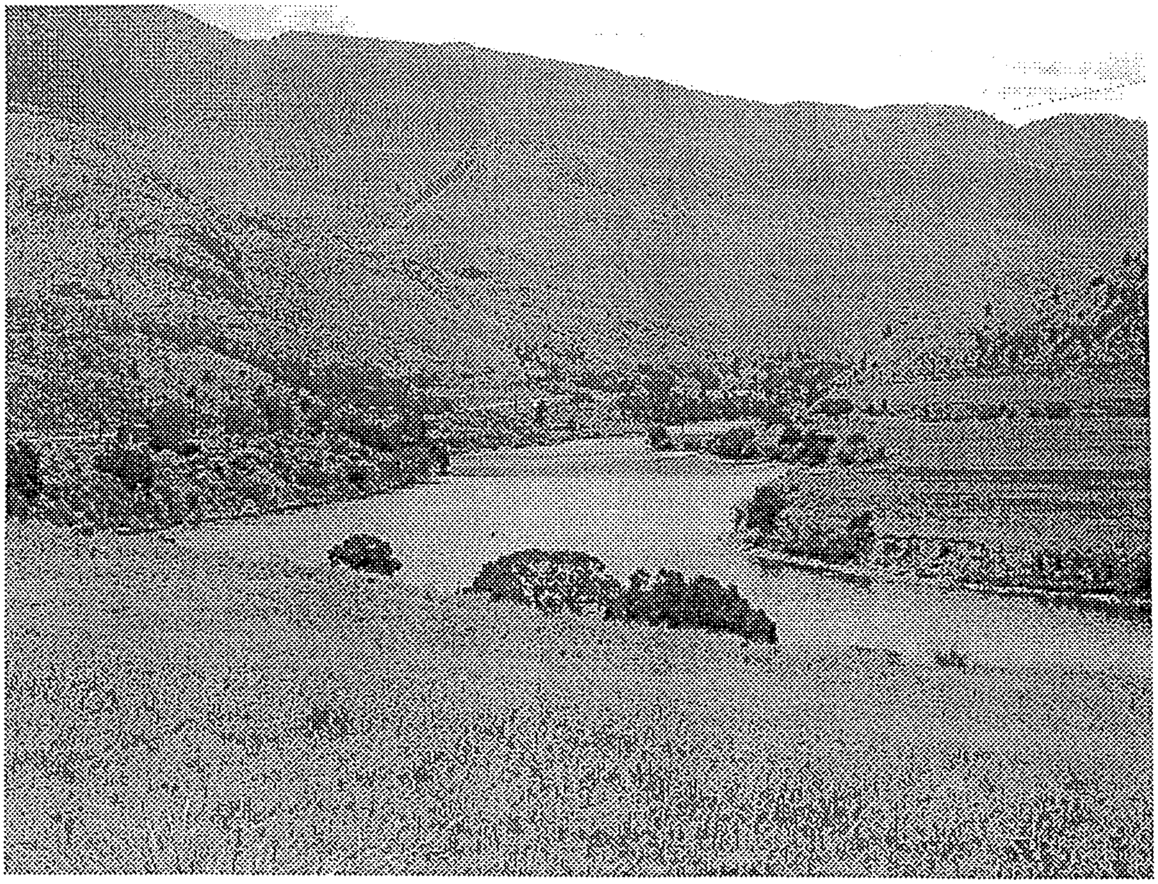

Photo 1. Portion of the Corwin Springs section, looking south (upstream).

Although cutthroat trout and rainbow trout abundance in the Corwin Springs section this year was statistically similar to estimates from previous years, point estimates suggest a trend of increasing abundance of fish larger than seven inches following the large floods of 1996 and 1997 (Figure 3). Our field observations of fish abundance in recent years support that this increase is real in this area of the river, not just an artifact of sampling.

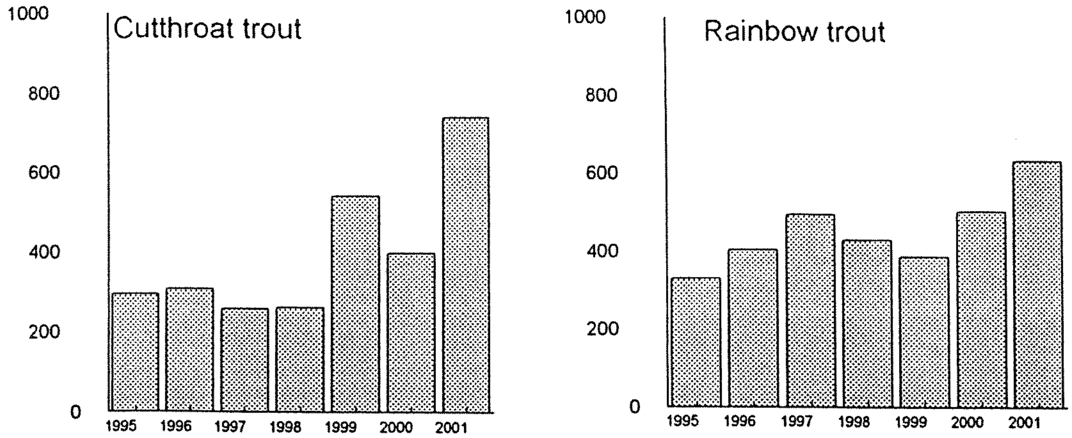

Figure 3. Cutthroat tout and rainbow trout abundance in the Corwin Springs section of the Yellowstone River based on spring sampling from 1995 through 2001. Estimates are for fish seven inches (TL) or longer. Vertical scales are fish/mile.

Brown trout abundance in the Corwin Springs section this year was similar to previous years (Figure 4). Like other trout species, brown trout continue to show healthy recruitment and survivorship in this area of the river.

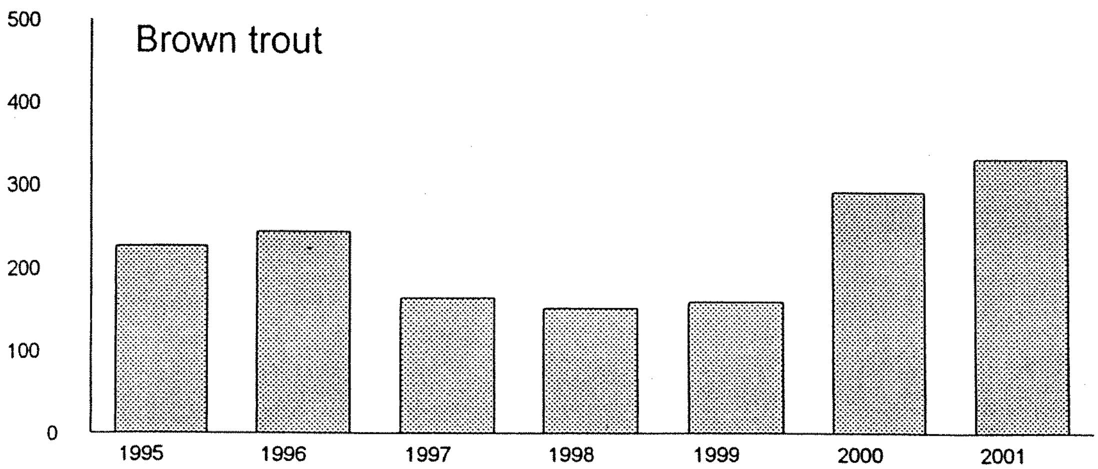

Figure 4. Brown trout abundance in the Corwin Springs section of the Yellowstone River based on spring sampling from 1995 through 2001. Estimates are for fish seven inches (TL) or longer. Vertical scale is fish/mile.

Mill Creek Bridge Section

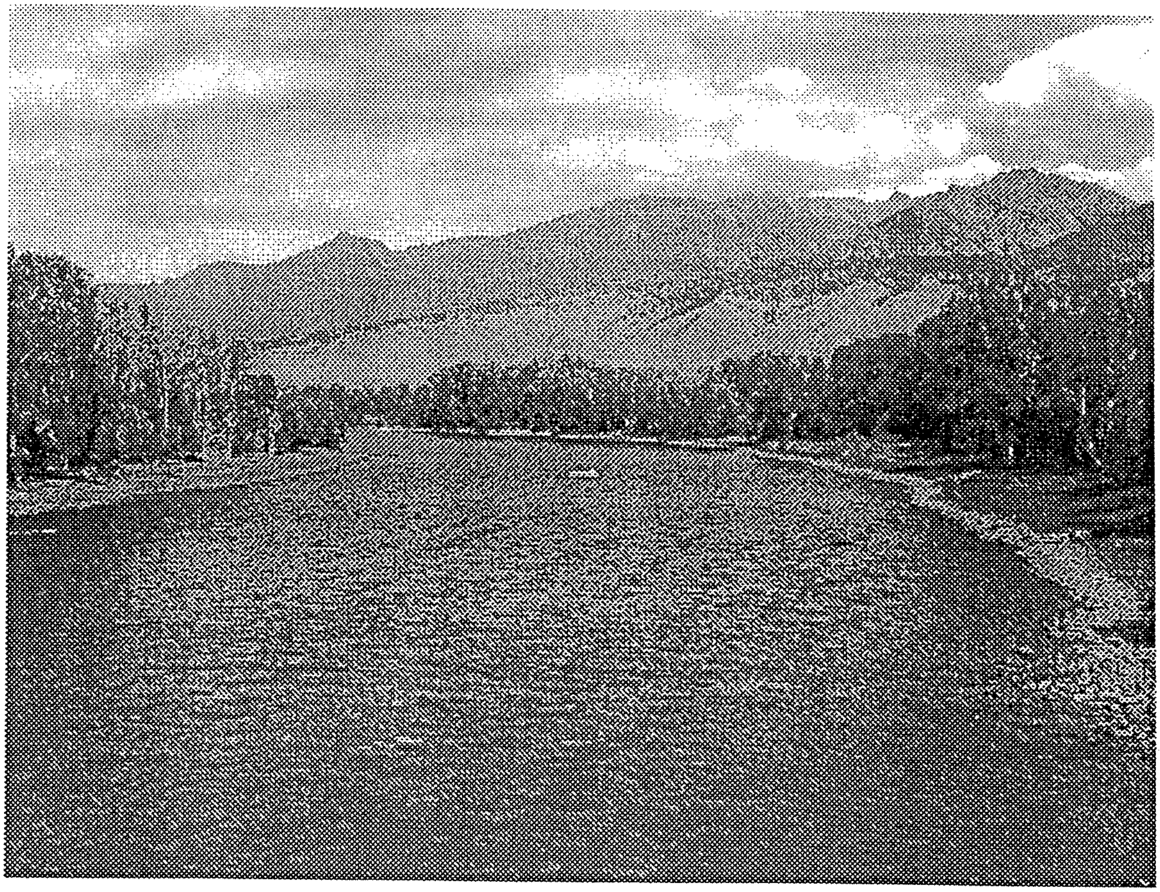

Photo 2. Portion of the Mill Creek Bridge section, looking north (downstream).

Our ability to capture trout, and brown trout in particular, varies considerably in the Mill Creek section, depending on river flow conditions. Often we capture many more fish during recapture surveys than during marking efforts, primarily because channel morphology at this location significantly favors capturing fish as flow increases approaching spring runoff. Large sampling errors are common (and difficult to avoid) some years when estimating trout abundance in this section using mark recapture techniques. Given this qualification, our surveys this year showed similar cutthroat and brown trout abundance in the Mill Creek section compared to estimates from previous years (Figure 5).

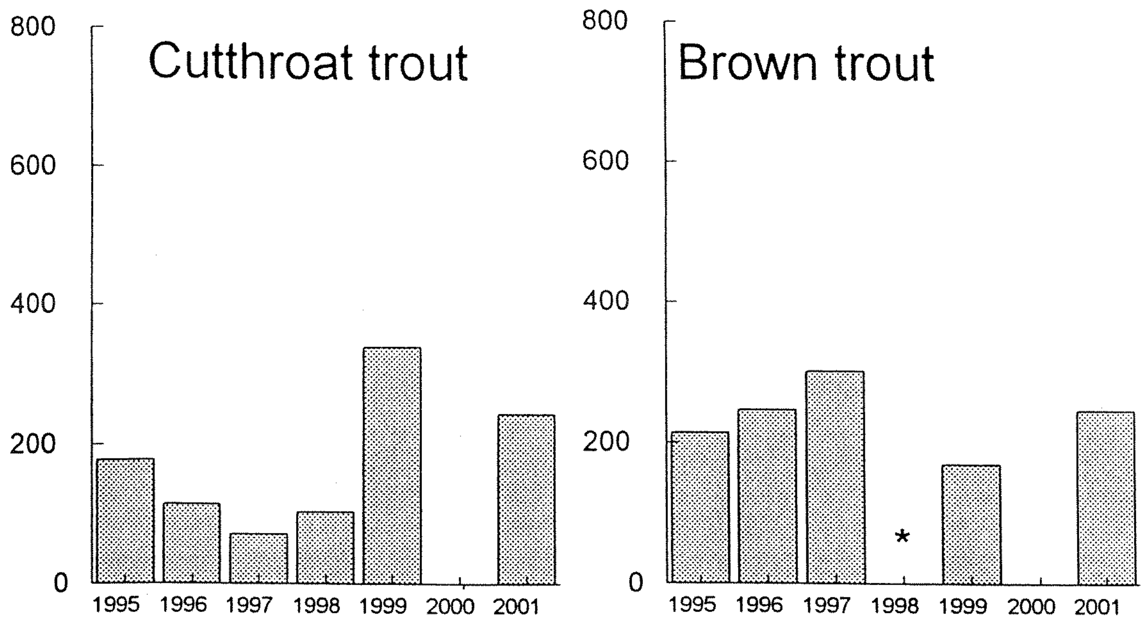

Figure 5. Cutthroat trout and brown trout abundance in the Mill Creek Bridge section of the Yellowstone River based on spring sampling from 1995 through 2001. Estimates are for fish seven inches (TL) or longer. Vertical scales are fish/mile. Fish were not sampled in this section in 2000. The estimate for brown trout in 1998 (*) is not shown because of the very high sampling error associated with this estimate.

Rainbow trout abundance increased in the Mill Creek Bridge section this year compared to recent estimates (Figure 6). Spring spawning species, including rainbow trout and cutthroat trout, have generally shown excellent recruitment and survivorship in all areas of the Yellowstone River sampled in recent years (Figure 7). Some of this performance seems reasonably linked to a series of mild winters, and to channel changes associated with the large floods of 1996 and 1997. Although not quantified, it is clear that natural river processes have restored many habitat features that were modified or lost during the floods. Biotic communities have responded by reestablishing and expanding into new habitats as they have become available.

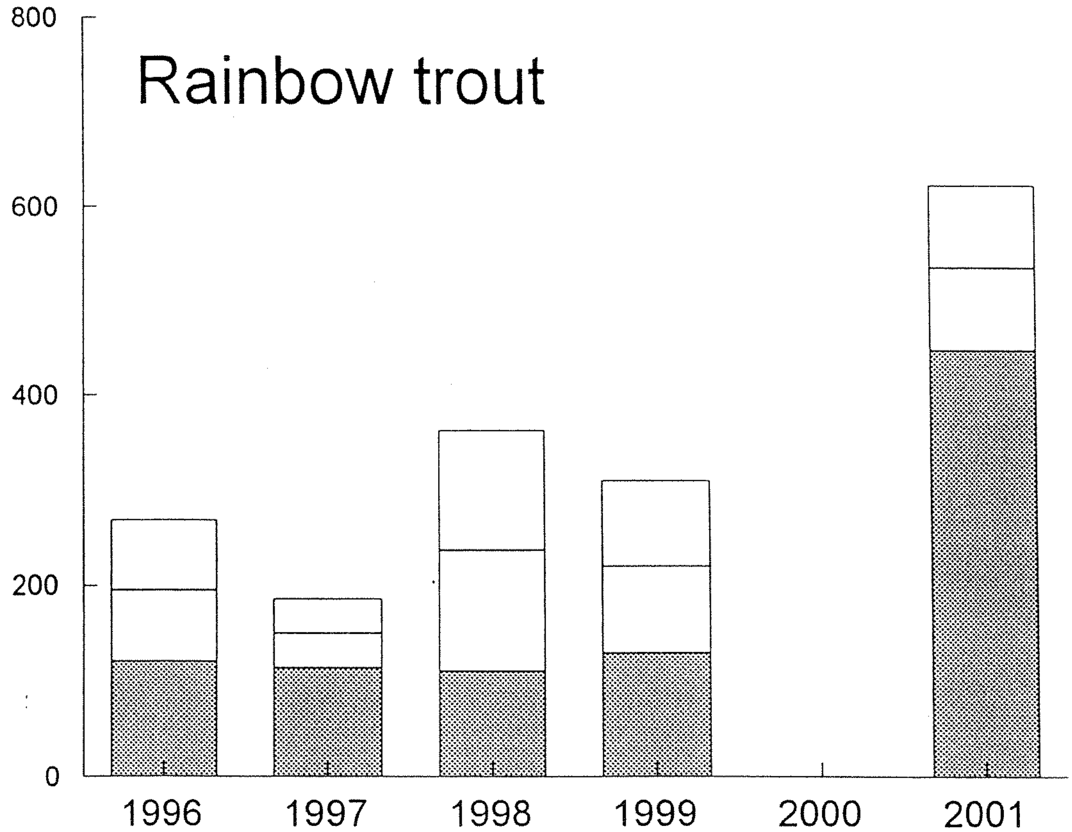

Figure 6. Rainbow trout abundance in the Mill Creek Bridge section of the Yellowstone River based on spring sampling from 1995 through 2001. Estimates are for fish seven inches (TL) or longer. Open intervals are plus or minus two SD of each point estimate. Vertical scale is fish/mile. Fish were not sampled in this section in 2000.

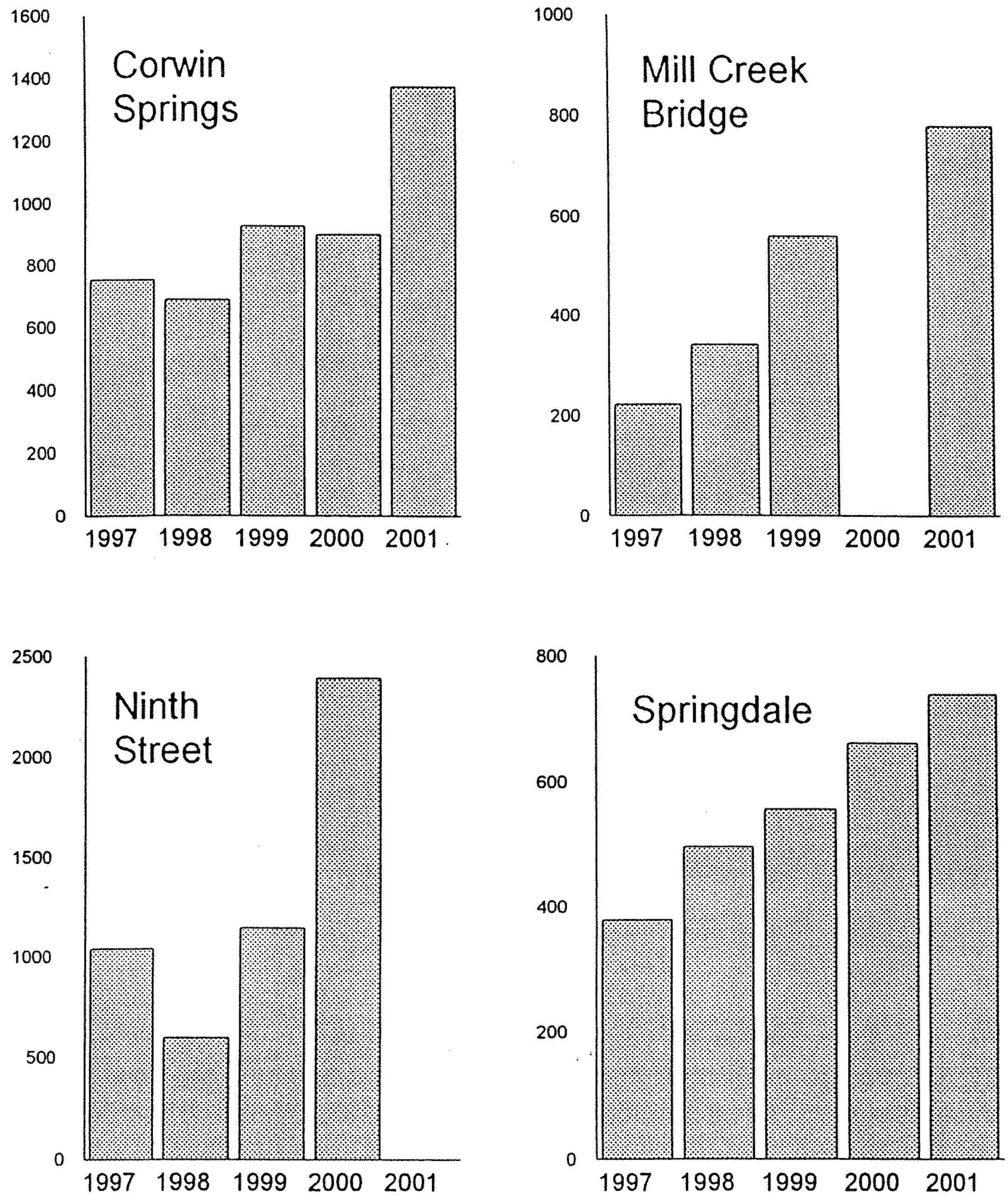

Figure 7. Rainbow trout and cutthroat trout abundance in four sections of the Yellowstone River based on spring sampling from 1997 through 2001. Estimates are for fish seven inches (TL) or longer. Vertical scales are fish/mile. Vertical scales differ. Fish were not sampled in the Mill Creek Bridge section in 2000, or in the Ninth Street section in 2001. Estimates of cutthroat trout abundance are not included in the total for the Ninth Street section in 1997 and 1998: too few cutthroats were captured during sampling in 1997 and 1998 to reliably estimate their abundance.

Springdale Section

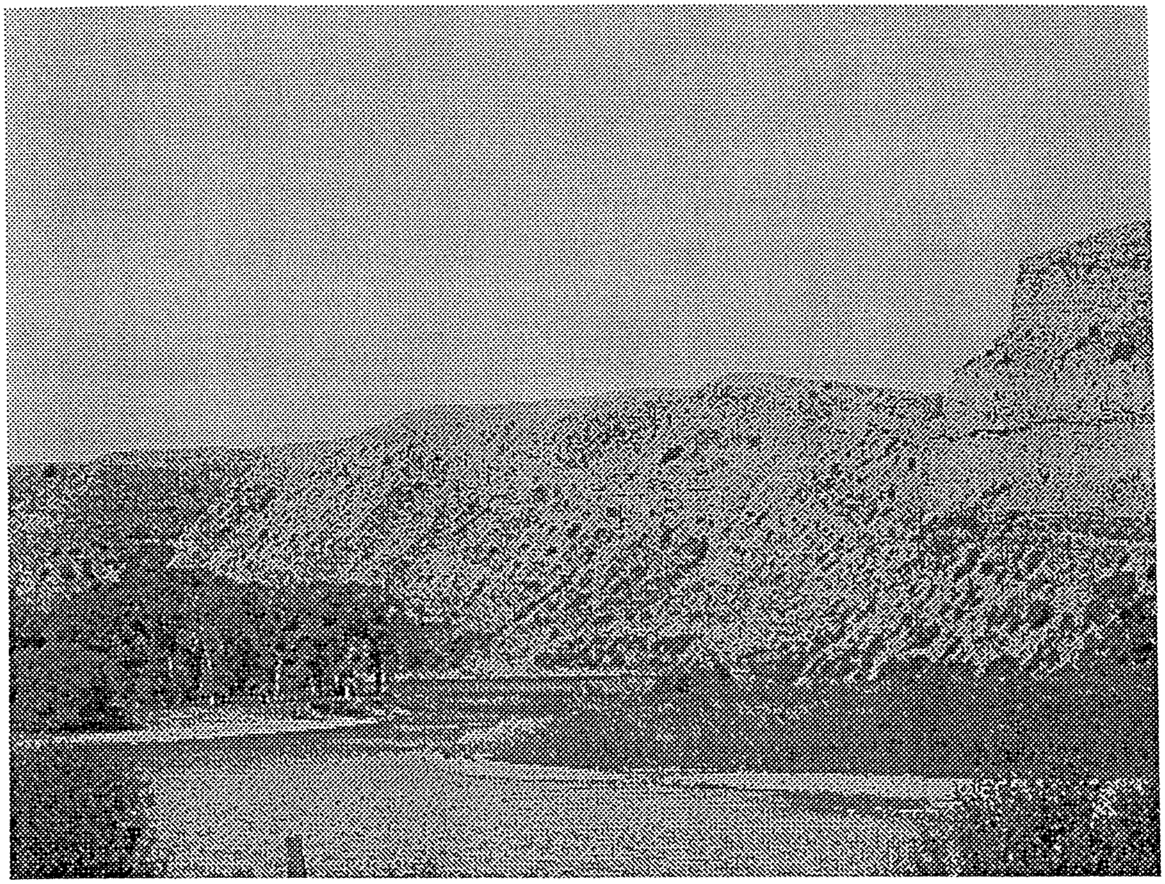

Photo 3. Portion of the Springdale section, looking west (upstream).

Cutthroat trout and brown trout abundance in the Springdale section was similar in 2001 to estimates from previous years (Figure 8). A trend of increasing rainbow trout abundance in the Springdale area, noted last year (Tohtz 2001), was evidenced again in spring 2001 (Figure 9).

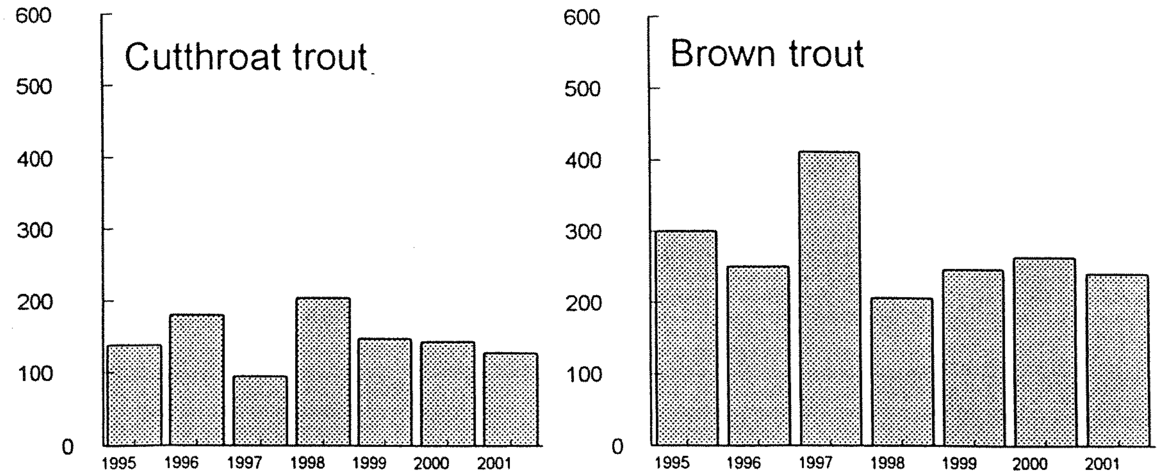

Figure 8. Cutthroat trout and brown trout abundance in the Springdale section of the Yellowstone River based on spring sampling from 1995 through 2001. Estimates are for fish seven inches (TL) or longer. Vertical scales are fish/mile.

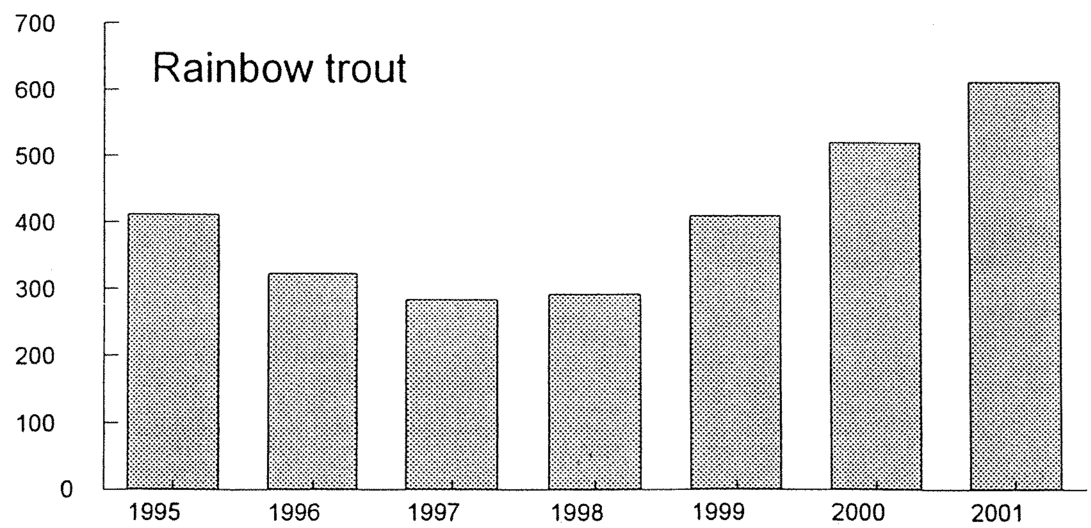

Figure 9. Rainbow trout abundance in the Springdale section of the Yellowstone River based on spring sampling from 1995 through 2001. Estimates are for fish seven inches (TL) or longer. Vertical scale is fish/mile.

B. Estimates of mountain whitefish abundance in two sections of the Yellowstone River based on spring sampling in 2001.

Our data for mountain whitefish from both sections sampled in 2001 fit the log-likelihood model well (Table 6). Although mountain

Table 6. Mountain whitefish/mile in two sections of the Yellowstone River based on spring sampling in 2001. Estimates are for fish seven inches (TL) or longer.

			Overall model			Pooled model		
Section (mark date):	N	SD	DF	Chi-square	P	DF	Chi-square	P\[1]
Mill Creek (April 20):	11,585	1,327	4	4.17	0.38	2	3.70	0.16
Springdale (April 7):	6,117	688	6	2.47	0.87	4	2.29	0.68

1. N = estimated number; SD = standard deviation; DF = degrees of freedom; P = probability value.

whitefish abundance will vary on an annual basis more than trout populations at similar locations in the Yellowstone River (e.g., Shepard 1992), it is typical that whitefish will be about ten times more abundant than trout throughout the upper river (Tohtz 1999; Figure 10).

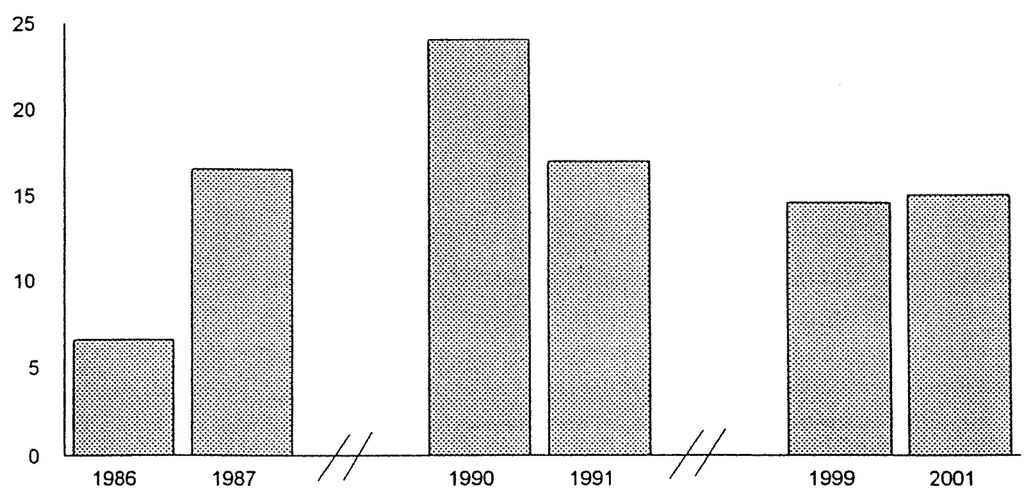

Figure 10. Mountain whitefish abundance in the Yellowstone River near the Mallard's Rest fishing access site (Paradise Valley) based on spring sampling in 1986, 1987, 1990, 1991, 1999, and 2001. Estimates are for fish seven inches (TL) or longer. Vertical scale is thousands of fish/mile.

In the Mill Creek Bridge section of the Paradise Valley, mountain whitefish abundance was similar this year to estimates from 1999 (Figure 11).

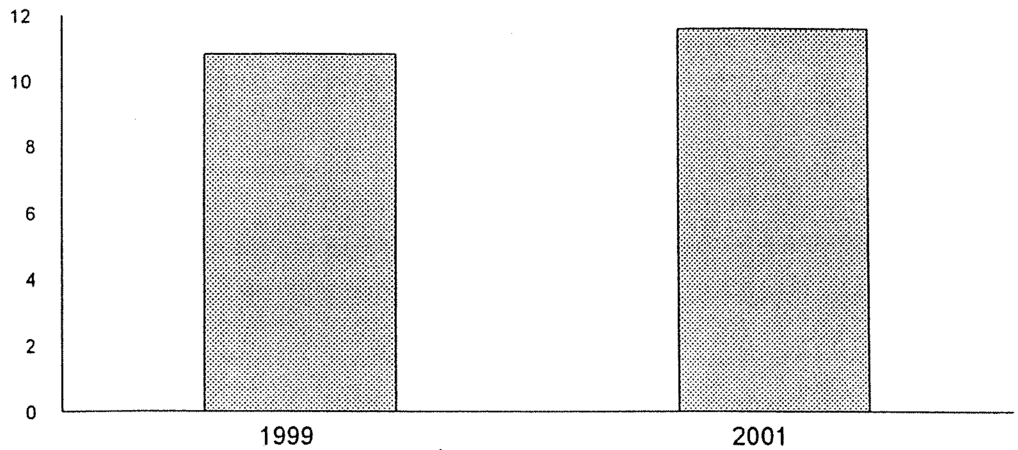

Figure 11. Mountain whitefish abundance in the Mill Creek Bridge section of the Yellowstone River based on spring sampling in 1999 and 2001. Estimates are for fish seven inches (TL) or longer. Vertical scale is thousands of fish/mile.

In contrast, mountain whitefish were more abundant at Springdale this year compared to estimates of abundance at this same location in 1999 (Figure 12). Whitefish abundance appears to have increased generally in many river areas east of Livingston (see also Section C, below). Consecutive mild winters in recent years have likely enhanced whitefish survivorship.

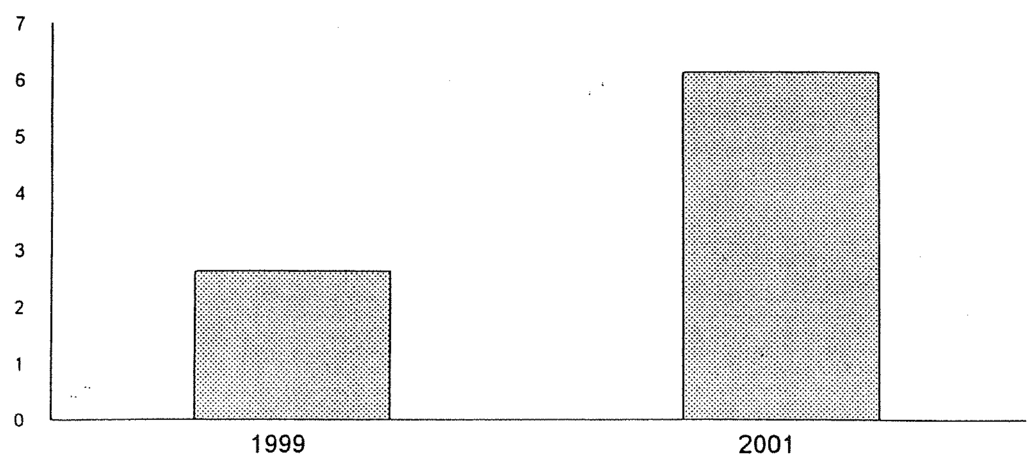

Figure 12. Mountain whitefish abundance in the Springdale section of the Yellowstone River based on spring sampling in 1999 and 2001. Estimates are for fish seven inches (TL) or longer. Vertical scale is thousands of fish/mile.

C. Estimates of fish abundance in three sections of the Shields River based on spring sampling in 2001.

Data for several fish species collected in the Convict Grade and Todd sections of the Shields river this spring fit the log-likelihood model well (Table 7). Estimates of fish abundance in the Tomschin section are based on fish removals, rather than mark recapture techniques (Table 8).

Table 7. Fish/mile in two sections of the Shields River based on spring sampling in 2001. Estimates are for fish six inches (TL) or longer.

Section (mark date):			Overall model			Pooled model		
Fish species	N	SD	DF	Chi-square	P	DF	Chi-square	P \[1]
Todd (March 22):								
Brown trout	347	80	6	6.62	0.36	2	0.72	0.70
Mountain whitefish	1,048	80	6	10.48	0.11	6	10.48	0.11
Convict Grade (March 15):								
Rainbow trout	208	38	4	2.14	0.71	2	1.76	0.41
Brown trout	232	32	8	6.38	0.61	5	6.13	0.29
Mountain whitefish	4,622	317	5	3.04	0.69	4	2.66	0.62

1. N = estimated number; SD = standard deviation; DF = degrees of freedom; P = probability value.

Table 8. Brown trout and mountain whitefish abundance in the Tomschin section of the Shields River based on spring sampling in 2001. Sampling occurred March 29, 2001.

Fish species:	Number of fish (pass 1, 2, 3)	Probability of capture	Estimated fish/mile	Standard error
Brown trout	22, 6, 2	0.75	158	0.84
Mountain whitefish	51, 5, 3	0.84	312	0.52

A key physical feature of the Shields River is a cross channel diversion structure installed about ten miles above the Shields River confluence with the Yellowstone River (Figure 13). This structure, sometimes called the Chadbourne diversion, significantly influences the distribution of fish within the drainage, primarily because it forms a barrier to passage of fish that might otherwise move upstream from the Yellowstone River. This barrier is

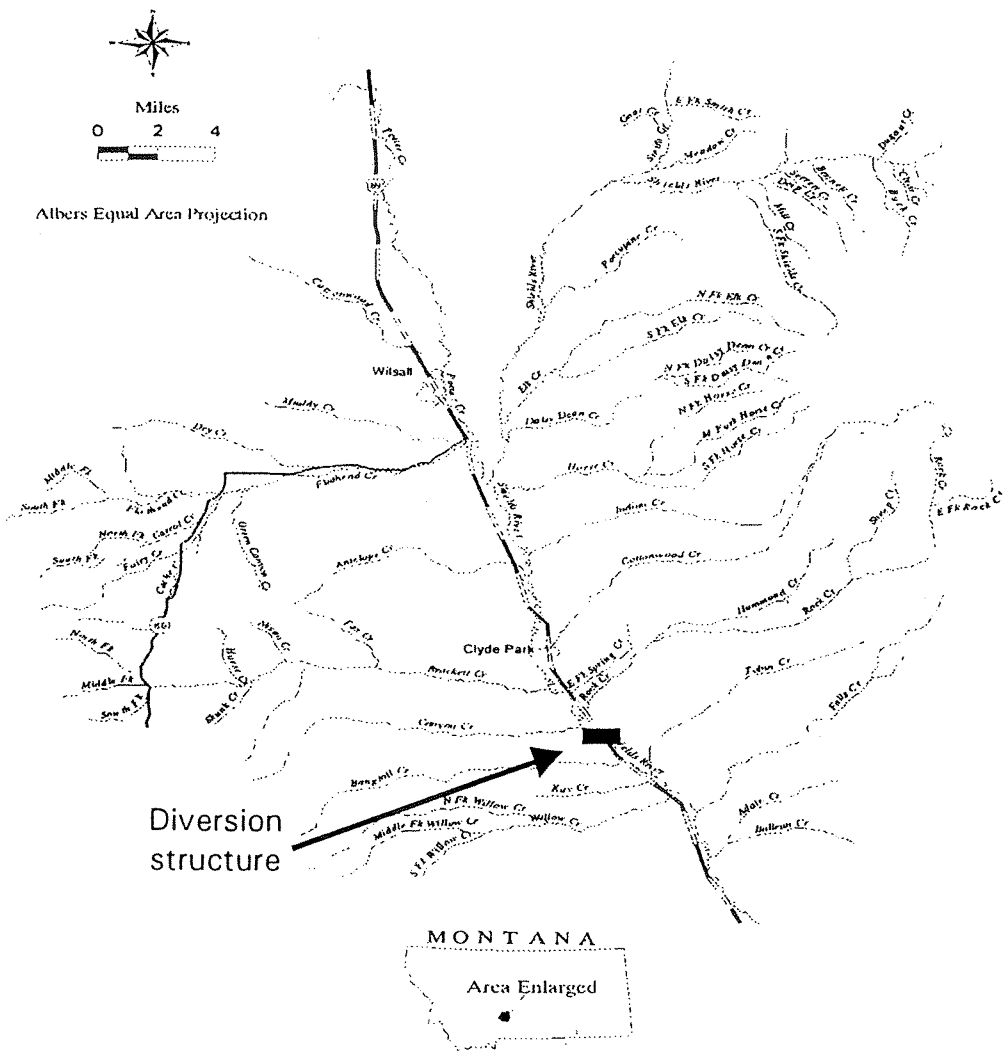

Figure 13. Shields River drainage showing the approximate location of a cross channel diversion installed about ten miles above the Shields River confluence with the Yellowstone River.

not absolute, and some fish, particularly strong swimming rainbow trout, are able to pass over the structure during periods of high flow. The structure is influential enough, however, to separate what appear to be largely resident fish populations above the barrier from the lower section of the Shields River where migrations of fish from the Yellowstone River are seasonally quite conspicuous. This structure explains, for example, why we find large numbers of mature rainbow trout in the lower Shields River in the spring, but few rainbow trout at sites above the barrier (Tohtz 2001). The influence of this structure is also apparent in the relatively high number of mountain whitefish that occur some years in the lower river, compared to their abundance at upstream sites (see below).

Brown trout and mountain whitefish abundance in the Tomschin section was similar this year to abundance estimated in 1999 (Figure 14).

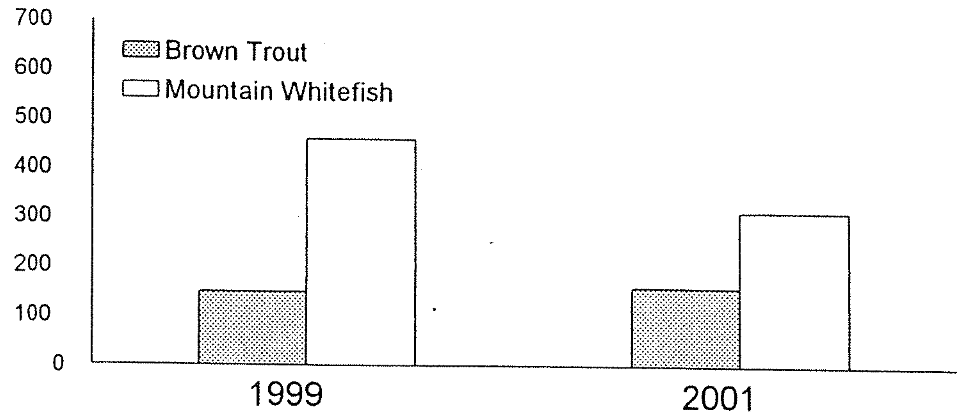

Figure 14. Brown trout and mountain whitefish abundance in the Tomschin section of the Shields River based on spring sampling in 1999 and 2001. Vertical scale is fish/mile.

The Tomschin section is located well above the Chadbourne diversion, isolated from what might otherwise be a stronger influence of the Yellowstone River fishery. Curiously, brown trout numbers in the Tomschin section are similar to brown trout abundance at other locations in the Shields River (Figure 15), including downstream sites where river volume

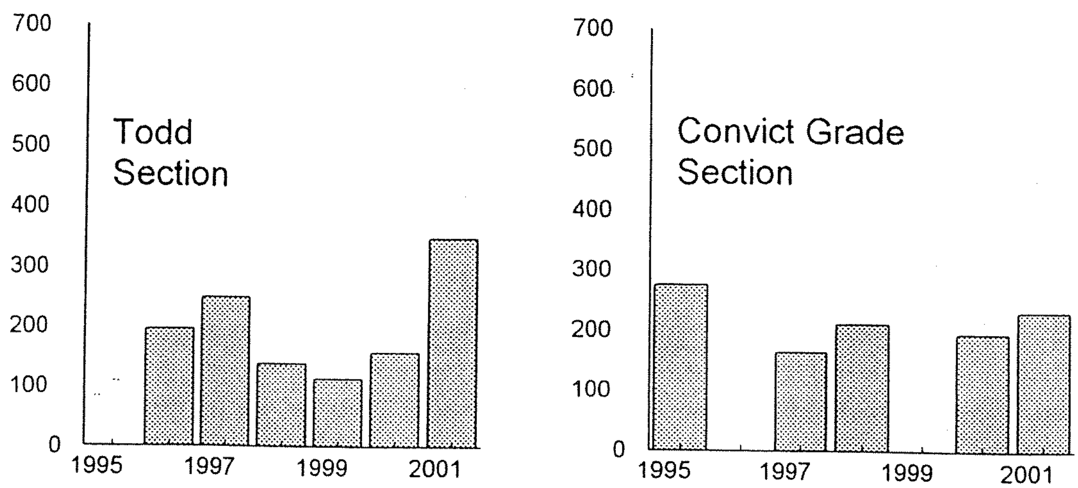

Figure 15. Brown trout abundance in the Todd and Convict Grade sections of the Shields River based on spring sampling from 1995 through 2001. Missing values are years when fish were not sampled at these locations. Vertical scales are fish/mile.

is significantly larger, where habitat features are more complex, and where fish can move freely from the Yellowstone River. The possibility that brown trout are seasonally more abundant in the lower Shield River during spawning activity in the fall, however, seems likely.

Mountain whitefish, in contrast to brown trout, tend to increase abundance in downstream areas of the Shields River (Tohtz 2001). Abundance of whitefish in the Tomschin section, for example, although stable at that location, is less than occurs in either the Todd or the Convict Grade sections downstream (Figure 16). Abundance of whitefish in the Convict Grade

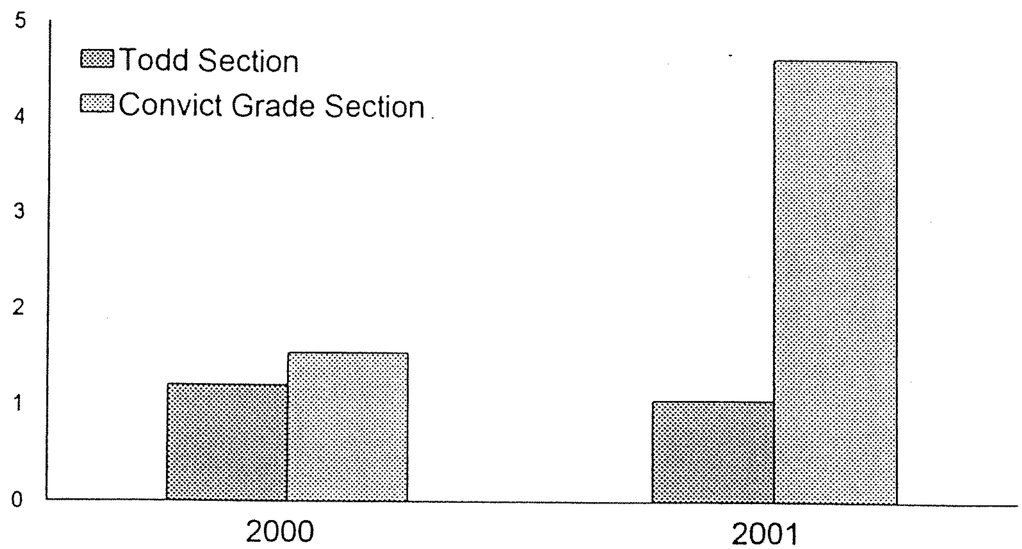

Figure 16. Mountain whitefish abundance in the Todd and Convict Grade sections of the Shields River based on spring sampling from 1995 through 2001. Vertical scale is thousands of fish/mile.

section seems to be strongly influenced by the Yellowstone River. A general increase in whitefish abundance in river areas east of Livingston this year (see Section B, above) appears to be reflected as well in a substantial increase in whitefish numbers in the Convict Grade section near the Shields River mouth (Figure 16). We did not observe a corresponding increase in whitefish abundance in Shields River areas above the Chadbourne diversion.

D. Genetic tests of Yellowstone Cutthroat trout collected from the Shields River and several of its tributaries in 1999.

Genetic tests for hybridization between Yellowstone cutthroat trout and rainbow trout showed different results at different locations for the samples collected in 1999 (Table 9). This pattern of difference demonstrates the

Table 9. Results of genetic tests of Yellowstone cutthroat trout collected from the Shields River and several of its tributaries in 1999. Tests examined potential hybridization with rainbow trout.

Stream name	Survey date	Number of fish	Hybrid fish?	Summary of laboratory results
Shields River\[1]	03/15/99-03/23/99	23	Yes	20 unhybridized Yellowstone cutthroat trout, 2 first generation hybrids, 1 probable first generation backcross
Porcupine Creek	05/05/99	34	Yes	33 unhybridized Yellowstone cutthroat trout, 1 first generation hybrid
N.F. Elk Creek	07/06/99	44	No	44 unhybridized Yellowstone cutthroat trout
S.F. Elk Creek	07/06/99	29	Yes	Hybrid swarm (all 29 fish of hybrid origin)
Daisy Dean Creek	10/21/99	25	No	25 unhybridized Yellowstone cutthroat trout
Horse Creek	10/13/99	30	No	30 unhybridized Yellowstone cutthroat trout
Cottonwood Creek	03/22/99	32	Yes	Hybrid swarm (all 32 fish of hybrid origin)

1. Shields River samples from different locations were combined after a contingency table chi-square analysis indicated that allele frequencies were statistically homogenous at 14 loci for which evidence of genetic variation had been detected.

challenge we face interpreting the extent to which cross breeding threatens any species that readily hybridizes in the wild. Although hybrid fish were detected in the mainstem Shields River, for example, most (87 percent) of the sample was unhybridized fish. Yellowstone cutthroat trout may be perfectly able to maintain their genetic identity in the Shields River under current conditions, despite coexisting with rainbow trout. Of course, it is possible that rainbow trout are newly pioneering this area of the river, in which case the degree of hybridization might increase over time. The single first generation hybrid detected in the Porcupine Creek sample is disturbing for this reason, although, again, 97 percent of this sample was unhybridized fish. Hybrid swarms occurred in Cottonwood Creek and in the South Fork Elk Creek, but alleles characteristic of rainbow trout were rare (less than 1 percent, on average) even in these samples. How do these slightly hybridized fish contribute to (or threaten) the long-term persistence of this species in this area of the drainage? More than anything else, our results to date, including tests of fish from the Yellowstone River (Tohtz 1999; Table 10), underscore our need to better understand the ecology of these fish in

Table 10. Results of genetic tests of Yellowstone cutthroat trout collected from the Yellowstone River in 1998. Tests examined potential hybridization with rainbow trout.

Section name	Survey date	Number of fish	Hybrid fish?	Summary of laboratory results
Corwin Springs	05/01/98	30	Yes	25 unhybridized Yellowstone cutthroat trout, 5 hybrids
Mill Creek Bridge	04/30/98	36	Yes	33 unhybridized Yellowstone cutthroat trout, 1 hybrid\[1]
Springdale	04/27/98	20	Yes	18 unhybridized Yellowstone cutthroat trout, 1 hybrid\[2]

1. Sample included one rainbow trout and one brown trout.
2. Sample included one rainbow trout.

our rivers. It seems likely that a variety of factors can reproductively isolate Yellowstone cutthroat trout from other species despite their occurrence in the same bodies of water. It also seems likely that the relatively undisturbed conditions of our local watersheds contribute significantly to the ability of these systems to support and maintain Yellowstone cutthroat trout, despite a variety of developments, uses, and abuses associated with the activities of people. Information that clarifies these processes is a priority at this time.

E. Summary of year 2001 spring gillnet catches at Dailey Lake.

The average number of rainbow trout caught in each gillnet at Dailey Lake was similar in 2001 to the number caught in 2000 (Table 11). Average fish length was slightly larger, a result that is influenced in part by the recent stocking of faster growing Arlee rainbow trout (Table 12; see also Tohtz 2001).

Table 11. Summaries of gillnet catches at Dailey Lake based on spring sampling from 1990 through 2001.

		Rainbow trout		Yellow perch		Walleye	
Year /1	Set date	Fish/net	Mean TL (inches)	Fish/net	Mean TL (inches)	Fish/net	Mean TL (inches)
1990	04/30	8.2	12.8	48.7	7.4	4.7	11.4
1991	05/14	5.3	14.8	21.8	7.5	3.0	12.0
1992	05/04	7.3	15.1	58.3	7.7	4.5	12.7
1993	------------	----------------------	no	Information	------------	---------------------------	
1994	05/12	9.3	15.2	32.3	8.7	11.5	11.3
1995	05/18	13.5	14.6	71.5	8.0	2.5	13.7
1996	------------	----------------------	no	Information	------------	---------------------------	
1997	04/23	9.8	17.4	35.8	8.8	15.3	14.6
1998	05/03	5.8	18.9	59.0	8.9	15.8	10.6
1999	04/27	10.3	15.0	210.3	6.3	15.0	13.4
2000	05/16	4.8	16.2	14.5	8.9	11.8	13.2
2001	05/17	4.5	17.4	8.5	8.5	11.8	13.5

1. Data summaries for years 1990 through 1992 are from Shepard 1993.

Table 12. Numbers of walleye and rainbow trout stocked in Dailey Lake from 1997 through 2001.

Year	Species	Variety	Number	Mean length (in)
1997	Walleye	Fort Peck	10,000	1.2
	Walleye	Fort Peck	4,810	3.2
	Rainbow trout	Eagle Lake	10,050	3.3
	Rainbow trout	Desmet	2,960\[1]	6.7
1998	Walleye	Fort Peck	10,000	1.4
	Walleye	Fort Peck	5,000	2.5
	Rainbow trout	Eagle Lake	10,192	3.9
	Rainbow trout	Desmet	5,440	5.3
1999	Walleye	Fort Peck	5,000	1.6
	Walleye	Fort Peck	5,000	3.3
	Rainbow trout	Eagle Lake	10,098	4.8
	Rainbow trout	Desmet	5,000	5.3
2000	Walleye	Fort Peck	5,000	1.6
	Walleye	Fort Peck	5,000	3.3
	Rainbow trout	Eagle Lake	10,000\[2]	3.5\[2]
	Rainbow trout	Desmet	4,769	4.6
	Rainbow trout	Arlee	10,140	2.5
2001	Walleye	Fort Peck	5,000	1.3
	Walleye	Fort Peck	5,000	3.2
	Rainbow trout	Eagle Lake	10,074	3.5\[2]
	Rainbow trout	Desmet	5,040	5.2
	Rainbow trout	Arlee	9,976	2.8

1. Number adjusted for loss of approximately 400 fish during transport from the hatchery.
2. Approximate

The average length of yellow perch in our sample this year was similar to average length last year (Table 11). The number of fish caught, however, was less than we have experienced in spring samples before. Low numbers of yellow perch may be an artifact of sampling, although several lakes in this area did experience fish kills related to water quality changes associated with recent drought. It is possible that yellow perch numbers have been suppressed by similar environmental factors, perhaps exacerbated by predation from other fish, and recent angler harvest. Although yellow perch are very capable of rapidly increasing their abundance, we will continue to monitor this situation, in part to determine whether or not changes in stocking rates of other fish might be appropriate. This monitoring should intensify, as necessary, if current drought conditions do not appreciably improve.

The number of walleye caught in our nets this year was similar to our sample in spring 2000 (Table 11). Average length was also similar. We did see several fish weighing over three pounds this year: one exceeded the 5.5 pound weight limit of our scale. Walleye growth rate is still slow, but current stocking rates, and time, seem to be producing a few larger fish each year.

LITERATURE CITED

Anonymous. 1994. MarkRecapture version 4.0: a software package for fishery population estimates. Montana Department of Fish, Wildlife and Parks, Bozeman.

Shepard, B.B. 1992. Fisheries of the upper Yellowstone River including tributary recruitment: Report for years 1989, 1990, and 1991. Progress report for federal aid project F-46-R-2, 3, and 4. Montana Department of Fish, Wildlife and Parks, Bozeman.

Shepard, B.B. 1993. Fisheries of Dailey lake: annual report for 1991 and 1992. Progress report for federal aid project F-46-R-2. Montana Department of Fish, Wildlife and Parks, Bozeman.

Tohtz, J. 1996a. Fisheries investigations in the Yellowstone and Shields river basins, Park County, Montana. Progress report for federal aid project F-78-R-1 and F-78-R-2. Montana Department of Fish, Wildlife and Parks, Bozeman.

Tohtz, J. 1996b. Fisheries investigations in the Yellowstone and Shields river basins, second report, 1996. Progress report for federal aid project F-78-R-2. Montana Department of Fish, Wildlife and Parks, Bozeman.

Tohtz, J. 1997. Fisheries investigations in the Yellowstone and Shields river basins, Park County, Montana: FY 1997. Progress report for federal aid project F-78-R-3. Montana Department of Fish, Wildlife and Parks, Bozeman.

Tohtz, J. 1998. Fisheries investigations in the Yellowstone and Shields river basins, Park County, Montana: FY 1998. Progress report for federal aid project F-78-R-4. Montana Department of Fish, Wildlife and Parks, Bozeman.

Tohtz, J. 1999. Fisheries investigations in the Yellowstone and Shields river basins, Park County, Montana: Annual Report for 1999. Progress report for federal aid project F-78-R-4. Montana Department of Fish, Wildlife and Parks, Bozeman.

Tohtz, J. 2001. Fisheries investigations in the Yellowstone and Shields river basins, Park County, Montana: Annual Report for 2000. Progress report for federal aid project F-113-R-1. Montana Department of Fish, Wildlife and Parks, Bozeman.

APPENDIX A: Common and scientific names for fish referred to in this report.

Common name	Scientific name
Brown trout	*Salmo trutta*
Mountain whitefish	*Prosopium williamsoni*
Rainbow trout	*Oncorhynchus mykiss*
Walleye	*Stizostedion vitreum*
Yellow perch	*Perca flavescens*
Yellowstone cutthroat trout (cutthroat trout)	*Oncorhynchus clarki bouvieri*