F-78-IC-5
Region 3

# FISHERIES INVESTIGATIONS IN THE YELLOWSTONE AND SHIELDS RIVER BASINS, PARK COUNTY, MONTANA: FY 1997

Progress Report for Federal Aid
Project F-78-R-3

by

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## ABSTRACT

Estimates of rainbow, brown, and cutthroat trout abundance in all areas of the Yellowstone river sampled in 1997 were similar to estimates in previous years. Record high runoff in the spring of 1996 at this point has had no measurable effect on trout abundance in these areas of the river.

The abundance of brown trout sampled in the Shields river near Clyde Park was similar this year to spring estimates in 1996. Mountain whitefish were three to fours times as abundant as brown trout at this same location.

Rainbow, brown, and cutthroat trout growth was similar in each of four sections of the Yellowstone river sampled in 1996. Brown trout from two locations in the Shields river below Clyde Park grew similarly to brown trout from the Yellowstone river.

Yellow perch and walleye growth in Dailey lake was typical of each species in Montana waters, based on analyses of scales collected from fish in 1997. Rainbow trout growth was exceptional, especially for fish older than age 2. Current stocking rates in combination with existing lake conditions apparently favor trout growth.

The average size of walleye and rainbow trout continues to increase in spring gillnet catches at Dailey lake. Natural reproduction and at least limited successful recruitment of new fish to the lake has been confirmed for rainbow trout.

Management objectives for Dailey lake over the next ten years are "to provide the best recreational fishery that Dailey lake can reasonably support using trout, walleye, and yellow perch". Montana's new warmwater fish management plan identifies Dailey lake as one of only three waterbodies in southwestern Montana with plans that include warm water fish.

Myxobolus cerebralis was confirmed for the first time in fish samples from the Yellowstone drainage. Based on other samples, the parasite apparently has a narrow geographical distribution in Park County at this time.

## 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:

### 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 appreciate the aquatic environment.

These statewide activities and objectives are addressed locally by ongoing fisheries investigations and management activities intended to enhance aquatic habitat and recreational fisheries in the upper Yellowstone drainage. For Montana state fiscal years 1997 and 1998, the Yellowstone and Shields drainage area workplans (state project 3301) contain six objectives (project objectives):

## Project Objectives

1. Determine the abundance, size composition, age composition, mortality rates, and angler harvest or catch rates of wild trout and other fish species in the Yellowstone and Shields rivers for the purpose of maintaining populations at existing levels and attempting to improve the present numbers of native Yellowstone cutthroat trout [1].

2. Determine the abundance, size composition, age composition, mortality rates, recruitment rates and spawning success of Yellowstone cutthroat trout in the primary tributary streams of the Yellowstone river and the Shields river for the purpose of improving or maintaining small tributary populations and possibly improving mainstem river numbers, plus enhancing some tributary populations using imprint plants of young-of-the-year and eyed eggs.

3. Determine the abundance, species structure and natural spawning success of fish populations in high mountain lakes to determine those capable of supporting selfsustaining populations: in those that do not, determine the level, species and frequency of supplemental stocking of fish that is essential to maintain a quality fishery.

4. Determine the abundance, species structure and natural spawning success of fish populations in Dailey lake and their relationship to lake water levels to insure maintenance of a stable quality fishery.

5. Provide public education and training programs and meetings to enhance the public's understanding of general environmental issues; fisheries issues; use of fisheries habitat protection laws and use of special angling regulations to insure the maintenance of the fisheries resource.

6. Provide private landowners with stream management techniques and information necessary to maintain or enhance fisheries habitat on waters within private lands.

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

Project objectives guide continuing efforts to maintain and enhance local fisheries. In support of these efforts, the following data collections, compilations, and analyses for state fiscal year 1997 (July 1, 1996 to June 30, 1997) are reported here under separate headings:

A. Estimates of rainbow, brown, and cutthroat trout abundance in four sections of the Yellowstone river based on spring sampling in 1997.

B. Estimates of brown trout and mountain whitefish abundance in one section of the Shields river based on spring sampling in 1997.

C. Fish age and growth based on scale collections from fish caught in the Yellowstone river, the Shields river, and Dailey lake.

D. Spring gillnet catches at Dailey lake in 1997.

E. Summary of warmwater fish management goals at Dailey lake for the ten year period 1997 to 2006.

F. Whirling disease samples and test results for fish collected in Park County in 1996 and 1997.

In this report, project objectives 1 and 2 are addressed under headings A through D. Project objective 4 is addressed under headings E and F. Project objectives 5 and 6 are addressed on an ongoing basis by meetings with various angler groups, school groups, local journalists, and the public. In fiscal year 1997, these meetings included committee and public sessions concerning flood damage from spring runoff, educational seminars for local elementary school children, meetings with Trout Unlimited and the Yellowstone Flyfishers to discuss a variety of fisheries topics, and meetings with Walleye Unlimited to discuss fish management at Dailey lake. 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 rainbow, brown, and cutthroat trout abundance in four sections of the Yellowstone river based on spring sampling in 1997.

This spring we sampled trout abundance in the same four sections of the Yellowstone river that we sampled last spring (Tohtz 1996a). In 1997 we again used the shorter section lengths (Table 1) established in 1996.

Table 1. Survey section locations on the Yellowstone river: 1996 and 1997.

| Section name | Length (feet) | Location\1 |
|---|---|---|
| Corwin Springs | 20,592 | T8S, R7E, S2,3,11,12,13,24<br>T8S, R8E, S19,30 |
| Mill Creek Bridge | 26,620 | T5S, R9E, S4,5,8<br>T4S, R9E, S28,32,33 |
| Ninth Street | 12,104 | T2S, R10E, S5,7,18<br>T2S, R9E, S24 |
| Springdale | 18,876 | T1S, R12E, S21,22,28,29,32<br>T2S, R12E, S5,6 |

1. Township, Range, Section

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.

Fish were collected in live cars, identified, 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 the Montana Department of 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.

2. Unless otherwise stated, all fish lengths in this report are total lengths (TL).

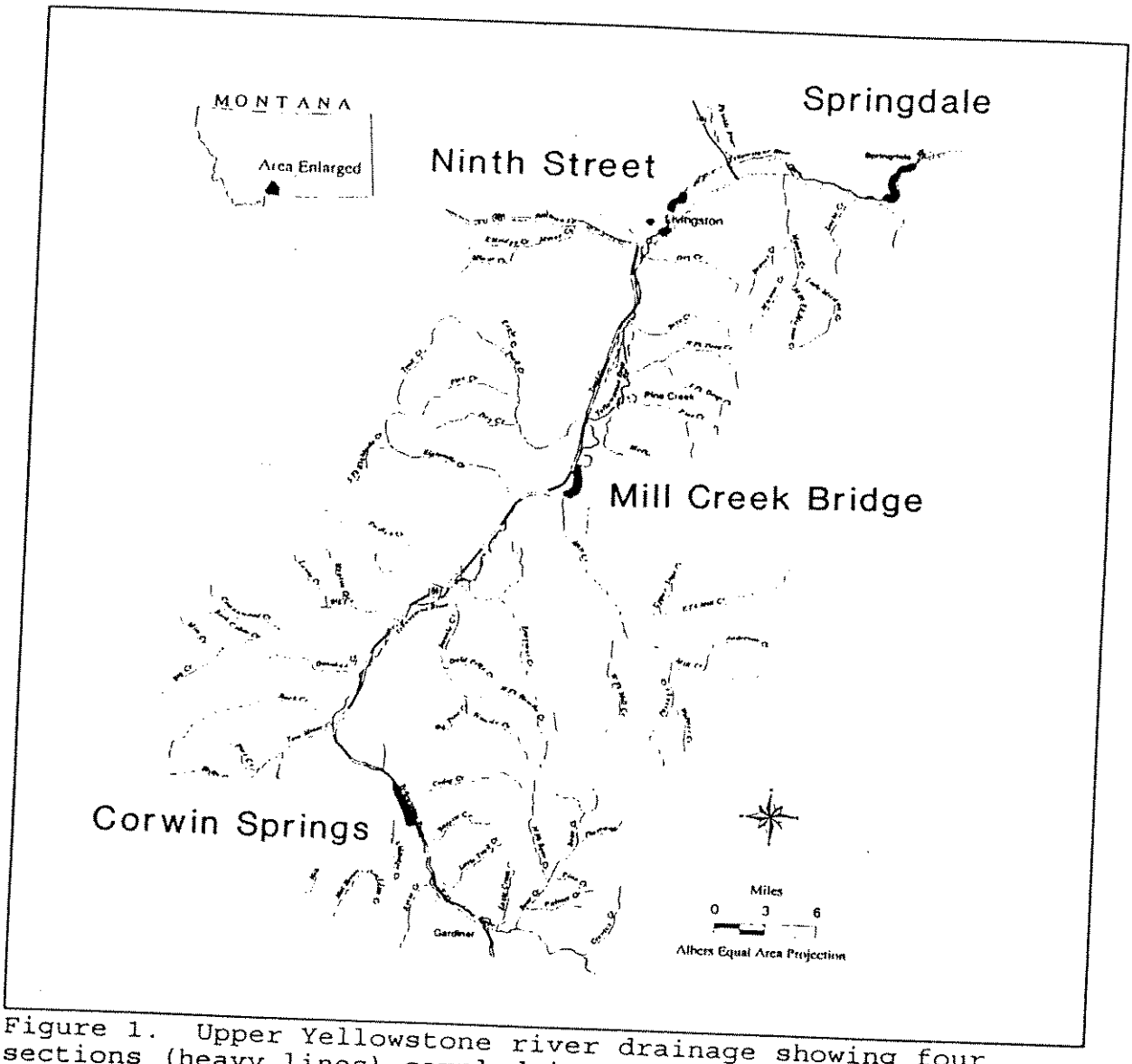


Figure 1. Upper Yellowstone river drainage showing four sections (heavy lines) sampled in spring 1996 and 1997.

B. Estimates of brown trout and mountain whitefish abundance in the Todd section of the Shields river based on spring sampling in 1997.

Fish were sampled in the Todd section of the Shields river this spring (Figure 2). This is a new survey section, first sampled last year (Tohtz 1996a; Table 2). Sampling is intended to provide fisheries information from which to assess the effects of a side channel improvement project to be constructed soon in this area of the river. The side channel project was scheduled to be implemented last fall, but was delayed, allowing a second opportunity to sample fish before the project is completed.

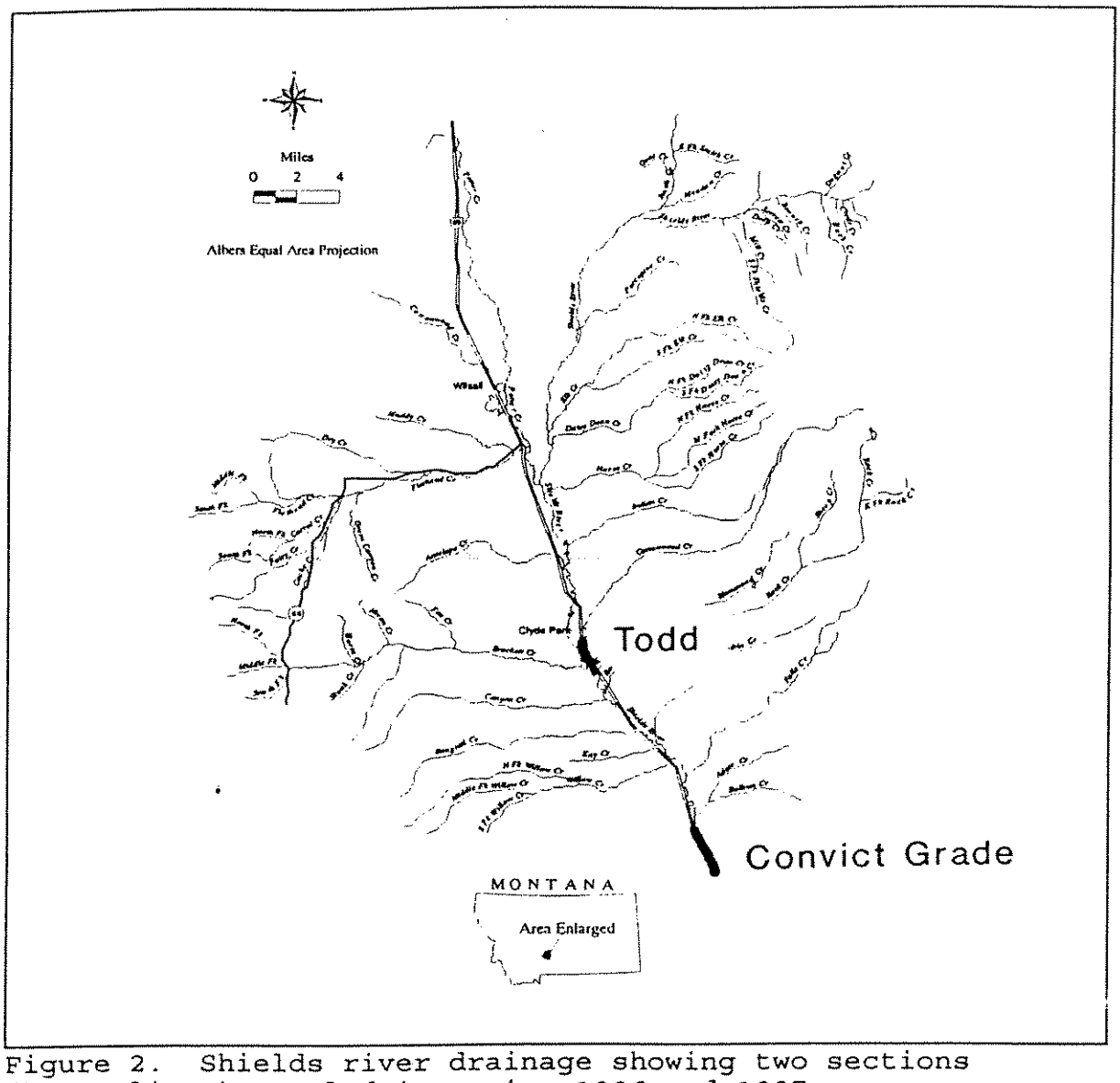


Figure 2. Shields river drainage showing two sections (heavy lines) sampled in spring 1996 and 1997.

Table 2. Survey section locations on the Shields river: 1996 and 1997.

| Section name | Length (feet) | Location\1 |
|---|---|---|
| Todd | 7,500 | T2N, R9E, S33 |
| Convict Grade | 7,724 | T1S, R10E, S22,23 |

1. Township, Range, Section

Fish were sampled with electrofishing gear mounted on a small drift boat. This gear included a 4,500 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 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 stream. Recapture sampling occurred conducted about two weeks later in each section.

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

C. Fish age and growth based on scale collections from fish caught in the Yellowstone river, the Shields river, and Dailey lake.

Age and growth were assessed this year from scales of fish caught in Dailey lake, two sections of the Shields river, and four sections of the mainstem Yellowstone river (Table 3). In each case the most recent scale sample available on acetate impressions was used for the analysis.

Table 3. Scale collections used to determine age and growth of fish caught in Dailey lake, the Shields river, and the Yellowstone river.

| Waterbody: Location | Species | Collection date | Sample size |
|---|---|---|---|
| Dailey lake | Rainbow trout | 4/23/97 | 28 |
| | Walleye | | 61 |
| | Yellow perch | | 44 |
| Shields river: | | | |
| Todd | Brown trout | 3/19/96 | 48 |
| Convict Grade | Brown trout | 3/20/96 | 39 |

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Table 3 (continued from page 8). Scale collections used to determine age and growth of fish caught in Dailey lake, the Shields river, and the Yellowstone river.

| Waterbody: Location | Species | Collection date | Sample size |
|---|---|---|---|
| Yellowstone river: | | | |
| Corwin | Rainbow trout | 4/10/96 | 94 |
| | Brown trout | | 73 |
| | Cutthroat trout | | 110 |
| Mill creek | Rainbow trout | 4/9/96 | 81 |
| | Brown trout | | 85 |
| | Cutthroat trout | | 66 |
| Ninth Street | Rainbow trout | 4/5/96 | 185 |
| | Brown trout | | 141 |
| | Cutthroat trout | | 39 |
| Springdale | Rainbow trout | 4/4/96 | 174 |
| | Brown trout | | 128 |
| | Cutthroat trout | | 107 |

Age was determined from the number of annuli on scales. Annuli were recognized by overcutting, changes in angle of formation, and circuli continuous between the anterior and posterior scale fields. The distance from the scale focus to each annulus and the scale edge was measured from acetate impressions projected on a microfiche reader. Annuli were considered fully formed only if circuli beyond the annulus suggested renewed growth.

Growth was estimated using a linear model approach to backcalculate fish lengths at the formation of each annulus (Weisberg 1986). This approach uses scale measurements as the observed data, and models fish growth as the sum of age effects and yearly variation in the environment (Weisberg and Frie 1987). Scale data were processed using software for this purpose produced by Minnesota Sea Grant, University of Minnesota (Weisberg 1989). The adequacy of data fit to this model was evaluated at alpha = 0.05.

D. Spring gillnet catches from Dailey lake in 1997.

Gillnet sampling in 1997 at Dailey lake mimicked previous spring sampling: a single overnight set using two floating and two sinking experimental gillnets (Shepard 1993) determined the entire sample. Results from the 1997 sample are compared to earlier gillnet catches.

E. Summary of warmwater fish management goals at Dailey lake for the ten year period 1997 to 2006

In March, 1996, FWP initiated the development of a new statewide warmwater fish management plan (Anon. 1996). This plan is intended to guide management direction for the next ten years. The planning effort included an internal (FWP) identification of issues, a refinement of the planning process, and the preparation of regional warmwater fisheries summaries. Public comment was solicited by a questionnaire mailed along with information about the planning process that included regional warmwater fish summaries (Anon. 1996). In addition, an angler advisory group was formed to participate directly in the planning process with regional supervisors from FWP. Management goals developed from this planning process are discussed for Dailey lake.

F. Whirling disease samples and test results for fish collected in Park County in 1996 and 1997.

In 1996 a single rainbow trout caught in the Ninth Street section of the Yellowstone river tested possible for Myxoblous cerebralis (Tohtz 1996a), but the sample was inadequate to conclusively establish the identity of the spore. Further sampling in 1996 and 1997 has confirmed that the parasite is present in the Yellowstone river drainage. As part of a statewide effort to document new infestations and to track the spread of whirling disease in Montana, many samples of fish from the Yellowstone river and its tributaries have been collected and tested for the presence of the Myxobolus parasite. Because of local interest in the status of this disease in the drainage, a summary of fish collections and whirling disease test results from recent samples is provided below.

## RESULTS AND DISCUSSION

### A. Estimates of rainbow, brown, and cutthroat trout abundance in four sections of the Yellowstone river based on spring sampling in 1997.

Most data for rainbow, brown, and cutthroat trout from each of the four sections sampled in 1997 fit the log-likelihood model well (Table 4). Brown trout information from the Mill Creek Bridge and Springdale sections modelled at probability values less than 0.05, probably because changing river conditions allowed better success catching this species during recapture surveys than we were able to achieve when marking the fish. No estimate of cutthroat abundance was possible in the Ninth Street section this year because too few cutthroat were captured at this location.

Table 4. Trout/mile in four sections of the Yellowstone river based on spring sampling in 1997. Estimates are for fish seven inches (TL) or longer.

| Section (mark date): | | | Overall model | | | Pooled model | | |
|---|---|---|---|---|---|---|---|---|
| Species | N | SD | DF | Chi-square | P | DF | Chi-square | P \1 |
| Corwin Springs (April 16): | | | | | | | | |
| RB | 494 | 118.3 | 7 | 6.86 | 0.44 | 5 | 5.62 | 0.35 |
| LL | 164 | 35.6 | 5 | 2.80 | 0.73 | 3 | 2.79 | 0.42 |
| YCT | 257 | 43.7 | 5 | 7.06 | 0.22 | 4 | 6.99 | 0.14 |
| Mill Creek Bridge (April 9): | | | | | | | | |
| RB | 150 | 18.1 | 7 | 9.11 | 0.24 | 7 | 9.11 | 0.24 |
| LL | 301 | 52.4 | 10 | 28.44 | < 0.01 | 6 | 21.31 | < 0.01 |
| YCT | 72 | 12.7 | 6 | 3.07 | 0.80 | 4 | 2.15 | 0.71 |
| Ninth St (April 5): | | | | | | | | |
| RB | 1035 | 163.4 | 6 | 4.97 | 0.55 | 6 | 4.97 | 0.55 |
| LL | 319 | 56.9 | 8 | 5.91 | 0.66 | 4 | 3.43 | 0.49 |
| YCT | ---------- | | no estimate | | | ---------- | | |
| Springdale (April 4): | | | | | | | | |
| RB | 283 | 39.3 | 7 | 6.47 | 0.49 | 5 | 6.24 | 0.28 |
| LL | 411 | 85.3 | 9 | 22.47 | < 0.01 | 5 | 11.43 | 0.04 |
| YCT | 95 | 47.6 | 4 | 1.04 | 0.90 | 1 | 0.67 | 0.41 |

1. Species: RB=rainbow, LL=brown, YCT= cutthroat trout; N=estimated number; SD=standard deviation; DF=degrees of freedom; P=probability value.

Rainbow and cutthroat trout numbers this year in the Corwin Springs and Mill Creek Bridge sections were similar to estimates from previous years (Figure 3; Figure 4). Brown trout abundance was also similar to estimates from the 1995 and 1996 surveys

($P < 0.05$ in the Mill Creek section in 1997; Figure 5). Brown trout numbers, especially in the Corwin Springs section, appear to have declined slightly over the last three years when compared to surveys made before 1995 (Figure 5). This possibility was noted in earlier reports (Tohtz 1996a; Tohtz 1996b). However, no statistically meaningful decline can be demonstrated from the data at this point. The abundance of all trout species will continue to be monitored each year in these upstream sections to determine population trends.

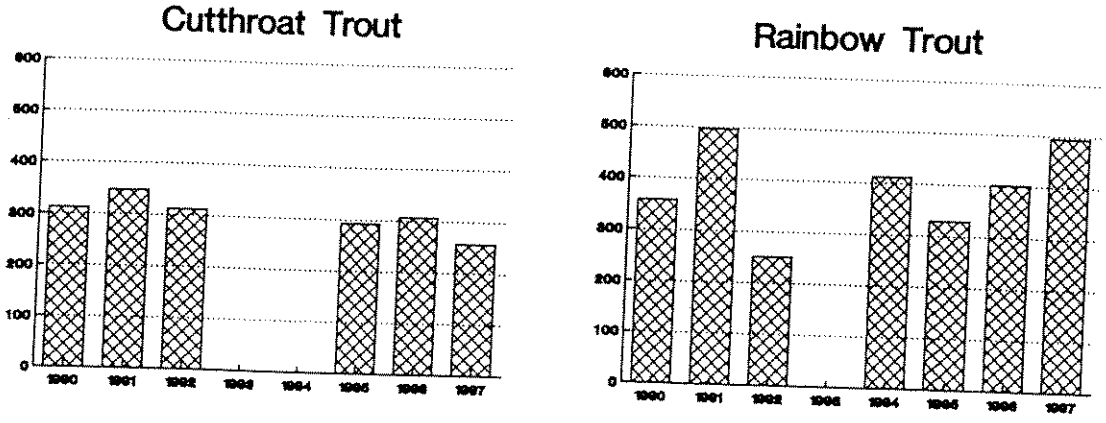


Figure 3. Cutthroat and rainbow trout abundance in the Corwin Springs section of the Yellowstone river based on spring sampling from 1990 to 1997. Vertical scales are fish/mile.

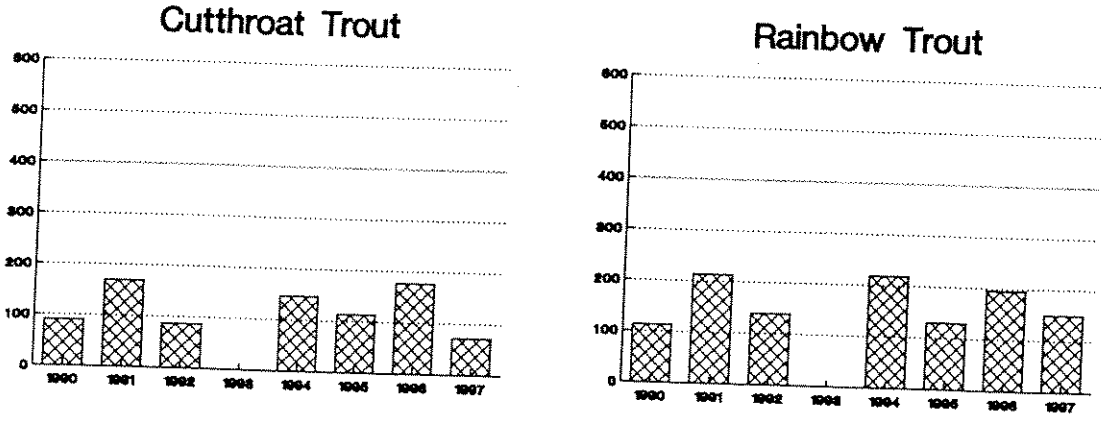


Figure 4. Cutthroat and rainbow trout abundance in the Mill Creek Bridge section of the Yellowstone river based on spring sampling from 1990 to 1997. Vertical scales are fish/mile.

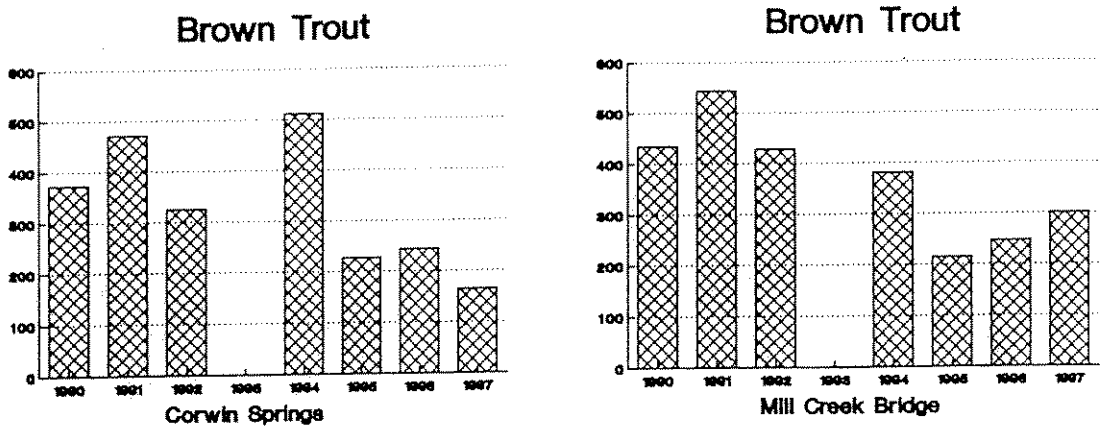


Figure 5. Brown trout abundance in the Corwin Springs and Mill Creek Bridge sections of the Yellowstone river based on spring sampling from 1990 to 1997. Vertical scales are fish/mile.

Cutthroat, rainbow, and brown trout abundance in the Springdale section ($P < 0.05$ for brown trout), and rainbow and brown trout abundance in the Ninth Street section, was similar in 1997 in all cases to estimates from previous years (Figure 6; Figure 7; Figure 8). In general, large scale flooding in the spring of 1996 has not yet had appreciable effects on trout abundance, although fish distributions may have changed. Our low success capturing cutthroat trout in the Ninth Street section, for example, remains a concern for future sampling efforts in this area of the river.

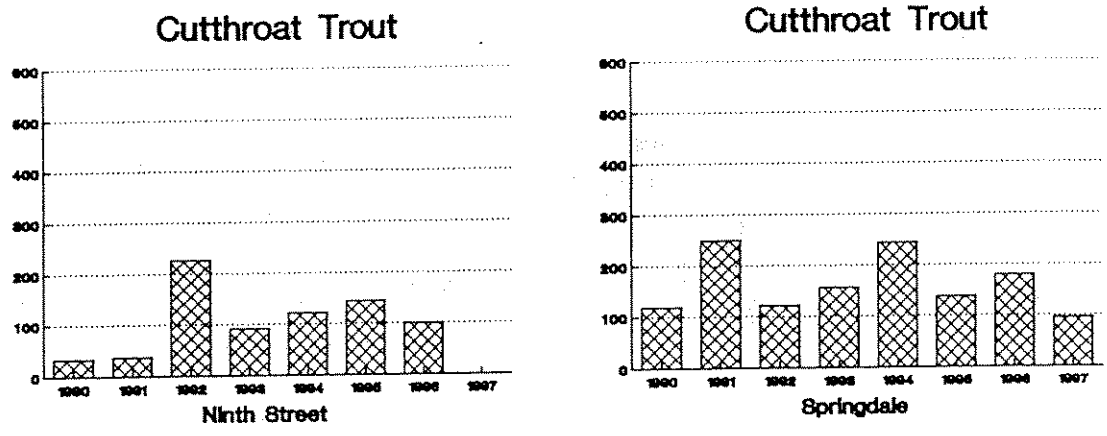


Figure 6. Cutthroat abundance in the Ninth Street and Springdale sections of the Yellowstone river based on spring sampling from 1990 to 1997. Vertical scales are fish/mile.

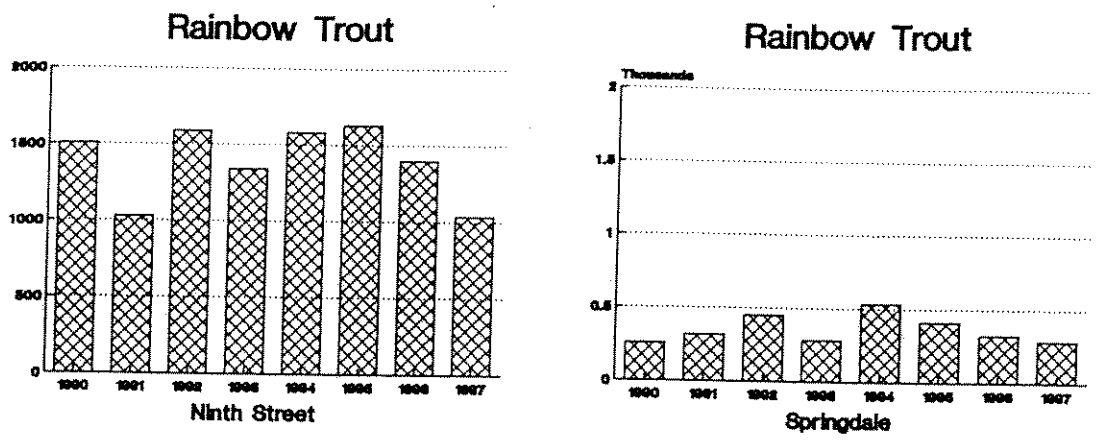


Figure 7. Rainbow trout abundance in the Ninth Street and Springdale sections of the Yellowstone river based on spring sampling from 1990 to 1997. Vertical scales are fish/mile.

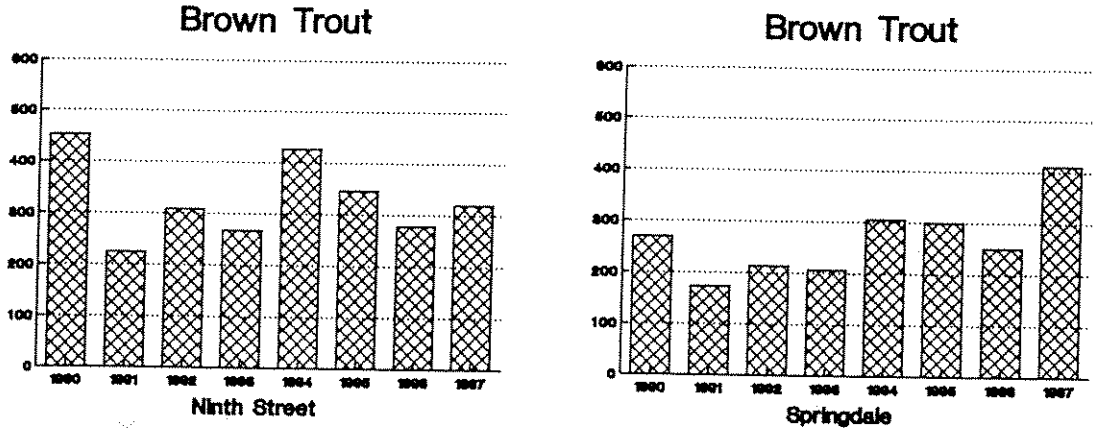


Figure 8. Brown trout abundance in the Ninth Street and Springdale sections of the Yellowstone river based on spring sampling from 1990 to 1997. Vertical scales are fish/mile.

The number of rainbow trout between six and twelve inches in the Ninth Street section of the Yellowstone river (the section of the upper river with the highest abundance of whirling disease susceptible rainbow trout) is similar this year to numbers estimated each year since 1990 (Tohtz 1996a; Tohtz 1996b; Figure 9). Healthy recruitment and survivorship of young fish that was apparent last year (Tohtz 1996a) continues in this area of the river, despite the recent detection of Myxobolus cerebralis in the drainage.

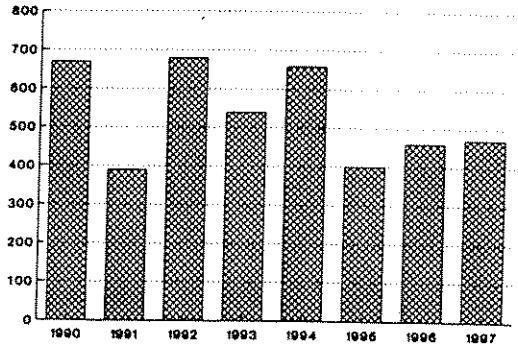


Figure 9. Abundance of rainbow trout between six and twelve inches (TL) in the Ninth Street section of the Yellowstone river based on spring sampling from 1990 to 1997. Vertical scale is fish/mile.

B. Estimates of brown trout and mountain whitefish abundance in the Todd section of the Shields river based on spring sampling in 1997.

Numbers of brown trout greater than seven inches in the Todd section were similar to numbers obtained in spring sampling in 1996 (Tohtz 1996b; Table 5). Smaller fish again were conspicuously absent from the samples: the majority of brown trout were 12 inches or larger (Figure 11).

Table 5. Brown trout and mountain whitefish number/1,000 feet in the Todd section of the Shields river based on spring sampling in 1997. Estimates are for fish seven inches (TL) or longer.

| Reach (mark date): | | | Overall model | | | Pooled model | | |
|---|---|---|---|---|---|---|---|---|
| Species | N | SD | DF | Chi-square | P | DF | Chi-square | P \1 |
| Todd (March 19, 1996): | | | | | | | | |
| LL | 37 | 17.2 | 4 | 7.14 | 0.13 | 1 | 0.44 | 0.51 |
| Todd (March 26, 1997): | | | | | | | | |
| LL | 47 | 29.4 | 5 | 5.11 | 0.40 | 3 | 2.42 | 0.49 |
| MWF | 205 | 73.0 | 4 | 5.38 | 0.25 | 3 | 5.38 | 0.15 |

1. Species: LL=brown trout, MWF=mountain whitefish; N=estimated number; SD=standard deviation; DF=degrees of freedom; P=probability value.

Mountain whitefish were three to four times as abundant as brown trout at this location in 1997 (Table 5). The size distribution of mountain whitefish in the sample was much more uniform than the size distribution of brown trout (Figure 10). Local recruitment appears to be better established for mountain whitefish than brown trout in this area of the river.

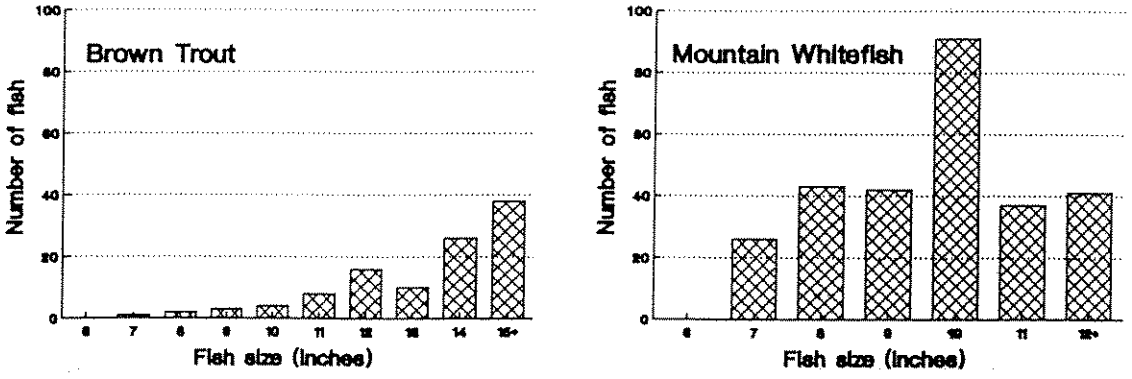


Figure 10. Length frequency distributions of brown trout and mountain whitefish caught in the Todd section of the Shields river, spring 1997.

C. Fish age and growth based on scale collections from fish caught in the Yellowstone river, the Shields river, and Dailey lake.

1. Yellowstone river:

Growth performance of rainbow, brown, and cutthroat trout was similar for each species in all four areas of the river sampled in 1996 (Table 6; Figure 11; Figure 12; Figure 13). A tendency for rainbow and brown trout to grow relatively slower in earlier years in the Ninth Street section compared to the other river areas (Figure 14) may be a local response to the much greater abundance of trout in the Ninth Street section (Part A, above).

Table 6. Mean length at annulus formation for rainbow, brown, and cutthroat trout sampled from the Yellowstone river in 1996.

| Location: (sample date) / Species | | Annulus 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Corwin Springs: (April 10, 1996) | | | | | | | |
| Rainbow | L:\1 | 8.1 | 10.9 | 14.2 | 16.2 | 18.4 | ---- |
| | SD: | 0.6 | 0.8 | 1.0 | 1.1 | 1.4 | ---- |
| | N: | 7 | 22 | 44 | 14 | 2 | ---- |
| Brown | L: | 8.3 | 11.8 | 14.9 | 17.1 | ---- | ---- |
| | SD: | 1.2 | 1.5 | 1.7 | 2.1 | ---- | ---- |
| | N: | 32 | 20 | 19 | 2 | ---- | ---- |
| Cutthroat | L: | 8.9 | 11.8 | 14.1 | 16.0 | ---- | ---- |
| | SD: | 0.4 | 0.5 | 0.5 | 1.0 | ---- | ---- |
| | N: | 18 | 50 | 40 | 2 | ---- | ---- |
| Mill Creek Bridge: (April 9, 1996) | | | | | | | |
| Rainbow | L: | 7.2 | 9.9 | 12.9 | 14.9 | ---- | ---- |
| | SD: | 0.7 | 1.0 | 1.2 | 1.4 | ---- | ---- |
| | N: | 21 | 37 | 11 | 12 | ---- | ---- |
| Brown | L: | 7.6 | 11.2 | 14.9 | 16.4 | 19.0 | ---- |
| | SD: | 1.0 | 1.4 | 1.6 | 1.8 | 2.1 | ---- |
| | N: | 25 | 22 | 19 | 17 | 2 | ---- |
| Cutthroat | L: | 7.2 | 10.5 | 12.7 | 15.2 | ---- | ---- |
| | SD: | 0.9 | 1.1 | 1.4 | 1.6 | ---- | ---- |
| | N: | 6 | 38 | 19 | 3 | ---- | ---- |
| Ninth Street: (April 5, 1996) | | | | | | | |
| Rainbow | L: | 6.3 | 8.2 | 10.5 | 13.8 | 16.6 | ---- |
| | SD: | 0.6 | 0.7 | 0.9 | 1.0 | 1.2 | ---- |
| | N: | 8 | 23 | 98 | 48 | 8 | ---- |
| Brown | L: | 6.2 | 9.2 | 11.2 | 15.3 | 18.7 | ---- |
| | SD: | 0.6 | 0.8 | 0.9 | 1.0 | 1.2 | ---- |
| | N: | 9 | 22 | 60 | 43 | 7 | ---- |
| Cutthroat | L: | 9.0 | 10.9 | 12.9 | 14.7 | ---- | ---- |
| | SD: | 0.3 | 0.3 | 0.4 | 0.4 | ---- | ---- |
| | N: | 4 | 17 | 11 | 7 | ---- | ---- |

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1 L=length (in); SD=standard deviation (in); N=sample size

Table 6 (continued from page 17). Mean length at annulus formation for rainbow, brown, and cutthroat trout sampled from the Yellowstone river in 1996.

| Location: (sample date) | | Annulus | | | | | |
|---|---|---|---|---|---|---|---|
| Species | | 1 | 2 | 3 | 4 | 5 | 6 |
| Springdale: (April 4, 1996) | | | | | | | |
| Rainbow | L:\1 | 7.3 | 9.8 | 11.8 | 13.9 | 15.9 | 17.2 |
| | SD: | 0.4 | 0.6 | 0.7 | 0.8 | 0.8 | 1.0 |
| | N: | 6 | 29 | 58 | 56 | 22 | 3 |
| Brown | L: | 6.8 | 9.5 | 11.6 | 14.4 | 16.7 | 18.4 |
| | SD: | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| | N: | 2 | 28 | 13 | 60 | 17 | 8 |
| Cutthroat | L: | 8.4 | 10.9 | 13.0 | 14.6 | 17.1 | ---- |
| | SD: | 0.6 | 0.7 | 0.8 | 0.8 | 1.0 | ---- |
| | N: | 4 | 20 | 63 | 18 | 2 | ---- |

1 L=length (in); SD=standard deviation (in); N=sample size

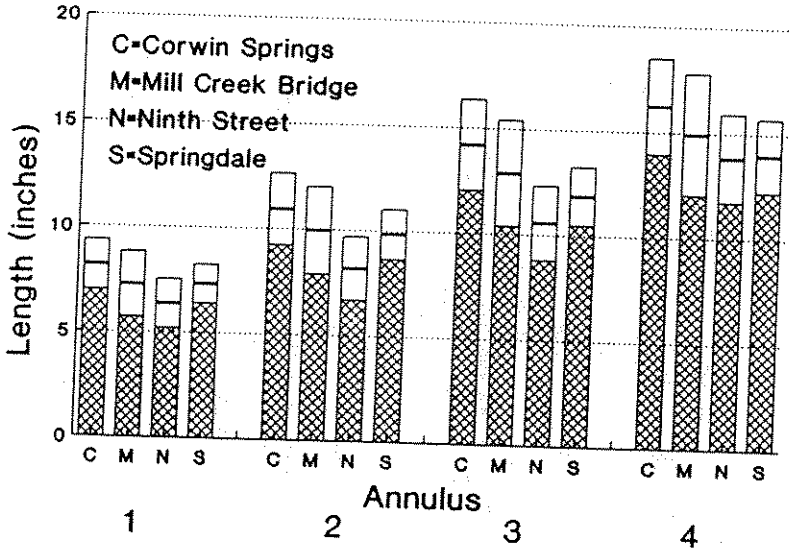


Figure 11. Mean length at annulus formation for rainbow trout from four sections of the Yellowstone river sampled in 1996. Open intervals are plus or minus 2 SD of each mean.

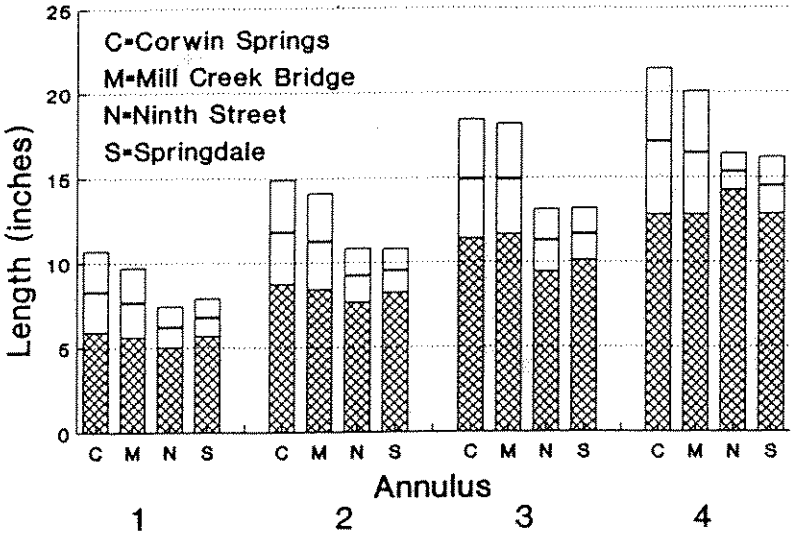


Figure 12. Mean length at annulus formation for brown trout from four sections of the Yellowstone river sampled in 1996. Open intervals are plus or minus 2 SD of each mean.

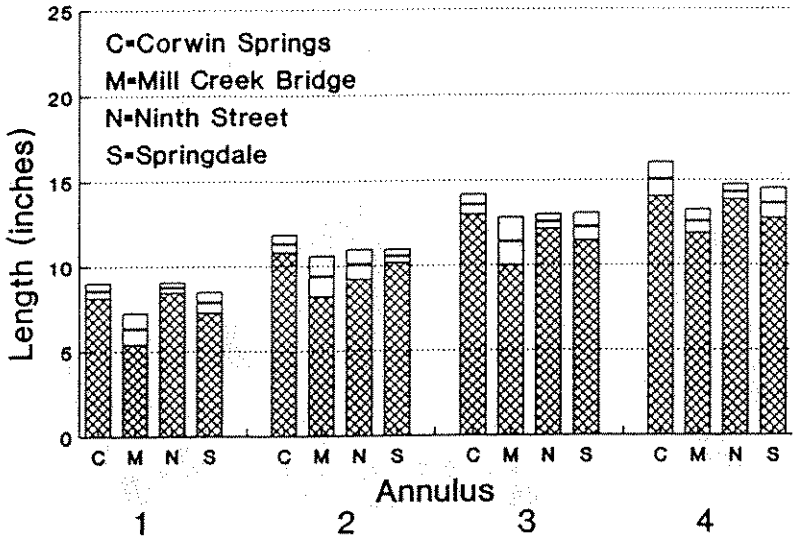


Figure 13. Mean length at annulus formation for cutthroat trout from four sections of the Yellowstone river sampled in 1996. Open intervals are plus or minus 2 SD of each mean.

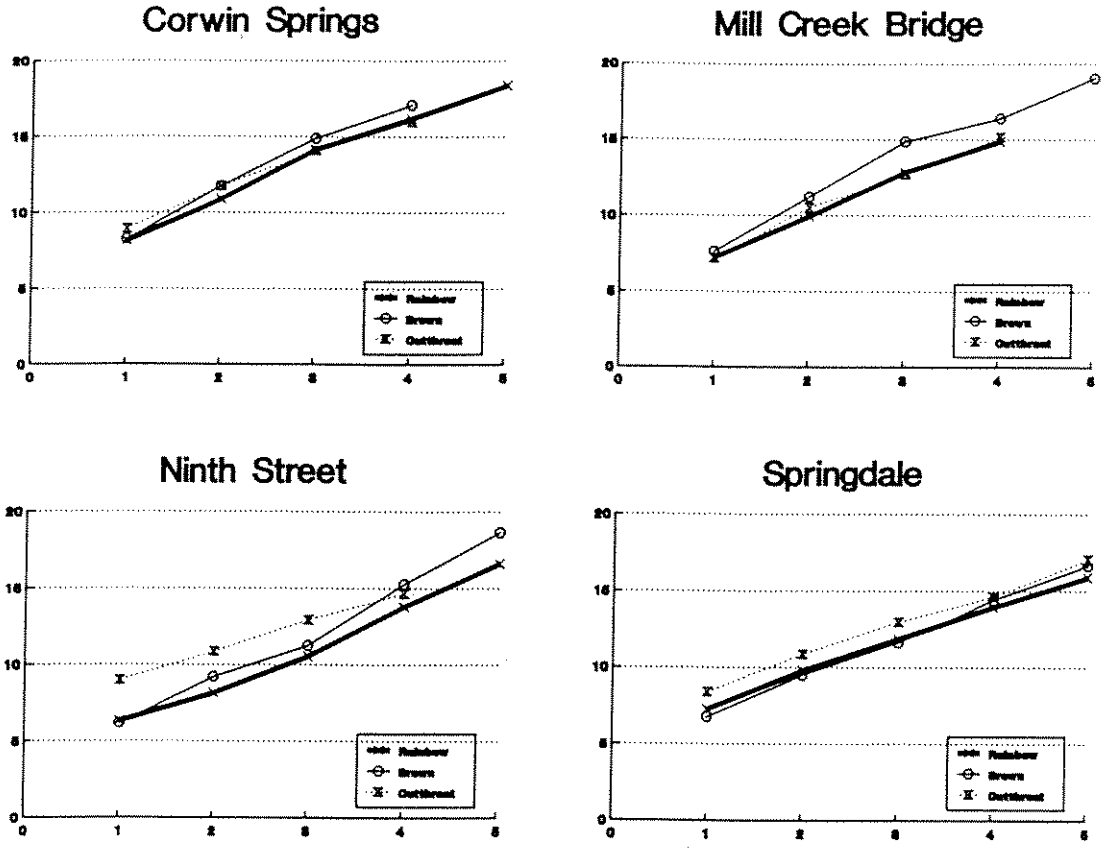


Figure 14. Mean length at annulus formation for rainbow, brown, and cutthroat trout from four sections of the Yellowstone river sampled in 1996. Horizontal scales show annulus number; vertical scales show fish length (inches).

2. Shields river:

Brown trout grew similarly in the Todd and Convict Grade sections of the Shields river in 1996, based on scale samples from both locations (Figure 15). Their growth was also similar to brown trout growth in the Yellowstone mainstem (Part C, number 1, above). The Convict Grade section occurs near the mouth of the Shields river and an exchange of fish between the two rivers would be expected. The Todd section, however, occurs about twenty river miles upstream from the mouth of the Shields river, and a concrete diversion structure spanning the Shields river forms a partial fish passage barrier between the Todd section and the Yellowstone river. Fish sampling to date in the Todd section suggests that brown trout move into the Todd section from other river areas (Tohtz 1996a; Part B, above). Despite physical obstacles and distance, it is possible that at least some of the

fish moving into the Todd section originate from the Yellowstone river.

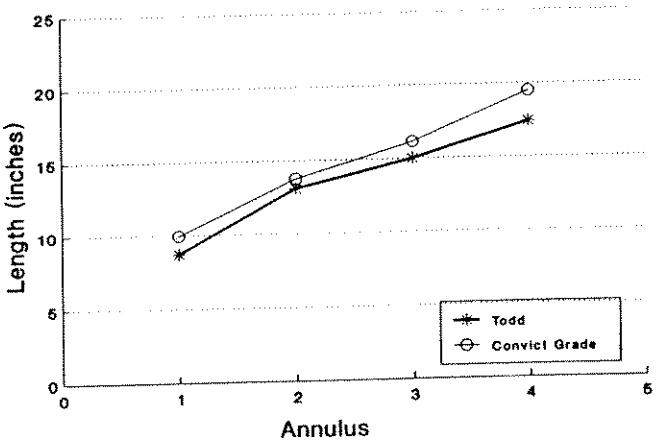


Figure 15. Mean length at annulus formation for brown trout caught in the Todd and Convict Grade sections of the Shields river in 1996.

3. Dailey lake

Scale analyses of yellow perch and walleye from Dailey lake show both species growing at rates very typical for these fish in Montana waters (e.g., Brown 1971; Figure 16). Steady, if conventional, growth of both species is one indication that stocking rates of walleye and rainbow trout each year (Table 7) do not exceed numbers at which unwanted growth suppressions might occur.

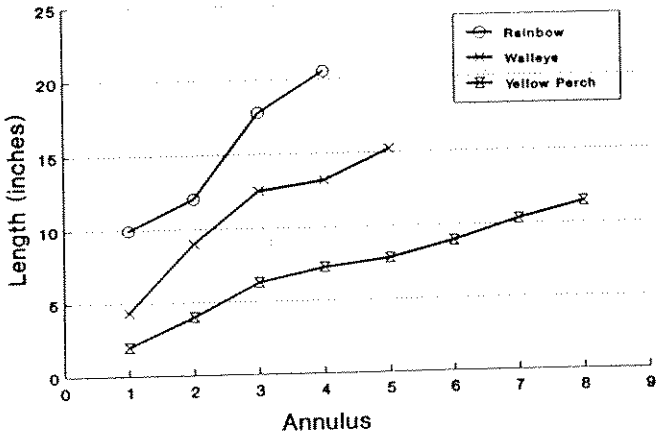


Figure 16. Mean length at annulus formation for yellow perch, walleye, and rainbow trout sampled from Dailey lake in 1997.

Table 7. Numbers of walleye and rainbow trout stocked in Dailey lake from 1990 to 1996.

| Year | Species | Variety | Number | Mean length (in) |
|---|---|---|---|---|
| 1990 | Walleye | | 775 | 7.7 |
| | Walleye | | 2,210 | 8.5 |
| | Walleye | Fort Peck | 688 | 4.5 |
| | Walleye | | 3,316 | 4.7 |
| | Walleye | | 3,780 | 4.1 |
| | Rainbow | Arlee | 20,026 | 4.3 |
| | Rainbow | Eagle Lake | 2,000 | 5.2 |
| 1991 | Walleye | Garrison | 9,918 | 1.9 |
| | Rainbow | Desmet | 2,000 | 5.4 |
| | Rainbow | Desmet | 1,532 | 6.9 |
| | Rainbow | Eagle Lake | 5,283 | 3.5 |
| | Rainbow | Eagle Lake | 3,480 | 4.4 |
| 1992 | Walleye | | 3,880 | 6.9 |
| | Walleye | Fort Peck | 10,000 | 1.1 |
| | Walleye | Fort Peck | 5,040 | 3.8 |
| | Rainbow | Desmet | 1,500 | 8.4 |
| | Rainbow | Eagle Lake | 15,769 | 3.2 |
| 1993 | Walleye | Fort Peck | 4,500 | 3.9 |
| | Walleye | Fort Peck | 10,000 | 1.2 |
| | Rainbow | Desmet | 5,000 | 6.3 |
| | Rainbow | Eagle Lake | 5,178 | 3.7 |
| 1994 | Walleye | Fort Peck | 10,000 | 7.2 |
| | Walleye | | 561 | 6.0 |
| | Walleye | Fort Peck | 5,175 | 4.0 |
| | Walleye | | 2,719 | 2.0 |
| | Rainbow | Desmet | 5,244 | 6.6 |
| | Rainbow | Eagle Lake | 10,050 | 4.3 |
| 1995 | Walleye | Fort Peck | 10,000 | 1.4 |
| | Walleye | Fort Peck | 4,930 | 3.8 |
| | Rainbow | Desmet | 4,992 | 5.9 |
| | Rainbow | Eagle Lake | 9,990 | 4.1 |
| 1996 | Walleye | Fort Peck | 10,800 | 1.5 |
| | Rainbow | Desmet | 5,280 | 5.2 |
| | Rainbow | Eagle Lake | 10,049 | 3.8 |

Rainbow trout grew especially well in Dailey lake, based on analysis of the 1997 scale samples (Figure 16). This excellent growth occurred after stocking rates of hatchery fish had been held essentially constant for several years (Table 7). Current

stocking rates, in combination with existing lake conditions apparently favor trout growth.

In 1996 and 1997, rainbow trout have been observed for the first time using the sixmile irrigation ditch that delivers water to Dailey lake as a new area for spawning. Natural reproduction of rainbow trout is occurring now in that ditch, and possibly along the lake shore as well. An unknown number of new fish is being added to the lake each year. For this reason alone, a conservative approach to modifying the stocking program at Dailey lake is warranted until future growth trends can be determined. Actions that might suppress current growth rates, such as significantly increasing the numbers of rainbow trout or walleye stocked each year, would be especially difficult to justify at this time.

D. Spring gillnet catches at Dailey lake in 1997.

The average length of walleye and yellow perch continues to increase slightly each year in gillnet catches at Dailey lake (Table 8). Although their numbers caught each year have

Table 8. Summary of gillnet catches from Dailey lake based on spring sampling from 1990 to 1997.

| | | Rainbow trout | | Yellow Perch | | Walleye | |
|---|---|---|---|---|---|---|---|
| Year\1 | Set date | Fish/ net | Mean TL (in) | Fish/ net | Mean TL (in) | Fish/ net | Mean TL (in) |
| 1990 | 4/30 | 8.2 | 12.8 | 48.7 | 7.4 | 4.7 | 11.4 |
| 1991 | 5/14 | 5.3 | 14.8 | 21.8 | 7.5 | 3.0 | 12.0 |
| 1992 | 5/04 | 7.3 | 15.1 | 58.3 | 7.7 | 4.5 | 12.7 |
| 1993 | ---------- no information ---------- | | | | | | |
| 1994 | 5/12 | 9.3 | 15.2 | 32.3 | 8.7 | 11.5 | 11.3 |
| 1995 | 5/18 | 13.5 | 14.6 | 71.5 | 8.0 | 2.5 | 13.7 |
| 1996 | ---------- no information ---------- | | | | | | |
| 1997 | 4/23 | 9.8 | 17.4 | 35.8 | 8.8 | 15.3 | 14.6 |

1. Data summaries 1990 to 1992 are from Shepard 1993.

varied, sometimes considerably, basic trends in species abundance are becoming clearer as this sampling is repeated:

Yellow perch have exhibited the most variability in numbers caught each year (Table 8). However, trend information based on gillnet success shows that their long-term abundance is similar each year since at least 1990 (Figure 17). This constancy is one indication of population stability. In contrast, walleye show evidence of increasing abundance (Figure 17), a cause for concern if their predation rates also increase enough to harm other populations of fish. However, no information at this time indicates that walleye abundance is detrimental; their predation on yellow perch likely contributes to the stability of numbers and increasing average size of yellow perch apparent since 1990.

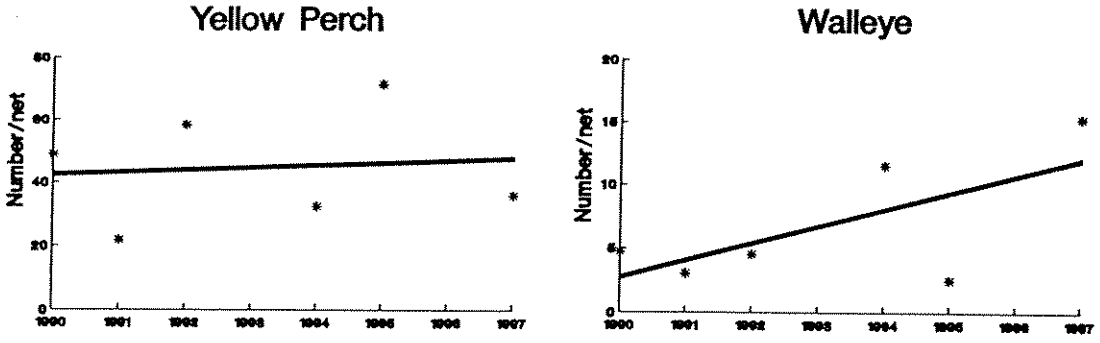


Figure 17. Trend in numbers of fish caught in gillnets at Dailey lake 1990 to 1997. Trend lines are least squares linear regressions. Vertical scales differ.

The average size of rainbow trout continues to increase in gillnet samples (Table 8). The numbers of fish caught in each net has also increased for several years suggesting increasing abundance (Figure 18), although this trend may have slowed in 1997 (Table 8). Recent natural spawning success of rainbow trout at Dailey lake may account for increasing fish abundance. This same phenomenon could also affect current population equilibria, perhaps favorably, if significant numbers of new fish survive in addition to those contributed from the hatcheries.

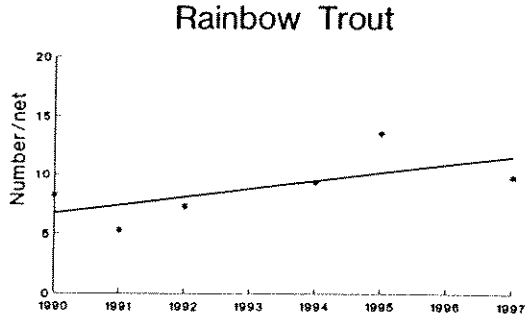


Figure 18. Trend in numbers of rainbow trout caught in gillnets at Dailey lake 1990 to 1997. Trend line is a least squares linear regression.

E. Summary of warmwater fish management goals at Dailey lake for the ten year period 1997 to 2006.

Montana's new warmwater fish management plan identifies Dailey lake as one of only three waterbodies in FWP Region Three (the southwest corner of Montana) with plans that include warm water fish. Management objectives for the next ten years are "to provide the best recreational fishery that Dailey lake can reasonably support using trout, walleye, and yellow perch" (Anon. 1997). Stocking rates for rainbow trout and walleye will continue at 10,000 to 15,000 fry each year, but can be adjusted downwards if necessary to improve fish growth. Yellow perch abundance remains the primary index of management success: adjustments in stocking rates of rainbow trout and walleye will be made to avoid an over-abundance of small sized perch.

F. Whirling disease samples and test results for fish collected in Park County in 1996 and 1997.

Fish have recently been collected from many areas in Park County to test for whirling disease (Table 9). Initially this sampling was conducted on an exploratory basis: Myxobolus cerebralis was not known to occur in the Yellowstone river or its tributaries (e.g., Tohtz 1996b). Since detection of the parasite in the Yellowstone drainage, sampling has been focused somewhat more carefully to determine the extent and hopefully the origin of the infection in this river basin. Fish collections to test for whirling disease will be continued for these reasons.

Table 9. Fish collections and laboratory results for fish collected in Park County to test for whirling disease, 1996 and 1997.

| Waterbody | Sample date | Species | Number | Size range (inches) | Test results/1 |
|---|---|---|---|---|---|
| Yellowstone river: 1996 | | | | | |
| Corwin Springs | 4/26/96 | Rainbow | 4 | 2.9-6.6 | Negative |
| | | Brown | 4 | 5.0-6.0 | Negative |
| Mill Creek | 4/23/96 | Rainbow | 24 | 3.4-6.9 | Negative |
| Ninth Street | 11/27/96 | Brown | 7 | 4.0-5.2 | Negative |
| | | Cutthroat | 3 | 7.3-9.7 | Negative |
| | | Sculpin | 5 | 3.0-3.8 | Negative |
| | 12/3/96 | Rainbow | 4 | 3.8-5.5 | Negative |
| | | Sculpin | 9 | 2.6-3.8 | Negative |

continued page 26

1. For presence of Myxobolus cerebralis

Table 9 (continued from page 25). Fish collections and laboratory results for fish collected in Park County to test for whirling disease, 1996 and 1997.

| Waterbody | Sample date | Species | Number | Size range (inches) | Test results |
|---|---|---|---|---|---|
| Yellowstone river: 1996 | | | | | |
| Ninth Street | 4/5/96 | Rainbow | 40 | 3.1-13.7 | Positive \2 |
| | | Brown | 2 | 10.2,10.7 | Negative |
| | | Cutthroat | 2 | 8.2,8.5 | Negative |
| Springdale | 4/4/97 | Rainbow | 43 | 3.9-7.0 | Negative |
| Yellowstone river: 1997 | | | | | |
| Corwin Springs | 5/2/97 | Rainbow | 13 | 3.7-8.6 | Negative |
| Mill Creek | 4/30/97 | Rainbow | 60 | 2.4-6.5 | Negative |
| Ninth Street | 4/15/97 | Rainbow | 28 | 3.4-11.5 | Negative |
| Springdale | 4/14/97 | Rainbow | 28 | 4.3-7.0 | Negative |
| Other Park County locations: 1996 and 1997 | | | | | |
| Armstrong Spring Creek | 7/16/97 | Rainbow | 47 | 2.0-4.3 | Negative |
| | | Brown | 28 | 2.5-7.1 | Negative |
| Billman Creek | 4/7/97 | Cutthroat | 5 | 9.6-12.3 | Negative |
| | | Brown | 1 | 11.4 | Negative |
| Big Creek | 4/1/97 | Rainbow | 28 | 1.7-9.3 | Negative |
| | | RBxCT \3 | 5 | 5.5-9.1 | Negative |
| Cedar Creek | 3/27/97 | Rainbow | 3 | 6.9-7.9 | Negative |
| | | RBxCT | 15 | 1.7-5.7 | Negative |
| | | Brown | 7 | 5.1-8.7 | Negative |
| | | Brook | 6 | 5.1-11.5 | Negative |
| | | Cutthroat | 1 | 4.8 | Negative |
| DePuy Spring Creek mouth | 4/3/97, 6/2/97 | Rainbow | 16 | 3.0-7.8 | Positive \4 |
| | | Brown | 25 | 2.0-7.8 | Negative |

continued page 27

2. One fish, questionable.
3. Rainbow x cutthroat hybrid.
4. Six fish, confirmed.

Table 9 (continued from page 26). Fish collections and laboratory results for fish collected in Park County to test for whirling disease, 1996 and 1997.

| Waterbody | Sample date | Species | Number | Size range (inches) | Test results |
|---|---|---|---|---|---|
| DePuy's Spring Creek | 7/16/97 | Rainbow | 38 | 1.8-3.9 | Negative |
| | | Brown | 31 | 2.1-3.5 | Negative |
| | | Cutthroat | 1 | 3.4 | Negative |
| Fleshman Creek | 12/3/96 | Rainbow | 2 | 4.8,7.8 | Negative |
| | | Mountain whitefish | 53 | 4.1-5.4 | Negative |
| | 3/24/97 | RBxCT | 26 | 1.8-3.9 | Negative |
| | | Brook | 15 | 6.5-9.8 | Negative |
| | | Cutthroat | 1 | 10.0 | Negative |
| Mol Heron Creek | 4/1/97 | Rainbow | 33 | 1.7-9.0 | Negative |
| | | RBxCT | 6 | 2.6-7.0 | Negative |
| Nelson's Hatchery | 2/25/97 | Rainbow | 150 | 7.0-9.0 | Negative |
| Nelson's Spring Creek | 7/17/97 | Rainbow | 30 | 1.5-4.4 | Negative |
| | | Brown | 32 | 2.3-3.5 | Negative |
| Rainbow Springs Hatchery | 3/13/97 | Cutthroat | 60 | 7.5-12.4 | Negative |
| Rainbow Springs Hatchery | 3/24/97 | Cutthroat | 30 | 2.4-4.5 | Negative |
| | | Rainbow | 60 | 5.1-10.6 | Negative |
| Shields river | 4/3/97 | Cutthroat | 2 | 8.6,11.2 | Negative |
| | | Brown | 1 | 9.4 | Negative |
| | | Mountain whitefish | 2 | 4.2,7.4 | Negative |
| Tom Miner Creek | 3/25/97 | RBxCT | 29 | 1.9-7.2 | Negative |
| | | Brown | 6 | 6.8-7.8 | Negative |

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

| Common name | Scientific name |
|---|---|
| Brook trout | Salvelinus fontinalis |
| Brown trout | Salmo trutta |
| Mountain whitefish | Prosopium williamsoni |
| Rainbow trout | Oncorhynchus mykiss |
| Sculpin | Cottus bairdi |
| Walleye | Stizostedion vitreum |
| Yellow perch | Perca flavescens |
| Yellowstone cutthroat (cutthroat trout) | Oncorhynchus clarki bouvieri |