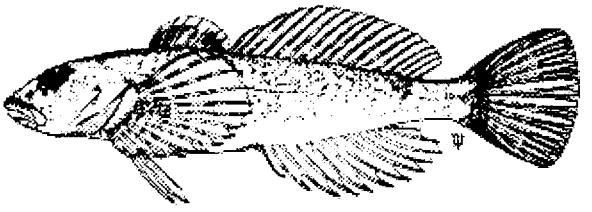
# DISTRIBUTION OF FISHES IN ALASKA'S UPPER BIRCH CREEK DRAINAGE DURING 1984, 1990 and 1995

By

Alan H. Townsend

Technical Report No. 96-4



Alaska Department of Fish & Game
Habitat and Restoration Division


May 1996

**The Alaska Department of Fish and Game administers all programs and activities free from discrimination on the basis of sex, color, race, religion, national origin, age, marital status, pregnancy, parenthood, or disability. For information on alternative formats available for this and other department publications contact the department ADA Coordinator (voice) 907/465-4120: (TTD) 907/478-3648. Any person who believes s/he has been discriminated against should write to: ADF&G, PO Box 25526, Juneau, AK 99802-5526 or O.E.O. U.S. Department of the Interior, Washington D.C. 20240.**

# DISTRIBUTION OF FISHES IN ALASKA'S UPPER BIRCH CREEK DRAINAGE DURING 1984, 1990 AND 1995

by

Alan H. Townsend

Technical Report No. 96-4

Janet Kowalski
Director
Habitat and Restoration Division
Alaska Department of Fish and Game
PO Box 25526
Juneau AK 99802-5526

May 1996

# Table of Contents

## List of Tables



## List of Figures

# Acknowledgments

I would like to thank Mr. Carl Lunderstadt for assisting with field data collection and preparation of the Birch Creek report. My thanks to Mr. Jim Vohden of the Alaska Department of Natural Resources for providing water quality data, to Ms. Sheree Warner for preparation of figures, and to Dr. Al Ott for assistance with and review of this report.

# Executive Summary

Mined and unmined streams in the Birch Creek drainage were sampled for the presence/absence of fish in 1984, 1990, and 1995. Numbers of Arctic grayling (*Thymallus arcticus*) and streams containing Arctic grayling increased from 1984 to 1990 and from 1990 to 1995. In 1995, additional fish species were found in 5 streams that had only Arctic grayling in 1990 and no fish or only Arctic grayling in 1984. Substantial improvements in water quality and mining practices resulted in lower turbidity and fewer fish barriers in streams during 1990 and 1995. It is postulated that increased presence of Arctic grayling and other fish species in the upper Birch Creek drainage was the result of improved water quality, better mining practices and fewer mines, reclamation of stream and riparian habitats, and enhanced fish passage in areas of active mining. Not only have there been increases in fish use but fish species diversity also has risen. We believe the key to future increases in fish use will be associated with the degree to which reclamation plans are developed and implemented.

# Introduction

Placer gold was discovered in the Birch Creek drainage in 1883. Some level of placer mining has occurred since the discovery, although activity was reduced during World War II and the 1960s. Mining activity increased along with gold prices during the mid-1970s and up to 80 operations were active on the upper reaches of Birch Creek during the 1980s (BLM 1988). The number of Annual Placer Mining Applications received by the state for authorization to mine in the Birch Creek drainage was 86 in 1985, 41 in 1990, and 46 in 1995.

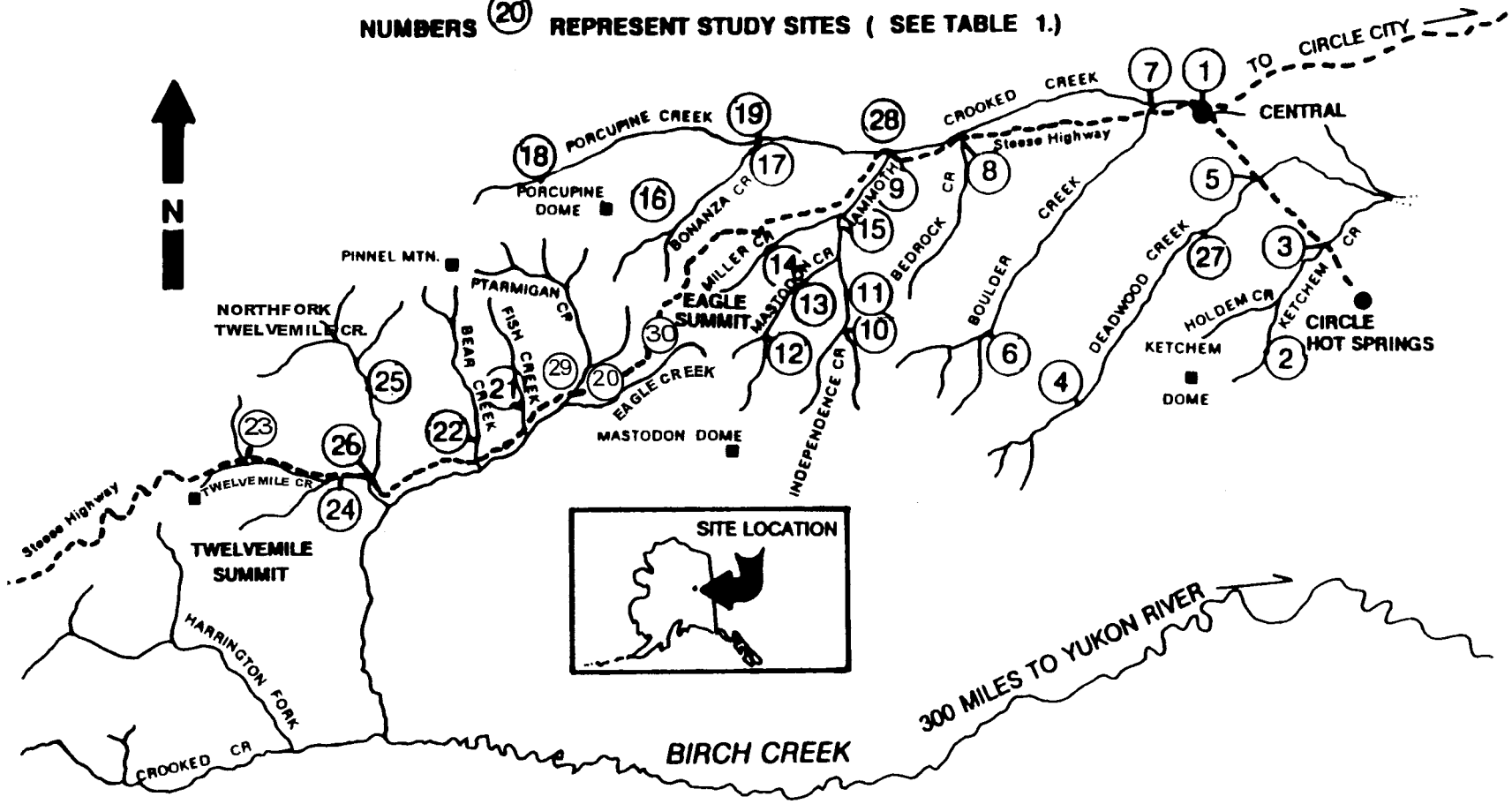
In 1984, the Alaska Legislature provided funding to the Departments of Fish and Game (ADF&G), Environmental Conservation (ADEC), and Natural Resources (ADNR) to assess the effects of placer mining on water quality and terrestrial and aquatic habitats. The three resource agencies selected the Birch Creek drainage as a study area because of its accessibility by road and the presence of multiple mining operations. Birch Creek is located in the Circle Mining District approximately 160 km (100 mi) northeast of Fairbanks, Alaska. Birch Creek is a clear, free-flowing stream that originates in the Yukon/Tanana uplands and flows 502 km (314 mi) to the Yukon River at a point 4.8 km (3 mi) south of the Arctic Circle (U.S. Department of Interior 1974).

The ADF&G component of the Birch Creek study included a determination of fish species present, an assessment of terrestrial and aquatic habitats, and an evaluation of benthic invertebrate densities and community structure. Results of ADF&G's 1984 field investigations were reported by Weber and Post (1985). They sampled 26 stream reaches on 16 different tributaries in the Birch Creek drainage (Figure 1). Seven of these streams had either not been mined within at least the last 50 years or had not been mined to a noticeable degree, and 9 streams had active or recent placer mining operations (Figure 2).

Since 1984, substantial changes have occurred in how placer mining operations are conducted. Recycling of wastewater with reduced discharges to aquatic systems, construction and maintenance of settling ponds outside of the active floodplain, and construction and maintenance of stream bypasses around active mine areas to facilitate fish passage are now used. Furthermore, reclamation of riparian and floodplain habitats became a requirement in 1992 under ADNR regulations (Figure 3).

# LOCATION OF SITES FOR PLACER STUDIES IN THE BIRCH CREEK WATERSHED

NUMBERS (20) REPRESENT STUDY SITES ( SEE TABLE 1.)




SCALE: 1:250,000

0 5 10 MILES

0 5 10 KILOMETERS

FIGURE 1.

**Figure 2. Unmined reach of Twelvemile Creek (Site #24) near confluence with North Fork Twelvemile Creek (top photo). Mined reach of Bonanza Creek in the Circle Mining District (bottom photo).**

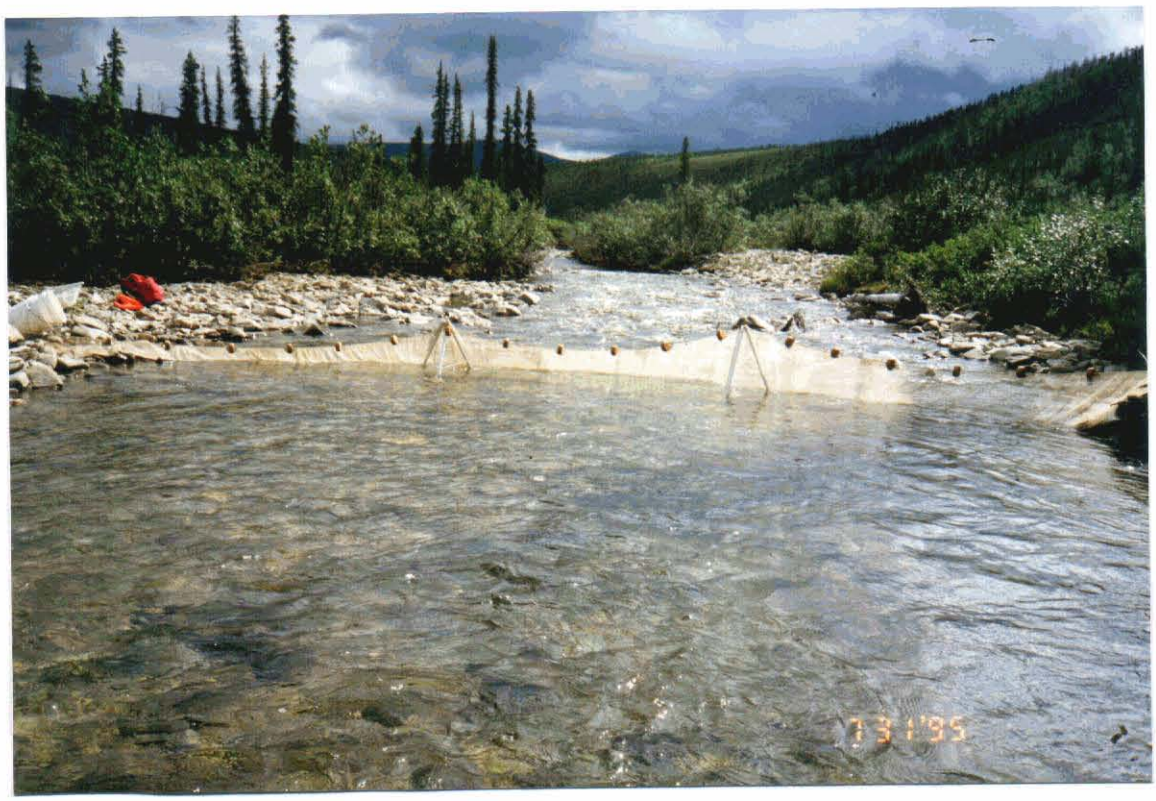


**Figure 3. Unstable sample reach in Porcupine Creek (top photo) following mining. A more stable sample reach in Bonanza Creek (bottom photo) following mining. Fish were present in both creeks.**

Because of improvements in mining practices, we postulated that changes in fish distribution within the Birch Creek drainage should have occurred since ADF&G's 1984 field investigation. Therefore, we developed a fisheries sampling program for summer 1990 to resample fish presence at the same study sites worked by Weber and Post in 1985. Our objective was to compare the catch, distribution, and species composition of fish in 1990 with those reported by Weber and Post. The number of fish using mined and unmined streams in 1990 had increased from what we found in 1984 (Townsend 1991). The encouraging results of the 1990 study prompted the 1995 fish resampling to determine if fisheries resources were continuing to recover in the most active placer mining district in Alaska.

## Methods and Sample Sites

Weber and Post (1985) used upstream and downstream block nets at each sample site. They then electrofished, from the upstream to the downstream block net, a 100 m reach with a Smith-Root Model 15-A electrofisher and captured all observed fishes. They used a single pass if no fish were observed. When fish were observed or collected, they made up to three passes with the electrofisher.

A Smith-Root Model 15-A electrofisher also was used to sample fish during 1990 and 1995. In 1990, electrofishing was conducted upstream through the sample reaches. Block nets were used only at the downstream end of the sample sites on Crooked Creek (Site #1) and Ketchem Creek (Site #2) where turbid water conditions would have prevented samplers from seeing stunned fish. At Crooked Creek (Site #1) and Ketchem Creek (Site #2), electrofishing proceeded from the upper end of the sample reach downstream to the block net. Water clarity allowed stunned fishes to be readily visible in the other sample sites. Electrofishing in 1995 was conducted using the same methods as Weber and Post (1985) except no upstream blocknet was used. Sampling was conducted July 23 to 25, 1990, and July 25 to August 1,1995, which corresponds closely with the beginning of the July 24 to August 29, 1984, sampling period used by Weber and Post.

Sample sites for the study were located in Crooked, Porcupine, Bonanza, Miller, Mammoth, Mastodon, Independence, Bedrock, Boulder, Ketchem, Deadwood, Ptarmigan, Fish, Bear, North Fork Twelvemile, Twelvemile, and Eagle Creeks (Figure 1). Sample sites in 1990 and 1995 were selected to coincide with the same sites sampled in 1984, except as noted.

Several readily recognizable changes had occurred within the 1984 sample sites that led to the selection of alternative sites for 1990 and 1995 sampling. Access to North Fork Twelvemile Creek (Site #25) was gained by helicopter in 1984 and was not accessible by four-wheel-drive vehicle in 1990. Ptarmigan Creek (Site #20) had exploratory placer mining conducted within the sample site after the 1984 study and Bates Creek had been diverted to facilitate an active placer mine that was adjacent to the site in 1995. A placer mine was in operation on Ketchem Creek (Site #2) in 1990 and access to this site was gated and locked in 1995. Between 1984 and 1990, the

Alaska Department of Transportation and Public Facilities channelized North Fork Twelvemile Creek immediately above Site #26 for erosion control at the Steese Highway bridge.

Alternate sample sites were chosen within about 100 m (328 ft) of the original sites on Independence and Miller Creeks. The 1990 alternate site on Mammoth Creek was about 1 km (0.6 mi) upstream from the 1984 site but the original stream reach had been reclaimed and was sampled in 1995. The alternate site on North Fork Twelvemile Creek was approximately 2 km (1.2 mi) downstream from the 1984 site. An additional site was added and worked on Ptarmigan Creek in 1990 (Site #29) about 0.8 km (0.5 mi) downstream of the 1984 site. No alternate sites were located to sample for fish presence on Ketchem Creek (Site #2) or Bonanza Creek (Site #16) in 1990.

In many cases, placer mining occurred in sites sampled in 1984 and 1990. Since 1984, placer mining had progressed through the Mammoth Creek (Site #9), Independence Creek (Sites #10 and 11), Mastodon Creek (Sites #12 and 13), Miller Creek (Site #15), Bonanza Creek (Sites #16 and #17), and Porcupine Creek (Site #18) sites.

A new site (mined) added in 1990 (Deadwood Creek [Site #27]) was resampled in 1995. Another new site (mined) was added in 1995, Eagle Creek (Site #30). Two of the 1984 sites were not sampled due to high water (Crooked Creek Site #1) and blocked access (Ketchem Creek Site #2). The Independence Creek Site #11 was being mined with recreational suction dredges and was not sampled.

# Results

During 1995, we sampled 23 of the sites originally worked in 1984 and caught fish in 22 (Table 1 and Appendix 1). During 1995, we caught Arctic grayling in Independence Creek (Site #10) and round whitefish (*Prosopium cylindraceum*) and Arctic grayling in Porcupine Creek (Site #18). The Porcupine (Site #18) and Independence (Site #10) Creek sites are upstream of the Crooked (Site #1) and Independence (Site #11) Creek areas that were sampled in 1995. These data suggest strongly that fish also were present in the Crooked (Site #1) and Independence (Site #11) Creek sites. Arctic grayling were found in more streams and in greater numbers within the Birch Creek drainage in 1995 than in 1990 (Table 1). Numbers of Arctic grayling captured increased from 1984 to 1995 (Figure 4).

In 1984, fish were caught in only one (Boulder Creek, Site #7) of nine streams where past or active mining was present. During 1990, we found fish in 6 of 10 mined streams. We caught fish in 9 of 10 mined streams in 1995 (Table 1). Fish were not found in Ketchem Creek (Site #3) during all sample years.

Unmined streams include North Fork Twelvemile, Twelvemile, Fish, Bear, and Ptarmigan Creeks, although some mining has occurred in Ptarmigan Creek since 1984. These streams are tributaries to upper Birch Creek which has been mined extensively. During 1990 and 1995, fish were in all these creeks but in 1984, fish were not found in Ptarmigan and Fish Creeks. Arctic grayling, round whitefish, and slimy sculpin (*Cottus cognatus*) were present in 1984 and 1990. Species diversity increased in 1990 when burbot (*Lota lota*) were captured.

Increased fish use and diversity have occurred in our Birch Creek sample sites since 1984. During 1984, 1990, and 1995, the number of 100 m stream reaches sampled in the Birch Creek drainage was 26, 24, and 25. Numbers of Arctic grayling, slimy sculpin, round whitefish, and burbot captured increased from 1984 to 1995 (Table 2). Two new species were captured in 1995: one longnose sucker (*Catastomus catostomus*) in Deadwood Creek and one juvenile chinook salmon (*Oncorhynchus tshawytscha*) in North Fork Twelvemile Creek.

**Table 1. Fish captured in the Birch Creek drainage (1984, 1990, and 1995).**

| Site No. | Creek | Location | 1984 AG | 1984 Other | 1990 AG | 1990 Other | 1995 AG | 1995 Other |
|---|---|---|---|---|---|---|---|---|
| 1 | Crooked | below mining | 0 | 0 | 8 | 0 | n/s | n/s |
| $2_a$ | Ketchem | above mining | 0 | 0 | n/s | n/s | n/s | n/s |
| 3 | Ketchem | below mining | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Deadwood | above mining | 0 | 0 | 0* | 0 | 11 | 0 |
| 5 | Deadwood | below mining | 0 | 0 | 16 | 0 | 5 | 3 |
| $27_b$ | Deadwood | mid way | n/s | n/s | 0 | 0 | 4* | 1 |
| 6 | Boulder | above mining | 0 | 0 | 0 | 0 | 11 | 0 |
| 7 | Boulder | below mining | 2 | 0 | 5 | 0 | 7 | 7 |
| 8 | Bedrock | not mined | 0 | 0 | 0 | 0 | 6 | 0 |
| $9_c$ | Mammoth | below Harrison Creek road | 0 | 0 | 9 | 1 | 12 | 1 |
| $10_d$ | Independence | above Russell site | 0 | 0 | 0 | 0 | 11 | 0 |
| 11 | Independence | below Russell site | 0 | 0 | 0 | 0 | n/s | n/s |
| $12_e$ | Mastodon | above Baker gulch | 0 | 0 | n/s | n/s | 5 | 0 |
| 13 | Mastodon | 0.4 km above Mammoth Creek | 0 | 0 | 0 | 0 | 18 | 0 |
| 14 | Miller | above recent mining | 0 | 0 | 0 | 0 | 15 | 0 |
| 15 | Miller | near mouth | 0 | 0 | 3 | 0 | 27 | 1 |
| $16_f$ | Bonanza | above Rebel Creek | 0 | 0 | n/s | n/s | 11 | 0 |
| 17 | Bonanza | 200 m above road | 0 | 0 | 0 | 0 | 8 | 0 |

Table 1. (continued)

| Site No. | Creek | Location | 1984 AG | 1984 Other | 1990 AG | 1990 Other | 1995 AG | 1995 Other |
|---|---|---|---|---|---|---|---|---|
| $18_g$ | Porcupine | above Yankee Creek | 0 | 0 | n/s | n/s | 15 | 2 |
| 19 | Porcupine | above road | 0 | 0 | 0 | 0 | 9 | 0 |
| $29_h$ | Ptarmigan | above Steese | n/s | n/s | 16 | 4 | n/s | n/s |
| $20_i$ | Ptarmigan | above Bates Creek | 0 | 0 | 69 | 25 | 5 | 23 |
| 21 | Fish | 150 m above Steese | 0 | 0 | 3 | 2 | 6 | 73 |
| 22 | Bear | 150 m above Steese | 13 | 0 | 15 | 23 | 6 | 11 |
| 23 | Twelvemile | near Reed Creek | 5 | 15 | 29 | 13 | 14 | 224 |
| 24 | Twelvemile | near mouth | 0 | 21 | 13 | 7 | 9 | 65 |
| 25 | North Fork Twelvemile | 2.4 km above Steese | 4 | 7 | 25 | 23 | 15 | 97 |
| 26j | North Fork Twelvemile | below Steese | 2 | 75 | 7 | 22 | 3 | 157 |
| $30_k$ | Eagle | above Rock Creek | n/s | n/s | n/s | n/s | 3 | 29 |

$2_a$ not sampled in 1990 due to low water and access blocked to site in 1995

$27_b$ new sample site in 1990 to determine upper limit of fish distribution, mined site

$9_c$ site moved upstream in 1990 because 1984 site was flooded by active mining operation, original site sampled in 1995

$10_d$ sites 10 and 11 were combined in 1990 since mining had progressed to encompass both sites and the reach between sites

Table 1. (concluded)

$12_e$ site not sampled because all water was subsurface at site 12 during 1990 sampling period

$16_f$ site inaccessible to fish due to dams, tailing, and ponds from mining activity since 1984, not sampled in 1990

$18_g$ access to above Yankee Creek blocked by dams, tailing, and ponds from mining activity since 1984, not sampled in 1990

$20_h$ small scale, about 0.8 ha disturbed, mining has occurred since 1984, channel change had occurred after 1990

$29_i$ site added in 1990 due to new disturbance in original site but not worked in 1995

$26_j$ erosion control work had been conducted instream immediately upstream from this sample site in 1990

$30_k$ new site in 1995, area mined and reclaimed since 1984

n/s not sampled

* mined since 1984

AG Arctic grayling

**Figure 4. Number of Arctic grayling caught in Birch Creek drainage (1984, 1990 and 1995).**

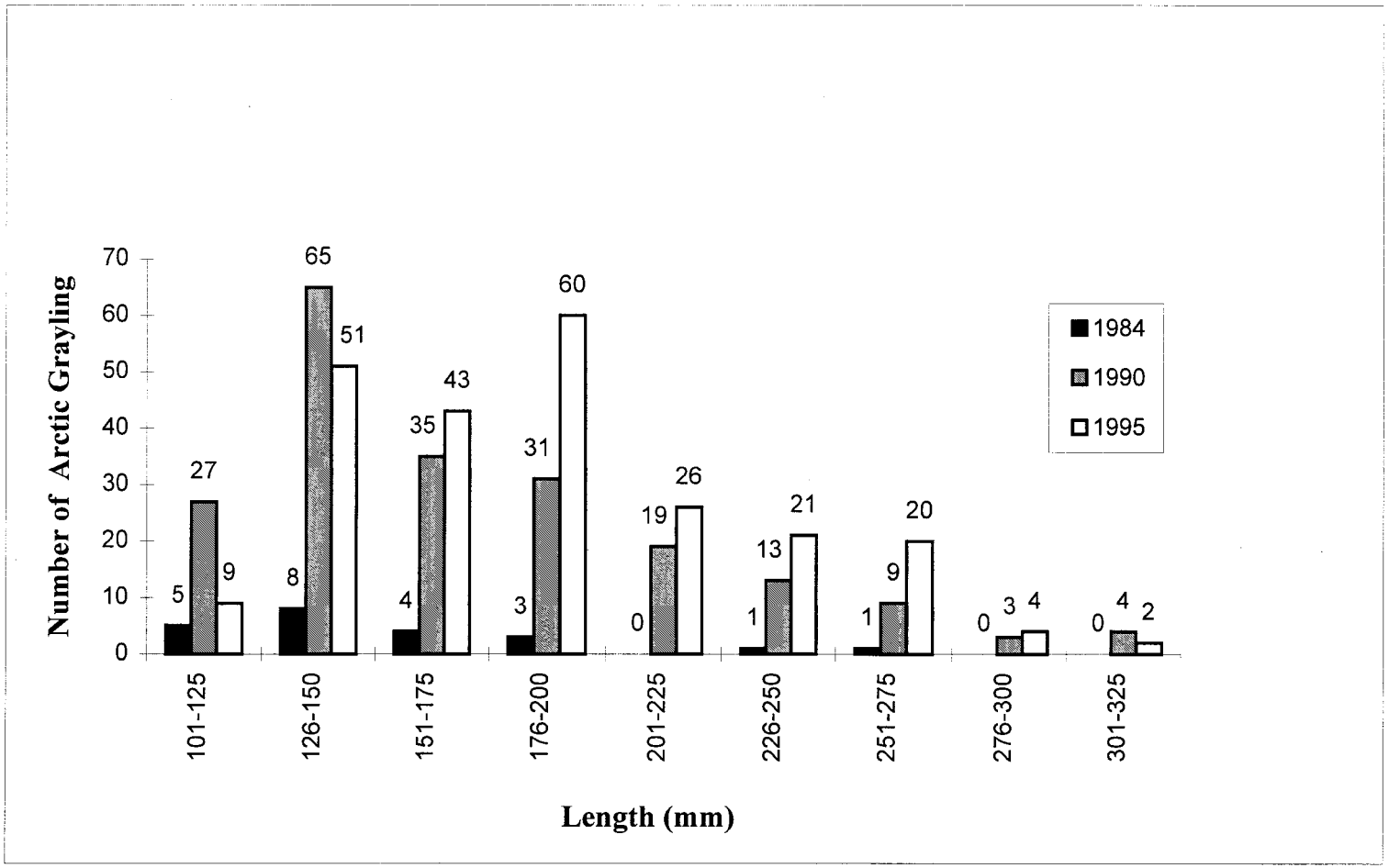


**Table 2. Total number of fish by species caught in all sample sites in 1984, 1990, and 1995.**

| Sample Year | Arctic Grayling | Slimy Sculpin | Round Whitefish | Burbot |
|---|---|---|---|---|
| 1984 | 25 | 112 | 1 | 0 |
| 1990 | 218 | 120 | 2 | 2 |
| 1995 | 236 | 688 | 17 | 10 |

# Discussion

Numbers of fish and species diversity have increased in our Birch Creek sample streams since 1984. We speculate reasons for increased fish presence include decreases in turbidity and settleable solids, reduced number of active mines, improved fish passage associated with stream bypasses, overall improvements in mining practices, reclamation completed by individual miners, and major flood events in fall 1989 and 1994. Major flood events probably removed fish barriers (e.g., dikes, culverts) and rearranged floodplain materials.

Scannell (1988) and Simmons (1984) found Arctic grayling avoid turbid water. Wagener and LaPerriere (1985), Weber and Post (1985), and Weber (1986) found decreased numbers of aquatic invertebrates in streams with increased turbidity. Arctic grayling feed primarily on invertebrates and locate their prey visually. When the amount of food is reduced and the ability of fish to locate food is impaired by turbidity, fewer Arctic grayling are likely to use the available habitat. Results of fish use of Birch Creek since 1984 appear to substantiate the findings of Scannell (1988), Simmons (1984), Wagener and LaPerriere (1985), and Weber and Post (1985) that highly elevated levels and extended duration of turbidity can cause a reduction in the use of aquatic habitat by Arctic grayling.

Water quality data collected by the ADNR, Division of Geological and Geophysical Services from 1984 to 1995 show turbidity declining in Birch Creek downstream of all mining (Ray 1990 and 1991, Vohden pers. comm. 1996). Mean turbidity during August 1984 in Birch Creek at the Steese Highway bridge was 60 NTUs. Mean turbidity at the same site in Birch Creek in 1990 (June to August) and 1995 (June to August) was 6 and 12 NTUs. From late July to early August 1995 when less turbid water conditions would be expected due to low flows, the automated water sampler was not functioning. Thus the mean turbidity for 1995 was probably less than 12 NTUs (Vohden pers. comm. 1996).

It is well known that Arctic grayling prefer clear water over turbid water (Scannell 1988). When fish distribution among sample sites during 1984, 1990, and 1995 are compared, it appears that turbid water in 1984 prevented Arctic grayling from migrating through the turbid water to clearwater tributaries. The increase in both species diversity and

number of fish present suggests that temporary losses (direct and indirect [i.e., migratory blockage]) of fish habitat can occur from chronic elevated turbidity. Exclusion of fish from otherwise suitable habitat represents a limitation to the natural dispersal of fish during the summer months when many fish, particularly Arctic grayling, expand their range to take advantage of foraging habitat in ephemeral streams.

Round whitefish, slimy sculpin, and burbot in the upper portions of the Birch Creek drainage were captured in low numbers in 1984 and 1990 but were more abundant in 1995. These species feed on aquatic invertebrates on the streambed substrate and while many of the sample streams still had not returned to a natural and stable condition, the increase in round whitefish, slimy sculpin, and burbot indicates that stream conditions continued to improve. The lack of stability in some streams or the lack of a stable benthic community may still limit the number of round whitefish, slimy sculpin, and burbot using previously disturbed habitat. In Fairbanks Creek, upstream of a fish barrier, only Arctic grayling occur (Townsend and Ott, unpubl. data) even though round whitefish, burbot, and slimy sculpin are present in Fish Creek immediately below the tailing barrier. We speculate that due to water quality degradation and the presence of the fish barrier that only Arctic grayling survived in Fairbanks Creek. Therefore, it is likely that a combination of physical barriers and water quality conditions in 1984 in Birch Creek contributed to the low numbers of round whitefish, slimy sculpin, and burbot by blocking natural upstream dispersal.

In summary, the following factors appear to have allowed fish to redistribute into mined streams since 1984; lower turbidity, increased stream stability, and improved fish passage. Although placer mining was still active on these streams and some turbidity was still present, fish were present in greater numbers and diversity. Decreases in stream turbidity from 1984 to 1995 probably are due to increased recycling of mining water and reduced non-point source runoff water from the mines because reclamation efforts have produced more stable overburden, settling pond sediments, and stream channels. Free movement of fish is attributable to construction of better stream bypasses and elimination of fish barriers. Many existing barriers were removed during the fall 1989 and 1994 flood events. Our 1990 data suggested that with continued water quality improvement and aquatic and terrestrial habitat rehabilitation, increases in fish use would occur. This prediction is supported by our 1995 data. We recommend

that periodic sampling be continued in the upper Birch Creek watershed to document changes in fish distribution, diversity, use, and relative abundance as mining continues and physical conditions of the watershed change.

## Literature Cited


Bureau of Land Management. 1988. Birch Creek placer mining final cumulative environmental impact statement. USDI. 350 pp.

Ray, S.R. 1990. Hydrologic and water quality investigations related to placer mining in Interior Alaska; summer 1989. Alaska Dept. of Natural Resources, Division of Geological and Geophysical Surveys, Public-data file 90-28. 59 pp.

_____. 1991. Hydrologic and water quality investigations related to placer mining in Interior Alaska; summer 1990. Alaska Dept. of Natural Resources, Division of Geological and Geophysical Surveys, Public-data file 91-19. 60 pp.

Scannell, P.O. 1988. Effects of elevated sediment levels from placer mining on survival and behavior of immature Arctic grayling. Master's thesis. University of Alaska Fairbanks, Fairbanks, Alaska. 93 pp.

Simmons, R.C. 1984. Effects of placer mining sedimentation on Arctic grayling of Interior Alaska. Master's thesis. University of Alaska Fairbanks, Fairbanks, AK. 120 pp.

Townsend, A.H. 1991. Distribution of fishes in Alaska's upper Birch Creek drainage during 1984 and 1990. Alaska Dept. of Fish and Game, Division of Habitat, Tech. Rept. 91-2. 14 pp.

U.S. Dept. of Interior. 1974. Final environmental statement Birch Creek National Wild River. 404 pp.

Vohden, J. 1996. Personal Communication. Alaska Dept. of Natural Resources, Division of Mining and Water Management.

Wagener, S.M. and J.D. LaPerriere. 1985. Effects of placer mining on the invertebrate communities of Interior Alaska streams. Freshwater Invertebrate Biology. 4(4):208-214.

Weber, P. and R. Post. 1985. Aquatic habitat assessments in mined and unmined portions of the Birch Creek watershed. Alaska Dept. of Fish and Game, Division of Habitat, Tech. Rept. 85-2. 65 pp.

Weber, P. 1986. Downstream effects of placer mining in the Birch Creek basin, Alaska. Alaska Dept of Fish and Game, Division of Habitat, Tech. Rept. 86-7. 21 pp.

**Appendix 1. Fish caught in Birch Creek sample sites during 1984, 1990, and 1995 (Arctic grayling = AG, slimy sculpin = CN, longnose sucker = LNS, chinook salmon = KS, burbot = BB, rainbow trout = RT, round whitefish = RWF).**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 8/16/84 | North Fork | 26 | AG | 111 | CN | 37 |
| | Twelvemile Creek | 26 | AG | 114 | CN | 38 |
| | | 26 | CN | 29 | CN | 32 |
| | | 26 | CN | 35 | CN | 39 |
| | | 26 | CN | 40 | CN | 35 |
| | | 26 | CN | 51 | CN | 39 |
| | | 26 | CN | 63 | CN | 39 |
| | | 26 | CN | 65 | CN | 40 |
| | | 26 | CN | 65 | CN | 44 |
| | | 26 | CN | 66 | CN | 40 |
| | | 26 | CN | 70 | CN | 44 |
| | | 26 | CN | 73 | CN | 45 |
| | | 26 | CN | 105 | CN | 56 |
| | | 26 | CN | 105 | CN | 60 |
| | | 26 | CN | 115 | CN | 64 |
| | | 26 | CN | 118 | CN | 67 |
| | | 26 | CN | 32 | CN | 73 |
| | | 26 | CN | 33 | CN | 74 |
| | | 26 | CN | 36 | CN | 81 |
| | | 26 | CN | 34 | CN | 57 |
| | | 26 | CN | 38 | CN | 35 |
| | | 26 | CN | 42 | CN | 44 |
| | | 26 | CN | 45 | CN | 40 |
| | | 26 | CN | 53 | CN | 44 |
| | | 26 | CN | 40 | CN | 41 |
| | | 26 | CN | 44 | CN | 59 |
| | | 26 | CN | 57 | CN | 59 |
| | | 26 | CN | 63 | CN | 67 |
| | | 26 | CN | 65 | CN | 66 |
| | | 26 | CN | 62 | CN | 76 |
| | | 26 | CN | 70 | CN | 73 |
| | | 26 | CN | 71 | CN | 75 |
| | | 26 | CN | 77 | CN | 104 |
| | | 26 | CN | 115 | CN | 116 |
| | | 26 | CN | 35 | CN | 36 |
| | | 26 | CN | 36 | CN | 40 |
| | | 26 | CN | 37 | | |
| | | | | | | |
| 8/16/84 | Twelvemile Creek | 23 | AG | 126 | CN | 96 |
| | | 23 | AG | 134 | CN | 98 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 8/16/84 | Twelvemile Creek | 23 | AG | 147 | CN | 74 |
| | | 23 | AG | 161 | CN | 52 |
| | | 23 | AG | 136 | CN | 53 |
| | | 23 | CN | 67 | CN | 55 |
| | | 23 | CN | 97 | CN | 49 |
| | | 23 | CN | 100 | CN | 108 |
| | | 23 | CN | 88 | RWF | 280 |
| | | | | | | |
| 8/16/84 | Twelvemile Creek | 24 | CN | 52 | CN | 32 |
| | | 24 | CN | 29 | CN | 33 |
| | | 24 | CN | 30 | CN | 52 |
| | | 24 | CN | 34 | CN | 56 |
| | | 24 | CN | 47 | CN | 65 |
| | | 24 | CN | 59 | CN | 69 |
| | | 24 | CN | 60 | CN | 24 |
| | | 24 | CN | 30 | CN | 62 |
| | | 24 | CN | 33 | CN | 62 |
| | | 24 | CN | 55 | CN | 69 |
| | | 24 | CN | 58 | | |
| | | | | | | |
| 8/17/84 | Bear Creek | 22 | AG | 105 | AG | 140 |
| | | 22 | AG | 123 | AG | 153 |
| | | 22 | AG | 129 | AG | 186 |
| | | 22 | AG | 152 | AG | 119 |
| | | 22 | AG | 264 | AG | 131 |
| | | 22 | AG | 114 | AG | 132 |
| | | | | | | |
| 8/26/84 | Boulder Creek | 7 | AG | 185 | AG | 195 |
| | | | | | | |
| 8/29/84 | North Fork | 25 | AG | 120 | CN | 92 |
| | Twelvemile Creek | 25 | AG | 143 | CN | 94 |
| | | 25 | AG | 157 | CN | 95 |
| | | 25 | AG | 230 | CN | 95 |
| | | 25 | CN | 57 | CN | 99 |
| | | 25 | CN | 61 | CN | 92 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/23/90 | Crooked Creek | 1 | AG | 182 | AG | 155 |
| | | 1 | AG | 194 | AG | 156 |
| | | 1 | AG | 150 | AG | 138 |
| | | 1 | AG | 148 | AG | 218 |
| | | | | | | |
| 7/23/90 | Deadwood Creek | 5 | AG | 187 | AG | 205 |
| | | 5 | AG | 195 | AG | 214 |
| | | 5 | AG | 320 | AG | 240 |
| | | 5 | AG | 290 | AG | 210 |
| | | 5 | AG | 240 | AG | 187 |
| | | 5 | AG | 302 | AG | 204 |
| | | 5 | AG | 226 | AG | 171 |
| | | 5 | AG | 213 | AG | 206 |
| | | | | | | |
| 7/24/90 | Boulder Creek | 7 | AG | 220 | AG | 247 |
| | | 7 | AG | 274 | AG | 298 |
| | | 7 | AG | 255 | | |
| | | | | | | |
| 7/24/90 | Mammoth Creek | 9 | AG | 306 | AG | 256 |
| | | 9 | AG | 262 | AG | 229 |
| | | 9 | AG | 253 | AG | 224 |
| | | 9 | AG | 304 | AG | 195 |
| | | 9 | AG | 262 | RT | 235 |
| | | | | | | |
| 7/24/90 | Miller Creek | 15 | AG | 235 | AG | 280 |
| | | 15 | AG | 230 | | |
| | | | | | | |
| 7/25/90 | Ptarmigan Creek | 29 | AG | 189 | AG | 124 |
| | | 29 | AG | 204 | AG | 126 |
| | | 29 | AG | 220 | AG | 128 |
| | | 29 | AG | 156 | AG | 141 |
| | | 29 | AG | 193 | AG | 174 |
| | | 29 | AG | 144 | AG | 119 |
| | | 29 | AG | 242 | CN | 110 |
| | | 29 | AG | 157 | CN | 91 |
| | | 29 | AG | 161 | CN | 76 |
| | | 29 | AG | 115 | CN | 89 |
| | | | | | | |
| 7/25/90 | Ptarmigan Creek | 20 | AG | 188 | AG | 186 |
| | | 20 | AG | 178 | AG | 144 |
| | | 20 | AG | 144 | AG | 180 |
| | | 20 | AG | 195 | AG | 142 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/25/90 | Ptarmigan Creek | 20 | AG | 153 | AG | 167 |
| | | 20 | AG | 161 | AG | 182 |
| | | 20 | AG | 162 | AG | 191 |
| | | 20 | AG | 191 | AG | 178 |
| | | 20 | AG | 130 | AG | 138 |
| | | 20 | AG | 138 | AG | 142 |
| | | 20 | AG | 185 | AG | 135 |
| | | 20 | AG | 136 | AG | 113 |
| | | 20 | AG | 182 | AG | 90 |
| | | 20 | AG | 132 | AG | 135 |
| | | 20 | AG | 144 | AG | 134 |
| | | 20 | AG | 170 | AG | 129 |
| | | 20 | AG | 155 | AG | 133 |
| | | 20 | AG | 150 | AG | 111 |
| | | 20 | AG | 112 | AG | 126 |
| | | 20 | AG | 128 | AG | 122 |
| | | 20 | AG | 141 | AG | 114 |
| | | 20 | AG | 138 | AG | 144 |
| | | 20 | AG | 146 | CN | 76 |
| | | 20 | AG | 130 | CN | 101 |
| | | 20 | AG | 131 | CN | 97 |
| | | 20 | AG | 94 | CN | 122 |
| | | 20 | AG | 101 | CN | 75 |
| | | 20 | AG | 97 | CN | 77 |
| | | 20 | AG | 211 | CN | 102 |
| | | 20 | AG | 190 | CN | 92 |
| | | 20 | AG | 172 | CN | 101 |
| | | 20 | AG | 166 | CN | 90 |
| | | 20 | AG | 149 | CN | 79 |
| | | 20 | AG | 131 | CN | 83 |
| | | 20 | AG | 134 | CN | 74 |
| | | 20 | AG | 135 | CN | 93 |
| | | 20 | AG | 124 | CN | 91 |
| | | 20 | AG | 124 | CN | 91 |
| | | 20 | AG | 117 | CN | 85 |
| | | 20 | AG | 110 | CN | 87 |
| | | 20 | AG | 151 | CN | 96 |
| | | 20 | AG | 162 | CN | 90 |
| | | 20 | AG | 138 | CN | 91 |
| | | 20 | AG | 138 | CN | 76 |
| | | 20 | AG | 212 | CN | 70 |
| | | 20 | AG | 179 | CN | 86 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/25/90 | Ptarmigan Creek | 20 | AG | 195 | RWF | 190 |
| | | | | | | |
| 7/25/90 | Fish Creek | 21 | AG | 195 | CN | 169 |
| | | 21 | AG | 167 | CN | 124 |
| | | 21 | AG | 139 | | |
| | | | | | | |
| 7/25/90 | Bear Creek | 22 | AG | 227 | CN | 132 |
| | | 22 | AG | 225 | CN | 117 |
| | | 22 | AG | 265 | CN | 107 |
| | | 22 | AG | 198 | CN | 129 |
| | | 22 | AG | 175 | CN | 130 |
| | | 22 | AG | 131 | CN | 84 |
| | | 22 | AG | 156 | CN | 100 |
| | | 22 | AG | 151 | CN | 114 |
| | | 22 | AG | 166 | CN | 110 |
| | | 22 | AG | 132 | CN | 108 |
| | | 22 | AG | 99 | CN | 122 |
| | | 22 | AG | 146 | CN | 95 |
| | | 22 | AG | 111 | CN | 71 |
| | | 22 | AG | 187 | CN | 65 |
| | | 22 | AG | 145 | CN | 70 |
| | | 22 | CN | 67 | CN | 75 |
| | | 22 | CN | 72 | CN | 124 |
| | | 22 | CN | 76 | CN | 103 |
| | | 22 | CN | 108 | CN | 105 |
| | | 22 | CN | 67 | | |
| | | | | | | |
| 7/25/90 | Twelvemile Creek | 24 | AG | 231 | AG | 150 |
| | | 24 | AG | 240 | AG | 172 |
| | | 24 | AG | 258 | AG | 154 |
| | | 24 | AG | 186 | AG | 102 |
| | | 24 | AG | 135 | CN | 74 |
| | | 24 | AG | 159 | CN | 70 |
| | | 24 | AG | 151 | CN | 59 |
| | | 24 | AG | 124 | CN | 89 |
| | | 24 | AG | 125 | CN | 95 |
| | | | | | | |
| 7/25/90 | North Fork | 26 | AG | 184 | CN | 75 |
| | Twelvemile Creek | 26 | AG | 216 | CN | 92 |
| | | 26 | AG | 156 | CN | 92 |
| | | 26 | AG | 140 | CN | 95 |
| | | 26 | AG | 141 | CN | 96 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/25/90 | North Fork | 26 | AG | 93 | CN | 75 |
| | Twelvemile Creek | 26 | AG | 110 | CN | 94 |
| | | 26 | CN | 104 | CN | 77 |
| | | 26 | CN | 82 | CN | 109 |
| | | 26 | CN | 90 | CN | 113 |
| | | 26 | CN | 96 | CN | 103 |
| | | 26 | CN | 77 | CN | 76 |
| | | 26 | CN | 71 | CN | 80 |
| | | 26 | CN | 74 | BB | 240 |
| | | 26 | CN | 102 | BB | 221 |
| | | 26 | CN | 98 | RWF | 240 |
| | | | | | | |
| 7/25/90 | North Fork | 25 | AG | 200 | CN | 65 |
| | Twelvemile Creek | 25 | AG | 196 | CN | 80 |
| | | 25 | AG | 175 | CN | 71 |
| | | 25 | AG | 218 | CN | 66 |
| | | 25 | AG | 222 | CN | 78 |
| | | 25 | AG | 175 | CN | 88 |
| | | 25 | AG | 154 | CN | 72 |
| | | 25 | AG | 126 | CN | 71 |
| | | 25 | AG | 148 | CN | 89 |
| | | 25 | AG | 136 | CN | 88 |
| | | 25 | AG | 132 | CN | 75 |
| | | 25 | AG | 135 | CN | 67 |
| | | 25 | AG | 100 | CN | 109 |
| | | 25 | AG | 98 | CN | 83 |
| | | 25 | AG | 98 | CN | 71 |
| | | 25 | AG | 101 | CN | 77 |
| | | 25 | AG | 164 | CN | 96 |
| | | 25 | AG | 183 | CN | 74 |
| | | 25 | AG | 141 | CN | 66 |
| | | 25 | AG | 138 | CN | 67 |
| | | 25 | AG | 97 | CN | 66 |
| | | 25 | AG | 125 | CN | 71 |
| | | 25 | AG | 122 | CN | 120 |
| | | 25 | AG | 96 | CN | 66 |
| | | 25 | AG | 90 | | |
| | | | | | | |
| 7/25/90 | Twelvemile Creek | 23 | AG | 226 | AG | 172 |
| | | 23 | AG | 217 | AG | 212 |
| | | 23 | AG | 162 | AG | 196 |
| | | 23 | AG | 175 | AG | 145 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/25/90 | Twelvemile Creek | 23 | AG | 228 | AG | 125 |
| | | 23 | AG | 122 | AG | 131 |
| | | 23 | AG | 261 | AG | 135 |
| | | 23 | AG | 183 | CN | 85 |
| | | 23 | AG | 120 | CN | 80 |
| | | 23 | AG | 137 | CN | 79 |
| | | 23 | AG | 147 | CN | 80 |
| | | 23 | AG | 140 | CN | 73 |
| | | 23 | AG | 138 | CN | 82 |
| | | 23 | AG | 133 | CN | 93 |
| | | 23 | AG | 126 | CN | 66 |
| | | 23 | AG | 137 | CN | 72 |
| | | 23 | AG | 127 | CN | 66 |
| | | 23 | AG | 127 | CN | 66 |
| | | 23 | AG | 103 | CN | 72 |
| | | 23 | AG | 106 | CN | 66 |
| | | 23 | AG | 112 | CN | 72 |
| | | 23 | AG | 140 | CN | 66 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/25/95 | Boulder Creek | 6 | AG | 184 | AG | 190 |
| | | 6 | AG | 266 | AG | 185 |
| | | 6 | AG | 215 | AG | 199 |
| | | 6 | AG | 250 | AG | 185 |
| | | 6 | AG | 194 | AG | 177 |
| | | 6 | AG | 170 | | |
| | | | | | | |
| 7/25/95 | Boulder Creek | 7 | AG | 295 | CN | 103 |
| | | 7 | AG | 260 | CN | 100 |
| | | 7 | AG | 177 | CN | 89 |
| | | 7 | AG | 124 | CN | 109 |
| | | 7 | AG | 153 | CN | 102 |
| | | 7 | AG | 133 | RWF | 256 |
| | | 7 | AG | 131 | RWF | 260 |
| | | | | | | |
| 7/26/95 | Ptarmigan Creek | 20 | AG | 264 | CN | 87 |
| | | 20 | AG | 226 | CN | 82 |
| | | 20 | AG | 219 | CN | 87 |
| | | 20 | AG | 197 | CN | 96 |
| | | 20 | AG | 204 | CN | 122 |
| | | 20 | CN | 88 | CN | 121 |
| | | 20 | CN | 79 | CN | 95 |
| | | 20 | CN | 91 | CN | 81 |
| | | 20 | CN | 90 | CN | 88 |
| | | 20 | CN | 105 | CN | 77 |
| | | 20 | CN | 92 | CN | 90 |
| | | 20 | CN | 70 | BB | 310 |
| | | 20 | CN | 85 | BB | 316 |
| | | 20 | CN | 100 | BB | 251 |
| | | | | | | |
| 7/26/95 | Fish Creek | 21 | AG | 220 | CN | 98 |
| | | 21 | AG | 199 | CN | 101 |
| | | 21 | AG | 182 | CN | 90 |
| | | 21 | AG | 173 | CN | 123 |
| | | 21 | AG | 124 | CN | 83 |
| | | 21 | AG | 141 | CN | 112 |
| | | 21 | CN | 78 | CN | 86 |
| | | 21 | CN | 110 | CN | 97 |
| | | 21 | CN | 85 | CN | 113 |
| | | 21 | CN | 94 | CN | 105 |
| | | 21 | CN | 82 | CN | 115 |
| | | 21 | CN | 85 | CN | 99 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/26/95 | Fish Creek | 21 | CN | 97 | CN | 70 |
| | | 21 | CN | 81 | CN | 65 |
| | | 21 | CN | 62 | CN | 91 |
| | | 21 | CN | 103 | CN | 81 |
| | | 21 | CN | 112 | CN | 71 |
| | | 21 | CN | 88 | CN | 109 |
| | | 21 | CN | 68 | CN | 64 |
| | | 21 | CN | 72 | CN | 87 |
| | | 21 | CN | 77 | CN | 116 |
| | | 21 | CN | 104 | CN | 116 |
| | | 21 | CN | 104 | CN | 112 |
| | | 21 | CN | 60 | CN | 93 |
| | | 21 | CN | 85 | CN | 78 |
| | | 21 | CN | 85 | CN | 99 |
| | | 21 | CN | 92 | CN | 74 |
| | | 21 | CN | 90 | CN | 84 |
| | | 21 | CN | 92 | CN | 107 |
| | | 21 | CN | 71 | CN | 93 |
| | | 21 | CN | 92 | CN | 116 |
| | | 21 | CN | 75 | CN | 73 |
| | | 21 | CN | 110 | CN | 86 |
| | | 21 | CN | 84 | CN | 71 |
| | | 21 | CN | 69 | CN | 76 |
| | | 21 | CN | 93 | CN | 66 |
| | | 21 | CN | 88 | CN | 63 |
| | | 21 | CN | 65 | CN | 65 |
| | | 21 | CN | 84 | CN | 70 |
| | | 21 | CN | 64 | | |
| | | | | | | |
| 7/26/95 | Bear Creek | 22 | AG | 236 | CN | 122 |
| | | 22 | AG | 204 | CN | 95 |
| | | 22 | AG | 237 | CN | 62 |
| | | 22 | AG | 202 | CN | 93 |
| | | 22 | AG | 160 | CN | 111 |
| | | 22 | AG | 168 | CN | 97 |
| | | 22 | BB | 327 | CN | 83 |
| | | 22 | BB | 229 | CN | 66 |
| | | 22 | RWF | 215 | | |
| | | | | | | |
| 7/26/95 | North Fork | 25 | AG | 248 | CN | 149 |
| | Twelvemile Creek | 25 | AG | 258 | CN | 87 |
| | | 25 | AG | 195 | CN | 85 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/26/95 | North Fork | 25 | AG | 228 | CN | 64 |
| | Twelvemile Creek | 25 | AG | 176 | CN | 63 |
| | | 25 | AG | 180 | CN | 90 |
| | | 25 | AG | 145 | CN | 41 |
| | | 25 | AG | 135 | CN | 70 |
| | | 25 | AG | 143 | CN | 66 |
| | | 25 | AG | 294 | CN | 85 |
| | | 25 | AG | 251 | CN | 78 |
| | | 25 | AG | 244 | CN | 62 |
| | | 25 | AG | 182 | CN | 72 |
| | | 25 | AG | 150 | CN | 87 |
| | | 25 | AG | 153 | CN | 86 |
| | | 25 | CN | 68 | CN | 60 |
| | | 25 | CN | 83 | CN | 66 |
| | | 25 | CN | 71 | CN | 75 |
| | | 25 | CN | 30 | CN | 76 |
| | | 25 | CN | 56 | CN | 35 |
| | | 25 | CN | 86 | CN | 81 |
| | | 25 | CN | 89 | CN | 77 |
| | | 25 | CN | 55 | CN | 78 |
| | | 25 | CN | 91 | CN | 68 |
| | | 25 | CN | 82 | CN | 63 |
| | | 25 | CN | 87 | CN | 77 |
| | | 25 | CN | 82 | CN | 83 |
| | | 25 | CN | 94 | CN | 64 |
| | | 25 | CN | 50 | CN | 66 |
| | | 25 | CN | 60 | CN | 57 |
| | | 25 | CN | 89 | CN | 65 |
| | | 25 | CN | 77 | CN | 90 |
| | | 25 | CN | 86 | CN | 79 |
| | | 25 | CN | 57 | CN | 80 |
| | | 25 | CN | 68 | CN | 65 |
| | | 25 | CN | 69 | CN | 60 |
| | | 25 | CN | 77 | CN | 90 |
| | | 25 | CN | 60 | CN | 62 |
| | | 25 | CN | 82 | CN | 74 |
| | | 25 | CN | 64 | CN | 75 |
| | | 25 | CN | 58 | CN | 56 |
| | | 25 | CN | 61 | CN | 85 |
| | | 25 | CN | 66 | CN | 51 |
| | | 25 | CN | 88 | CN | 57 |
| | | 25 | CN | 60 | CN | 66 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/26/95 | North Fork | 25 | CN | 71 | CN | 70 |
| | Twelvemile Creek | 25 | CN | 79 | CN | 65 |
| | | 25 | CN | 79 | CN | 91 |
| | | 25 | CN | 64 | CN | 92 |
| | | 25 | CN | 69 | CN | 75 |
| | | 25 | CN | 64 | CN | 76 |
| | | 25 | CN | 92 | CN | 58 |
| | | 25 | CN | 92 | CN | 63 |
| | | 25 | CN | 61 | CN | 76 |
| | | 25 | CN | 78 | CN | 61 |
| | | 25 | CN | 62 | BB | 294 |
| | | 25 | CN | 57 | BB | 236 |
| | | 25 | CN | 67 | BB | 261 |
| | | 25 | CN | 75 | RWF | 272 |
| | | 25 | CN | 65 | RWF | 215 |
| | | 25 | CN | 64 | RWF | 240 |
| | | | | | | |
| 7/26/95 | Eagle Creek | 30 | AG | 213 | CN | 111 |
| | | 30 | AG | 186 | CN | 75 |
| | | 30 | AG | 138 | CN | 66 |
| | | 30 | CN | 90 | CN | 80 |
| | | 30 | CN | 100 | CN | 72 |
| | | 30 | CN | 105 | CN | 87 |
| | | 30 | CN | 102 | CN | 74 |
| | | 30 | CN | 110 | CN | 96 |
| | | 30 | CN | 78 | CN | 70 |
| | | 30 | CN | 76 | CN | 95 |
| | | 30 | CN | 72 | CN | 80 |
| | | 30 | CN | 99 | CN | 91 |
| | | 30 | CN | 107 | CN | 85 |
| | | 30 | CN | 89 | CN | 82 |
| | | 30 | CN | 95 | CN | 75 |
| | | 30 | CN | 66 | CN | 93 |
| | | | | | | |
| 7/27/95 | Miller Creek | 14 | AG | 186 | AG | 187 |
| | | 14 | AG | 220 | AG | 185 |
| | | 14 | AG | 183 | AG | 155 |
| | | 14 | AG | 170 | AG | 168 |
| | | 14 | AG | 210 | AG | 197 |
| | | 14 | AG | 189 | AG | 183 |
| | | 14 | AG | 181 | AG | 170 |
| | | 14 | AG | 139 | | |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/27/95 | Miller Creek | 15 | AG | 275 | AG | 180 |
| | | 15 | AG | 279 | AG | 135 |
| | | 15 | AG | 256 | AG | 189 |
| | | 15 | AG | 144 | AG | 191 |
| | | 15 | AG | 180 | AG | 183 |
| | | 15 | AG | 176 | AG | 183 |
| | | 15 | AG | 138 | AG | 184 |
| | | 15 | AG | 180 | AG | 138 |
| | | 15 | AG | 162 | AG | 137 |
| | | 15 | AG | 177 | AG | 135 |
| | | 15 | AG | 181 | AG | 138 |
| | | 15 | AG | 142 | AG | 107 |
| | | 15 | AG | 173 | AG | 167 |
| | | 15 | AG | 134 | RWF | 233 |
| | | | | | | |
| 7/27/95 | Mastodon Creek | 13 | AG | 186 | AG | 182 |
| | | 13 | AG | 203 | AG | 171 |
| | | 13 | AG | 184 | AG | 188 |
| | | 13 | AG | 205 | AG | 174 |
| | | 13 | AG | 160 | AG | 172 |
| | | 13 | AG | 186 | AG | 175 |
| | | 13 | AG | 200 | AG | 176 |
| | | 13 | AG | 153 | AG | 173 |
| | | 13 | AG | 141 | AG | 138 |
| | | | | | | |
| 7/27/95 | Mastodon Creek | 12 | AG | 188 | AG | 259 |
| | | 12 | AG | 181 | AG | 170 |
| | | 12 | AG | 191 | | |
| | | | | | | |
| 7/27/95 | Independence Creek | 10 | AG | 178 | AG | 160 |
| | | 10 | AG | 175 | AG | 163 |
| | | 10 | AG | 193 | AG | 163 |
| | | 10 | AG | 173 | AG | 138 |
| | | 10 | AG | 166 | AG | 135 |
| | | 10 | AG | 133 | | |
| | | | | | | |
| 7/31/95 | Twelvemile Creek | 23 | AG | 268 | CN | 93 |
| | | 23 | AG | 224 | CN | 78 |
| | | 23 | AG | 258 | CN | 79 |
| | | 23 | AG | 242 | CN | 54 |
| | | 23 | AG | 226 | CN | 72 |
| | | 23 | AG | 149 | CN | 82 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/31/95 | Twelvemile Creek | 23 | AG | 160 | CN | 81 |
| | | 23 | AG | 178 | CN | 80 |
| | | 23 | AG | 154 | CN | 83 |
| | | 23 | AG | 212 | CN | 73 |
| | | 23 | AG | 143 | CN | 85 |
| | | 23 | AG | 132 | CN | 74 |
| | | 23 | AG | 206 | CN | 84 |
| | | 23 | AG | 105 | CN | 80 |
| | | 23 | CN | 97 | CN | 84 |
| | | 23 | CN | 80 | CN | 66 |
| | | 23 | CN | 63 | CN | 81 |
| | | 23 | CN | 56 | CN | 82 |
| | | 23 | CN | 79 | CN | 73 |
| | | 23 | CN | 79 | CN | 77 |
| | | 23 | CN | 72 | CN | 72 |
| | | 23 | CN | 72 | CN | 78 |
| | | 23 | CN | 84 | CN | 80 |
| | | 23 | CN | 88 | CN | 76 |
| | | 23 | CN | 80 | CN | 71 |
| | | 23 | CN | 81 | CN | 79 |
| | | 23 | CN | 74 | CN | 71 |
| | | 23 | CN | 84 | CN | 70 |
| | | 23 | CN | 71 | CN | 82 |
| | | 23 | CN | 79 | CN | 87 |
| | | 23 | CN | 81 | CN | 84 |
| | | 23 | CN | 75 | CN | 85 |
| | | 23 | CN | 79 | CN | 76 |
| | | 23 | CN | 83 | CN | 72 |
| | | 23 | CN | 85 | CN | 86 |
| | | 23 | CN | 78 | CN | 62 |
| | | 23 | CN | 79 | CN | 82 |
| | | 23 | CN | 65 | CN | 72 |
| | | 23 | CN | 80 | CN | 85 |
| | | 23 | CN | 77 | CN | 71 |
| | | 23 | CN | 85 | CN | 74 |
| | | 23 | CN | 74 | CN | 72 |
| | | 23 | CN | 74 | CN | 72 |
| | | 23 | CN | 76 | CN | 80 |
| | | 23 | CN | 65 | CN | 72 |
| | | 23 | CN | 81 | CN | 84 |
| | | 23 | CN | 77 | CN | 74 |
| | | 23 | CN | 71 | CN | 78 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/31/95 | Twelvemile Creek | 23 | CN | 85 | CN | 77 |
| | | 23 | CN | 81 | CN | 91 |
| | | 23 | CN | 94 | CN | 77 |
| | | 23 | CN | 81 | CN | 75 |
| | | 23 | CN | 70 | CN | 80 |
| | | 23 | CN | 81 | CN | 83 |
| | | 23 | CN | 76 | CN | 79 |
| | | 23 | CN | 81 | CN | 79 |
| | | 23 | CN | 78 | CN | 76 |
| | | 23 | CN | 76 | CN | 85 |
| | | 23 | CN | 76 | CN | 71 |
| | | 23 | CN | 74 | CN | 78 |
| | | 23 | CN | 74 | CN | 78 |
| | | 23 | CN | 77 | CN | 77 |
| | | 23 | CN | 77 | CN | 70 |
| | | 23 | CN | 90 | CN | 87 |
| | | 23 | CN | 52 | CN | 84 |
| | | 23 | CN | 76 | CN | 78 |
| | | 23 | CN | 84 | CN | 84 |
| | | 23 | CN | 70 | CN | 70 |
| | | 23 | CN | 74 | CN | 90 |
| | | 23 | CN | 78 | CN | 70 |
| | | 23 | CN | 71 | CN | 77 |
| | | 23 | CN | 74 | CN | 92 |
| | | 23 | CN | 85 | CN | 82 |
| | | 23 | CN | 65 | CN | 75 |
| | | 23 | CN | 71 | CN | 71 |
| | | 23 | CN | 74 | CN | 83 |
| | | 23 | CN | 80 | CN | 79 |
| | | 23 | CN | 80 | CN | 76 |
| | | 23 | CN | 80 | CN | 40 |
| | | 23 | CN | 80 | CN | 98 |
| | | 23 | CN | 80 | CN | 77 |
| | | 23 | CN | 71 | CN | 78 |
| | | 23 | CN | 85 | CN | 84 |
| | | 23 | CN | 69 | CN | 74 |
| | | 23 | CN | 71 | CN | 78 |
| | | 23 | CN | 74 | CN | 75 |
| | | 23 | CN | 77 | CN | 71 |
| | | 23 | CN | 80 | CN | 57 |
| | | 23 | CN | 74 | CN | 81 |
| | | 23 | CN | 100 | CN | 70 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/31/95 | Twelvemile Creek | 23 | CN | 85 | CN | 83 |
| | | 23 | CN | 72 | CN | 80 |
| | | 23 | CN | 73 | CN | 79 |
| | | 23 | CN | 80 | CN | 90 |
| | | 23 | CN | 70 | CN | 70 |
| | | 23 | CN | 84 | CN | 75 |
| | | 23 | CN | 82 | CN | 80 |
| | | 23 | CN | 80 | CN | 80 |
| | | 23 | CN | 91 | CN | 87 |
| | | 23 | CN | 87 | CN | 78 |
| | | 23 | CN | 90 | CN | 80 |
| | | 23 | CN | 73 | CN | 76 |
| | | 23 | CN | 69 | CN | 67 |
| | | 23 | CN | 77 | CN | 86 |
| | | 23 | CN | 86 | CN | 81 |
| | | 23 | CN | 78 | CN | 81 |
| | | 23 | CN | 71 | CN | 63 |
| | | 23 | CN | 65 | CN | 80 |
| | | 23 | CN | 74 | CN | 90 |
| | | 23 | CN | 75 | CN | 72 |
| | | 23 | CN | 81 | CN | 80 |
| | | 23 | CN | 65 | CN | 76 |
| | | 23 | CN | 82 | CN | 77 |
| | | 23 | CN | 75 | CN | 63 |
| | | 23 | CN | 67 | RWF | 275 |
| | | 23 | CN | 71 | RWF | 285 |
| | | 23 | CN | 74 | RWF | 239 |
| | | 23 | CN | 75 | RWF | 271 |
| | | 23 | CN | 71 | RWF | 263 |
| | | 23 | CN | 77 | | |
| | | | | | | |
| 7/31/95 | Twelvemile Creek | 24 | AG | 302 | CN | 80 |
| | | 24 | AG | 270 | CN | 52 |
| | | 24 | AG | 247 | CN | 60 |
| | | 24 | AG | 223 | CN | 111 |
| | | 24 | AG | 230 | CN | 82 |
| | | 24 | AG | 215 | CN | 84 |
| | | 24 | AG | 220 | CN | 73 |
| | | 24 | AG | 107 | CN | 61 |
| | | 24 | AG | 303 | CN | 55 |
| | | 24 | CN | 77 | CN | 62 |
| | | 24 | CN | 69 | CN | 72 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/31/95 | Twelvemile Creek | 24 | CN | 49 | CN | 60 |
| | | 24 | CN | 63 | CN | 60 |
| | | 24 | CN | 76 | CN | 63 |
| | | 24 | CN | 98 | CN | 68 |
| | | 24 | CN | 59 | CN | 76 |
| | | 24 | CN | 92 | CN | 58 |
| | | 24 | CN | 54 | CN | 63 |
| | | 24 | CN | 60 | CN | 62 |
| | | 24 | CN | 60 | CN | 72 |
| | | 24 | CN | 57 | CN | 105 |
| | | 24 | CN | 85 | CN | 67 |
| | | 24 | CN | 76 | CN | 44 |
| | | 24 | CN | 62 | CN | 55 |
| | | 24 | CN | 67 | CN | 71 |
| | | 24 | CN | 78 | CN | 66 |
| | | 24 | CN | 86 | CN | 62 |
| | | 24 | CN | 83 | CN | 46 |
| | | 24 | CN | 46 | CN | 80 |
| | | 24 | CN | 44 | BB | 180 |
| | | 24 | CN | 80 | KS | 55 |
| | | | | | | |
| 7/31/95 | North Fork | 26 | AG | 266 | CN | 84 |
| | Twelvemile Creek | 26 | AG | 165 | CN | 69 |
| | | 26 | AG | 261 | CN | 66 |
| | | 26 | CN | 71 | CN | 100 |
| | | 26 | CN | 66 | CN | 78 |
| | | 26 | CN | 67 | CN | 92 |
| | | 26 | CN | 98 | CN | 67 |
| | | 26 | CN | 80 | CN | 87 |
| | | 26 | CN | 67 | CN | 60 |
| | | 26 | CN | 54 | CN | 75 |
| | | 26 | CN | 52 | CN | 52 |
| | | 26 | CN | 57 | CN | 61 |
| | | 26 | CN | 81 | CN | 56 |
| | | 26 | CN | 82 | CN | 35 |
| | | 26 | CN | 87 | CN | 101 |
| | | 26 | CN | 62 | CN | 95 |
| | | 26 | CN | 58 | CN | 95 |
| | | 26 | CN | 67 | CN | 70 |
| | | 26 | CN | 69 | CN | 57 |
| | | 26 | CN | 65 | CN | 61 |
| | | 26 | CN | 59 | CN | 56 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/31/95 | North Fork | 26 | CN | 63 | CN | 80 |
| | Twelvemile Creek | 26 | CN | 60 | CN | 56 |
| | | 26 | CN | 71 | CN | 60 |
| | | 26 | CN | 70 | CN | 63 |
| | | 26 | CN | 75 | CN | 54 |
| | | 26 | CN | 82 | CN | 55 |
| | | 26 | CN | 102 | CN | 88 |
| | | 26 | CN | 80 | CN | 67 |
| | | 26 | CN | 57 | CN | 31 |
| | | 26 | CN | 52 | CN | 57 |
| | | 26 | CN | 68 | CN | 57 |
| | | 26 | CN | 61 | CN | 72 |
| | | 26 | CN | 57 | CN | 52 |
| | | 26 | CN | 102 | CN | 53 |
| | | 26 | CN | 76 | CN | 52 |
| | | 26 | CN | 62 | CN | 54 |
| | | 26 | CN | 52 | CN | 51 |
| | | 26 | CN | 54 | CN | 37 |
| | | 26 | CN | 83 | CN | 33 |
| | | 26 | CN | 74 | CN | 60 |
| | | 26 | CN | 60 | CN | 48 |
| | | 26 | CN | 96 | CN | 100 |
| | | 26 | CN | 51 | CN | 75 |
| | | 26 | CN | 60 | CN | 60 |
| | | 26 | CN | 32 | CN | 79 |
| | | 26 | CN | 69 | CN | 86 |
| | | 26 | CN | 72 | CN | 52 |
| | | 26 | CN | 62 | CN | 72 |
| | | 26 | CN | 61 | CN | 50 |
| | | 26 | CN | 51 | CN | 69 |
| | | 26 | CN | 64 | CN | 82 |
| | | 26 | CN | 84 | CN | 62 |
| | | 26 | CN | 78 | CN | 71 |
| | | 26 | CN | 58 | CN | 63 |
| | | 26 | CN | 56 | CN | 63 |
| | | 26 | CN | 59 | CN | 55 |
| | | 26 | CN | 62 | CN | 42 |
| | | 26 | CN | 64 | CN | 63 |
| | | 26 | CN | 57 | CN | 74 |
| | | 26 | CN | 73 | CN | 79 |
| | | 26 | CN | 72 | CN | 65 |
| | | 26 | CN | 64 | CN | 75 |

**Appendix 1. (continued)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 7/31/95 | North Fork | 26 | CN | 82 | CN | 39 |
| | Twelvemile Creek | 26 | CN | 82 | CN | 58 |
| | | 26 | CN | 56 | CN | 60 |
| | | 26 | CN | 56 | CN | 50 |
| | | 26 | CN | 56 | CN | 69 |
| | | 26 | CN | 63 | CN | 65 |
| | | 26 | CN | 100 | CN | 61 |
| | | 26 | CN | 68 | CN | 58 |
| | | 26 | CN | 68 | CN | 56 |
| | | 26 | CN | 50 | CN | 58 |
| | | 26 | CN | 51 | CN | 72 |
| | | 26 | CN | 107 | CN | 66 |
| | | 26 | CN | 104 | CN | 79 |
| | | 26 | CN | 70 | CN | 46 |
| | | 26 | CN | 66 | CN | 90 |
| | | 26 | CN | 64 | CN | 46 |
| | | 26 | CN | 62 | CN | 64 |
| | | 26 | CN | 88 | CN | 79 |
| | | 26 | CN | 48 | CN | 65 |
| | | 26 | CN | 53 | CN | 51 |
| | | 26 | CN | 61 | CN | 74 |
| | | 26 | CN | 74 | CN | 98 |
| | | 26 | CN | 96 | CN | 55 |
| | | 26 | CN | 60 | CN | 64 |
| | | 26 | CN | 94 | CN | 61 |
| | | 26 | CN | 41 | CN | 77 |
| | | 26 | CN | 49 | CN | 66 |
| | | 26 | CN | 103 | BB | 235 |
| | | 26 | CN | 91 | RWF | 235 |
| | | | | | | |
| 8/1/95 | Bonanza Creek | 16 | AG | 157 | AG | 137 |
| | | 16 | AG | 146 | AG | 146 |
| | | 16 | AG | 145 | AG | 141 |
| | | 16 | AG | 170 | AG | 146 |
| | | 16 | AG | 126 | AG | 147 |
| | | 16 | AG | 135 | | |
| | | | | | | |
| 8/1/95 | Bonanza Creek | 17 | AG | 135 | AG | 131 |
| | | 17 | AG | 163 | AG | 126 |
| | | 17 | AG | 148 | AG | 137 |
| | | 17 | AG | 115 | AG | 114 |
| 8/1/95 | Porcupine Creek | 19 | AG | 180 | AG | 148 |

**Appendix 1. (concluded)**

| Date | Stream | Site | Species | Length (mm) | Species | Length (mm) |
|---|---|---|---|---|---|---|
| 8/1/95 | Porcupine Creek | 19 | AG | 137 | AG | 162 |
| | | 19 | AG | 150 | AG | 150 |
| | | 19 | AG | 157 | AG | 119 |
| | | 19 | AG | 157 | | |
| | | | | | | |
| 8/1/95 | Porcupine Creek | 18 | AG | 218 | AG | 212 |
| | | 18 | AG | 238 | AG | 190 |
| | | 18 | AG | 244 | AG | 200 |
| | | 18 | AG | 196 | AG | 189 |
| | | 18 | AG | 182 | AG | 154 |
| | | 18 | AG | 204 | AG | 201 |
| | | 18 | AG | 194 | RWF | 227 |
| | | 18 | AG | 144 | RWF | 267 |
| | | 18 | AG | 205 | | |
| | | | | | | |
| 8/1/95 | Mammoth Creek | 9 | AG | 230 | AG | 126 |
| | | 9 | AG | 182 | AG | 105 |
| | | 9 | AG | 147 | AG | 171 |
| | | 9 | AG | 173 | AG | 169 |
| | | 9 | AG | 153 | AG | 144 |
| | | 9 | AG | 128 | RWF | 230 |
| | | 9 | AG | 160 | | |
| | | | | | | |
| 8/1/95 | Bedrock Creek | 8 | AG | 252 | AG | 187 |
| | | 8 | AG | 237 | AG | 240 |
| | | 8 | AG | 225 | AG | 145 |
| | | | | | | |
| 8/2/95 | Deadwood Creek | 5 | AG | 250 | AG | 164 |
| | | 5 | AG | 205 | CN | 91 |
| | | 5 | AG | 226 | CN | 91 |
| | | 5 | AG | 203 | LNS | 111 |
| | | | | | | |
| 8/2/95 | Deadwood Creek | 27 | AG | 254 | AG | 184 |
| | | 27 | AG | 261 | RWF | 211 |
| | | 27 | AG | 133 | | |
| | | | | | | |
| 8/2/95 | Deadwood Creek | 4 | AG | 288 | AG | 182 |
| | | 4 | AG | 247 | AG | 275 |
| | | 4 | AG | 230 | AG | 269 |
| | | 4 | AG | 275 | AG | 220 |
| | | 4 | AG | 234 | AG | 184 |
| | | 4 | AG | 270 | | |