SCOTT RIVER MONITORING PLAN

SEDIMENT SAMPLING & ANALYSIS - 2000

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& Scott River Watershed Council

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Final Report

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SISKIYOU RESOURCE CONSERVATION DISTRICT
BOARD OF DIRECTORS

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SCOTT RIVER - 2000
SEDIMENT SAMPLING ANALYSIS

Abstract

Spawning gravels in the Scott River and several tributaries were sampled for sediment composition during the low flow period of 2000. Using a McNeil core sampler, 300 samples were collected, sieved into 7 size classes, and analyzed from 12 mainstem and 4 tributary sites in the Scott Valley area of the basin. Methods and sites followed the protocols of the 1989 baseline monitoring performed as part of a granitic sediment study. Comparing 2000 results to those of 1989 reveals several observations. The mainstem Scott River appears to be getting coarser in its sediment composition, particularly in the mid-section of the valley below Highway 3. This reduction in fine sediment may reflect the readjustment of the river's gradient following removal of a small diversion dam and its 30 year accumulation of stored sediment in the river channel behind it. For the tributaries, two of the sites showed reduction in fine sediment, while the other two showed increases. Effects of the 1997 flood could explain some of the higher sediment levels at these sites. Repeated sampling of the same sites, plus some additional ones, is strongly encouraged to occur by 2004, in anticipation of the sediment TMDL to be completed for the Scott by 2005.

Introduction

This analysis of the 2000 sediment sampling data is the sediment portion of the "Scott River Monitoring Plan" grant by the California Dept. of Fish and Game to the Siskiyou Resource Conservation District (RCD) and the Scott River Watershed CRMP (now Council). The objective of this grant is to "implement a basin-wide monitoring plan over three years to ensure continuous monitoring and assessment of completed projects."

The Scott River Watershed Council's Monitoring Committee has identified the need to determine the effectiveness and validity of completed restoration projects. In the Council's Fish Population and Habitat Plan, long-term trend monitoring was also found to be needed to evaluate stream habitat conditions and identify any water quality limiting factors for salmon and steelhead health.

The only extensive sediment sampling of the Scott River previously done was in 1989 as part of the Scott River Basin Granitic Sediment Study by Sommarstrom, Kellogg, and Kellogg (1990) for the Siskiyou RCD, funded by the U.S. Fish and Wildlife Service. Sampling focus of that effort was on determining the extent of impact of sand-sized sediment on salmon and steelhead spawning habitat in the Scott River and selected tributaries. Its monitoring results serve as a quantitative baseline of sediment composition of spawning gravels for most of the Scott Valley area.

Objective of Sediment Sampling Analysis: To sample in 2000 the previous (1989) sediment sampling locations, analyze the data, and compare the results related to sediment conditions in these spawning gravel areas of the Scott River and selected tributaries.

Background

Several collaborative watershed groups have formed in the Scott River Basin to address the improvement of stream conditions, including sediment. In 1990, the French Creek Watershed Advisory Group was formed with the goal: *"to reduce sediment yield in the French Creek watershed and to reduce, as much as is feasible, the potential for negative cumulative watershed effects."* A 1991 French Creek watershed erosion control assessment was performed by the Soil Conservation Service to help with site-specific measures and practices (US SCS 1991). Since the 1990 sediment study found roads to contribute over 60% of the sand-sized sediment to the Scott River, a Road Management Plan and a Monitoring Plan were adopted in 1992. Significant road improvement work immediately occurred on all ownerships, and the plans have continued to be implemented. Sediment trend monitoring has involved McNeil sampling of one spawning site and V* fine sediment sampling of rearing pools in several different reaches of the French Creek drainage.

In 1992, the Scott River Watershed Coordinated Resource Management and Planning (CRMP) committee was created for the entire Scott basin, succeeded by the Watershed Council in 1999. A healthy and productive watershed and community are the group's primary goal, rather than just sediment reduction. The water quality objective in the adopted Fish Population and Habitat Plan is to: *"evaluate water quality conditions in the Scott River drainage for anadromous fish"*. To help improve fish habitat conditions, sediment-reduction efforts, including upslope erosion inventories and control projects, were completed or are in progress by the Council and its sponsor, the Siskiyou RCD. A list of these sediment assessments, inventories, and reduction projects can be found in Appendix A.

Several legal and regulatory decisions were made in the past decade related to the streams of the Scott River Watershed. The water quality of the Scott River and its tributaries was listed as "impaired" for sediment and temperature, under Section 303(d) of the Clean Water Act, by the North Coast Regional Water Quality Control Board and the US EPA. As a result, a Total Maximum Daily Load (TMDL) pollutant target and strategy for sediment and temperature must be prepared for the river system, to be completed by April 2005. Coho salmon in the region were listed as threatened under the federal Endangered Species Act in 1997 by the National Marine Fisheries Service. This listing increases the need to understand and improve the quality of coho habitat in the Scott River system.

Methods

The substrate of the Scott River and several tributaries was measured using the same methodology as the 1989 sampling effort, commonly referred to as the McNeil core sampler method (Sommarstrom et al. 1990). All of the 2000 samples were again collected during the low flow period, beginning in August, but this time extending to late October.

The focus of the following descriptions is on any changes to the original 1989 methods. Since 1995, a protocol for the sampling, processing, and analysis of stream substrate for salmonids has become used as standard guidelines in the North Coast region (Valentine 1995). Only minor differences in protocol, however, were noted between these two.

Locations

Most of the original sites were selected to evaluate sediment changes potentially attributable to tributary sources of sediment or to changes in stream gradient. Sampling sites in 2000 were comparable to those of 1989, with the following exceptions (see Figure 1 and Table 1). In the mainstem Scott, several properties had changed ownership and different access opportunities resulted in slightly different locations. In addition, channel morphology (e.g., location of spawning riffles and runs) of a few sites had altered and the study reach needed to be moved somewhat. These changes, however, were minor as the location sites were moved up or down stream a maximum of 500-1,000 feet (sites affected are noted in Table 1).

A new site was also added to the original 11 sites, creating a total of 12 mainstem sampling sites. This new site (J-2) is located between Fay Lane and Callahan just downstream of the confluence of Sugar Creek. The justification for adding the new site is that this upper Scott River reach was the longest (6.0 miles) not sampled in 1989 and another evaluation point in substrate composition was needed. While this reach's condition is complicated by the presence of the dredger tailings along the west side, the site can be used to help evaluate the effect of Sugar Creek's sediment input to the Scott.

Of the original 6 tributary sample sites, 4 were re-measured: Etna Creek at Highway 3 bridge (E2), French Creek at the Highway 3 (F2) and Miner's Creek Road (F3) bridges, and Sugar Creek near the mouth below the Highway 3 bridge (S1).

Collection and Analysis of Samples

A McNeil sampler was used with a 6 inch wide core opening and a 12 inch deep tube. Contents of each sample were labeled and placed in a 5 gallon plastic bucket in the field. Samples were sieved off-site. Six sieve sizes were used as before: 25.0 mm, 12.5 mm, 6.35mm, 4.75mm, 2.36mm, and 0.85 mm. Wet measurements were made volumetrically by recording the amount of displaced water from the retained material in a 500 mL or 1000 mL graduated cylinder. The fines and water passing the smallest screen (<0.85 mm)

Figure 1. Location of Scott River Sediment Sampling Sites, 1989 and 2000

were placed in a 1000 mL Imhoff cone. After 10 minutes (set by a timer), the settled material was recorded.

Ten percent of the samples (or 2 per sampling site) were set aside to be dried. Samples were taken to the US Forest Service soils laboratory in Yreka several months later, where they were oven dried and weighed. By correlating wet volume (ml) with dry weight (pounds) measurements for each sieve sample (mm), and converting pounds to grams, a ratio was obtained to get a volumetric equivalent dry weight in grams for each sieve size: 25 mm = 2.35; 12.5 mm = 2.44; 6.35 mm = 2.77; 4.75 mm = 2.35; 2.36 mm = 2.69; 0.85 mm = 2.4; less than 0.85 mm = 1.1.

These 2000 conversion ratios were very comparable (within 10%) to the 1989 ratios for 5 of the 7 sieve categories, but were significantly (36-50%) different for 2 of the sieve sizes (2.36 and 0.85 mm). Since this difference could not be readily explained, the 1989 ratios were applied instead to the 2000 wet volume data for conversion in order for the dry weights from the two years to be more accurately comparable. These conversion factors were: 25 mm = 2.47; 12.5 mm = 2.56; 6.35 mm = 2.54; 4.75 mm = 2.16; 2.36 mm = 1.98; 0.85 mm = 1.6; less than 0.85 mm = 1.0. [The net effect causes the 2000 data to be slightly higher for the smaller sediment classes at some sites.]

Sample Size

The 1989 sampling study evaluated the optimum sample size statistically for the Scott River and the tributary sites. For sites with uniform substrate, 15-20 samples were estimated to be adequate to reasonably evaluate the substrate quality (i.e., a small margin of error). The decision for 2000 was to take 20 samples at each site in the mainstem Scott and 15 samples in the tributaries. As a result, this year's effort altered the number of samples – increasing the number for most sites (D, E, F, K, E2, F2, F3, S1) and decreasing the number for the balance (A, G, H, I, J). Only site H had 25 samples collected, or half the amount of the previous effort, while site K had 15 samples due to the difficulty of collecting and sieving samples in the predominantly cobble-sized substrate. The total samples collected were 300, slightly larger than the 293 samples from 1989. See Table 1 for the number at each site.

River Reaches

The 1989 study divided the mainstem Scott River into 10 roughly equal reaches, mainly from bridge to bridge where cross-sections were taken (see Figure 3-5, Sommarstrom et al 1990). Reaches usually included at least one sediment sample site. Reaches were numbered from downstream (beginning at River Mile 21.2 at USGS gage station) to upstream (ending at River Mile 55.9 below Forks at Callahan). These reaches were used for sediment storage and transport analyses and again referred to here in the Discussion.

Table 1. Locations of Substrate Sampling Sites & Sample Sizes, 2000

Site / Landowner	**River Mile**	**# Samples**	**Rationale**
Scott River – Mainstem			
A [2]	23.5	20	Below Shackleford Cr.
B	24.5	20	Above Shackleford Cr.
C [2]	29.5	20	Below Moffett Cr.
D	32.2	20	Above Moffett, below Kidder
E [2]	32.3	20	Above Kidder Cr.
F	34.7	20	Lowest gradient reach
G	38.8	20	Below Etna Cr.
H	42.5	25	Above Etna Cr.
I	47.5	20	Below French Cr.
J	49.7	20	Above French Cr.
J2 [1]	53.4	20	Below Sugar Cr.
K	55.7	15	Below South & East Forks
	Sub-Total =	240	
Etna Creek			
E2	2.3	15	Site since 1982
French Creek			
F2	0.6	15	Site since 1982
F3	1.4	15	French WAG site
Sugar Creek			
S1	0.5	15	Another DG tributary
	Sub-Total =	60	
	TOTAL =	300	

1/ New site in 2000.

2/ Site location altered slightly since 1989.

Results

Sediment size distribution for the percent retained on each sieve size is provided in Appendix B. However, a more useful way to look at percentage fines is described below in Table 2: the cumulative percentages less than the four smallest sieve sizes. These sizes less than 6.3 mm represent the finer sediments. Results from 1989 are also included in this table for each site.

Table 2. Comparison of Cumulative Percentage of Fine Sediments, 1989 & 2000
(percent less than sieve size, based on dry weight in grams)

Site	6.3 mm		4.75		2.36		0.85	
	1989	2000	1989	2000	1989	2001	1989	2000
Mainstem Scott								
A	26.8	33.7	24.0	29.1	19.2	20.4	8.0	7.4
B	41.0	50.5	35.1	44.3	24.7	31.5	11.1	10.4
C	36.5	36.4	31.9	31.7	23.9	23.5	11.0	11.0
D	92.7	72.2	88.2	62.9	72.7	41.2	20.1	8.9
E	82.4	84.3	76.3	77.7	56.5	53.6	19.9	9.8
F	82.1	75.7	74.7	65.7	52.9	42.6	21.6	14.2
G	56.7	57.6	50.0	50.3	37.0	36.3	17.0	16.8
H	40.1	41.6	35.3	36.1	25.8	25.8	10.5	11.0
I	36.8	40.2	33.4	35.6	26.5	26.4	12.2	11.3
J	28.2	25.8	25.0	21.7	17.9	14.5	7.4	5.8
J2	--	18.3	--	14.7	--	9.5	--	4.0
K	30.6	32.6	27.2	26.3	19.4	17.0	6.4	4.0
Tributaries								
E2	28.3	16.9	25.1	12.6	18.3	7.9	5.1	2.8
F2	42.6	33.9	39.0	28.9	27.6	19.9	8.2	6.9
F3	33.4	46.0	29.2	42.2	17.6	32.4	8.2	10.9
S1	30.8	33.8	26.4	29.6	18.0	21.7	6.3	9.9

A visual comparison is provided in Figures 2 through 4 for the Scott River mainstem. For fines less than 0.85 mm, the results show a 2000 reduction for 10 of the 12 sites, no change in one site, and a slight increase in another site. Three mid-valley sites (D, E, F) indicated significant reductions of 35-56%. For the next larger size class of less than 2.36 mm, only two sites have decreased, 8 sites have increased, and one site showed no change. Very similar results hold for fines less than 4.7 mm and 6.4 mm. Site D consistently had lower levels of fine sediment in 2000 than in 1989.

Figure 5 depicts the changes for the smaller three sediment size classes in the three tributaries of Etna, French, and Sugar creeks. Both Etna and lower French Creek sites (each below the State Highway 3 bridge crossings) showed consistently lower percentages for sediment sizes less than 0.85, 2.36 and 4.7 in 2000 compared to 1989.

Figure 2.

Figure 3.

Figure 4.

Figure 5.

However, the opposite was found for upper French Creek (at Miner's Creek Rd. bridge) and Sugar Creek (below Highway 3): fine sediment levels were higher in the most recent sampling.

It should be noted that "fine sediment" is a range of sizes of stream substrate channel materials, depending on the definition used. Some have called "large fine sediments" to be 0.83 to 4.71 mm, and "small fine sediment" to be less than 0.83 mm (Platts et al. 1983). For juvenile fish, large fine particles can trap alevins in the redds, while the small fine particles decrease water permeability through the spawning gravels. As noted in Sommarstrom et al. (1990), several laboratory and field studies comparing percentage fine sediment to percentage emergence of salmon eggs were also performed on substrate of 6.4 and 9.5 mm. For geologists and engineers, sediment between 4 and 8 mm is considered fine gravel, between 2 and 4 is very fine gravel, and between 0.5 and 2.0 mm is coarse sand (ASCE 1975).

Discussion

The mainstem Scott River appears to be getting coarser in its sediment composition, most notably in the mid-valley section below Highway 3. In 1989, the three sites D, E, and F contained the highest percentage of fine sediments, each about 20% in the size finer than 0.85 mm. The Scott River Basin Granitic Sediment Study also noted that this reach (#3) between Highway 3 and Scott Valley Ranch (below Moffett Creek) contained the second highest volume of stored sediment per mile of any reach, only exceeded by the reach (#2) downstream to Meamber Bridge.

A major factor that may explain this dramatic change was the removal of the lower Scott Valley Irrigation District diversion dam in 1987-89. This small rock and timber dam was built on the Scott at the mouth of Moffett Creek below Fort Jones in 1956-57, was partially removed in 1987, and completely removed in 1989 before the August - September 1989 sediment sampling was done. Estimated measurements of the stored sediment in this reach reflected the recent effect of the dam. Acting as a gradient control structure for 30 years, sediment had stored behind it and had altered the gradient of the river: the immediate area upstream had the lowest slope in the river. As a result of the dam's removal, sediment was moving downstream and the streambed was readjusting its slope and sediment transport capacity in 1989 and the following years. This reach was noted for its high transport capacity in 1989 due to the prevalent small grain size, large width, low slope, and low roughness. It appears that the smallest fines of the stored sediment have flushed downstream and out of the valley, since the three lower sites did not increase in this size of fines.

Between 1989 and 2000, the river and tributaries had experienced five years of drought-induced low flows and six years of average to above average runoff, including a large flood on New Year's Day, 1997. In the Scott's mainstem, the flood caused the channel to change location in several sections, in some sites reworking past flood deposits and in others cutting into the older terrace streambanks (e.g., between dredger tailings and

French Creek mouth, and one mile above Meamber Bridge) (Gary Black, Siskiyou RCD, pers. comm.). In several of the tributary watersheds, flood flows caused damage to roads and washed out several culverts along with the roadbed.

In the 1990 study, the quantitative sediment evaluation of the mainstem sites correlated with the locations of previous chinook salmon spawning surveys. Carcass recovery surveys going back to 1978 found a predominance of spawning activity in the lower valley reach (sites A and B), where the gravel quality was lowest in percent fines (in addition to the upper sites near Callahan). Recent 1998 and 1999 Scott River spawning surveys from the California Dept. of Fish and Game for chinook carcass sites and redd locations again indicate highest spawning use in the lowest reaches below Meamber Bridge. However, redd surveys are indicating spawning activity below Highway 3 (sites D and E). Little to no spawning continues to be the pattern in the Highway 3 to Black Bridge section (sites F & G).

The Scott Valley spawning gravels are very significant as the area is known to collect over 80% of the Scott River's chinook carcasses and over 60% of the identified redds, though the canyon area is more difficult to survey (CDFG 1998-99). Valley gravels provide a critical component of the anadromous fish spawning needs, particularly since they are not as prone to scour during flooding as the canyon section. During drought years like 1994, the canyon plays a crucial role when flow conditions impede access to the valley for spawning (Mark Pisano, CDFG, pers. comm.).

Interpreting the 2000 sediment results and changes in the three tributaries is more challenging. Etna Creek's watershed is relatively stable and the monitoring site has a fairly high gradient with small cobble substrate, which could explain why the fines in the spawning gravels appear to be winnowing out. No significant damage was known to occur from the 1997 flood. For French Creek, significant erosion control measures have been taken on at least 42 miles of its 119 miles of road (74 miles on granitic soils) (French Creek WAG, 1996). However, debris slides took out several upper road culverts in the 1997 flood (i.e., Paynes Creek, High C, North Fork roads) and lower French Creek altered its channel above Miner's Creek by cutting into the 1964 flood deposits (Jay Power, USFS, pers. comm.). The reworking of that new channel, as well as new flood deposits from upper tributaries, may partly explain the increased sediment levels at the upper French Creek monitoring site (F3). Bank erosion of floodplain alluvium introduces mainly fine sediment. This site is also the first downstream reach with a low gradient, and a longer term sediment deposition area. Miner's Creek deposits into this area, and a known upstream erosion "hot spot" with significant gullying has not been able to be treated on that tributary. The actual gradient of these creek reaches is not known.

The lowest monitoring site on French Creek, below Highway 3 near the mouth, has shown consistent coarsening. Possible reasons include the sediment transport capacity may be greater there, or the sediment deposited at the upper site has not yet moved into this site. Sugar Creek's increase in fine sediment at this site near the mouth suggests an investigation of upslope sediment sources, particularly its public and private road system.

The County Road, however, has had road improvements since 1989 (Bob Driscoll, Siskiyou County Road Dept., pers.comm.).

Using percentage fines as an analysis tool for sediment monitoring data continues to have its strengths and weaknesses. If one size class decreases, the other size classes have to increase. This relative percent indicator can distort or ignore the textural quality of the remainder of the spawning gravel (Platts et al 1983). Studies have investigated other indices of gravel quality (e.g., geometric mean, fredle index), yet the conclusions continue to support that the percentage of substrate less than a given size is the best indicator of changes in field substrate composition because it measures the portion of the particle size distribution that was modified (Sommarstrom et al 1990;Young et al 1991;Klingeman et al. 1998).

Conclusions

Last year's 2000 sediment sampling and analysis provides a contribution to both sediment trend monitoring and sediment-related project monitoring in the Scott River and several tributaries, particularly for evaluating changes in the quality of spawning gravels. In comparison to the 1989 baseline monitoring results, the mainstem Scott River appears to be getting coarser in its sediment composition, most significantly in the mid-section of the valley below Highway 3. This reduction in fine sediment may reflect the readjustment of the river's gradient after the removal of a small diversion dam in 1987-89, and its 30 year accumulation of stored sediment. For the tributaries, two of the sites decreased in fine sediment content while two other sites increased. Effects of the 1997flood could explain some of the higher sediment levels at these sites.

Repeated sampling of the same sites, plus some additional ones, is strongly encouraged to occur by 2004, in anticipation of the sediment TMDL to be completed for the Scott River watershed by 2005. To better evaluate recently funded road erosion reduction projects (Appendix A), new McNeil sampling sites should be added for spawning gravel reaches in Moffett Creek, Shackleford/ Mill Creek, Lower Mill Creek, and Clark Creek. Only indirect evaluations are possible now, by looking at results of mainstem sites upstream and downstream of the tributaries. Sugar Creek's increase in fine sediment suggests an investigation of upslope sediment sources, particularly its public and private road system.

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APPENDIX A

SISKIYOU RCD / SCOTT RIVER WATERSHED COUNCIL

UPSLOPE WATERSHED CONDITIONS
Project List, 1989-2001

Watershed & Sediment Assessments

Project Year / Title	Funder	Amount
<u>FY 1989-90</u>		
Scott River Basin Granitic Sediment Study	USFWS/TF	$ 50,000
<u>FY 1990-91</u>		
Phase II -French Creek Subbasin Erosion Control Assessment	USFWS/TF	$ 30,768
<u>FY 1999-2000</u>		
Moffett Creek Upland Gross Assessment	SWRCB	$ 88,505 In progress
<u>FY 2000-2001</u>		
Scott River Watershed Planning & Assessment	SWRCB	$185,621 funded

Road Erosion Inventories & Reduction Projects

Project Year / Title	Funder	Amount
<u>FY 1993-94</u>		
French Creek Watershed Granitic Erosion Control Project	ERO	$110,000
<u>FY 1998-99</u>		
Shackleford/Mill Road Erosion Inventory	CDFG	$ 41,605
Shackleford/Mill Road Erosion Reduction	USFWS/USBR	$ 99,521
South Fork Road Erosion Inventory and Reduction	USFWS/TF	$ 47,795
<u>FY 2000-2001</u>		
Etna /Clark Creek Road Erosion Inventory	CDFG	$ 49,224 funded
Lower Scott/Mill Creek Road Erosion Inventory	CDFG	$ 77,513 funded

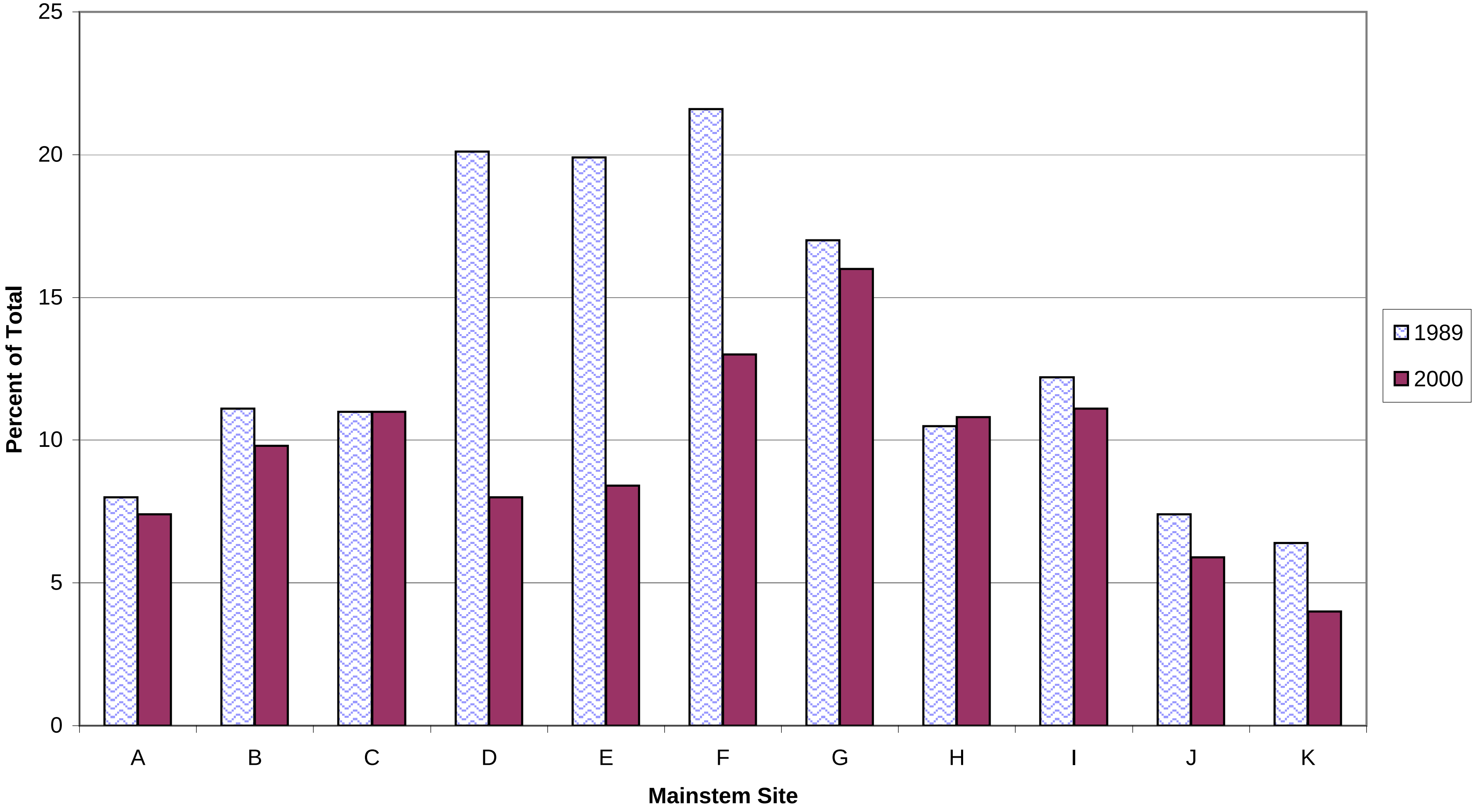
APPENDIX B

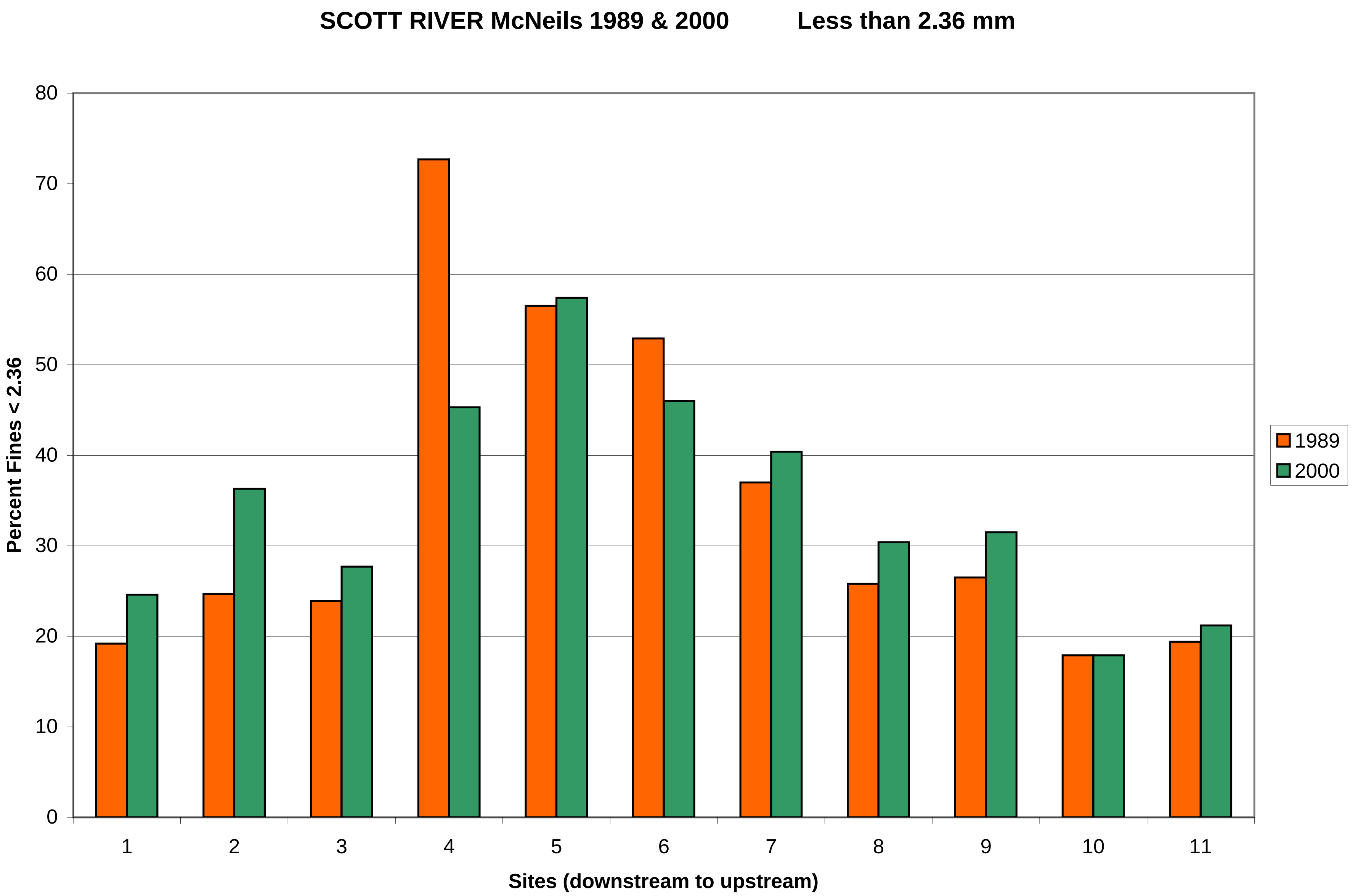
SEDIMENT COMPOSITION

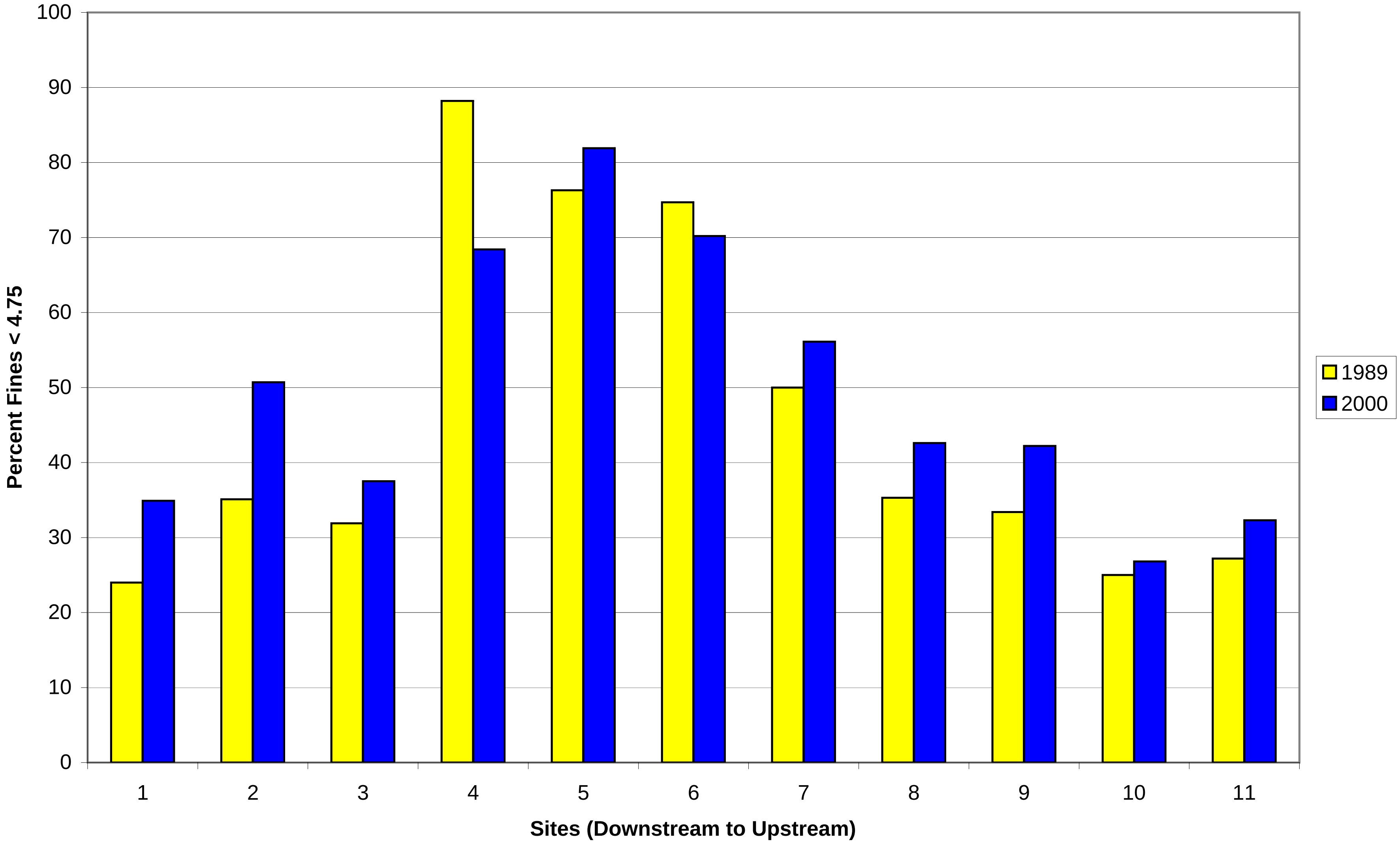
Figure 2.

Scott River Comparison for 1989 & 2000

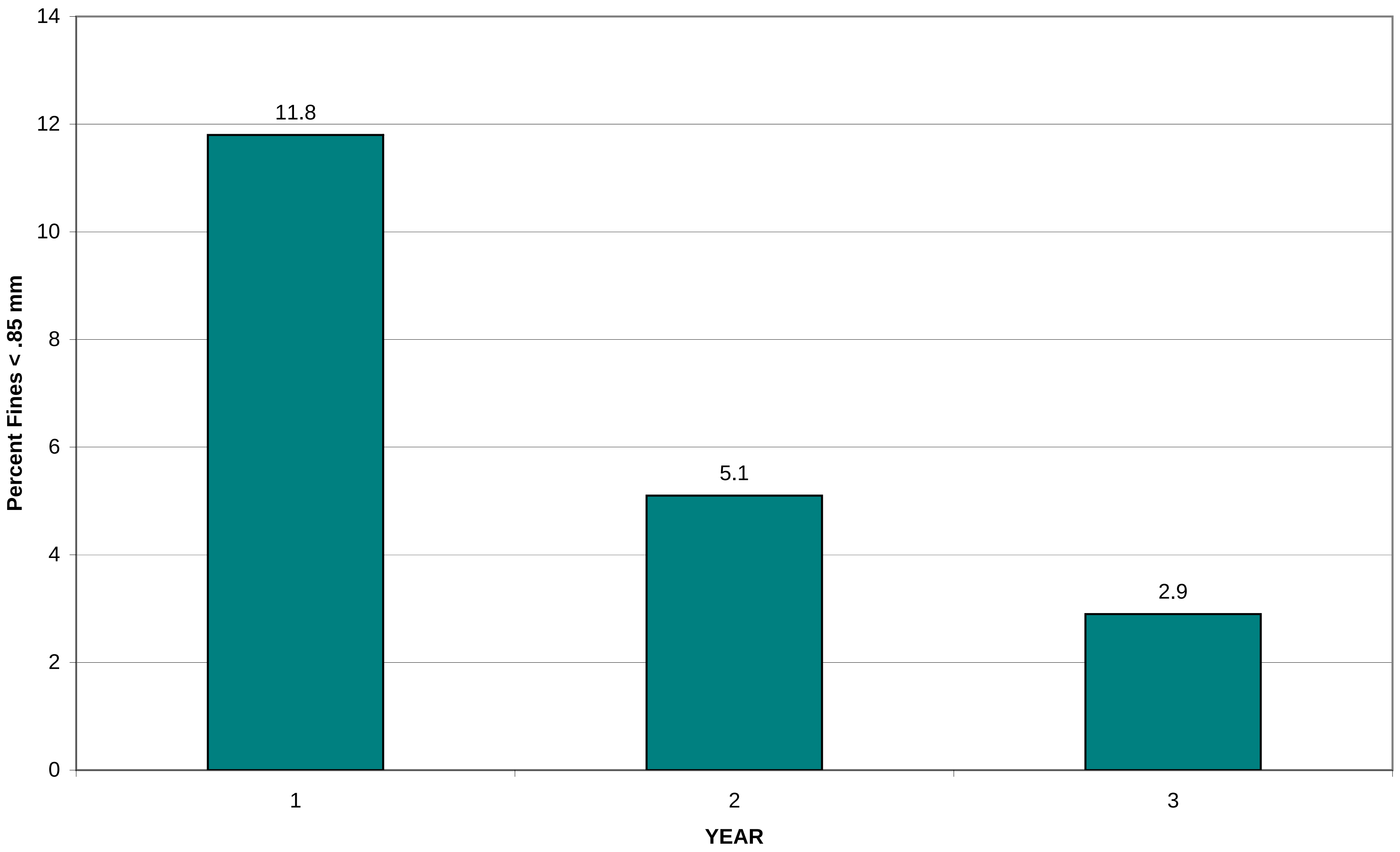
Cumulative Percent < 0.85 mm




SCOTT RIVER McNeils 1989 & 2000 Less than 2.36 mm
Percent Fines < 2.36
0
10
20
30
40
50
60
70
80
1
2
3
4
5
6
7
8
9
10
11
Sites (downstream to upstream)
1989
2000


SCOTT RIVER McNeils 1989 & 2000 Less than 4.75 mm

ETNA CREEK McNeils 1982-89-00



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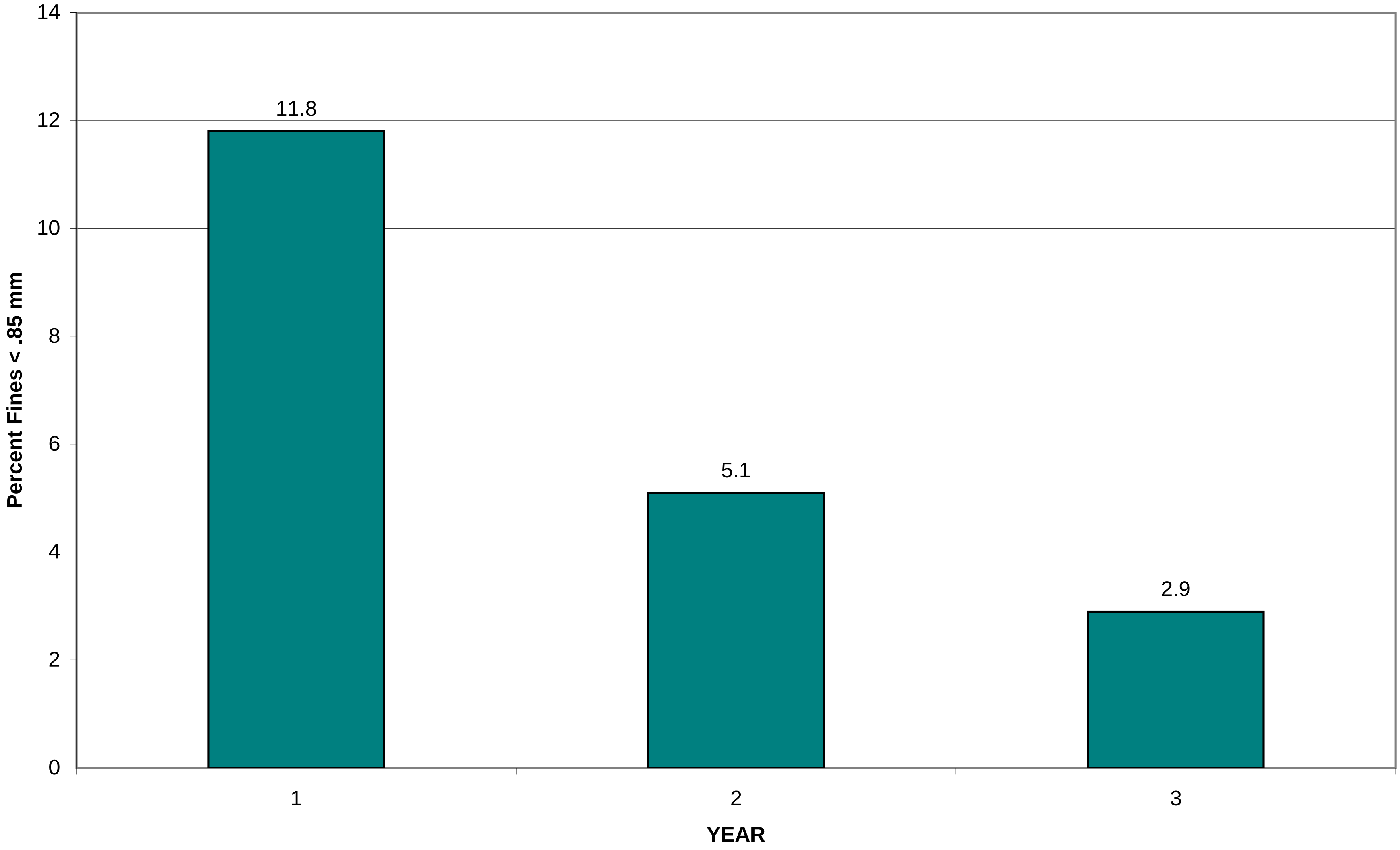
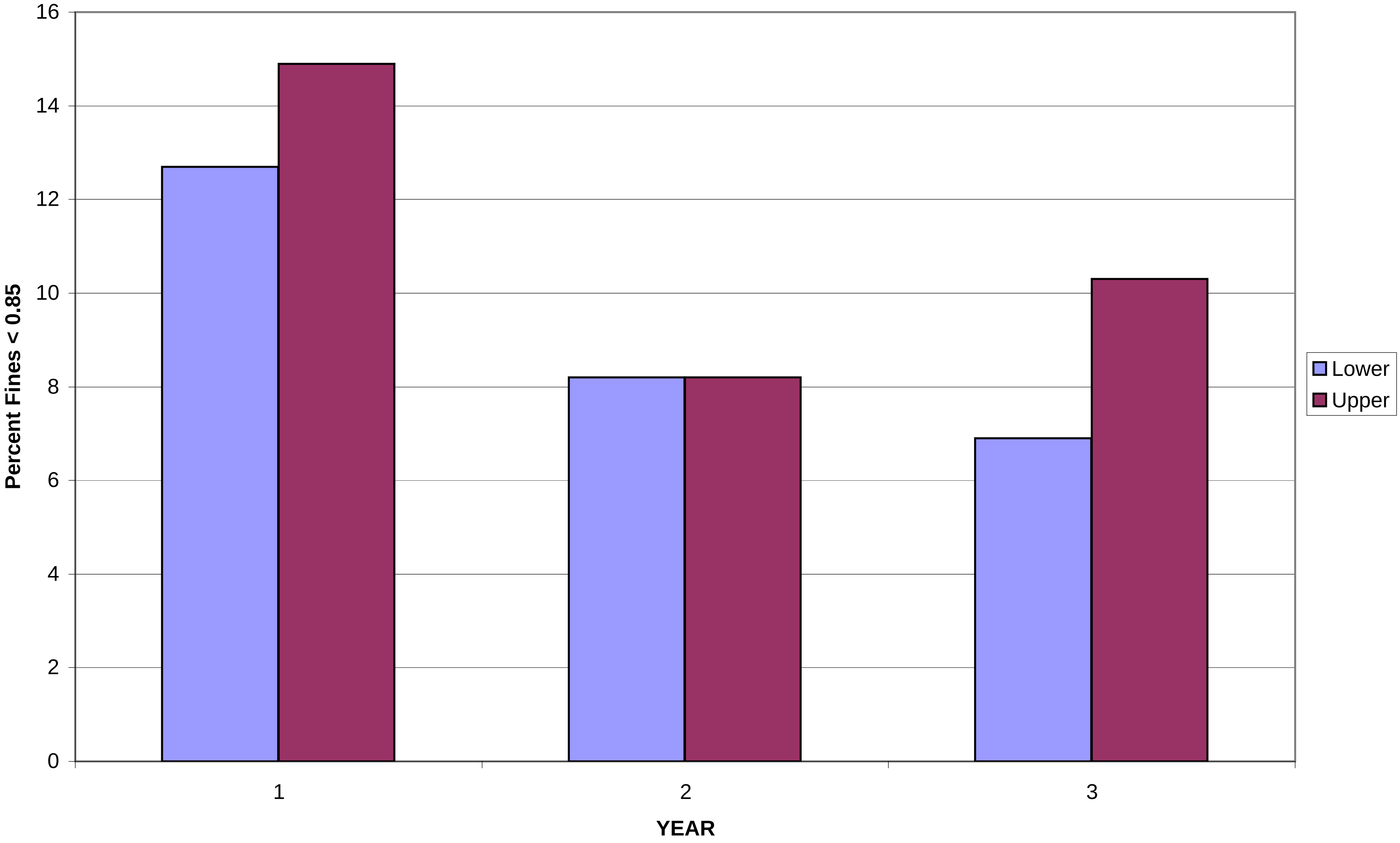
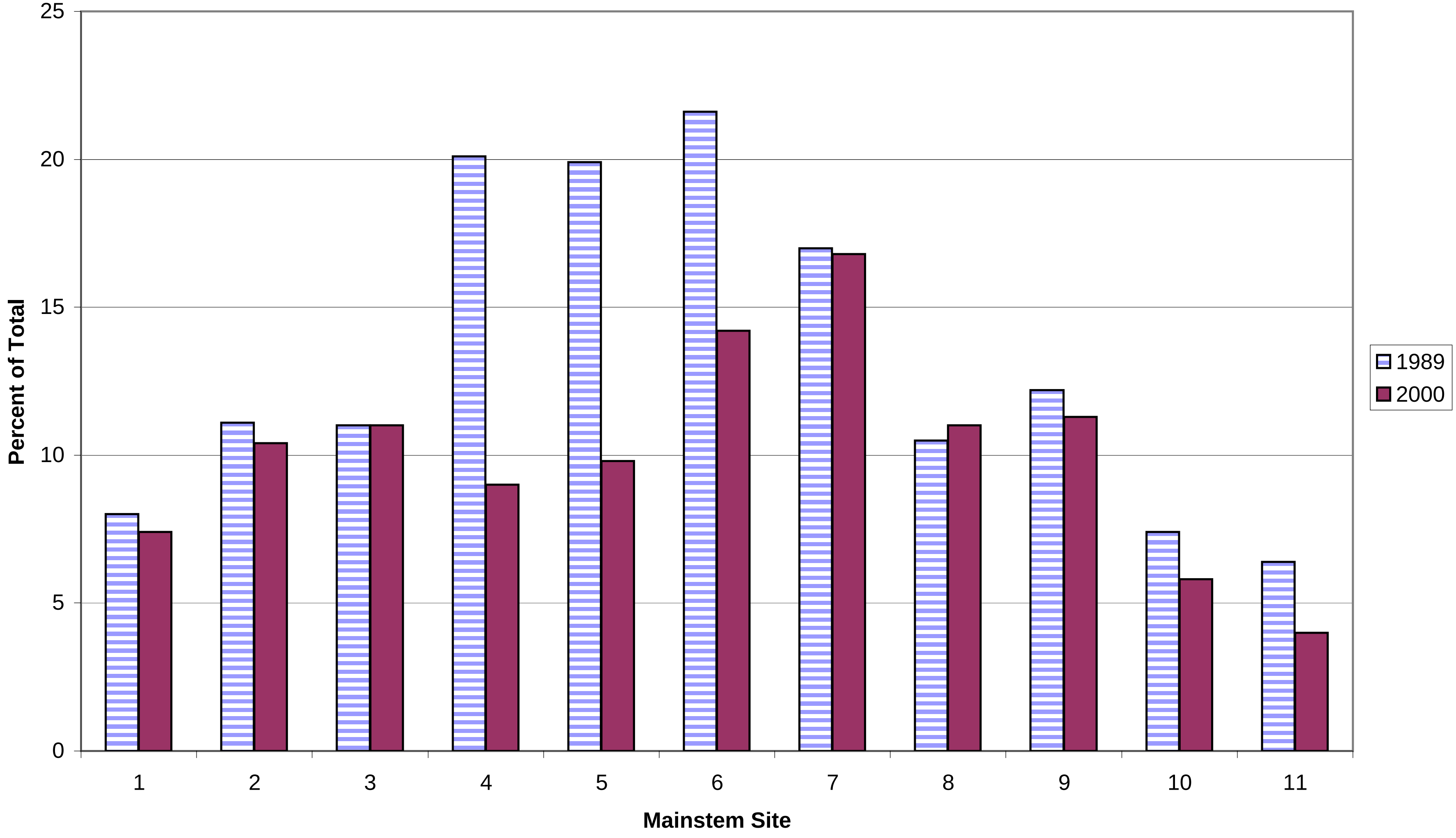


FRENCH CREEK McNeils at 2 Sites 1982-1989-2000





Scott River Comparison for 1989 & 2000

McNeil Core Sediment Results <0.85 mm

McNEIL SAMPLING SITE PHOTOS – 1989 AND 2000

Figure 1-A. Site A - 1989 Sampling – Nutting. Looking upstream.

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Figure 2-A. Site B - 1989 Sampling - Meamber Bridge – Tozier

Figure 2-B.   Site B - 2000 Sampling - Meamber Bridge – Tozier

Figure 2-C. Site B - 2000 Sampling – Tozier. Upstream view of transect length.

Figure 3-A. Site F – 1989 Sampling – Tobias (now Hanna). Looking upstream to transects.

Figure 3-B. Site F - 1989 Sampling – Tobias (now Hanna). Transect site – downstream view.

Figure 3-C. Site F - 2000 Sampling – Hanna @ Serpa / Airport Rd. Bridge. Downstream view.

Figure 3-D. Site F - 2000 Sampling – Hanna. Transect site.

Figure 3-E.   Site F - 2000 Sampling – Hanna. Transect site.

Figure 3-F. Site F - 2000 Sampling – Hanna. Upstream view.

Figure 4. Site G - 2000 Sampling – Hurlimann.

Figure 5-A. Site I – 1989 Sampling – Spencer.

Figure 5-B. Site I - 2000 Sampling – Spencer.

Figure 6-A. Site J – 1989 Sampling – Barnes. Looking upstream from Fay Lane Bridge.

Figure 6-B. Site J – 2000 Sampling – Barnes. Upstream view of transect length.

Figure 6-C. Site J – 2000 Sampling – Barnes. Transect site.

Figure 6-D. Site J – 2000 Sampling – Barnes. Downstream view to Fay Lane Bridge.

Figure 7-A. Site K- 2000 Sampling Site – Hayden. Near Red Bridge. Upstream view.

Figure 7-B. Site K- 2000 Sampling Site – Hayden. Near Red Bridge. Upstream view.

Figure 8-A. French Creek Site F2 – 2000 Sampling Site – Transect site above Highway 3 Bridge.

Figure 8-B. French Creek Site F2 – 2000 Sampling Site

Figure 9-A. French Creek Site F3 – 2000 Sampling Site. Transect site.

Figure 9-B. French Creek Site F3 – 2000 Sampling Site. Upstream view.