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DEPOSITION OF FINE SEDIMENT IN THE SALMON RIVER WATERSHED, PAYETTE AND BOISE NATIONAL FORESTS, IDAHO

STATISTICAL SUMMARY OF INTRAGRAVEL MONITORING, 1975-2010

Newly Installed Goat Creek Culvert, South Fork Salmon River, 1955.

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Summary

This report summarizes core sampling results for the Upper South Fork Salmon River (Upper SFSR), Upper Secesh River, and Chamberlain Basin, updated to include data collected through 2011. Sediment monitoring has occurred in the upper SFSR since 1975 and represents one of the longest such data sets available. In the Upper SFSR, this allows evaluation of sediment conditions as they recovered from floods in 1964-65, through watershed rehabilitation efforts, changes in management, and now may have been influenced by extensive fires in 2006 and 2007 and by extremely high spring discharge in 2008 and 2010. It seems clear that the fact that neither the fires nor the flooding had any deleterious effects on intragravel conditions, and vegetal recovery is happening quickly.

The other watersheds provide a wilderness reference setting and a lower relief SFSR area (the Upper Secesh) that has been managed differently, though recent fire activity has occurred in them as well. Intragravel conditions in these three watersheds are readily compared. Results of this report are generally consistent with recent reports in this series and indicate that the wilderness and Upper Secesh spawning areas are more similar to each other than they are to the Upper SFSR.

This intragravel monitoring is part of a more comprehensive sediment monitoring program performed by the Payette National Forest and, to a lesser extent, the Boise National Forest. We are required by terms and conditions of various consultations under the Endangered Species Act to continue monitoring sediment conditions in the SFSR watershed, but we are altering, with approval of the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, the monitoring schedule to accommodate fiscal constraints. The proposed changes are described in Nelson and Bonaminio (2009). We touch on them somewhat in this report, but they relate primarily to the interstitial monitoring to be covered in a subsequent report.

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Introduction

Sediment monitoring in the South Fork Salmon River (SFSR) watershed began in response to severe flooding caused by rain on snow in the winter of 1964-65 that inundated important habitat for anadromous fish (Nelson *et al.* 2002; Platts *et al.* 1989). Monitoring was begun with core sampling using techniques modified from McNeil (1964), and Platts *et al.* (1989), and we present some trend analyses dating back to 1966 in this report. Formal sediment monitoring by the Boise National Forest (BOF), however, began in 1975 (Corley 1976). The effort was begun using a 6-inch core sampler at 5 permanent locations in known spawning areas on the SFSR and in one such location on Johnson Creek, a major tributary to the East Fork South Fork Salmon River (EFSFSR), which is a parallel watershed located one drainage to the east of the SFSR. The Johnson Creek sampling was used to obtain control (*i.e.*, largely unaffected by the floods) data for comparison with the SFSR data. At that time, Corley also established several permanent photopoints for photographic monitoring of streambed changes over time. This monitoring has been continued (with some interruption) up to the present time.

The Payette National Forest (PAF) subsequently began additional sediment monitoring using similar core sampling techniques[1] in other watersheds: in 1981 sites were established in the Secesh River watershed, a major tributary to the SFSR that is of generally somewhat lower relief in its upper reaches where the monitoring sites were placed; and in 1989 sites were placed in the Chamberlain Creek watershed[2] in the Frank Church River Of No Return Wilderness (FC-RONRW), a largely undisturbed area of granitic geology similar to that of the SFSR watershed. For the past decade, the PAF has reported annually or biennially on the results of this monitoring and the SFSR monitoring. Our monitoring and reporting has served to satisfy requirements of the original PAF Land and Resource Management Plan (LRMP) (USFS 1988) and terms and conditions of ongoing actions and individual project consultations pursuant to the listing of Snake River Spring/Summer and Fall Chinook salmon (*Oncorhynchus tshawytscha*), Snake River steelhead (*O. mykiss*) and Columbia River bull trout (*Salvelinus confluentus*) as threatened under the Endangered Species Act of 1973 (ESA) as amended (16 USC 1531 *et seq*.). In addition, the 1988 LRMP specified certain conditions pertaining to streambed sediment levels in the SFSR prior to initiation of certain new projects and anticipated establishment of standards and guidelines based partly on this monitoring related for management actions in the SFSR. More recently, the PAF's revised LRMP (USFS 2003) specifies watershed condition indicators (WCIs) based on intragravel sediment conditions that have been revised (Nelson and Burns 2005) as required by the Biological Opinion (BO) issued by the National Marine Fisheries Service (NMFS) as a result of formal ESA consultation on the revised plan (NMFS 2003).

Analysis of the data collected since Nelson and Burns (2008) represents a unique opportunity to make additional assessments of the effects of large disturbances in the SFSR watershed. Previous reports concluded that the Upper SFSR watershed appeared to have regained much of its resilience to disturbances like flood events because of rehabilitation efforts that have occurred since the flooding of 1964-65 (*e.g.*, Nelson *et al.* 1998, 2001) and that sediment conditions may be relatively insensitive to natural disturbances like wildfire (*e.g.*, Nelson *et al.* 2001). Nelson and Burns (2008) included analysis of data collected after the relatively mild wildfires in the watershed in 2006 and reported little apparent effect. In 2007, larger fires that burned more aggressively

[1] Minor differences have been described previously (*e.g.*, Nelson *et al.* 1996).
[2] Although a core sample was taken in Chamberlain Creek in 1981, additional sampling was discontinued until 1989.

occurred over the whole SFSR watershed (Figure 1) with some of the more intense burning in the Poverty fire salvage area near Goat Creek (Nelson 2009), which was one of the most prominent sources of sediment during the 1964-65 flooding. In 2006 and 2007, approximately 441,771 acres (53%) of the SFSR watershed burned in those two years[3]; the locations of our core sampling sites in the SFSR watershed are also displayed in Figure 1 (next page). Although spring runoff in 2008 was very rapid, with the mainstem SFSR and Johnson Creek experiencing their second highest recorded peak discharges (Nelson 2008) and in the mainstem SFSR a level similar to the level that resulted in the breach at the Oxbow in 1974, there have not been any widespread significant rain-on-snow flood events in the Upper SFSR since the fires; however, there was some isolated flooding from Buckhorn and Fitsum Creeks in 2010 following rain on high elevation snowpack. Overall, the watershed, in general, appears to have shown resilience to these events.

The purpose of this report is to summarize the sediment core data collected in the SFSR watershed (after 1975 only and as required by the LRMP Biological Opinion (BO) (NMFS 2003) and the BO issued pursuant to the consultation on the SFSR road (NMFS 1993), the Secesh River watershed, and the Chamberlain Creek watershed. This report updates the results of core sampling since the last summary report (Nelson 2010) with data through 2011.

[3] Computed with ArcMap® using the PAF fire history geodatabase and a watershed boundary from the Idaho 6th-level watershed boundary delineation (WBD).

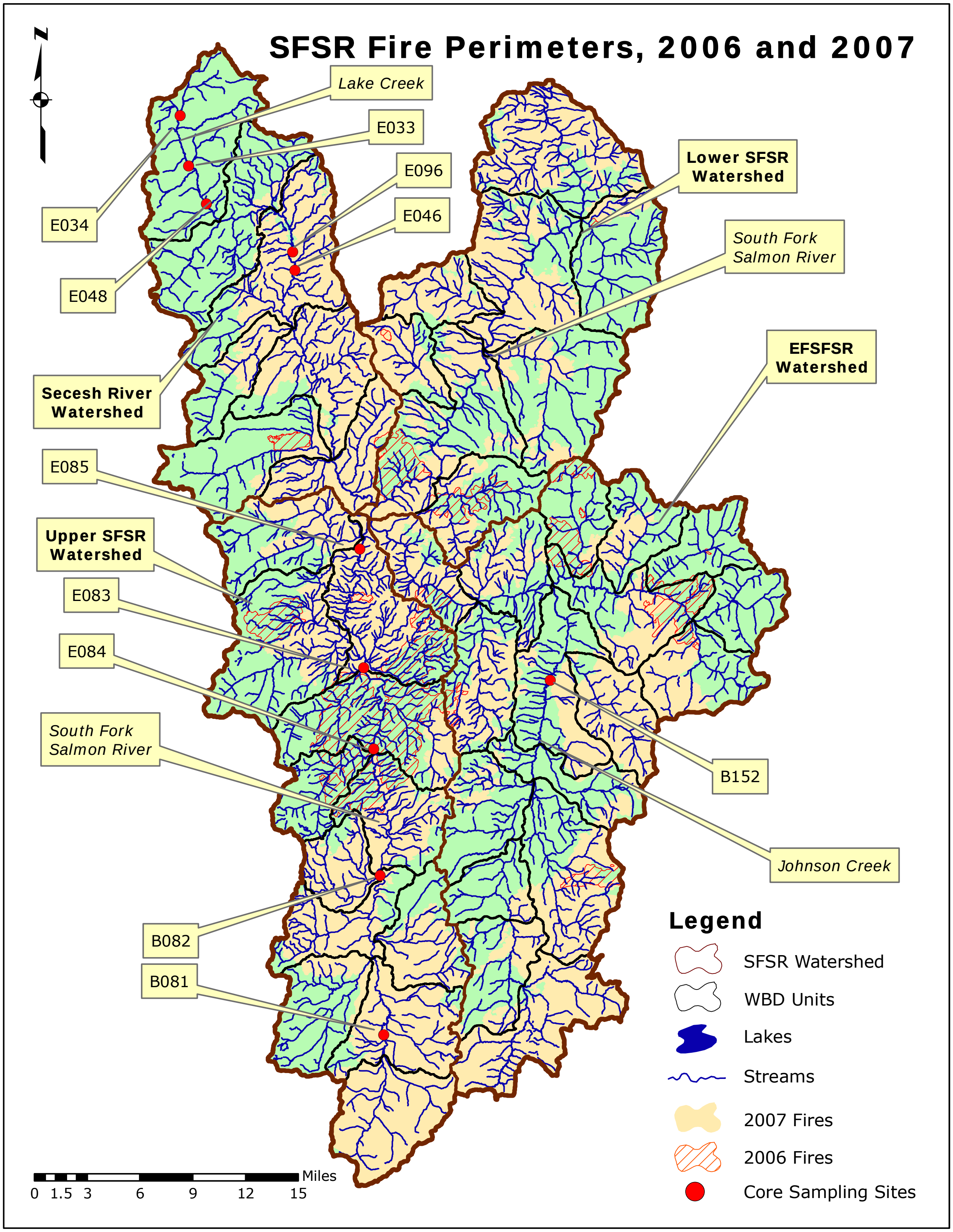

Figure 1.—Areas burned in the South Fork Salmon River Watershed in 2006 and 2007 and locations of the core sampling sites.

Methods

Methods are thoroughly described in Nelson *et al*. (2002), with a minor modification described in Nelson *et al.* (2004); information presented in those reports is not reiterated here. The core sampling on the SFSR had traditionally been conducted by the BOF, sometimes with the assistance of PAF crews, and had used a slightly different sampling protocol than the PAF sampling in the other two watersheds; the precise methods and the differences between the PAF and BNF protocols are well described in several other reports in this series and have been shown to produce comparable results (Nelson *et al*. 2002; Newberry 1988). Beginning in 2007, however, the PAF was largely responsible for coordinating the annual sampling using the normal PAF protocol.

As in Nelson and Burns (2008), we display multiple comparisons among spawning areas within watersheds to supplement the interbasin comparisons. The use of ANOVA and the *post hoc* Tukey's HSD test are described in the previous reports mentioned above, but it should be noted that for Chamberlain Basin, where we have only two sites, ANOVA is equivalent to a simple t-test. Summary data are displayed as in Nelson and Burns (2008): light green for "Functioning Appropriately" (FA), light turquoise for "Functioning At Risk" (FR), and rose for "Functioning At Unacceptable Risk" (FUR). This report also provides time series analyses covering all years (overall or long-term models) and for 2001-20011 (recent or short-term models) to facilitate application to the revised WCIs presented in Nelson and Burns (2005)[4]; trends that would be considered to indicate improvement are highlighted in light green, those that would be considered to indicate deteriorating conditions are shown in rose. Where analyses include evaluation of the most recent five years of sampling, the "recent" time periods are highlighted in medium grey. In a departure from previous reporting, the significance of the first-order Durbin-Watson statistic (DW) is not displayed because of changes to the display system of the SAS® system with version 9; autocorrelation is significant when values of DW are close to 2 and has been shown previously to be the typical (essentially ubiquitous) situation in our time series.

All statistical tables have been placed in Appendix 1 (summaries, trends, and intrabasin comparisons[5]) and Appendix 2 (interbasin comparisons), all time series graphs have been placed in Appendix 3, all intragravel quality graphs have been placed in Appendix 4, and all streamflow graphs have been placed in Appendix 5. A final appendix (Appendix 6) identifies the meanings of acronyms and abbreviations used in the report. As always, changes to tabular data and reflect corrections to the underlying database and/or previous reports and changes in time series analyses and graphics reflect primarily updates but may also reflect corrections to the underlying database and/or previous reports.

[4] This time period occasionally varies when there are missing data.

[5] The statistical summary tables and the comparison tables all show overall and recent means, but the former were calculated using Microsoft® Excel® and the latter using SAS®; consequently, some rounding differences may, in rare cases, cause the results to appear to be different.

Study Areas

A brief description of study area locations is presented here to update the GPS coordinates provided in Nelson and Burns (2008) because some errors were discovered and because the datum information was not provided. The Universal Transverse Mercator (UTM) coordinates identified here use the North American Datum of 1983 (NAD83), Zone 11T. Refer to Nelson *et al.* (2002) and to previous reports listed therein for additional information.

South Fork Salmon River

Study areas for sediment monitoring are located in important Chinook and steelhead spawning areas of the SFSR at Stolle Meadows (604287E, 4938304N)[6], immediately upstream of the mouth of Dollar Creek (603408E, 4952855N), Poverty Flat (602389E, 4964367N), immediately upstream of the Oxbow breach (601210E, 4971767N), and immediately downstream of the Glory Hole near Krassel Guard Station (600504E, 4982390N); the Johnson Creek site is at the spawning area located in the vicinity of the Ice Hole Campground (618301E, 4971245N).

Secesh River

Study areas are located in important Chinook spawning areas of Lake Creek upstream of Corduroy Junction (582549E, 5021563N), near the mouth of Threemile Creek (583499E, 5016988N), and downstream of Burgdorf, Idaho (585253E, 5013605N) and of the Secesh River in the Secesh Meadows subdivision (593309E, 5009475N) and at Chinook Campground (593560E, 5007795N).

Chamberlain Basin

Study areas are located at one known Chinook spawning area downstream of the mouth of Flossie Creek (640501E, 5025768N) and one on West Fork Chamberlain Creek downstream of the mouth of Game Creek (643426E, 5027268N).

Starting in 2010 the Payette began implementing a revised monitoring schedule (Nelson and Bonaminio 2009). The revised sampling schedule discussed in Nelson and Bonaminio (2009) listed Chamberlain to be monitored in 2011, however due to budgetary constraints it was decided to use the second alternative discussed, which places Chamberlain Creek on a three year rotation for sampling. Sampling in Chamberlain occurred in 2009 and will be sampled again in 2012. This revision also reclassified the Oxbow (E083) and Threemile Creek (E033) sites as "optional," meaning that they can be skipped if not all sites can be completed in a season. They would be sampled in the following year.

[6] See change in location described in Nelson *et al.* (2008).

Results and Discussion

South Fork Salmon River

All size classes of fine particles were slightly higher than those reported in Nelson 2010 (Tables 1-6). Nelson and Burns (2008) reported that none of the spawning areas in the mainstem SFSR would be considered FA according to the intragravel sediment WCI of a five-year mean level of 28% fine particles smaller than 6mm in particle diameter and no more than two samples in excess of 28%, but this is no longer true; two mainstem sites (B081 and B082) can now be rated FA. The Poverty Flat site (E084) is the only site still rated FUR. Fines appeared to drop in 2010 but have risen slightly in 2011; this may have been due to the late and high run off year.

In general, long-term trends were not very similar to recent trends, with more appearance of improving (*i.e.*, reduction in fines) trends in the recent models (Tables 7 and 8). This is difficult to interpret, but it needs to be stressed that the longer time series should be regarded as more accurate; the principal utility of the short-term or recent trends is to help interpret functional rating. It is also reasonable, by extension, to use the difference between long-term and recent trends at a site as evidence of a pending change in sign. For example, the long-term trends in large fine sediments at the Stolle Meadows (B081) and Dollar Creek (B082) sites is gradually upward, but in the recent model large fines trend downward at both sites. In this way, a change toward gradually improving conditions is suggested at these two sites.

The intrabasin comparisons (Tables 9-13) revealed that the Poverty Flat spawning area stood alone with respect to intragravel conditions, having the highest concentrations of fine particles of all size classes. The lowest intragravel quality for either Chinook or steelhead was observed at Poverty Flat from 2008 to 2011.

Secesh River

Fine sediments have consistently been lower in the Lake Creek and Secesh River spawning areas (Tables 13-19) than in the mainstem upper SFSR spawning areas, except for the anomalous Threemile Creek site (E033) that continues to be influenced by unconsolidated mine spoils nearby (Nelson *et al.* 2001 *et seq.*). Fine sediment concentrations were generally similar to their long-term mean levels, and all of these sites except the Threemile Creek site would currently receive a rating of FA under the revised WCI guidelines. The Secesh River sites, excluding the Threemile creek site, were used as reference sites for generating the revised ratings because they usually exhibit sediment conditions similar to those of the wilderness Chamberlain Basin sites (Nelson and Burns 2005)[7]. The Threemile Creek site, however, is clearly functioning at risk (FR) and is not far from the FUR category for intragravel fine sediments. Recently, it was decided that the Threemile Creek site would be regarded as "optional" if the full suite of core sampling sites could not be sampled during a field season because it generates little new information (Nelson and Bonaminio 2009). This site has not been sampled since 2009 but should be revisited in 2012 if possible.

The Secesh Meadows spawning area appeared to be the only one with a long-term trend toward reductions in fine sediments (Table 16). The recent models (Table 19)

[7] This is not strictly correct; the Secesh sites were not reference sites in an analytical comparison of developed and reference sites, but were of sufficient intragravel quality compared to true reference sites to be used for determining expected natural intragravel conditions in the SFSR watershed.

suggest the potential for an improving trend at the Chinook Campground site (E046), but the long-term view suggests that most sites are either stable or trending gradually upward in fine sediments. Inspection of the time series graphs (Figures 51-90) suggest a step change in the mid-1990s at several sites, which we have previously suggested (*e.g.*, Nelson *et al.* 1996, 1999) resulted from improving conditions brought about by implementation of the first PAF LRMP (USFS 1988). The improvement suggested by those earlier efforts, however, is no longer a reasonable inference given the lack of long-term trends showing reduction in fines, unless there was merely some short-term improvement that has since been lost. Nelson *et al.* (2004, 2006) provide additional discussion of this issue.

Statistical comparison of watersheds (Tables 20-24) showed that intragravel conditions at all sites were more or less similar in the Secesh River watershed except for the problematic Threemile Creek site. The Burgdorf (E048) and Secesh Meadows sites were statistically lowest in large and small fines in 2011.

Chamberlain Basin

These sites have not been monitored since 2009 but will be sampled in 2012. For the latest discussion on these sites, refer to Nelson (2010); however, the data tables are updated here.

Conclusions

This report summarizes the results of long-term sediment monitoring in three large watersheds and shows that such long-term studies are very valuable for understanding watershed processes. Annual variation is large and periodic events can dramatically influence trends; monitoring at biennial or longer scales would limit accurate interpretations in a reasonable time frame. What we can conclude, in a general sense, from this monitoring in the SFSR is that the major spawning areas, while relatively favorable for salmon and steelhead spawning, are probably somewhat worse than they were before the floods of 1964-65 and have not improved well as anticipated by implementation of the SFSR Road Reconstruction Project (Nelson and Burns 2008). Of the five sites, most have large fine sediment concentrations that were lower in the past five years than the period 1986-1990 used as a baseline in the BO (NMFS 1993). Of these two, the former is downcutting as the channel continues to adjust to the breach of the Oxbow and the latter is the control site on Johnson Creek that was not as damaged during the 1964-65 flooding as the mainstem SFSR. More thorough discussion of this issue can be found in Nelson and Burns (2008).

Previous reports have indicated that there is considerable annual variation in large fine sediment concentration at all areas, but the index tended to correspond loosely with annual variation in mean annual discharge such that lower sediment concentrations seem to be somewhat more likely than high ones during low flow periods and *vice versa*. This is not discussed specifically here, but can be referenced in Nelson (2010).

Overall, we have consistently found that intragravel conditions tend to be similar in both the Secesh River and Chamberlain Creek watersheds, though both contain sites that probably do not reflect overall conditions. This allowed us to use our long-term data set to rigorously determine expected fine sediment concentrations under reference conditions and propose sediment-based functional condition indicator values to support analyses of potential effects in project planning. We have not presented that data here, but Nelson and Burns (2005) provides the initial analyses and several reports in this series apply indicators based on those analyses to non-granitic settings.

The data presented reflects the second year of a reduced sampling effort. The PAF still believes that not sampling the Oxbow, Threemile and Chamberlain annually will not affect the analysis of the SFSR watershed. The Oxbow and Threemile sites historically have been anomalous sites and least likely to show similar trends in fine sediments throughout their respective watersheds. Chamberlain will be sampled in 2012 in order to provide a pulse check on the control site, but will continue to be monitored on a three year rotation (Nelson and Bonaminio, 2009). It has been reported in the past by Nelson and Burns that the Dollar and Glory sites behave similarly in response to flooding. The PAF suggests sampling these sites biennially at opposite intervals in order to help reduce the sampling burden as availability for crew time is decreasing each season.

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Appendix 1. Statistical Summary Tables

South Fork Salmon River

Statistical Summaries

Table 1.—Mean annual percentages of fine sediments from core sampling in the Stolle Meadows spawning area (B081), South Fork Salmon River, 1977-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1977	40	22.2	1.1	30.0	18.5	0.9	32.2	4.5	0.3	44.8	19.2	0.6	20.1
1978	40	19.9	0.9	28.5	17.1	0.8	28.5	5.8	0.3	34.1	20.3	0.5	17.0
1979	40	23.0	1.1	30.2	19.2	0.9	29.2	6.4	0.4	41.5	19.1	0.6	19.3
1980	40	20.7	1.4	43.9	16.2	1.2	46.0	3.6	0.2	43.0	44.8	3.3	46.8
1981	40	22.7	1.0	28.2	18.0	0.9	31.9	5.3	0.4	46.1	38.1	2.0	32.7
1982	40	17.5	1.0	37.0	14.0	0.9	41.4	4.5	0.4	53.7	48.4	2.7	35.6
1983	40	22.4	1.3	36.0	18.8	1.1	37.4	4.7	0.4	48.7	35.9	2.6	46.1
1984	40	25.0	1.0	25.5	20.8	0.9	28.2	4.4	0.2	35.4	29.9	1.4	28.7
1985	40	22.7	0.7	20.5	18.8	0.7	22.9	4.5	0.3	37.2	33.6	1.2	21.9
1986	40	26.3	1.1	27.6	21.5	1.1	32.3	5.4	0.3	36.9	31.3	2.2	43.5
1987	40	27.0	1.6	37.7	21.5	1.3	39.1	5.1	0.4	55.0	35.1	2.3	42.2
1988	40	20.4	1.3	39.1	16.3	1.1	43.2	4.1	0.3	40.7	45.1	3.7	52.3
1989	40	22.7	1.1	30.7	17.9	0.9	31.5	4.6	0.2	33.8	39.0	1.9	31.3
1990	40	25.8	1.4	35.1	20.7	1.3	39.7	5.5	0.4	45.2	32.6	1.8	35.3
1991	40	26.2	1.8	43.9	21.0	1.7	51.4	5.0	0.4	53.1	35.1	2.4	43.1
1992	35	24.5	1.2	28.1	20.4	1.2	34.9	5.1	0.3	36.3	37.9	2.4	37.0
1993	20	23.4	1.3	24.7	19.0	1.2	28.0	4.6	0.4	35.5	36.5	2.1	25.4
1994	40	18.9	1.2	40.2	13.6	1.0	48.3	2.7	0.5	112.0	54.1	3.9	45.7
1995	40	26.7	1.1	25.7	21.8	0.9	26.9	5.9	0.5	55.0	28.2	1.5	32.8
1996	40	32.8	2.2	41.9	28.1	2.1	47.6	6.0	0.5	52.9	25.8	2.7	65.3
1997	40	25.5	1.7	41.8	20.4	1.5	47.8	5.6	0.5	53.3	35.6	2.8	49.6
1998	40	24.3	1.4	37.0	19.7	1.2	38.2	5.4	0.4	49.0	36.6	2.9	50.6
1999	40	28.6	1.5	33.4	24.3	1.5	38.3	5.3	0.3	41.9	30.0	2.7	57.8
2000	40	26.9	1.3	29.7	21.2	1.2	35.7	6.3	0.4	43.3	30.7	1.9	38.6
2001	40	28.9	1.4	29.9	23.0	1.0	28.8	6.4	0.4	41.5	20.9	1.2	35.8
2002	40	30.4	1.4	29.7	25.4	1.4	33.7	6.8	0.5	44.8	25.0	1.8	44.4
2003	40	31.2	1.4	27.7	25.6	1.3	32.0	7.5	0.4	36.3	23.4	2.0	54.9
2004	40	31.3	2.2	45.3	26.5	2.1	49.5	7.9	0.5	42.3	27.4	2.5	56.7
2005	25	32.8	2.0	29.9	28.1	1.8	32.8	8.0	0.7	40.9	22.1	1.9	42.6
2006	40	27.0	1.2	27.1	22.8	1.1	29.8	7.5	0.4	34.5	29.3	1.7	36.1
2007	40	23.5	1.5	39.6	20.9	1.4	42.3	7.1	0.7	66.4	27.3	2.2	50.0
2008	40	23.8	1.9	51.0	21.4	1.8	51.9	7.7	0.8	64.5	26.8	3.0	70.2
2009	40	24.3	1.5	38.5	21.8	1.4	40.1	7.7	0.6	50.4	28.0	2.3	52.7
2010	40	22.2	1.6	46.3	19.6	1.5	48.4	6.1	0.6	57.8	33.2	2.7	51.1
2011	40	27.7	1.7	39.4	24.2	1.5	40.2	8.0	0.7	58.9	23.9	2.0	52.5
Recent	.	**24.3**	**1.6**	**43.0**	**21.6**	**1.5**	**44.6**	**7.2**	**0.7**	**59.6**	**27.8**	**2.4**	**55.3**
Overall	.	**25.1**	**1.4**	**34.3**	**20.8**	**1.3**	**37.4**	**5.7**	**0.4**	**47.6**	**31.7**	**2.2**	**41.9**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean;
CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 2.—Mean annual percentages of fine sediments from core sampling in the Dollar Creek spawning area (B082), South Fork Salmon River, 1977-2010 [a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1977	40	29.0	1.0	22.5	25.6	1.0	24.8	5.5	0.3	34.4	15.8	0.5	19.9
1978	40	31.1	1.0	20.5	27.8	1.0	21.6	6.7	0.3	32.5	14.7	0.4	19.1
1979	40	28.1	1.1	24.3	25.3	1.0	25.7	8.5	0.4	26.7	16.0	0.5	20.4
1980	40	27.7	1.2	27.4	24.3	1.1	29.7	4.9	0.3	38.5	28.3	1.4	30.9
1981	40	26.2	1.0	23.3	22.6	0.9	24.3	7.0	0.4	33.4	30.9	1.7	35.1
1982	40	27.5	1.0	23.6	23.8	0.9	24.2	6.3	0.3	30.6	29.2	1.3	27.3
1983	40	27.8	1.0	23.6	24.5	1.0	24.8	4.1	0.1	20.9	30.3	2.1	44.6
1984	40	26.5	1.1	25.4	23.0	1.0	26.5	3.6	0.2	41.1	29.1	1.4	31.4
1985	40	29.7	0.8	16.4	26.1	0.7	17.7	4.3	0.1	20.4	25.0	0.9	22.9
1986	40	28.7	0.9	20.4	24.4	0.9	22.5	4.5	0.2	29.1	28.2	1.3	28.9
1987	40	28.6	0.8	17.4	24.3	0.7	19.3	4.1	0.2	31.1	30.0	1.5	31.7
1988	40	26.8	1.1	25.2	22.3	0.9	26.0	4.2	0.2	34.0	29.6	1.4	29.7
1989	40	30.9	1.2	24.6	26.7	1.2	27.3	4.0	0.2	35.8	25.5	1.3	31.6
1990	40	30.2	1.0	21.5	24.7	0.8	19.8	4.7	0.3	38.7	23.2	1.0	27.9
1991	40	26.6	0.8	17.9	21.8	0.7	19.9	3.3	0.2	32.0	29.2	1.1	23.2
1992	40	26.4	1.0	25.0	22.8	0.9	25.4	4.0	0.2	37.2	31.0	2.0	40.7
1993	40	29.5	1.5	31.4	24.6	1.4	35.6	4.1	0.2	34.3	26.9	1.5	35.5
1994	40	26.0	1.4	35.2	20.2	1.4	45.2	2.5	0.4	108.2	39.6	3.0	47.5
1995	40	25.6	1.2	29.2	21.5	1.0	30.0	4.6	0.3	34.2	29.6	1.9	40.5
1996	40	27.8	0.7	16.6	23.9	0.7	17.7	5.3	0.2	27.6	28.3	1.1	25.2
1997	40	28.9	0.9	18.9	23.8	0.8	20.5	4.6	0.2	28.5	26.3	1.2	29.5
1998	40	42.7	1.8	26.0	37.2	1.8	30.6	9.6	0.5	31.0	15.6	1.0	40.2
1999	40	26.3	1.3	31.8	22.0	1.2	34.6	3.7	0.2	40.9	28.6	1.4	30.5
2000	40	30.5	1.2	24.0	25.8	1.2	29.3	4.1	0.2	33.8	24.1	1.0	26.8
2001	40	29.3	1.3	28.2	25.0	1.1	28.7	5.7	0.9	101.1	22.3	1.5	42.9
2002	40	27.8	1.3	28.5	23.5	1.1	30.6	4.7	0.2	28.9	26.4	1.8	44.2
2003	40	30.2	1.3	26.9	25.7	1.1	27.4	5.6	0.3	31.4	24.5	1.8	45.4
2004	40	29.7	0.9	19.8	25.0	0.9	22.8	7.0	0.5	41.8	22.7	1.1	31.3
2005	40	32.4	1.2	22.8	27.4	1.2	28.4	7.2	0.6	50.9	20.7	0.9	28.1
2006	40	33.6	1.0	19.1	28.6	1.0	22.6	7.9	0.4	35.2	21.3	1.1	31.9
2007	40	24.2	1.2	30.6	21.8	1.1	32.1	4.7	0.5	62.9	27.1	1.8	43.0
2008	40	27.3	1.3	30.3	24.1	1.2	31.9	5.9	0.6	60.2	22.1	1.3	36.8
2009	40	22.8	1.1	30.0	19.9	1.1	33.5	4.1	0.5	68.8	28.1	1.8	41.0
2010	40	25.4	2.2	55.8	22.5	1.9	52.8	5.9	0.5	55.3	33.9	4.3	79.9
2011	40	25.8	1.2	29.9	22.8	1.1	30.5	4.0	0.3	40.0	26.2	2.1	50.3
Recent	.	25.1	1.4	35.3	22.2	1.3	36.2	5.0	0.5	57.4	27.5	2.3	50.2
Overall	.	28.5	1.1	25.5	24.4	1.1	27.6	5.2	0.3	40.9	26.0	1.5	34.7

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 3.—Mean annual percentages of fine sediments from core sampling in the Poverty Flat spawning area (E084), South Fork Salmon River, 1977-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1977	40	35.9	1.1	19.4	31.3	1.1	21.7	13.2	0.9	45.4	11.9	0.4	19.9
1978	40	33.7	1.2	22.1	29.2	1.1	24.8	11.1	0.8	47.6	12.5	0.4	21.4
1979	40	32.4	0.9	17.4	28.9	0.8	17.8	11.8	0.7	35.7	13.6	0.4	17.2
1980	40	29.3	0.9	18.4	26.4	0.8	19.7	6.0	0.4	41.3	23.2	1.1	29.7
1981	40	30.1	1.1	23.9	26.6	1.1	26.3	8.7	0.6	42.1	23.7	1.3	35.6
1982	40	30.4	1.3	26.1	26.7	1.2	28.5	7.5	0.4	37.1	23.1	1.8	49.7
1983	40	35.5	0.8	14.0	31.5	0.8	15.7	5.5	0.3	31.2	17.8	0.7	25.6
1984	40	28.9	1.0	22.2	25.3	1.0	24.2	4.7	0.4	49.9	25.2	1.4	35.8
1985	40	36.0	1.3	23.5	32.3	1.3	26.3	5.5	0.3	39.5	17.9	1.1	38.4
1986	40	34.1	0.9	17.0	29.4	0.9	19.5	6.0	0.4	46.7	22.0	1.6	46.6
1987	40	33.8	1.0	19.4	28.6	1.1	24.9	7.5	0.4	29.7	18.4	1.1	37.0
1988	40	30.2	1.1	23.2	25.2	1.0	25.2	4.7	0.3	39.2	26.6	2.0	47.0
1989	40	28.3	1.3	28.4	24.3	1.2	32.4	4.4	0.3	39.0	27.3	1.6	37.7
1990	40	29.8	1.1	24.2	25.5	1.2	28.7	5.4	0.3	37.7	25.2	1.5	38.0
1991	40	31.2	1.2	24.2	26.9	1.1	27.1	4.8	0.4	56.7	23.6	1.4	38.4
1992	40	31.2	0.9	18.6	27.1	0.9	21.5	7.4	0.4	38.1	22.1	1.4	40.5
1993	40	35.1	1.3	23.4	30.7	1.3	26.4	5.5	0.4	41.3	18.6	1.1	37.7
1994	40	33.4	1.3	25.2	26.2	1.7	40.2	4.3	0.8	113.0	25.5	2.1	52.7
1995	40	29.8	1.6	34.7	25.5	1.5	36.5	5.9	0.5	50.4	25.0	1.5	37.8
1996	40	35.3	1.5	26.9	29.7	1.5	32.9	5.9	0.5	47.9	18.2	1.2	40.1
1997	40	36.8	1.2	20.5	31.7	1.2	23.1	9.0	0.4	28.7	18.3	1.3	43.2
1998	40	28.0	1.1	25.3	23.4	1.0	26.9	4.2	0.2	33.1	26.6	1.4	34.4
1999	38	37.8	1.3	21.4	31.6	1.3	26.0	7.8	0.5	38.9	17.7	1.2	41.4
2000	40	31.5	2.3	45.8	27.7	2.1	47.9	4.5	0.3	41.3	33.0	3.4	65.4
2001	40	30.4	1.8	37.7	24.4	1.6	40.6	4.3	0.5	68.8	28.0	3.0	68.2
2002	40	37.6	1.6	26.4	32.3	1.7	33.6	7.1	0.5	47.4	16.4	0.8	31.2
2003	40	37.4	1.6	27.4	32.6	1.6	31.6	6.6	0.6	58.1	18.9	1.4	46.3
2004	40	30.5	1.4	28.1	26.6	1.3	31.9	8.0	0.5	40.7	29.9	2.4	50.1
2005	40	27.7	1.9	42.6	23.9	1.8	47.9	8.1	1.1	84.1	28.9	2.7	57.9
2006	40	38.5	1.3	20.5	33.3	1.4	25.8	9.3	0.5	33.8	16.9	0.9	31.9
2007	40	40.6	2.9	45.0	37.3	2.8	46.7	12.5	1.0	51.3	16.7	1.8	68.1
2008	40	41.6	1.3	20.1	38.6	1.4	22.2	14.7	0.9	37.6	12.1	0.7	36.3
2009	40	35.9	1.5	26.8	32.6	1.5	29.8	10.3	0.8	46.4	16.0	1.1	43.8
2010	40	35.6	1.5	27.5	32.8	1.5	28.2	13.4	0.9	43.0	18.1	1.5	52.2
2011	40	36.2	1.6	27.1	32.1	1.5	30.5	9.0	0.7	49.2	14.5	0.9	39.2
Recent	.	**38.0**	**1.8**	**29.3**	**34.7**	**1.7**	**31.5**	**11.9**	**0.9**	**45.5**	**15.5**	**1.2**	**47.9**
Overall	.	**33.4**	**1.3**	**25.6**	**29.1**	**1.3**	**28.9**	**7.6**	**0.5**	**46.1**	**21.0**	**1.4**	**41.0**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).
[a] Annual means in tan shading correspond to data from most recent five years.

Table 4.—Mean annual percentages of fine sediments from core sampling in the Glory spawning area (E085), South Fork Salmon River, 1977-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1977	40	31.8	1.0	19.1	28.0	1.0	21.5	7.0	0.5	42.8	13.6	0.3	15.9
1978	40	31.7	1.2	24.6	28.4	1.1	23.8	11.0	0.3	19.9	13.2	0.6	27.3
1979	40	32.8	1.2	23.1	28.8	1.1	23.4	6.1	0.2	22.9	14.1	0.5	21.4
1980	40	30.6	1.1	23.6	25.0	0.9	24.0	6.1	0.4	39.4	23.9	1.4	36.5
1981	40	27.2	0.9	21.4	24.1	0.9	23.4	5.0	0.4	51.3	25.2	1.3	33.5
1982	40	24.5	1.3	34.1	20.7	1.2	36.6	5.2	0.3	33.9	28.5	1.6	34.8
1983	40	24.5	1.0	25.7	21.4	0.9	26.5	4.2	0.2	26.9	30.1	1.5	30.9
1984	40	22.1	1.1	30.6	19.1	1.0	32.8	3.1	0.2	41.7	33.7	1.5	28.5
1985	40	28.9	1.3	29.0	25.8	1.3	31.1	4.0	0.2	37.7	25.8	1.4	33.9
1986	40	22.5	1.1	30.4	19.1	1.1	35.3	3.2	0.2	38.2	34.0	1.5	27.5
1987	40	28.8	1.1	23.2	24.2	0.9	23.6	5.2	0.5	57.4	25.6	1.2	30.8
1988	40	25.2	1.0	25.8	21.7	0.9	27.3	3.8	0.1	24.6	31.1	1.5	30.9
1989	40	24.1	1.1	29.3	19.6	1.0	32.9	3.7	0.2	30.6	30.0	1.5	30.7
1990	40	28.6	1.1	24.3	24.9	1.1	27.5	3.5	0.2	32.5	25.9	1.3	32.5
1991	40	23.6	1.0	27.7	19.9	0.9	27.3	3.8	0.4	60.1	31.8	1.3	26.9
1992	40	27.4	1.0	23.9	24.0	1.0	25.9	5.2	0.3	35.0	28.1	1.6	35.6
1993	40	22.8	1.1	30.2	18.8	1.0	32.0	3.8	0.2	39.0	32.4	2.0	40.0
1994	39	19.9	1.8	40.2	14.3	1.5	46.3	0.3	0.2	292.7	50.7	5.0	44.0
1995	40	34.9	1.7	30.8	30.7	1.7	34.5	5.1	0.3	43.3	17.5	1.2	42.3
1996	40	34.3	1.0	17.8	30.3	1.0	20.2	5.8	0.6	63.7	20.0	0.9	28.9
1997	40	34.2	1.0	18.5	29.2	1.0	21.9	5.9	0.3	32.8	19.6	0.9	29.9
1998	40	38.7	1.2	20.1	33.4	1.1	21.7	7.2	0.4	39.3	16.8	1.0	35.9
1999	40	35.2	1.5	27.7	30.7	1.6	32.4	6.5	0.7	64.1	18.9	1.0	34.4
2000	40	30.7	1.4	28.7	26.3	1.4	33.1	4.7	0.5	61.7	24.1	1.4	36.2
2001	40	23.1	0.9	24.1	19.3	0.8	26.5	3.4	0.3	52.9	32.5	1.4	27.4
2002	40	27.7	1.1	24.8	23.9	1.1	27.8	5.4	0.4	47.7	25.1	1.0	25.1
2003	40	31.8	2.0	40.5	28.2	2.0	44.5	5.4	0.6	72.6	24.6	1.7	44.4
2004	40	30.7	1.4	28.9	26.2	1.3	31.6	6.3	0.5	52.0	23.5	1.5	39.3
2005	40	26.2	1.3	30.7	22.2	1.1	32.3	5.7	0.5	58.5	26.3	1.3	32.5
2006	40	40.0	1.4	22.9	35.9	1.5	25.6	11.7	0.7	40.4	15.4	1.2	49.8
2007	40	30.5	1.3	26.3	28.1	1.2	27.5	9.0	0.5	35.800	19.6	1.1	35.3
2008	20	27.7	1.3	20.2	25.3	1.2	21.0	10.0	0.5	24.800	24.2	2.0	37.8
2009	40	23.8	1.1	28.0	21.2	1.0	28.5	6.0	0.4	41.000	28.3	2.0	44.1
2010	40	32.0	2.0	39.9	29.3	1.9	41.2	14.0	1.2	54.000	21.2	2.2	65.7
2011	40	.	.	.	.	.	.	.	.	.	.	.	.
Recent	.	**30.8**	**1.4**	**27.5**	**28.0**	**1.4**	**28.8**	**9.9**	**0.7**	**39.2**	**21.7**	**1.7**	**46.5**
Overall	.	**28.9**	**1.2**	**26.8**	**25.0**	**1.2**	**28.9**	**5.8**	**0.4**	**44.7**	**24.9**	**1.4**	**34.5**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 5.—Mean annual percentages of fine sediments from core sampling in the Oxbow spawning area, South Fork Salmon River (E083), 1977-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1977	40	35.0	1.1	19.0	31.4	1.0	20.0	7.3	0.4	36.5	12.7	0.4	20.7
1978	40	36.4	0.6	10.6	32.7	0.6	11.3	11.6	0.6	32.2	11.8	0.2	12.6
1979	40	34.9	1.0	17.5	31.2	1.0	19.5	10.1	0.5	32.1	12.7	0.3	15.3
1980	40	32.0	1.3	25.9	27.7	1.2	27.8	7.2	0.3	29.2	22.0	1.1	31.1
1981	40	31.4	0.7	14.8	27.5	0.7	15.3	8.3	0.4	27.3	22.0	1.0	27.4
1982	40	30.5	1.3	26.4	26.8	1.2	29.0	6.8	0.4	37.9	24.1	1.8	47.5
1983	40	36.2	0.9	16.5	31.9	0.9	16.9	6.3	0.3	33.9	19.0	1.0	32.9
1984	40	33.5	0.7	13.2	29.4	0.7	14.8	5.0	0.3	43.1	20.0	0.8	26.4
1985	40	36.6	0.9	14.8	32.4	0.8	16.1	5.4	0.3	35.9	17.0	0.7	26.9
1986	40	35.6	0.7	12.6	29.8	0.6	13.7	5.7	0.4	44.7	18.3	0.7	23.4
1987	40	35.5	0.7	13.2	30.3	0.7	13.7	6.6	0.3	25.4	18.8	0.6	19.0
1988	40	29.7	1.3	27.6	24.6	1.2	29.8	4.4	0.2	31.1	25.4	1.6	38.9
1989	40	30.0	1.2	24.8	24.9	1.1	27.0	5.2	0.3	33.5	25.6	1.5	37.2
1990	40	31.7	1.4	27.1	26.2	1.3	31.6	5.5	0.3	37.2	23.2	1.6	44.6
1991	40	27.1	1.1	25.8	21.9	0.9	26.6	4.6	0.3	41.3	26.6	1.6	37.6
1992	40	28.3	1.3	28.5	23.7	1.3	33.6	5.9	0.4	42.6	27.8	2.0	46.4
1993	20	21.8	1.4	28.5	16.7	1.1	30.2	3.4	0.2	29.8	38.0	3.2	37.6
1994	40	29.2	1.6	24.3	18.3	1.2	30.0	0.1	0.0	16.2	32.2	2.3	32.5
1995	40	34.1	1.2	22.8	27.4	1.1	26.3	6.1	0.3	32.3	19.5	1.0	32.9
1996	40	32.2	1.3	25.9	26.7	1.2	28.0	5.9	0.4	40.7	22.2	1.3	36.2
1997	40	36.3	0.7	12.9	31.6	0.7	14.2	7.6	0.3	29.1	17.1	0.5	19.2
1998	40	29.2	1.1	23.5	23.2	1.0	28.3	5.9	0.4	39.0	23.6	1.0	25.5
1999	40	31.3	1.5	29.8	25.6	1.5	37.5	6.8	0.5	50.6	22.2	1.4	38.9
2000	40	29.4	1.1	24.1	23.4	1.1	30.7	5.7	0.5	56.4	23.2	1.1	31.1
2001	40	27.6	1.1	25.8	21.4	1.1	32.8	4.6	0.4	52.0	22.8	1.0	27.5
2002	40	29.5	1.4	29.7	25.0	1.4	34.4	6.4	0.8	81.8	26.0	1.6	38.4
2003	40	33.5	1.4	27.1	28.5	1.5	33.6	7.1	0.5	43.6	20.0	1.0	31.8
2004	40	31.3	0.9	18.2	26.4	0.9	21.0	7.9	0.5	39.4	20.4	0.7	20.9
2005	40	27.1	1.2	27.4	22.3	1.0	28.9	6.3	0.6	59.2	24.9	1.4	35.9
2006	.	.	.	.	.	.	.	.	.	.	.	.	.
2007	40	29.4	1.1	23.1	25.8	1.0	25.0	8	0.7	50.5	18.4	0.9	29.6
2008	.	.	.	.	.	.	.	.	.	.	.	.	.
2009	.	.	.	.	.	.	.	.	.	.	.	.	.
2010	40	22.4	0.9	24.5	19.6	0.8	27.2	6	0.4	43.8	23.4	1.0	26.1
2011	.												
Recent	.	**28.7**	**1.1**	**24.1**	**24.5**	**1.0**	**27.1**	**7.1**	**0.5**	**47.3**	**21.4**	**1.0**	**28.9**
Overall	.	**31.4**	**1.1**	**22.0**	**26.5**	**1.0**	**24.9**	**6.3**	**0.4**	**42.3**	**21.8**	**1.1**	**30.9**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 6.—Mean annual percentages of fine sediments from core sampling in the Ice Hole area (B152), Johnson Creek, 1977-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1977	40	31.8	1.0	19.1	28.0	1.0	21.5	7.0	0.5	42.8	13.6	0.3	15.9
1978	40	31.7	1.2	24.6	28.4	1.1	23.8	11.0	0.3	19.9	13.2	0.6	27.3
1979	40	32.8	1.2	23.1	28.8	1.1	23.4	6.1	0.2	22.9	14.1	0.5	21.4
1980	40	30.6	1.1	23.6	25.0	0.9	24.0	6.1	0.4	39.4	23.9	1.4	36.5
1981	40	27.2	0.9	21.4	24.1	0.9	23.4	5.0	0.4	51.3	25.2	1.3	33.5
1982	40	24.5	1.3	34.1	20.7	1.2	36.6	5.2	0.3	33.9	28.5	1.6	34.8
1983	40	24.5	1.0	25.7	21.4	0.9	26.5	4.2	0.2	26.9	30.1	1.5	30.9
1984	40	22.1	1.1	30.6	19.1	1.0	32.8	3.1	0.2	41.7	33.7	1.5	28.5
1985	40	28.9	1.3	29.0	25.8	1.3	31.1	4.0	0.2	37.7	25.8	1.4	33.9
1986	40	22.5	1.1	30.4	19.1	1.1	35.3	3.2	0.2	38.2	34.0	1.5	27.5
1987	40	28.8	1.1	23.2	24.2	0.9	23.6	5.2	0.5	57.4	25.6	1.2	30.8
1988	40	25.2	1.0	25.8	21.7	0.9	27.3	3.8	0.1	24.6	31.1	1.5	30.9
1989	40	24.1	1.1	29.3	19.6	1.0	32.9	3.7	0.2	30.6	30.0	1.5	30.7
1990	40	28.6	1.1	24.3	24.9	1.1	27.5	3.5	0.2	32.5	25.9	1.3	32.5
1991	40	23.6	1.0	27.7	19.9	0.9	27.3	3.8	0.4	60.1	31.8	1.3	26.9
1992	40	27.4	1.0	23.9	24.0	1.0	25.9	5.2	0.3	35.0	28.1	1.6	35.6
1993	40	22.8	1.1	30.2	18.8	1.0	32.0	3.8	0.2	39.0	32.4	2.0	40.0
1994	20	19.9	1.8	40.2	14.3	1.5	46.3	0.3	0.2	292.7	50.7	5.0	44.0
1995	40	34.9	1.7	30.8	30.7	1.7	34.5	5.1	0.3	43.3	17.5	1.2	42.3
1996	40	34.3	1.0	17.8	30.3	1.0	20.2	5.8	0.6	63.7	20.0	0.9	28.9
1997	40	34.2	1.0	18.5	29.2	1.0	21.9	5.9	0.3	32.8	19.6	0.9	29.9
1998	40	38.7	1.2	20.1	33.4	1.1	21.7	7.2	0.4	39.3	16.8	1.0	35.9
1999	40	35.2	1.5	27.7	30.7	1.6	32.4	6.5	0.7	64.1	18.9	1.0	34.4
2000	40	30.7	1.4	28.7	26.3	1.4	33.1	4.7	0.5	61.7	24.1	1.4	36.2
2001	40	23.1	0.9	24.1	19.3	0.8	26.5	3.4	0.3	52.9	32.5	1.4	27.4
2002	40	27.7	1.1	24.8	23.9	1.1	27.8	5.4	0.4	47.7	25.1	1.0	25.1
2003	40	31.8	2.0	40.5	28.2	2.0	44.5	5.4	0.6	72.6	24.6	1.7	44.4
2004	40	30.7	1.4	28.9	26.2	1.3	31.6	6.3	0.5	52.0	23.5	1.5	39.3
2005	40	26.2	1.3	30.7	22.2	1.1	32.3	5.7	0.5	58.5	26.3	1.3	32.5
2006	40	40.0	1.4	22.9	35.9	1.5	25.6	11.7	0.7	40.4	15.4	1.2	49.8
2007	40	25.3	1.1	28.7	17.0	0.9	32.0	5.8	0.3	37.5	19.6	1.1	35.3
2008	20	22.4	1.1	21.8	13.5	0.7	23.3	6.6	0.4	26.1	24.2	2.0	37.8
2009	40	19.6	0.9	29.6	13.5	0.6	30.5	3.6	0.2	42.4	28.3	2.0	44.1
2010	40	26.3	1.8	43.2	14.2	0.8	37.4	9.4	0.9	58.9	21.2	2.2	65.7
2011	40	20.9	1.1	32.6	18.8	1.0	33.9	4.0	0.3	45.5	30.7	2.0	40.4
Recent	.	**20.8**	**1.0**	**30.5**	**18.9**	**0.9**	**31.3**	**5.0**	**0.4**	**45.0**	**31.1**	**1.9**	**39.0**
Overall	.	**26.2**	**1.0**	**25.0**	**23.0**	**1.0**	**27.2**	**4.7**	**0.3**	**42.5**	**27.6**	**1.6**	**35.0**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Time Series Analyses

Overall Models

Table 7.—Overall regression models (y = bx + a) for percent fine sediments and geometric mean particle diameter from core sampling, SFSR spawning areas, 1977-2011.

Substrate Class[a]	Ordinary Least Squares				Autoregression		
	a	b	r^2	Dw[b]	a	b	r^2
Stolle Meadows (B081)							
LF	-351.91	0.19**	0.04	1.19	-358.14	0.19**	0.24
CF	-373.14	0.20**	0.05	1.17	-379.36	0.20**	0.26
SF	-177.85	0.09**	0.09	1.19	-178.60	0.09**	0.26
GM	441.95	-0.21**	0.02	0.99	455.06	-0.21*	0.31
Dollar Creek (B082)							
LF	52.80	-0.01	0.00	1.26	52.61	-0.01	0.16
CF	63.09	-0.02	0.00	1.27	62.90	-0.02	0.16
SF	-7.73	0.01	0.00	0.99	-7.81	0.01	0.29
GM	-48.30	0.04	0.00	1.11	-44.11	0.04	0.25
Poverty Flat (E084)							
LF	-250.62	0.14**	0.02	1.08	-251.29	0.14**	0.25
CF	-250.69	0.14**	0.02	1.05	-251.12	0.14**	0.26
SF	-110.38	0.06**	0.02	0.77	-110.38	0.06+	0.43
GM	5.68	0.01	0.00	0.81	9.06	0.01	0.40
Glory Hole (E085)							
LF	-180.82	0.10**	0.01	1.06	-189.13	0.11*	0.28
CF	-201.62	0.11**	0.02	1.04	-208.85	0.12*	0.29
SF	-162.18	0.08**	0.05	0.74	-193.81	0.10**	0.50
GM	66.77	-0.02	0.00	0.96	60.35	-0.02	0.33
Oxbow (E083)							
LF	463.90	-0.22**	0.06	1.22	464.81	-0.22**	0.23
CF	398.89	-0.19**	0.05	1.12	387.19	-0.18**	0.27
SF	72.83	-0.03**	0.01	1.01	94.96	-0.04*	0.30
GM	-137.02	0.08**	0.01	0.95	-127.33	0.07	0.31
Ice Hole (B152)							
LF	304.01	-0.14**	0.04	0.90	308.92	-0.14**	0.37
CF	279.57	-0.13**	0.04	0.92	281.96	-0.13**	0.35
SF	-8.64	0.01	0.00	1.33	-7.83	0.01	0.14
GM	-650.72	0.34**	0.08	0.93	-646.93	0.34**	0.37

[a] LF – Large Fines (≤6.3mm). CF – Coarse Fines (≤4.75mm).
SF – Small Fines (≤0.85mm). GM – Geometric Mean Particle Diameter.
[b] DW - First order Durbin-Watson statistic.

Significance:
[†]Moderately significant (P<0.10).
*Significant (P<0.05).
**Highly significant (P<0.01).

Recent Models

Table 8.—Recent regression models (y = bx + a) for percent fine sediments and geometric mean particle diameter from core sampling, SFSR spawning areas, 2000-2011.

Substrate Class[a]	Ordinary Least Squares				Autoregression		
	a	b	r^2	Dw[b]	a	b	r^2
Stolle Meadows (B081)							
LF	1829.00	-0.90**	0.06	1.34	1717.00	-0.84*	0.21
CF	1169.00	-0.57**	0.03	1.31	1069.00	-0.52+	0.19
SF	60.88	-0.03	0.00	1.27	60.92	-0.03	0.16
GM							
Dollar Creek (B082)							
LF	1374.00	-0.67**	0.05	1.40	1332.00	-0.65**	0.15
CF	886.82	-0.43**	0.02	1.43	849.84	-0.41*	0.12
SF	262.05	-0.13*	0.01	1.27	250.57	-0.12	0.16
GM							
Poverty Flat (E084)							
LF	-515.35	0.28	0.00	0.94	-679.70	0.36	0.30
CF	-897.41	0.46*	0.01	0.95	-1043.00	0.54	0.30
SF	-1166.00	0.59**	0.09	0.99	-1196.00	0.60**	0.35
GM							
Glory Hole (E085)							
LF	-597.12	0.31+	0.01	1.20	-790.35	0.41	0.21
CF	-956.11	0.49**	0.02	1.20	-1121.00	0.57+	0.22
SF	-1519.00	0.76**	0.20	0.93	-1746.00	0.88**	0.49
GM							
Oxbow (E083)[c]							
LF	1141.00	-0.56**	0.05	1.21	1149.00	-0.56**	0.21
CF	-133.08	0.08	0.00	1.07	2.53	0.01	0.24
SF	-175.83	0.09+	0.01	1.30	-107.48	0.06	0.17
GM							
Ice Hole (B152)							
LF	1484.00	-0.73**	0.08	1.02	1525.00	-0.75**	0.33
CF	1064.00	-0.52**	0.05	0.96	1088.00	-0.53*	0.33
SF	29.08	-0.01	0.00	1.12	34.31	-0.01	0.23
GM							

[a] LF – Large Fines (≤6.3mm). CF – Coarse Fines (≤4.75mm).
SF – Small Fines (≤0.85mm). GM – Geometric Mean Particle Diameter.
[b] DW - First order Durbin-Watson statistic.
[c] Trend is for 1997-2007, without 2006 data.

Significance:
†Moderately significant (P<0.10).
*Significant (P<0.05).
**Highly significant (P<0.01).

Intrabasin Comparisons

Table 9.—Multiple comparisons[a] of mean percent large fines among SFSR spawning areas by year[b].

Year	Stolle (B081)	Dollar (B082)	Oxbow (E083)	Poverty (E084)	Glory (E085)	Johnson (B152)
1977	22.2D	29.0C	35.0BA	35.9A	31.8BC	24.4D
1978	19.9D	31.1B	36.4A	33.7BA	31.7B	25.5C
1979	23.0C	28.1B	34.9A	32.4A	32.8A	23.1C
1980	20.7C	27.7BA	32.0A	29.3BA	30.6A	25.4B
1981	22.7D	26.2C	31.4A	30.1BA	27.2BC	25.9DC
1982	17.5C	27.5BA	30.5A	30.4A	24.5B	27.3BA
1983	22.4C	27.8B	36.2A	35.5A	24.5CB	27.9B
1984	25.0CD	26.5CB	33.5A	28.9B	22.1D	27.9CB
1985	22.7D	29.7C	36.6A	36.0BA	28.9C	32.3BC
1986	26.3D	28.7DC	35.6A	34.1BA	22.5E	31.6BC
1987	27.0B	28.6B	35.5A	33.8A	28.8B	27.9B
1988	20.4C	26.8BA	29.7A	30.2A	25.2B	26.1BA
1989	22.7C	30.9A	30.0A	28.3BA	24.1C	25.7BC
1990	25.8BC	30.2A	31.7A	29.8BA	28.6BA	23.7C
1991	26.0B	26.0B	27.0BA	31.0A	23.0C	28.0BA
1992	24.5B	26.4B	28.3BA	31.2A	27.4BA	26.2B
1993	23.4C	29.5B	21.8C	35.1A	22.8C	30.4BA
1994	12.9D	18.3C	29.2A	26.0A	19.9BC	24.9BA
1995	26.7C	25.6C	34.0BA	29.8BC	34.9A	33.3BA
1996	32.8BA	27.8B	32.2BA	35.3A	34.3A	28.5B
1997	25.5B	28.9B	36.3A	36.8A	34.2A	27.8B
1998	24.3C	42.7A	29.2B	28.0CB	38.7A	26.9CB
1999	28.6C	26.3C	31.3BC	37.8A	35.2BA	26.9C
2000	26.9BA	30.5A	29.4A	31.5A	30.7A	23.7B
2001	28.9A	26.1BA	27.6BA	30.4A	23.1B	30.5A
2002	30.4B	27.8B	29.5B	37.6A	27.7B	30.1B
2003	31.2B	30.2B	33.5BA	37.4A	31.8BA	24.4C
2004	31.3A	29.7A	31.3A	30.5A	30.7A	21.9B
2005	32.8A	32.4A	27.1B	27.7BA	26.2B	25.5B
2006	27.0C	33.6B	.	38.5A	40.0A	22.0D
2007	19.0C	20.0CB	24.0CB	35.0A	25.0B	15.0D
2008	19.6CB	22.9B	.	35.2A	22.4B	17.1C
2009	19.9B	19.2B	.	30.5A	19.6B	17.9B
2010	18.4C	21.5BC	18.5C	29.6A	26.3BA	17.5C
2011	27.7B	25.8B	.	36.2A	.	20.9C
Recent	**24.3C**	**25.1C**	**28.7B**	**38.0A**	**31.1B**	**20.9D**
Overall	**25.1E**	**28.5C**	**31.5B**	**33.4A**	**29.0C**	**26.2D**

[a] Mean values in a row with different letters are significantly different (P<0.10) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.
[c] FA rating based on declining trend (Table 8).

Table 10.—Multiple comparisons[a] of mean percent coarse fines among SFSR spawning areas by year[b].

Year	Stolle (B081)	Dollar (B082)	Oxbow (E083)	Poverty (E084)	Glory (E085)	Johnson (B152)
1977	18.5C	25.6B	31.4A	31.3A	28.0BA	21.8C
1978	17.1D	27.8B	32.7A	29.2B	28.4B	23.1C
1979	19.2C	25.3B	31.2A	28.9A	28.8A	19.5C
1980	16.2C	24.3BA	27.7A	26.4A	25.0BA	22.3B
1981	18.0D	22.6C	27.5A	26.6BA	24.1BC	22.8C
1982	14.0C	23.8BA	26.8A	26.7A	20.7B	24.4BA
1983	18.8C	24.5B	31.9A	31.5A	21.4CB	24.9B
1984	20.8CD	23.0CB	29.4A	25.3B	19.1D	25.0B
1985	18.8C	26.1B	32.4A	32.3A	25.8B	29.4BA
1986	21.5CB	24.4B	29.8A	29.4A	19.1C	28.4A
1987	21.5B	24.3B	30.3A	28.6A	24.2B	24.6B
1988	16.3B	22.3A	24.6A	25.2A	21.7A	22.7A
1989	17.9D	26.7A	24.9BA	24.3BA	19.6DC	21.9BC
1990	20.0C	24.0BA	26.0A	25.0A	24.0BA	20.0B
1991	21.0BC	21.8BC	21.9BC	26.9A	19.9C	25.1BA
1992	20.4B	22.8B	23.7BA	27.1A	24.0BA	23.4BA
1993	19.0C	24.6B	16.7C	30.7A	18.8C	26.2BA
1994	7.7D	11.5DC	18.3BA	16.0B	14.3BC	20.6A
1995	21.8C	21.5C	27.4BA	25.5BC	30.7A	29.2BA
1996	28.1BA	23.9B	26.7BA	29.7A	30.3A	24.3B
1997	20.4B	23.8B	31.6A	31.7A	29.2A	23.6B
1998	19.7B	37.2A	23.2B	23.4B	33.4A	22.9B
1999	24.3B	22.0B	25.6B	31.6A	30.7A	23.0B
2000	21.0B	25.0BA	23.0BA	27.0A	26.0BA	20.0C
2001	23.0BA	21.0B	21.0B	24.0BA	19.0C	26.0A
2002	25.4B	23.5B	25.0B	32.3A	23.9B	26.5B
2003	25.6BC	25.7BC	28.5BA	32.6A	28.2BA	20.5C
2004	26.5A	25.0A	26.4A	26.6A	26.2A	18.9B
2005	28.0A	27.0BA	22.0B	23.0BA	22.0C	22.0B
2006	22.7C	28.6B	.	33.3A	35.9A	19.1C
2007	12.1CD	14.8CB	15.6CB	23.0A	17.0B	10.4D
2008	12.0C	15.9B	.	21.8A	13.5CB	11.8C
2009	12.4B	13.6B	.	20.1A	13.5B	12.2B
2010	11.8B	14.7BA	11.9B	17.5A	14.2BA	11.8B
2011	24.2B	22.8CB	.	32.1A	.	18.8C
Recent	**21.6D**	**22.2DC**	**24.5C**	**34.7A**	**28.2B**	**18.9E**
Overall	**21.0E**	**24.4C**	**27.0B**	**29.1A**	**25.0C**	**23.0D**

[a] Mean values in a row with different letters are significantly different (P<0.10) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.

Table 11.—Multiple comparisons[a] of mean percent small fines among SFSR spawning areas by year[b].

Year	Stolle (B081)	Dollar (B082)	Oxbow (E083)	Poverty (E084)	Glory (E085)	Johnson (B152)
1977	4.5C	5.5CB	7.3B	13.2A	7.0B	4.8C
1978	5.8B	6.7B	11.6A	11.1A	11.0A	6.5B
1979	6.4D	8.5C	10.1B	11.8A	6.1D	6.0D
1980	3.6C	4.9B	7.2A	6.0B	6.1BA	5.5B
1981	5.3C	7.0B	8.3BA	8.7A	5.0C	4.6C
1982	4.5C	6.3BA	6.8A	7.5A	5.2BC	4.7C
1983	4.7BC	4.1C	6.3A	5.5BA	4.2C	4.2C
1984	4.4BA	3.6BC	5.0A	4.7A	3.1C	3.3C
1985	4.5BC	4.3C	5.4BA	5.5A	4.0C	3.6C
1986	5.4BA	4.5B	5.7A	6.0A	3.2C	4.2BC
1987	5.1B	4.1B	6.6A	7.5A	5.2B	5.2B
1988	4.1A	4.2A	4.4A	4.7A	3.8A	4.8A
1989	4.6BA	4.0B	5.2A	4.4BA	3.7B	4.2B
1990	5.5A	4.7A	5.5A	5.4A	3.5B	3.4B
1991	4.9A	3.2C	4.6BA	4.8BA	3.7B	4.2BA
1992	5.1CB	4.0CD	5.9B	7.4A	5.2CB	3.5D
1993	4.6BA	4.1BC	3.4C	5.5A	3.8BC	4.2BC
1994	0.2BA	0.4A	0.1B	0.0B	0.3BA	0.3BA
1995	5.9BA	4.6B	6.1A	5.9BA	5.1BA	5.4BA
1996	6.0A	5.3A	5.9A	5.9A	5.8A	3.7B
1997	5.6DC	4.6D	7.6B	9.0A	5.9C	5.3DC
1998	5.4CD	9.6A	5.9CB	4.2D	7.2B	5.6C
1999	5.3BC	3.7C	6.8BA	7.8A	6.5BA	4.6C
2000	6.3A	4.1A	5.7A	4.5A	4.7A	4.9A
2001	6.4A	2.8C	4.6B	4.3B	3.4CB	3.8CB
2002	6.8A	4.6B	6.3BA	7.1A	5.4BA	4.3C
2003	7.4A	5.5B	7.0BA	6.5BA	5.3B	5.2C
2004	7.9A	7.0A	7.9A	8.0A	6.3BA	4.6B
2005	8.0A	7.2A	6.3A	8.1A	5.7A	5.7A
2006	7.5C	7.9CB	.	9.3B	11.7A	5.6D
2007	4.7CB	3.1C	5.5B	8.8A	5.8B	3.5C
2008	5.2CB	3.9CD	.	10.3A	6.6B	3.3D
2009	5.1B	2.7C	.	7.1A	3.6C	3.9CB
2010	4.0B	3.9B	3.8B	9.3A	9.4A	3.5B
2011	7.6A	4.4B	.	8.7A	.	3.5B
Recent	**7.2C**	**5.0D**	**7.1C**	**11.9A**	**9.8B**	**5.0D**
Overall	**5.7C**	**5.2D**	**6.4B**	**7.5A**	**5.7C**	**5.0E**

[a] Mean values in a row with different letters are significantly different ($P<0.10$) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.

Table 12.—Multiple comparisons[a] of mean geometric mean particle diameter among SFSR spawning areas by year[b].

Year	Stolle (B081)	Dollar (B082)	Oxbow (E083)	Poverty (E084)	Glory (E085)	Johnson (B152)
1977	19.2A	15.8B	12.7C	11.9C	13.6C	17.2B
1978	20.3A	14.7C	11.8D	12.5D	13.2DC	16.4B
1979	19.1A	16.0B	12.7C	13.6C	14.1C	18.3A
1980	44.8A	28.3CB	22.0C	23.2CB	23.9CB	29.5B
1981	38.1A	30.9B	22.0C	23.7C	25.2C	26.3CB
1982	48.4A	29.2B	24.1B	23.1B	28.5B	25.4B
1983	35.9A	30.3BA	19.0C	17.8C	30.1BA	25.5B
1984	29.9A	29.1BA	20.0D	25.2BC	33.7A	23.7DC
1985	33.6A	25.0B	17.0C	17.9C	25.8B	20.7C
1986	31.3BA	28.2B	18.3C	22.0C	34.0A	21.5C
1987	35.1A	30.0BA	18.8C	18.4C	25.6B	26.7B
1988	45.1A	29.6B	25.4B	26.6B	31.1B	31.7B
1989	39.0A	25.5B	25.6B	27.3B	30.0B	28.5B
1990	32.6A	23.2C	23.2C	25.2BC	25.9BC	29.9BA
1991	35.0A	29.0BA	26.0B	23.0C	31.0BA	26.0B
1992	37.9A	31.0BA	27.8BC	22.1C	28.1BC	32.5BA
1993	36.5A	26.9BC	38.0A	18.6D	32.4BA	23.4DC
1994	73.0A	55.3B	32.2C	35.1C	50.7B	38.2C
1995	28.2A	29.6A	19.5B	25.0A	17.5B	18.8B
1996	25.0BA	28.0BA	22.0BD	18.0D	20.0DC	29.0A
1997	35.6A	26.3B	17.1C	18.3C	19.6C	26.1B
1998	36.6A	15.6C	23.6B	26.6B	16.8C	27.5B
1999	30.0A	28.6A	22.2BC	17.7C	18.9C	27.4BA
2000	30.7BC	24.1DC	23.2D	33.0BA	24.1DC	38.6A
2001	20.0C	24.0B	22.0B	28.0BA	32.0A	25.0BA
2002	25.0A	26.4A	26.0A	16.4B	25.1A	26.4A
2003	23.4B	24.5B	20.0B	18.9B	24.6B	34.1A
2004	27.0CB	22.0C	20.0D	29.0B	23.0CB	38.0A
2005	22.1B	20.7B	24.9BA	28.9A	26.3BA	29.8A
2006	29.3B	21.3C	.	16.9DC	15.4D	35.2A
2007	27.3B	27.1B	18.4C	16.7C	19.6C	34.7A
2008	26.8BA	22.1B	.	12.1C	24.2BA	30.2A
2009	28.0A	28.1A	.	16.0B	28.3A	28.5A
2010	33.2A	33.9A	23.4BC	18.1C	21.2C	31.4BA
2011	23.9B	26.1BA	.	14.5C	.	30.7A
Recent	**27.8B**	**27.5B**	**21.4C**	**15.5D**	**21.5C**	**31.1A**
Overall	**31.8A**	**26.0C**	**21.5D**	**21.0D**	**24.9C**	**27.6B**

[a] Mean values in a row with different letters are significantly different (P<0.10) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.

Statistical Summaries

Table 13.—Mean annual percentages of fine sediments from core sampling in the Corduroy Junction spawning area (E034), Lake Creek, 1981-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1981	40	16.3	1.1	44.2	9.4	0.6	43.3	5.4	0.6	66.8	48.0	3.4	45.2
1982	40	14.1	0.9	39.1	9.2	0.6	39.0	2.9	0.3	59.9	47.2	3.3	44.2
1983	40	16.8	0.9	35.0	11.0	0.7	38.5	3.9	0.2	38.1	47.7	3.3	43.7
1984	40	19.5	1.3	43.4	12.9	1.0	49.6	4.3	0.3	43.3	37.6	3.6	59.9
1985	40	22.2	1.1	30.1	14.4	0.8	34.2	5.7	0.4	40.3	32.8	1.9	37.0
1986	.	.	.	.	.	.	.	.	.	.	.	.	.
1987	40	22.3	1.6	45.6	14.9	1.0	43.5	5.2	0.8	91.1	37.7	4.3	71.7
1988	.	.	.	.	.	.	.	.	.	.	.	.	.
1989	38	33.1	1.4	25.4	21.9	1.4	39.0	8.5	0.5	33.2	19.4	1.2	37.5
1990	40	23.7	1.5	40.6	16.1	1.3	49.2	5.1	0.3	38.0	28.6	2.1	45.9
1991	37	28.2	1.3	28.2	19.6	1.1	32.8	6.2	0.3	32.9	25.0	1.7	41.6
1992	40	28.5	1.2	25.9	18.1	0.9	30.1	7.4	0.9	77.8	24.4	1.7	43.9
1993	40	26.8	1.6	36.9	18.5	1.5	51.1	6.5	0.4	40.3	26.8	1.8	43.0
1994	.	.	.	.	.	.	.	.	.	.	.	.	.
1995	40	17.7	1.9	67.0	12.6	1.6	82.2	3.2	0.3	54.3	43.2	3.7	54.4
1996	40	21.9	1.6	47.6	13.9	0.8	35.7	5.6	0.8	94.7	34.3	3.1	58.0
1997	40	23.9	1.7	44.8	16.8	1.1	42.0	4.8	0.6	80.1	30.2	2.4	49.4
1998	40	20.9	1.4	43.0	14.0	1.0	46.1	4.7	0.4	54.8	35.7	3.8	67.4
1999	40	19.4	1.3	41.8	13.8	1.0	45.2	3.6	0.3	53.6	39.6	3.9	62.0
2000	38	23.1	1.6	42.7	16.1	1.4	53.5	5.0	0.3	42.2	35.0	3.4	59.8
2001	40	26.5	1.2	27.4	18.3	1.0	35.2	5.8	0.5	53.9	25.4	1.5	37.8
2002	40	23.2	1.1	29.3	15.3	0.8	34.5	5.6	0.3	38.0	28.7	1.7	38.3
2003	40	25.8	1.6	38.3	17.0	0.9	33.4	6.2	1.1	107.3	27.7	1.9	42.3
2004	40	21.6	1.2	35.4	14.3	0.8	34.6	5.0	0.4	56.1	32.6	2.5	48.1
2005	40	20.4	1.0	32.6	13.4	0.7	32.9	4.9	0.5	63.7	31.9	1.7	34.6
2006	40	25.0	1.7	43.7	15.1	0.8	33.8	7.7	1.6	127.7	30.1	2.2	46.5
2007	40	21.6	1.1	30.9	14.5	0.8	33.7	5.0	0.4	48.9	31.9	2.3	45.8
2008	40	21.7	1.5	43.8	13.3	0.8	40.1	6.4	0.8	77.7	32.2	2.7	52.8
2009	40	22.8	1.9	52.7	13.9	1.0	44.3	6.7	0.9	86.9	33.6	3.4	63.0
2010	40	23.8	1.7	45.6	15.0	0.9	39.2	6.8	0.8	76.1	33.1	3.5	67.1
2011	40	25.3	2.0	50.8	15.1	0.9	37.8	8.0	1.300	99.6	31.5	3.0	61.1
Recent	**.**	**23.0**	**1.6**	**44.8**	**14.4**	**0.9**	**39.0**	**6.6**	**0.8**	**77.8**	**32.5**	**3.0**	**58.0**
Overall	**.**	**22.7**	**1.4**	**39.7**	**14.9**	**1.0**	**41.2**	**5.6**	**0.6**	**63.5**	**33.3**	**2.7**	**50.1**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 14.—Mean annual percentages of fine sediments from core sampling in the Burgdorf spawning area (E048), Lake Creek, 1981-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1981	40	19.4	1.0	32.9	12.8	0.7	34.5	4.5	0.3	37.7	39.5	2.6	42.0
1982	40	20.4	1.1	32.6	13.4	0.7	34.6	4.9	0.3	37.9	38.3	2.9	47.7
1983	40	20.8	1.1	33.5	13.4	0.8	36.7	5.4	0.3	33.4	41.1	3.3	51.1
1984	40	19.2	1.1	34.8	12.3	0.8	42.7	4.4	0.3	41.5	38.0	2.5	41.8
1985	40	22.0	0.9	26.7	13.9	0.7	30.0	5.6	0.3	35.7	33.3	2.1	40.5
1986	.	.	.	.	.	.	.	.	.	.	.	.	.
1987	40	21.6	1.4	40.1	14.2	1.1	49.5	4.7	0.4	48.3	39.1	3.6	58.0
1988	.	.	.	.	.	.	.	.	.	.	.	.	.
1989	38	29.4	1.2	26.1	23.1	1.3	34.0	7.3	0.8	45.6	22.7	2.8	53.0
1990	40	19.6	1.5	47.3	12.7	1.2	59.7	4.3	0.4	66.2	39.4	3.2	51.1
1991	39	20.4	1.4	42.0	13.5	1.1	50.8	4.5	0.3	48.1	40.1	3.2	49.5
1992	40	19.8	1.1	34.2	13.6	0.9	42.3	4.4	0.3	41.5	41.5	2.4	36.0
1993	30	21.5	1.2	30.9	15.7	1.1	37.4	3.6	0.3	42.0	38.3	3.1	44.5
1994	30	21.0	1.3	33.8	14.4	0.9	36.2	3.7	0.4	54.9	37.9	2.8	41.1
1995	40	14.2	1.3	59.0	9.3	1.0	65.6	3.0	0.3	62.5	55.3	5.6	63.7
1996	40	16.8	1.0	38.1	10.3	0.7	40.9	3.8	0.3	55.6	40.7	3.4	53.4
1997	40	18.5	0.9	31.4	12.3	0.7	35.8	3.8	0.2	36.9	36.1	2.3	40.9
1998	40	16.7	1.4	52.9	11.2	1.0	56.7	3.3	0.4	71.0	54.1	5.9	68.6
1999	40	18.5	1.5	50.4	12.7	1.1	55.3	3.8	0.3	55.8	47.4	4.5	59.4
2000	40	19.6	1.0	32.7	13.0	0.8	39.8	4.2	0.2	37.4	40.1	2.6	41.0
2001	40	21.1	1.3	39.1	14.4	1.0	45.0	4.0	0.4	55.8	39.1	3.0	48.4
2002	40	20.2	1.5	48.0	14.0	1.2	52.7	3.9	0.3	55.7	41.5	4.0	60.6
2003	40	21.1	1.5	45.9	13.8	1.1	50.4	5.3	0.4	48.4	42.7	4.5	66.3
2004	40	21.2	1.5	43.3	13.8	1.0	47.5	5.3	0.4	49.9	37.1	2.7	45.7
2005	40	24.1	1.3	34.9	15.7	1.0	39.8	6.0	0.5	50.5	31.0	2.5	51.9
2006	40	21.2	1.3	39.6	13.6	0.9	41.8	5.4	0.4	52.3	39.2	3.3	53.3
2007	40	15.7	1.0	39.9	10.6	0.7	44.1	3.5	0.3	52.8	51.0	2.7	33.5
2008	.	.	.	.	.	.	.	.	.	.	.	.	.
2009	40	18.8	1.3	43.3	12.8	0.9	45.4	4.0	0.3	50.8	41.0	3.6	55.7
2010	40	14.8	1.1	45.8	9.7	0.8	50.6	3.4	0.3	50.5	52.8	3.5	41.4
2011	40	16.3	1.4	55.5	10.9	1.0	56.3	3.0	0.4	71.3	47.3	4.0	53.9
Recent	**.**	**18.5**	**1.2**	**43.2**	**12.2**	**0.9**	**46.3**	**4.3**	**0.4**	**54.7**	**43.7**	**3.3**	**48.3**
Overall	**.**	**19.8**	**1.2**	**39.8**	**13.3**	**0.9**	**44.9**	**4.4**	**0.4**	**49.6**	**40.9**	**3.3**	**49.8**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 15.—Mean annual percentages[a] of fine sediments from core sampling in the Threemile Creek spawning area (E033), Lake Creek, 1981-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1981	40	25.8	1.1	28.0	13.8	0.6	27.6	9.4	0.6	37.7	22.9	2.2	60.5
1982	40	24.7	1.0	26.3	13.1	0.6	30.7	9.0	0.7	46.0	23.0	1.5	40.9
1983	40	28.9	1.2	25.5	17.1	0.9	31.7	9.1	0.5	32.1	19.8	1.2	38.2
1984	40	28.8	1.0	22.7	15.7	0.6	23.3	9.7	0.6	39.3	17.7	0.9	32.0
1985	40	28.0	1.5	33.1	15.0	0.9	39.7	10.0	0.6	35.9	19.7	1.6	51.0
1986	.	.	.	.	.	.	.	.	.	.	.	.	.
1987	30	29.2	1.6	29.9	16.7	1.1	35.7	9.3	0.6	38.3	19.4	1.7	46.7
1988	.	.	.	.	.	.	.	.	.	.	.	.	.
1989	39	32.1	1.3	24.8	19.6	1.1	33.5	9.2	0.4	27.4	17.2	1.4	51.6
1990	40	27.2	1.4	32.9	14.8	0.9	36.8	9.6	0.8	52.5	18.0	0.9	33.3
1991	39	30.8	0.9	18.5	17.1	0.8	29.1	10.8	0.6	36.7	15.8	0.6	24.7
1992	40	34.9	1.5	27.7	21.6	1.1	31.4	10.1	0.8	47.2	13.8	0.7	32.0
1993	40	32.6	1.3	25.4	20.0	1.4	44.0	10.2	0.6	36.1	15.8	0.8	30.8
1994	10	57.5	4.4	24.1	43.9	4.9	35.0	11.1	1.5	43.5	7.3	1.0	42.9
1995	40	23.2	1.8	49.2	12.4	1.2	58.7	8.6	0.8	62.4	30.7	3.4	69.7
1996	40	30.0	2.1	44.1	13.6	0.9	40.1	12.8	1.5	75.0	18.9	1.8	59.3
1997	40	35.9	2.6	45.4	19.1	1.4	46.3	13.1	1.5	72.7	16.1	1.5	60.4
1998	40	31.4	1.9	38.4	17.3	1.0	36.3	10.9	1.0	57.9	18.2	1.6	56.1
1999	40	28.8	1.8	39.7	17.7	1.2	43.4	7.8	0.6	51.6	20.8	1.9	56.3
2000	40	30.4	1.3	26.6	19.8	1.1	34.3	7.9	0.4	35.5	18.9	1.1	35.3
2001	40	31.9	2.2	44.6	18.5	1.1	39.2	10.8	1.6	93.5	18.4	1.4	49.0
2002	40	34.3	1.8	33.3	19.5	1.2	37.8	12.0	1.0	52.1	16.2	1.5	59.6
2003	40	32.3	1.2	23.9	19.9	1.0	30.7	9.4	0.5	31.8	16.8	1.1	41.0
2004	40	34.7	2.1	38.4	20.2	1.3	40.3	11.5	1.0	56.7	16.3	1.3	51.6
2005	40	35.4	2.2	38.9	17.9	1.1	39.7	14.8	1.1	48.3	14.7	1.5	65.5
2006	40	30.0	1.5	32.6	16.7	1.0	36.1	10.4	0.8	50.8	18.7	1.5	52.0
2007	40	27.8	1.4	31.2	15.6	1.0	40.6	9.6	0.7	43.2	19.0	1.2	39.4
2008	30	31.6	3.1	53.1	17.6	1.5	45.6	11.4	1.7	82.1	16.7	1.2	39.7
2009	40	30.1	1.8	37.5	18.3	1.1	38.4	9.0	0.8	55.5	19.6	1.5	49.9
2010	.	.	.	.	.	.	.	.	.	.	.	.	.
2011	.	.	.	.	.	.	.	.	.	.	.	.	.
Recent	.	**31.0**	**2.0**	**38.7**	**17.2**	**1.1**	**40.1**	**11.0**	**1.0**	**56.0**	**17.7**	**1.4**	**49.3**
Overall	.	**31.4**	**1.7**	**33.2**	**18.2**	**1.2**	**37.3**	**10.3**	**0.9**	**49.7**	**18.2**	**1.4**	**47.0**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 16.—Mean annual percentages[a] of fine sediments from core sampling in the Secesh Meadows spawning area (E096), Lake Creek, 1981-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1981	40	14.2	0.6	26.8	8.6	0.5	33.4	4.1	0.2	35.5	48.9	2.4	31.0
1982	40	17.9	0.9	32.3	11.8	0.6	33.6	4.4	0.2	31.8	38.2	2.8	46.2
1983	40	18.9	0.8	28.3	12.6	0.6	29.7	4.4	0.3	36.2	40.7	2.3	35.9
1984	40	18.6	1.1	36.7	12.6	0.7	37.4	4.0	0.3	43.2	36.4	2.9	51.1
1985	40	21.2	1.2	35.1	14.3	0.9	40.6	4.8	0.3	38.8	36.5	2.5	42.9
1986	40	20.6	1.0	30.5	13.8	0.8	34.6	4.9	0.3	32.7	38.6	2.6	42.9
1987	40	21.2	1.1	33.3	14.4	0.8	36.5	4.9	0.3	44.4	40.4	2.7	41.5
1988	.	.	.	.	.	.	.	.	.	.	.	.	.
1989	40	27.2	1.0	23.4	19.3	0.9	28.4	5.6	0.4	43.2	26.8	1.4	32.8
1990	40	22.7	1.1	30.4	15.7	0.8	30.7	4.9	0.4	49.4	33.7	2.0	37.5
1991	40	23.0	1.0	28.1	16.4	0.8	32.4	4.8	0.3	41.7	32.5	2.1	41.3
1992	40	25.2	1.0	26.0	17.0	0.8	30.2	4.6	0.3	45.5	29.3	1.9	41.7
1993	40	24.0	0.9	25.0	17.1	0.8	29.5	4.6	0.2	32.5	30.5	1.6	32.4
1994	40	24.2	0.9	23.5	17.6	0.8	29.1	3.9	0.3	45.0	32.8	1.9	36.9
1995	23	16.8	1.5	43.5	11.4	1.2	49.7	3.4	0.4	63.5	43.7	4.4	48.8
1996	20	28.0	1.1	17.9	19.5	1.0	21.8	6.4	0.4	29.7	25.7	1.6	28.6
1997	40	15.5	0.8	34.4	11.1	0.6	37.0	2.7	0.2	49.6	47.2	2.0	26.5
1998	20	19.3	1.5	35.1	13.0	1.1	39.4	4.5	0.4	43.3	43.3	4.4	45.6
1999	.	.	.	.	.	.	.	.	.	.	.	.	.
2000	19	18.0	1.5	37.2	12.8	1.2	41.1	3.8	0.4	43.4	43.3	4.0	40.6
2001	40	20.6	0.8	25.8	13.3	0.6	26.7	5.3	0.3	34.3	36.3	2.4	41.6
2002	40	25.1	1.1	26.9	17.5	0.9	31.7	5.5	0.3	29.7	29.3	2.2	47.5
2003	20	20.6	1.6	34.2	13.3	1.3	43.5	5.9	0.4	32.0	40.2	3.8	42.8
2004	38	24.2	0.9	21.7	15.6	0.7	27.9	6.8	0.3	25.6	33.8	1.9	34.5
2005	40	21.9	0.9	26.2	12.8	0.7	33.4	7.1	0.4	31.7	35.2	2.0	35.1
2006	40	16.2	1.0	37.6	8.8	0.5	39.4	5.9	0.4	40.2	51.1	2.9	36.3
2007	40	18.5	0.7	25.5	10.9	0.5	27.0	5.9	0.3	30.7	45.4	2.3	32.4
2008	30	15.1	1.1	41.3	9.0	0.7	41.5	4.7	0.4	45.5	55.1	4.6	45.4
2009	40	15.3	1.2	49.0	8.9	0.7	51.9	5.0	0.4	50.7	55.3	3.6	41.1
2010	40	17.6	1.1	39.7	10.2	0.7	43.6	5.8	0.4	46.5	46.8	3.0	40.1
2011	40	17.0	1.0	39.0	11.0	0.8	44.1	5.0	0.3	42.0	47.2	2.9	38.5
Recent	**.**	**16.7**	**1.0**	**38.9**	**10.0**	**0.7**	**41.6**	**5.2**	**0.4**	**43.1**	**50.0**	**3.3**	**39.5**
Overall	**.**	**20.3**	**1.0**	**31.5**	**13.5**	**0.8**	**35.4**	**4.9**	**0.3**	**39.9**	**39.5**	**2.7**	**39.3**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean;
CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 17.—Mean annual percentages[a] of fine sediments from core sampling in the Chinook Campground spawning area (E046), Lake Creek, 1981-2010[a].

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1981	40	15.5	0.7	26.9	10.0	0.5	29.9	3.7	0.2	29.8	37.2	1.8	30.0
1982	40	15.1	0.5	23.1	9.8	0.4	27.3	3.6	0.1	26.3	43.4	1.9	28.3
1983	40	18.4	0.9	29.4	12.6	0.7	34.7	4.1	0.3	40.3	39.8	2.1	34.0
1984	40	19.8	0.8	26.9	13.7	0.8	35.7	4.1	0.2	29.2	35.8	2.0	34.9
1985	40	19.7	0.8	24.2	13.5	0.6	29.1	4.1	0.1	22.5	36.7	1.7	28.7
1986	.	.	.	.	.	.	.	.	.	.	.	.	.
1987	40	21.2	1.3	38.9	15.2	1.0	43.5	3.9	0.3	49.5	37.6	3.9	65.1
1988	.	.	.	.	.	.	.	.	.	.	.	.	.
1989	38	31.1	1.1	21.2	21.5	1.0	29.0	6.9	0.2	19.3	20.8	1.3	38.0
1990	40	24.7	1.0	26.5	19.1	0.9	31.2	3.6	0.2	34.3	28.6	1.6	34.7
1991	40	20.8	1.1	32.9	14.1	0.8	35.5	4.4	0.3	44.1	35.6	1.9	34.5
1992	40	19.4	1.1	35.0	12.9	0.8	38.4	4.4	0.3	41.7	43.5	2.8	40.6
1993	40	21.0	0.9	26.2	15.0	0.7	29.0	3.5	0.2	44.4	35.1	2.3	41.9
1994	40	23.2	1.1	29.4	16.2	1.0	40.3	4.3	0.2	30.3	33.1	2.6	50.1
1995	40	18.6	1.7	58.5	13.3	1.4	64.9	3.6	0.3	58.6	49.4	5.1	65.3
1996	40	23.1	1.3	36.1	17.7	1.1	39.1	3.2	0.2	45.5	36.2	2.9	50.6
1997	40	20.5	1.2	37.9	14.2	1.0	46.6	3.8	0.2	40.2	39.7	2.8	44.9
1998	40	20.6	1.4	43.8	13.9	1.2	55.1	4.4	0.3	42.6	43.0	3.5	51.3
1999	40	19.2	1.6	51.2	13.7	1.3	60.2	3.7	0.3	54.2	44.8	4.2	59.9
2000	40	19.2	1.2	39.2	13.3	1.1	50.0	4.1	0.3	44.6	42.5	3.1	46.8
2001	40	22.6	1.1	30.6	15.3	0.8	33.0	4.7	0.4	50.1	34.2	2.5	46.4
2002	40	21.6	1.6	45.8	15.8	1.3	52.8	3.8	0.2	37.7	38.0	3.5	58.5
2003	40	23.9	1.3	35.6	16.7	1.1	42.7	5.0	0.3	36.9	30.9	2.2	46.0
2004	40	22.6	1.0	29.1	15.2	0.8	33.1	5.5	0.3	32.8	33.2	2.0	38.7
2005	38	23.3	0.9	24.9	15.4	0.8	31.8	5.4	0.3	32.7	32.6	2.0	37.4
2006	40	20.2	1.0	32.2	13.1	0.7	35.1	5.1	0.3	34.6	39.2	2.9	47.4
2007	40	16.6	0.9	33.6	10.8	0.6	37.2	4.2	0.3	39.7	47.9	3.0	39.2
2008	40	19.3	1.1	37.5	12.0	0.7	37.4	5.7	0.5	59.6	39.6	3.6	57.4
2009	40	16.1	1.3	49.6	11.0	1.0	55.7	3.4	0.3	47.5	49.6	3.9	49.4
2010	40	18.7	1.1	37.2	12.4	0.8	39.7	4.1	0.3	44.4	42.7	3.3	48.2
2011	40	20.8	0.9	28.2	14.2	0.7	30.3	5.0	0.3	39.4	38.1	2.3	37.6
Recent	.	**18.3**	**1.1**	**37.2**	**12.1**	**0.8**	**40.1**	**4.4**	**0.3**	**46.1**	**44.5**	**3.2**	**45.5**
Overall	.	**20.6**	**1.1**	**34.2**	**14.2**	**0.9**	**39.6**	**4.3**	**0.3**	**39.8**	**39.3**	**2.7**	**43.5**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean;
CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Time Series Analyses

Overall Models

Table 18.—Overall regression models (y = bx + a) for percent fine sediments and geometric mean particle diameter from core sampling, Secesh River spawning areas, 1989-2011.

Substrate Class[a]	Ordinary Least Squares				Autoregression		
	a	b	r^2	Dw[b]	a	b	r^2
Corduroy Junction (E034)							
LF	-211.70	0.12**	0.01	1.34	-208.16	0.12*	0.13
CF	-100.86	0.06**	0.01	1.34	-98.87	0.06	0.12
SF	-108.88	0.06**	0.01	1.61	-107.85	0.06**	0.06
GM	617.18	-0.29**	0.02	1.20	601.70	-0.29**	0.19
Burgdorf (E048)							
LF	227.47	-0.10**	0.01	1.08	198.75	-0.09	0.25
CF	154.20	-0.07**	0.01	1.02	126.75	-0.06	0.30
SF	60.22	-0.03**	0.01	1.20	60.41	-0.03*	0.19
GM	-454.45	0.25**	0.01	1.22	-420.23	0.23+	0.17
Threemile Creek (E033)							
LF	-296.22	0.16**	0.01	1.11	-330.23	0.18*	0.24
CF	-198.77	0.11**	0.01	1.10	-226.44	0.12*	0.25
SF	-104.62	0.06**	0.01	1.35	-108.53	0.06+	0.13
GM	209.51	-0.10**	0.01	1.13	229.52	-0.11	0.23
Secesh Meadows (E096)							
LF	162.60	-0.07**	0.01	1.32	154.18	-0.07	0.18
CF	213.08	-0.10**	0.03	1.26	204.83	-0.10**	0.22
SF	-87.79	0.05**	0.04	1.46	-87.98	0.05**	0.13
GM	-627.18	0.33**	0.03	1.18	-605.49	0.32**	0.22
Chinook Campground (E046)							
LF	-1.36	0.01	0.00	1.01	-52.73	0.04	0.28
CF	34.68	-0.01	0.00	0.90	-17.75	0.02	0.34
SF	-43.14	0.02**	0.01	1.35	-47.21	0.03*	0.16
GM	-223.16	0.13*	0.00	1.21	-148.74	0.09	0.20

[a] LF – Large Fines (≤6.3mm). CF – Coarse Fines (≤4.75mm).
SF – Small Fines (≤0.85mm). GM – Geometric Mean Particle Diameter.
[b] DW - First order Durbin-Watson statistic.

Significance:
[†]Moderately significant (P<0.10).
*Significant (P<0.05).
**Highly significant (P<0.01).

Recent Models

Table 19.—Recent regression models (y = bx + a) for fine sediments and geometric mean particle diameter from core sampling, Secesh River spawning areas, 2000-2011.

Substrate Class[a]	Ordinary Least Squares				Autoregression		
	a	b	r^2	Dw[b]	a	b	r^2
Corduroy Junction (E034)							
LF	-126.92	0.07	0.00	1.59	-94.08	0.06	0.05
CF	245.45	-0.12	0.00	1.51	269.51	-0.13	0.07
SF	-446.94	0.23*	0.01	1.80	-446.64	0.23*	0.03
GM	-818.56	0.42	0.01	1.46	-971.09	0.50	0.11
Burgdorf (E048)							
LF	1246.00	-0.61**	0.05	1.14	1141.00	-0.56*	0.28
CF	856.31	-0.42**	0.05	1.08	764.69	-0.38+	0.31
SF	251.58	-0.12**	0.03	1.15	237.64	-0.12	0.23
GM	-2068.00	1.05**	0.02	1.47	-1951.00	0.99+	0.12
Threemile Creek (E033)							
LF	575.93	-0.27	0.00	1.31	498.40	-0.23	0.15
CF	638.70	-0.31*	0.02	1.27	624.09	-0.30	0.16
SF	-78.44	0.04	0.00	1.46	-122.91	0.07	0.10
GM	-161.19	0.09	0.00	1.42	-90.41	0.05	0.13
Secesh Meadows (E096)							
LF	1987.00	-0.98**	0.15	1.74	2001.00	-0.99**	0.19
CF	1540.00	-0.76**	0.17	1.73	1543.00	-0.76**	0.23
SF	286.30	-0.14**	0.03	1.58	296.11	-0.14*	0.09
GM	-4553.00	2.29**	0.11	1.62	-4585.00	2.31**	0.15
Chinook Campground (E046)							
LF	1132.00	-0.55**	0.04	1.26	1040.00	-0.51*	0.20
CF	962.55	-0.47**	0.05	1.12	852.82	-0.42*	0.27
SF	109.61	-0.05	0.01	1.52	97.74	-0.05	0.10
GM	-2251.00	1.14**	0.03	1.59	-2168.00	1.10*	0.09

[a] LF – Large Fines (≤6.3mm). CF – Coarse Fines (≤4.75mm).
SF – Small Fines (≤0.85mm). GM – Geometric Mean Particle Diameter.
[b] DW - First order Durbin-Watson statistic.

Significance:
†Moderately significant (P<0.10).
*Significant (P<0.05).
**Highly significant (P<0.01).

Intrabasin Comparisons

Table 20.—Multiple comparisons[a] of mean percent large fines among Secesh River spawning areas by year[b].

Year	Corduroy Junction (E034)	Burgdorf (E048)	Threemile Creek (E033)	Secesh Meadows (E096)	Chinook Campground (E046)
1981	16.3CB	19.4B	25.8A	14.2C	15.5C
1982	14.1D	20.4B	24.7A	17.9CB	15.1CD
1983	16.8C	20.8B	28.9A	18.9CB	18.4CB
1984	19.5B	19.2B	28.8A	18.6B	19.8B
1985	22.2B	22.0B	28.0A	21.2B	19.7B
1986	.	.	.	.	.
1987	22.3B	21.6B	29.2A	21.2B	21.2B
1988	.	.	.	.	.
1989	33.1A	29.4BA	32.1A	27.2B	31.1BA
1990	23.7BA	19.6B	27.2A	22.7BA	24.7A
1991	28.2A	20.4B	30.8A	23.0B	20.8B
1992	28.5B	19.8C	34.9A	25.2B	19.4C
1993	26.8B	21.5C	32.6A	24.0CB	21.0C
1994	.	21.0B	57.5A	24.2B	23.2B
1995	17.7BA	14.2B	23.2A	16.8B	18.6BA
1996	21.9DC	16.8D	30.0A	28.0BA	23.1BC
1997	23.9B	18.5CB	35.9A	15.5C	20.5CB
1998	20.9B	16.7B	31.4A	19.3B	20.6B
1999	19.4B	18.5B	28.8A	.	19.2B
2000	23.1B	19.6CB	30.4A	18.0C	19.2CB
2001	26.5B	21.1C	31.9A	20.6C	22.6CB
2002	23.2B	20.2B	34.3A	25.1B	21.6B
2003	25.8B	21.1B	32.3A	20.6B	23.9B
2004	21.6B	21.2B	34.7A	24.2B	22.6B
2005	20.4B	24.1B	35.4A	21.9B	23.3B
2006	25.0B	21.2CB	30.0A	16.2D	20.2CD
2007	21.6B	15.7C	27.8A	18.5CB	16.6C
2008	21.7B	.	31.6A	15.1C	19.3CB
2009	22.8B	18.8CB	30.1A	15.3C	16.1C
2010	23.8A	14.8B	.	17.6B	18.7B
2011	25.3A	16.3B	.	17.0B	20.8BA
Recent	**23.1B**	**17.4C**	**31.0A**	**16.8C**	**18.3C**
Overall	**22.7B**	**19.7C**	**30.7A**	**20.3C**	**20.6C**

[a] Mean values in a row with different letters are significantly different (P<0.10) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.

Table 21.—Multiple comparisons[a] of mean percent coarse fines among Secesh River spawning areas by year[b].

Year	Corduroy Junction (E034)	Burgdorf (E048)	Threemile Creek (E033)	Secesh Meadows (E096)	Chinook Campground (E046)
1981	9.4B	12.8A	13.8A	8.6B	10.0B
1982	9.2C	13.4A	13.1A	11.8BA	9.8BC
1983	11.0B	13.4B	17.1A	12.6B	12.6B
1984	12.9B	12.3B	15.7A	12.6B	13.7BA
1985	14.4A	13.9A	15.0A	14.3A	13.5A
1986	.	.	.	.	.
1987	14.9A	14.2A	16.7A	14.4A	15.2A
1988	.	.	.	.	.
1989	21.9A	23.1A	19.6A	19.3A	21.5A
1990	16.1BA	12.7B	14.8B	15.7BA	19.1A
1991	19.0A	13.0C	17.0BA	16.0BA	14.0B
1992	18.1B	13.6C	21.6A	17.0B	12.9C
1993	18.5BA	15.7B	20.0A	17.1BA	15.0B
1994	.	14.4B	43.9A	17.6B	16.2B
1995	12.6A	9.3A	12.4A	11.4A	13.3A
1996	13.9B	10.3C	13.6B	19.5A	17.7A
1997	16.8BA	12.3C	19.1A	11.1C	14.2BC
1998	14.0BA	11.2B	17.3A	13.0B	13.9BA
1999	13.8B	12.7B	17.7A	.	13.7B
2000	16.1BA	13.0B	19.8A	12.8B	13.3B
2001	18.3A	14.4B	18.5A	13.3B	15.3BA
2002	15.3B	14.0B	19.5A	17.5BA	15.8BA
2003	17.0BA	13.8B	19.9A	13.3B	16.7BA
2004	14.3B	13.8B	20.2A	15.6B	15.2B
2005	13.4B	15.7BA	17.9A	12.8B	15.4BA
2006	15.1BA	13.6B	16.7A	8.8C	13.1B
2007	14.5A	10.6B	15.6A	10.9B	10.8B
2008	13.3B	.	17.6A	9.0C	12.0CB
2009	13.9B	12.8B	18.3A	8.9C	11.0CB
2010	15.0A	9.7C	.	10.2BC	12.4BA
2011	15.1A	10.9B	.	11.0B	14.2A
Recent	**14.4B**	**11.5C**	**17.2A**	**10.1D**	**12.1C**
Overall	**15.0B**	**13.2D**	**17.5A**	**13.4D**	**14.2B**

[a] Mean values in a row with different letters are significantly different (P<0.10) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.

Table 22.—Multiple comparisons[a] of mean percent small fines among Secesh River spawning areas by year[b].

Year	Corduroy Junction (E034)	Burgdorf (E048)	Threemile Creek (E033)	Secesh Meadows (E096)	Chinook Campground (E046)
1981	5.4B	4.5CB	9.4A	4.1CB	3.7C
1982	2.9D	4.9B	9.0A	4.4CB	3.6CD
1983	3.9C	5.4B	9.1A	4.4CB	4.1C
1984	4.3B	4.4B	9.7A	4.0B	4.1B
1985	5.7B	5.6B	10.0A	4.8CB	4.1C
1986	.	.	.	.	.
1987	5.2B	4.7B	9.3A	4.9B	3.9B
1988	.	.	.	.	.
1989	8.5BA	7.3BC	9.2A	5.6D	6.9DC
1990	5.1B	4.3B	9.6A	4.9B	3.6B
1991	6.2B	4.5C	10.8A	4.8CB	4.4C
1992	7.4B	4.4C	10.1A	4.6C	4.4C
1993	6.5B	3.6C	10.2A	4.6C	3.5C
1994	.	3.7B	11.1A	3.9B	4.3B
1995	3.2B	3.0B	8.6A	3.4B	3.6B
1996	5.6B	3.8B	12.8A	6.4B	3.2B
1997	4.8B	3.8B	13.1A	2.7B	3.8B
1998	4.7B	3.3B	10.9A	4.5B	4.4B
1999	3.6B	3.8B	7.8A	.	3.7B
2000	5.0B	4.2B	7.9A	3.8B	4.1B
2001	5.8B	4.0B	10.8A	5.3B	4.7B
2002	5.6B	3.9B	12.0A	5.5B	3.8B
2003	6.2B	5.3B	9.4A	5.9B	5.0B
2004	5.0B	5.3B	11.5A	6.8B	5.5B
2005	4.9B	6.0B	14.8A	7.1B	5.4B
2006	7.7BA	5.4B	10.4A	5.9B	5.1B
2007	5.0CB	3.5D	9.6A	5.9B	4.2CD
2008	6.4B	.	11.4A	4.7B	5.7B
2009	6.7B	4.0C	9.0A	5.0CB	3.4C
2010	6.8A	3.4B	.	5.8A	4.1B
2011	8.1A	3.4B	.	4.8B	4.8B
Recent	**6.6B**	**3.9D**	**11.0A**	**5.3C**	**4.4DC**
Overall	**5.6B**	**4.4D**	**10.3A**	**5.0C**	**4.3D**

[a] Mean values in a row with different letters are significantly different (P<0.10) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.

Table 23.—Multiple comparisons[a] of mean geometric mean particle diameter among Secesh River spawning areas by year[b].

Year	Corduroy Junction (E034)	Burgdorf (E048)	Threemile Creek (E033)	Secesh Meadows (E096)	Chinook Campground (E046)
1981	48.0BA	39.5B	22.9C	48.9A	40.3BA
1982	47.2A	38.3A	23.0B	38.2A	46.4A
1983	47.7A	41.1A	19.8B	40.7A	40.9A
1984	37.6A	38.0A	17.7B	36.4A	36.8A
1985	32.8A	33.3A	19.7B	36.5A	37.7A
1986	.	.	.	.	.
1987	37.7A	39.1A	19.4B	40.4A	38.5A
1988	.	.	.	.	.
1989	19.0B	22.0BA	17.0C	26.0A	21.0BA
1990	28.6B	39.4A	18.0C	33.7BA	29.6B
1991	25.0C	40.1A	15.8D	32.5B	36.3BA
1992	24.4B	41.5A	13.8C	29.3B	44.5A
1993	26.8C	38.3A	15.8D	30.5BC	35.9BA
1994	.	37.9A	7.3B	32.8A	34.2A
1995	43.2BA	55.3A	30.7B	43.7BA	50.6A
1996	34.3BA	40.7A	18.9C	25.7BC	37.2A
1997	30.2C	36.1BC	16.1D	47.2A	40.6BA
1998	35.7B	54.1A	18.2C	43.3BA	44.0BA
1999	39.6A	47.4A	20.8B	.	45.8A
2000	35.0A	40.1A	18.9B	43.3A	43.4A
2001	25.4B	39.1A	18.4B	36.3A	34.9A
2002	28.7B	41.5A	16.2C	29.3B	39.1A
2003	27.7C	42.7A	16.8D	40.2BA	31.7BC
2004	32.6A	37.1A	16.3B	33.8A	34.1A
2005	31.9A	31.0A	14.7B	35.2A	33.5A
2006	30.1C	39.2CB	18.7D	51.1A	40.1B
2007	31.9B	51.0A	19.0C	45.4A	49.1A
2008	32.2B	.	16.7C	55.1A	40.6B
2009	33.6C	41.0BC	19.6D	55.3A	50.8BA
2010	33.1B	52.8A	.	46.8A	43.7BA
2011	31.5B	47.3A	.	47.2A	38.1BA
Recent	**32.5C**	**46.3BA**	**17.8D**	**49.7A**	**44.5B**
Overall	**33.3C**	**41.3A**	**18.5D**	**39.3B**	**39.4B**

[a] Mean values in a row with different letters are significantly different (P<0.10) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.

Chamberlain Basin

Statistical Summaries

Table 24.—Mean annual percentages[a] of fine sediments from core sampling in the Chamberlain Creek spawning area (E032), Chamberlain Basin, 1981-2010.

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1981	40	24.7	1.5	37.2	14.9	0.9	39.3	7.2	0.5	41.6	30.3	2.5	52.0
1982	.	.	.	.	.	.	.	.	.	.	.	.	.
1983	.	.	.	.	.	.	.	.	.	.	.	.	.
1984	.	.	.	.	.	.	.	.	.	.	.	.	.
1985	.	.	.	.	.	.	.	.	.	.	.	.	.
1986	.	.	.	.	.	.	.	.	.	.	.	.	.
1987	.	.	.	.	.	.	.	.	.	.	.	.	.
1988	.	.	.	.	.	.	.	.	.	.	.	.	.
1989	36	31.9	1.0	19.4	22.9	0.8	21.5	5.8	0.3	28.7	23.2	1.2	29.8
1990	40	28.6	1.0	21.1	20.8	0.7	22.1	4.7	0.2	26.2	28.4	1.4	31.7
1991	40	26.4	1.0	23.8	18.4	0.8	27.2	5.1	0.2	30.9	33.5	1.9	36.4
1992	40	28.5	1.3	29.4	19.9	0.9	30.0	5.7	0.3	36.2	28.7	2.0	45.0
1993	40	21.9	0.9	25.4	17.1	0.8	29.0	2.8	0.3	59.1	42.2	2.0	29.7
1994	40	22.4	1.5	42.1	15.5	1.0	40.9	4.4	0.5	76.7	41.3	3.5	53.4
1995	40	16.9	1.4	51.6	12.8	1.1	56.1	2.3	0.2	58.8	61.5	5.1	52.2
1996	40	23.9	1.2	31.1	18.5	1.0	34.3	3.0	0.1	29.5	39.6	2.6	42.2
1997	40	15.7	1.1	45.5	11.3	0.9	50.0	2.3	0.2	44.1	55.6	4.1	46.3
1998	40	13.9	1.2	53.8	9.6	0.9	57.5	2.6	0.2	53.4	68.8	6.2	57.4
1999	40	17.2	1.3	47.9	12.4	1.0	53.1	2.7	0.2	50.9	60.0	4.6	48.1
2000	40	19.8	1.3	42.7	15.0	1.0	44.2	3.1	0.2	46.6	52.4	4.4	53.6
2001	40	24.0	1.4	37.4	17.8	1.2	41.8	4.0	0.3	40.7	41.4	3.5	53.5
2002	40	15.0	1.4	58.9	11.5	1.1	62.0	2.3	0.2	64.0	80.9	6.5	51.1
2003	40	15.3	1.2	47.9	10.8	0.9	51.0	3.0	0.2	52.4	75.1	4.5	37.6
2004	40	23.0	1.3	34.7	16.3	0.9	35.6	4.7	0.3	36.7	46.6	3.6	48.6
2005	40	23.3	1.5	39.7	16.4	1.1	41.9	5.0	0.4	45.0	46.3	4.6	62.8
2006	40	24.4	1.6	40.4	16.8	1.1	40.3	5.4	0.5	63.9	42.3	3.6	53.2
2007	40	20.8	1.2	37.4	14.5	0.9	39.2	4.3	0.3	46.9	49.9	3.7	47.0
2008	40	20.3	1.3	40.9	13.7	0.9	42.9	4.1	0.3	44.6	46.6	3.5	48.1
2009	40	14.3	1.3	59.0	9.9	0.9	59.5	2.8	0.3	72.5	71.4	5.7	50.6
2010	.	.	.	.	.	.	.	.	.	.	.	.	.
2011	.	.	.	.	.	.	.	.	.	.	.	.	.
Recent	**.**	**20.6**	**1.4**	**43.5**	**14.3**	**1.0**	**44.8**	**4.3**	**0.4**	**54.6**	**51.3**	**4.2**	**52.3**
Overall	**.**	**21.5**	**1.3**	**39.4**	**15.3**	**0.9**	**41.8**	**4.0**	**0.3**	**47.7**	**48.5**	**3.7**	**46.8**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).

[a] Annual means in tan shading correspond to data from most recent five years.

Table 25.—Mean annual percentages[a] of fine sediments from core sampling in the West Fork Chamberlain Creek spawning area (E136), Chamberlain Basin, 1991-2010.

Year	N	Large Fines			Coarse Fines			Small Fines			GMPD		
		M	SE	CV	M	SE	CV	M	SE	CV	M	SE	CV
1991	38	29.0	1.3	27.5	17.9	0.9	31.0	8.4	0.4	30.6	23.2	1.5	40.7
1992	40	31.9	1.1	22.1	21.0	0.9	26.5	8.3	0.4	28.4	19.5	1.1	34.4
1993	40	31.4	1.3	25.8	21.3	1.1	31.7	6.9	0.5	42.7	20.9	1.2	35.2
1994	40	25.9	1.0	25.4	18.1	0.9	32.4	5.4	0.3	34.7	23.3	1.1	29.8
1995	40	25.1	1.3	32.2	16.5	0.9	35.9	6.0	0.3	36.0	26.0	2.0	47.7
1996	40	34.2	0.9	16.2	24.6	0.7	18.5	6.6	0.4	33.8	18.4	0.8	28.0
1997	40	28.7	1.1	23.5	19.3	0.9	30.0	6.3	0.2	23.2	22.6	1.3	36.7
1998	40	30.6	0.8	17.3	21.9	0.7	19.4	5.4	0.2	28.3	20.4	1.0	31.8
1999	40	31.5	1.2	24.1	22.5	1.0	27.3	6.1	0.3	33.4	20.3	1.3	40.7
2000	40	33.4	0.8	16.0	23.1	0.8	21.0	7.4	0.4	38.4	18.6	0.9	31.2
2001	40	28.0	1.1	25.5	20.5	0.9	28.3	4.9	0.3	35.7	23.2	1.3	35.4
2002	40	34.9	1.1	19.8	23.6	0.9	24.0	8.3	0.4	30.2	18.8	1.2	40.4
2003	24	33.0	1.4	20.3	21.3	1.1	26.0	8.9	0.6	31.8	19.6	1.3	31.5
2004	40	33.8	1.2	22.6	20.8	0.8	23.7	10.1	0.6	36.0	18.6	1.1	38.6
2005	40	32.8	1.2	23.0	20.0	0.8	26.0	10.1	0.5	32.4	19.9	1.6	50.6
2006	40	32.5	1.1	21.0	19.7	0.8	24.9	10.0	0.5	31.1	19.9	1.0	33.3
2007	40	33.1	1.0	19.0	20.3	0.7	22.9	10.5	0.6	34.1	18.4	1.0	35.4
2008	40	26.7	1.0	23.9	17.1	0.7	27.6	7.0	0.4	33.1	23.0	1.2	31.7
2009	40	27.7	1.0	22.3	18.3	0.8	26.2	6.7	0.4	33.7	22.4	1.3	37.4
2010	.	.	.	.	.	.	.	.	.	.	.	.	.
2011	.	.	.	.	.	.	.	.	.	.	.	.	.
Recent	.	**30.6[b]**	**1.1**	**21.8**	**19.1**	**0.8**	**25.5**	**8.9**	**0.5**	**32.9**	**20.7**	**1.2**	**37.7**
Overall	.	**30.7**	**1.1**	**22.5**	**20.4**	**0.9**	**26.5**	**7.5**	**0.4**	**33.0**	**20.9**	**1.2**	**36.3**

Abbreviations: GMPD – Geometric Mean Particle Diameter; N – Sample Size; M – Mean; SE – Standard Error of the Mean; CV – Coefficient of Variation (%).
[a] Annual means in tan shading correspond to data from most recent five years.
[b] FA rating based on declining trend (Table 27).

Time Series Analyses

Overall Models

Table 26.—Overall regression models (y = bx + a) for percent fine sediments and geometric mean particle diameter from core sampling, Chamberlain Basin spawning areas, 1981-2011 (note: no data collected in 2010, 2011; see Nelson and Bonaminio 2009).

Substrate Class[a]	Ordinary Least Squares				Autoregression		
	a	b	r^2	Dw[b]	a	b	r^2
			Chamberlain Creek (E032)				
LF	843.50	-0.41**	0.07	1.26	788.02	-0.38**	0.25
CF	672.12	-0.33**	0.08	1.28	636.08	-0.31**	0.24
SF	61.60	-0.03*	0.01	1.32	54.26	-0.03	0.17
GM	-2663.00	1.36**	0.08	1.33	-2551.00	1.30**	0.22
			West Fork Chamberlain Creek (E136)				
LF	-141.65	0.09+	0.00	1.37	-103.52	0.07	0.15
CF	83.58	-0.03	0.00	1.44	53.83	-0.02	0.11
SF	-252.82	0.13**	0.05	1.11	-73.67	0.04	0.33
GM	210.47	-0.10+	0.00	1.54	184.04	-0.08	0.08

[a] LF – Large Fines (≤6.3mm). CF – Coarse Fines (≤4.75mm).
SF – Small Fines (≤0.85mm). GM – Geometric Mean Particle Diameter.
[b] DW - First order Durbin-Watson statistic.

Significance:
†Moderately significant (P<0.10).
*Significant (P<0.05).
**Highly significant (P<0.01).

Recent Models

Table 27.—Recent regression models (y = bx + a) for fine sediments and geometric mean particle diameter from core sampling, Chamberlain Basin spawning areas, 1991-2011 (note: no data collected in 2010, 2011; see Nelson and Bonaminio 2009).

Substrate Class[a]	Ordinary Least Squares				Autoregression		
	a	b	r^2	Dw[b]	a	b	r^2
Chamberlain Creek (E032)							
LF	254.63	-0.12	0.00	1.54	204.68	-0.09	0.08
CF	514.19	-0.25*	0.01	1.54	478.06	-0.23	0.09
SF	-182.47	0.09*	0.01	1.62	-185.17	0.09†	0.09
GM	620.90	-0.28	0.00	1.54	817.75	-0.38	0.09
West Fork Chamberlain Creek (E136)							
LF	893.13	-0.43**	0.03	1.43	925.34	-0.45*	0.13
CF	1104.00	-0.54**	0.09	1.59	1099.00	-0.54**	0.13
SF	-287.78	0.15*	0.02	1.09	-117.18	0.06	0.32
GM	-378.21	0.20	0.01	1.67	-411.73	0.22	0.04

[a] LF – Large Fines (≤6.3mm). CF – Coarse Fines (≤4.75mm).
SF – Small Fines (≤0.85mm). GM – Geometric Mean Particle Diameter.
[b] DW - First order Durbin-Watson statistic.

Significance:
†Moderately significant (P<0.10).
*Significant (P<0.05).
**Highly significant (P<0.01).

Intrabasin Comparisons

Table 28.—Multiple comparisons[a] of mean percent large fines between Chamberlain Basin spawning areas by year[b].

Year	Chamberlain (E032)	WF Chamberlain (E136)
1991	26.4A	29.0A
1992	28.5B	31.9A
1993	21.9B	31.4A
1994	22.4B	25.9A
1995	16.9B	25.1A
1996	23.9B	34.2A
1997	15.7B	28.7A
1998	13.9B	30.6A
1999	17.2B	31.5A
2000	19.8B	33.4A
2001	24.0B	28.0A
2002	15.0B	34.9A
2003	15.3B	33.0A
2004	23.0B	33.8A
2005	23.3B	32.8A
2006	24.4B	32.5A
2007	20.8B	33.1A
2008	20.3B	26.7A
2009	14.3B	27.7A
2010	.	.
2011	.	.
Recent	**20.6B**	**30.6A[d]**
Overall[c]	**20.4B**	**30.7A**

[a] Mean values in a row with different letters are significantly different ($P<0.10$) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.
[c] This value may differ from summary table because some early data for E032 have been excluded.
[d] FA rating based on declining trend (Table 27).

Table 29.—Multiple comparisons[a] of mean percent coarse fines between Chamberlain Basin spawning areas by year[b].

Year	Chamberlain (E032)	WF Chamberlain (E136)
1991	18.4A	17.9A
1992	19.9A	21.0A
1993	17.1B	21.3A
1994	15.5B	18.1A
1995	12.8B	16.5A
1996	18.5B	24.6A
1997	11.3B	19.3A
1998	9.6B	21.9A
1999	12.4B	22.5A
2000	14.9B	23.1A
2001	17.8B	20.5A
2002	11.5B	23.6A
2003	10.8B	21.3A
2004	16.3B	20.8A
2005	16.4B	20.0A
2006	16.8B	19.7A
2007	14.5B	20.3A
2008	13.7B	17.1A
2009	9.9B	18.3A
2010	.	.
2011	.	.
Recent	**14.3B**	**19.1A**
Overall[c]	**14.7B**	**20.4A**

[a] Mean values in a row with different letters are significantly different ($P<0.10$) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.
[c] This value may differ from summary table because some early data for E032 are excluded.

Table 30.—Multiple comparisons[a] of mean percent small fines between Chamberlain Basin spawning areas by year[b].

Year	Chamberlain (E032)	WF Chamberlain (E136)
1991	5.1B	8.4A
1992	5.7B	8.3A
1993	2.8B	6.9A
1994	4.4A	5.4A
1995	2.3B	6.0A
1996	3.0B	6.6A
1997	2.3B	6.3A
1998	2.6B	5.4A
1999	2.7B	6.1A
2000	3.1B	7.4A
2001	4.0B	4.9A
2002	2.3B	8.3A
2003	3.0B	8.9A
2004	4.7B	10.1A
2005	5.0B	10.1A
2006	5.4B	10.0A
2007	4.3B	10.5A
2008	4.1B	7.0A
2009	2.8B	6.7A
2010	.	.
2011	.	.
Recent	**4.3B**	**8.9A**
Overall[c]	**3.7B**	**7.5A**

[a] Mean values in a row with different letters are significantly different ($P<0.10$) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.
[c] This value may differ from summary table because some early data for E032 are excluded.

Table 31.—Multiple comparisons[a] of mean geometric mean particle diameters between Chamberlain Basin spawning areas by year.

Year	Chamberlain (E032)	WF Chamberlain (E136)
1991	33.5A	23.2B
1992	28.7A	19.5B
1993	42.2A	20.9B
1994	41.3A	23.3B
1995	61.5A	26.0B
1996	39.6A	18.4B
1997	55.6A	22.6B
1998	68.8A	20.4B
1999	60.0A	20.3B
2000	52.4A	18.6B
2001	41.4A	23.2B
2002	80.9A	18.8B
2003	75.1A	19.6B
2004	46.6A	18.6B
2005	46.3A	19.9B
2006	42.3A	19.9B
2007	49.9A	18.4B
2008	46.6A	23.0B
2009	71.4A	22.4B
2010	.	.
2011	.	.
Recent	**51.3A**	**20.7B**
Overall	**51.8A**	**20.9B**

[a] Mean values in a row with different letters are significantly different ($P<0.10$) by Tukey's HSD test.
[b] Annual means in tan shading correspond to data from most recent five years.
[c] This value may differ from summary table because some early data for E032 are excluded.

Appendix 3. Time Series Graphs

South Fork Salmon River

Overall Models

Stolle Meadows (B081)

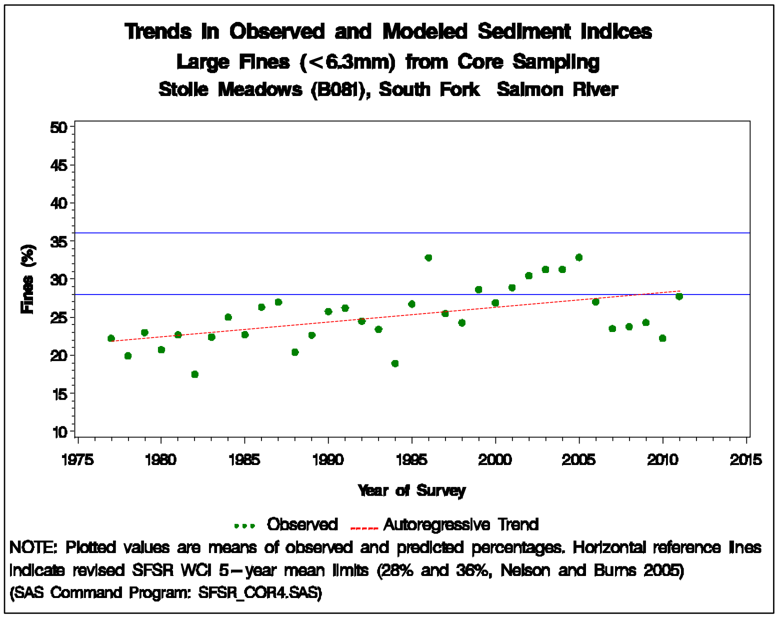

Figure 2.— Time trends in large fine sediments in the Stolle Meadows spawning area, upper SFSR, 1977-2011.

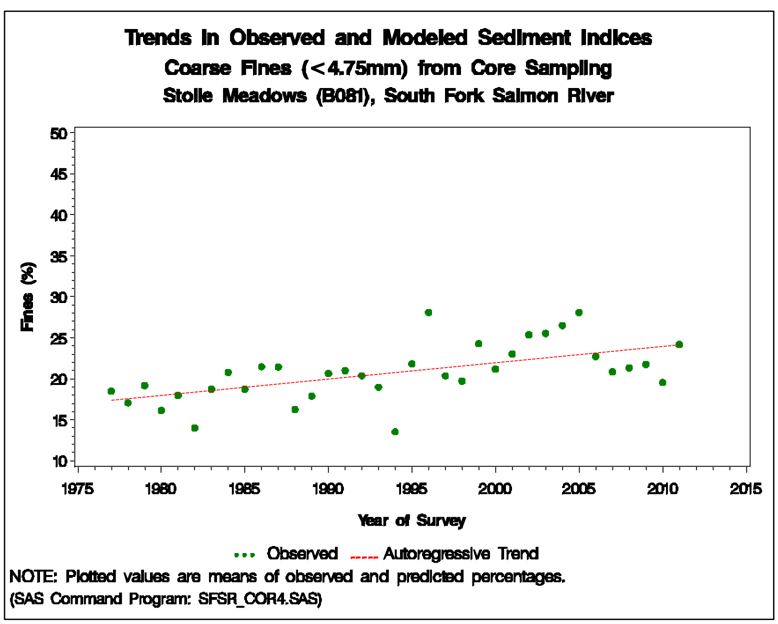

Figure 3.— Time trends in coarse fine sediments in the Stolle Meadows spawning area, upper SFSR, 1977-2011.

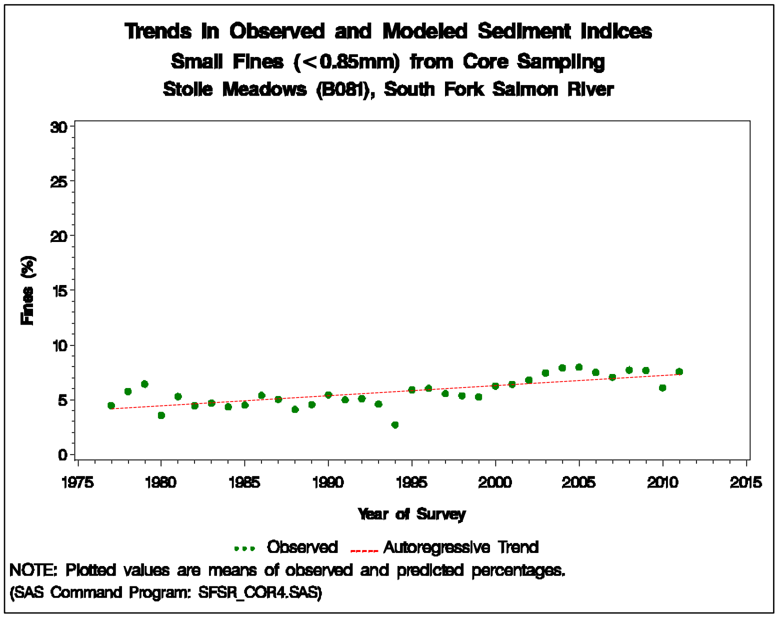

Figure 4.—Time trends in small fine sediments in the Stolle Meadows spawning area, upper SFSR, 1977-2011.

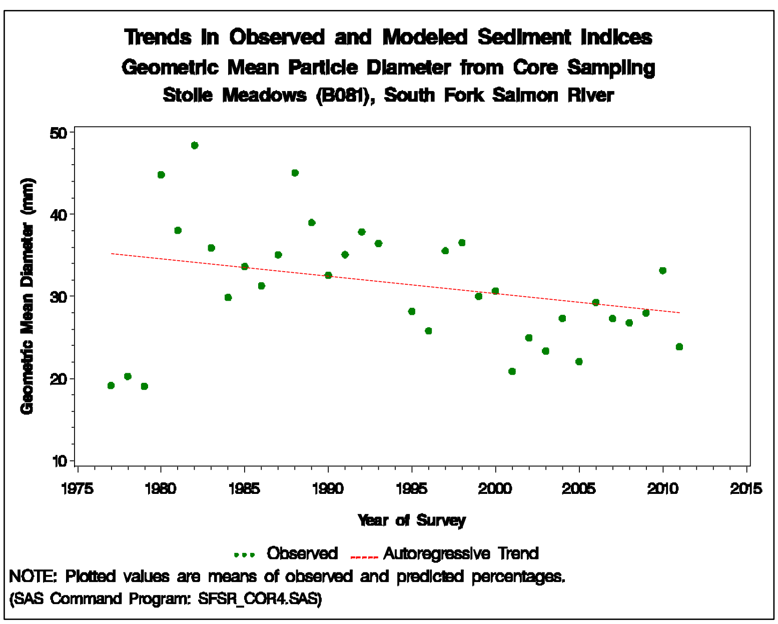

Figure 5.— Time trends in geometric mean particle diameter in the Stolle Meadows spawning area, upper SFSR, 1977-2011.

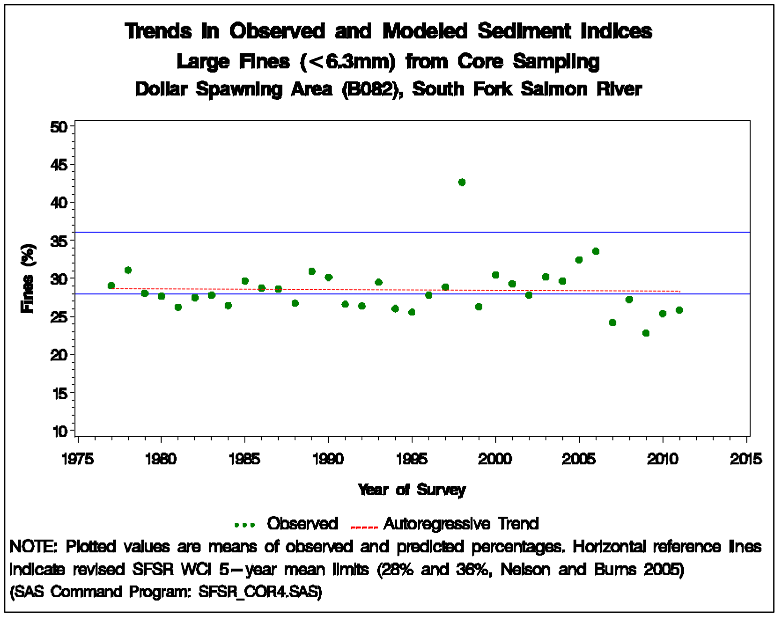

Figure 6.— Time trends in large fine sediments in the Dollar Creek spawning area, upper SFSR, 1977-2011.

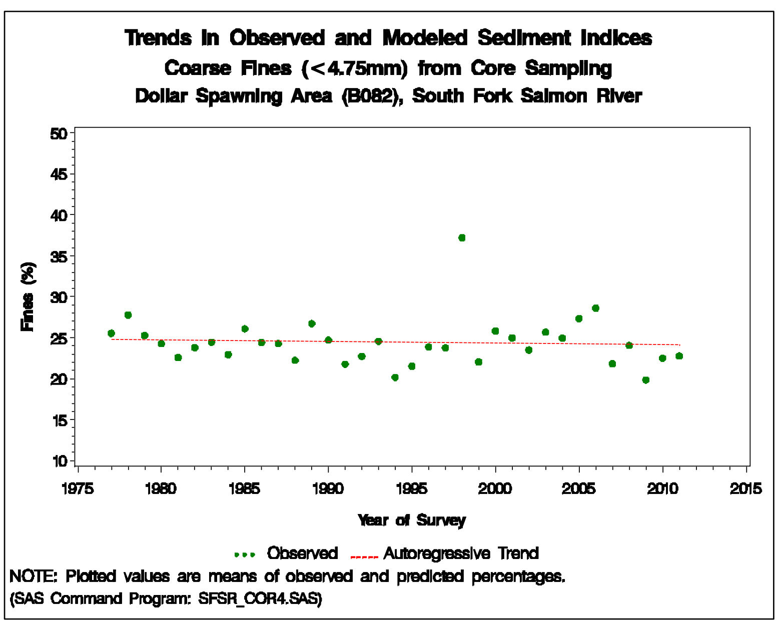

Figure 7.— Time trends in coarse fine sediments in the Dollar Creek spawning area, upper SFSR, 1977-2011.

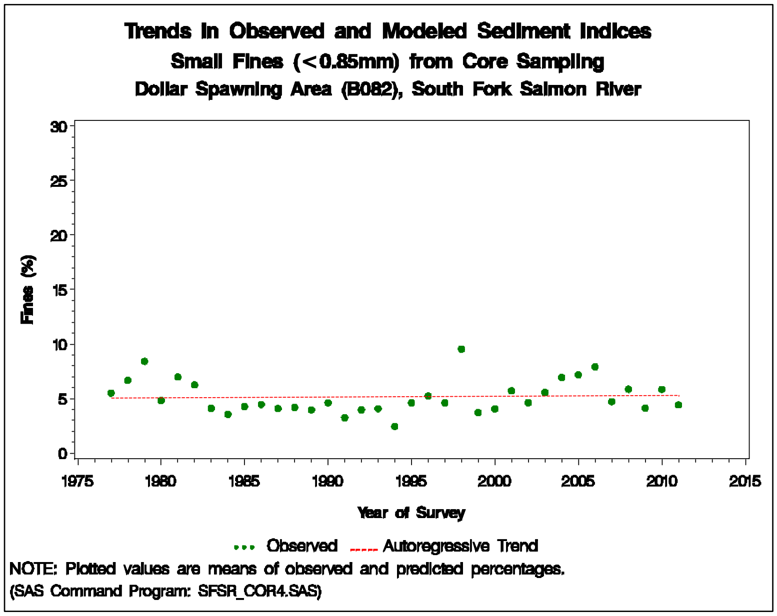

Figure 8.—Time trends in small fine sediments in the Dollar Creek spawning area, upper SFSR, 1977-2011.

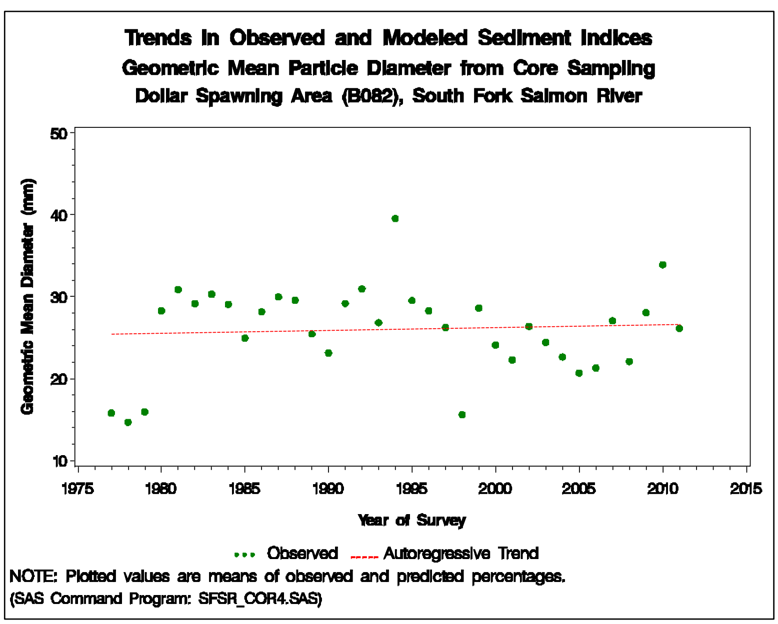

Figure 9.—Time trends in geometric mean particle diameter in the Dollar Creek spawning area, upper SFSR, 1977-2011.

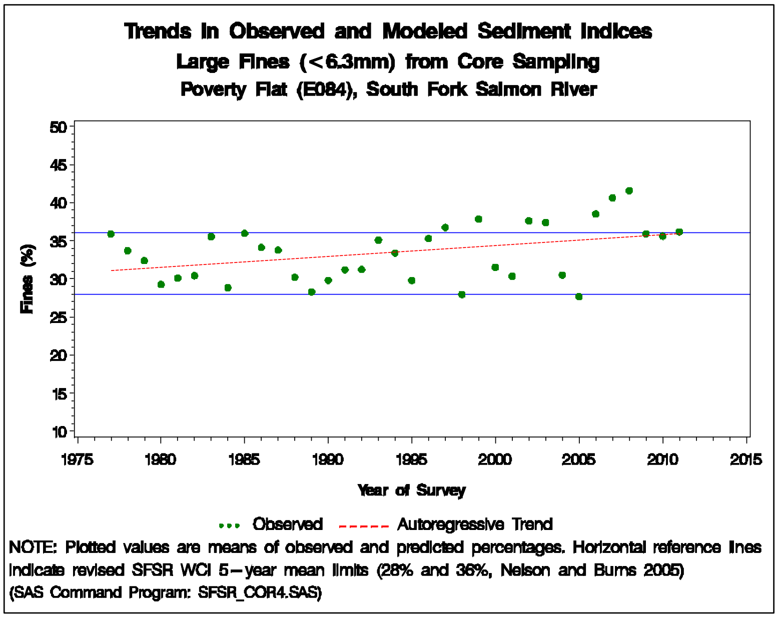

Figure 2.—Time trends in large fine sediments in the Poverty Flat spawning area, upper SFSR, 1977-2011.

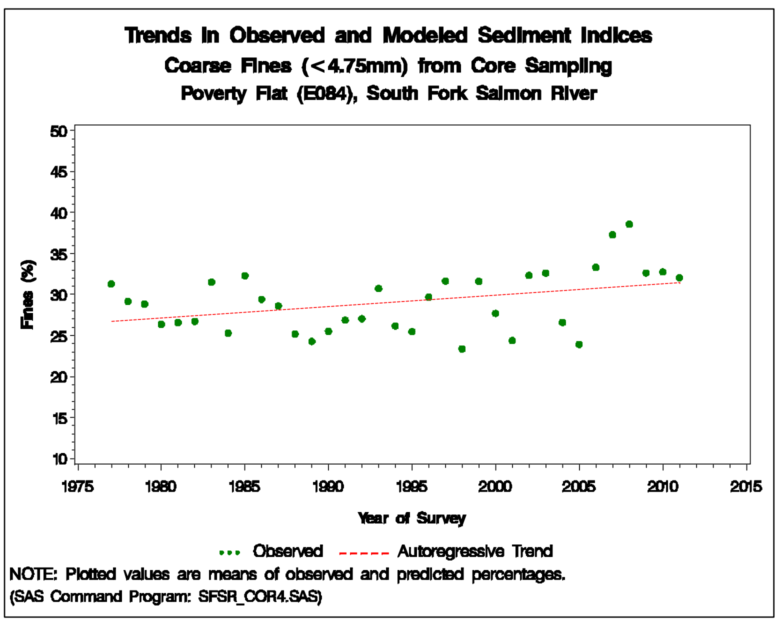

Figure 3.—Time trends in coarse fine sediments in the Poverty Flat spawning area, upper SFSR, 1977-2011.

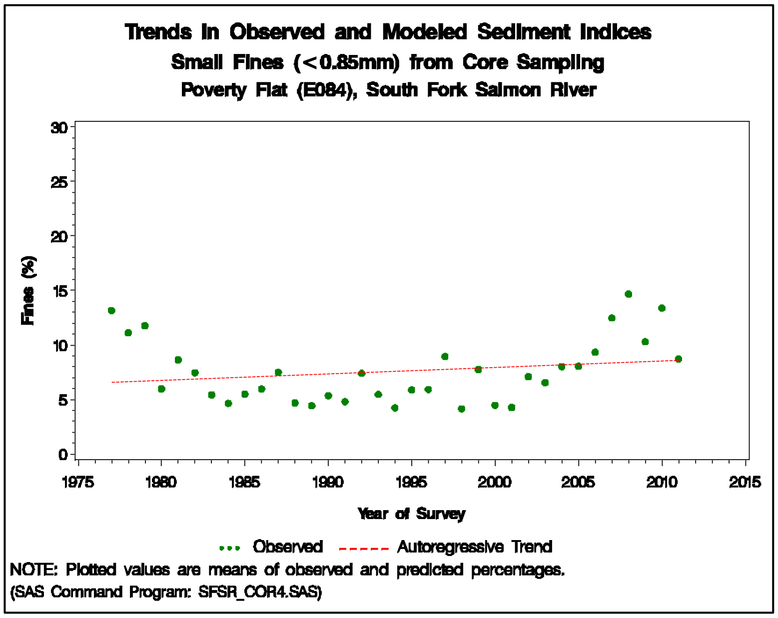

Figure 4.—Time trends in small fine sediments in the Poverty Flat spawning area, upper SFSR, 1977-2011.

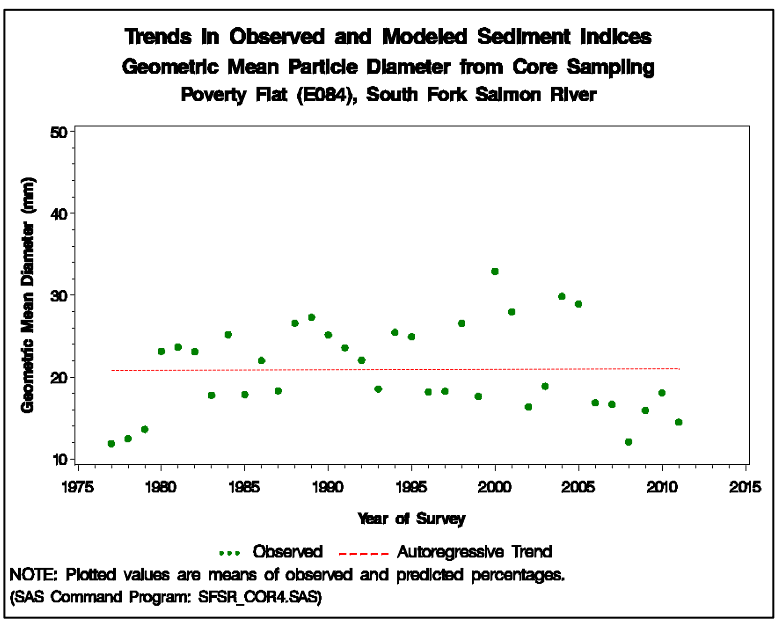

Figure 5.—Time trends in geometric mean particle diameter in the Poverty Flat spawning area, upper SFSR, 1977-2011.

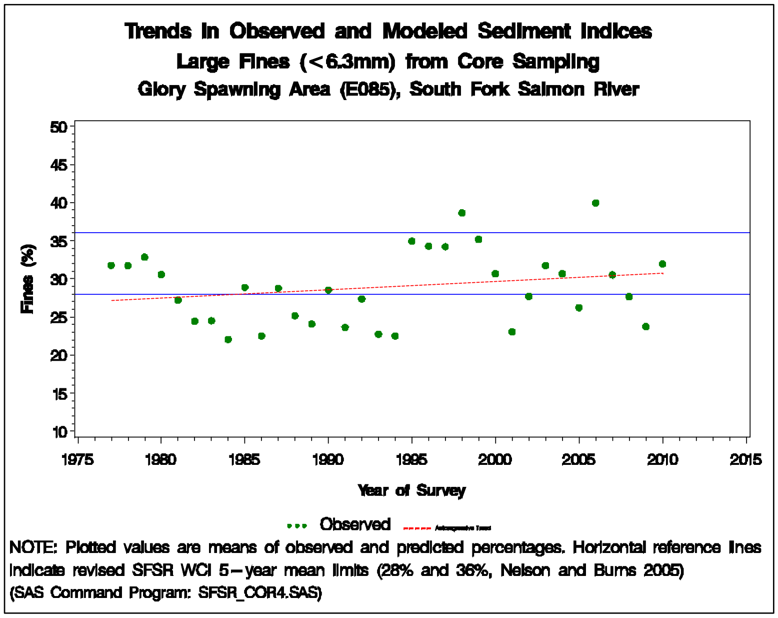

Figure 6.—Time trends in large fine sediments in the Glory Hole spawning area, upper SFSR, 1977-2010 (data not collected in 2011).

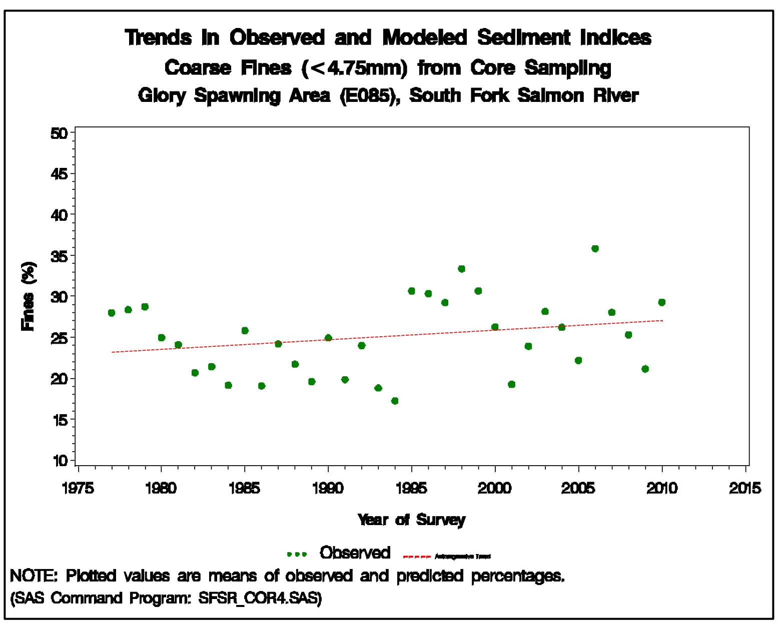

Figure 15.—Time trends in coarse fine sediments in the Glory Hole spawning area, upper SFSR, 1977-2010(data not collected in 2011).

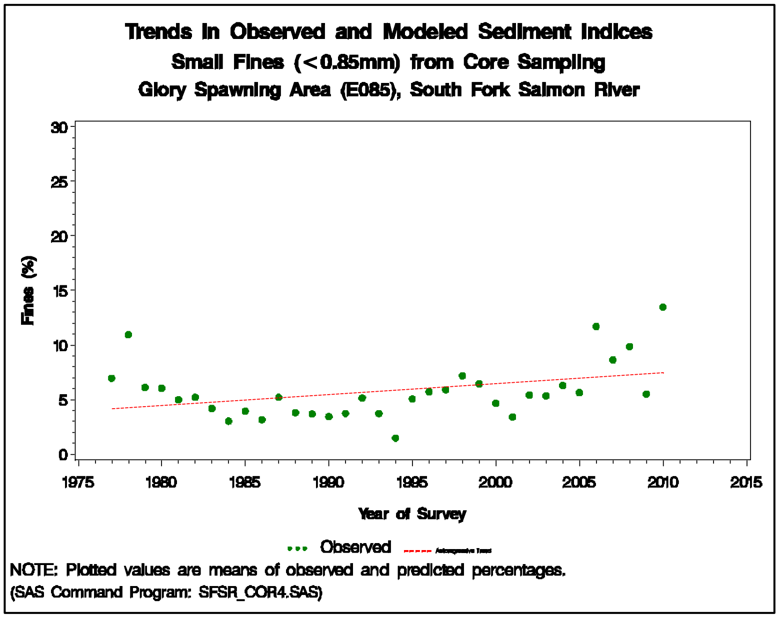

Figure 7.—Time trends in small fine sediments in the Glory Hole spawning area, upper SFSR, 1977-2010(data not collected in 2011).

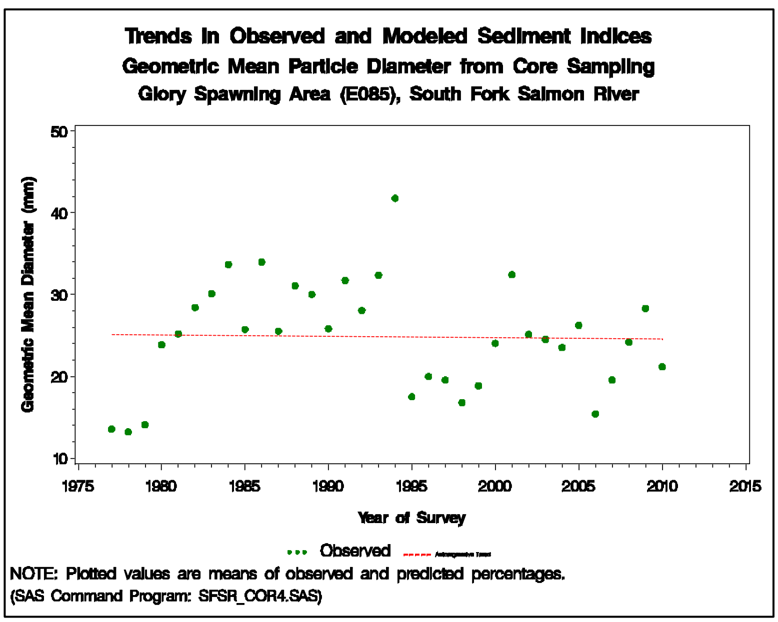

Figure 17.—Time trends in geometric mean particle diameter in the Glory Hole spawning area, upper SFSR, 1977-2010 (data not collected in 2011).

Oxbow (E083)

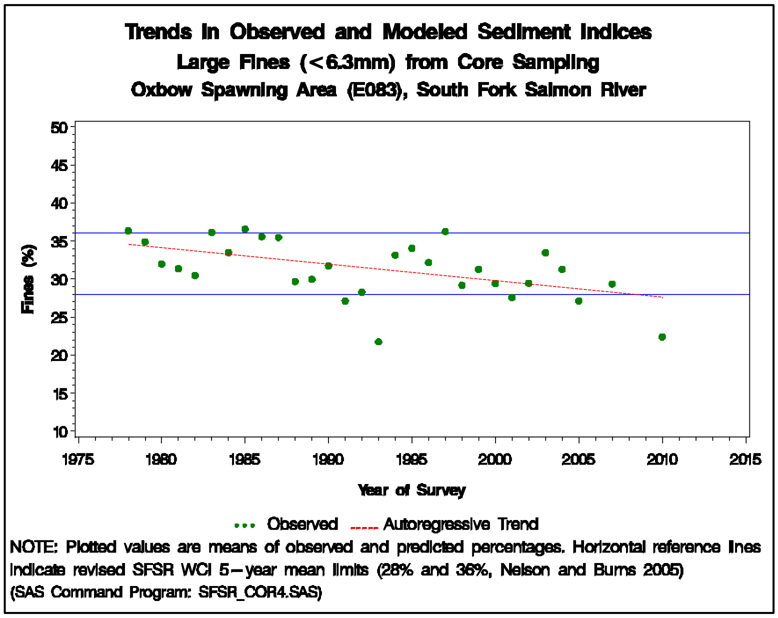

Figure 18.—Time trends in large fine sediments in the Oxbow spawning area, upper SFSR, 1977-2010 (NOTE: no data collected here in 2006, 2008, 2009, or 2011).

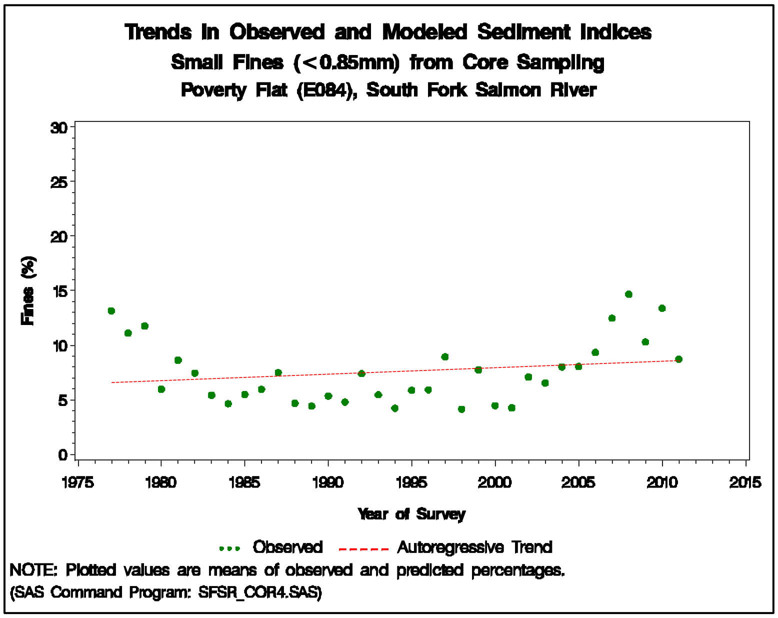

Figure 19.—Time trends in coarse fine sediments in the Oxbow spawning area, upper SFSR, 1977-2010 (NOTE: no data collected here in 2006, 2008, 2009, or 2011).

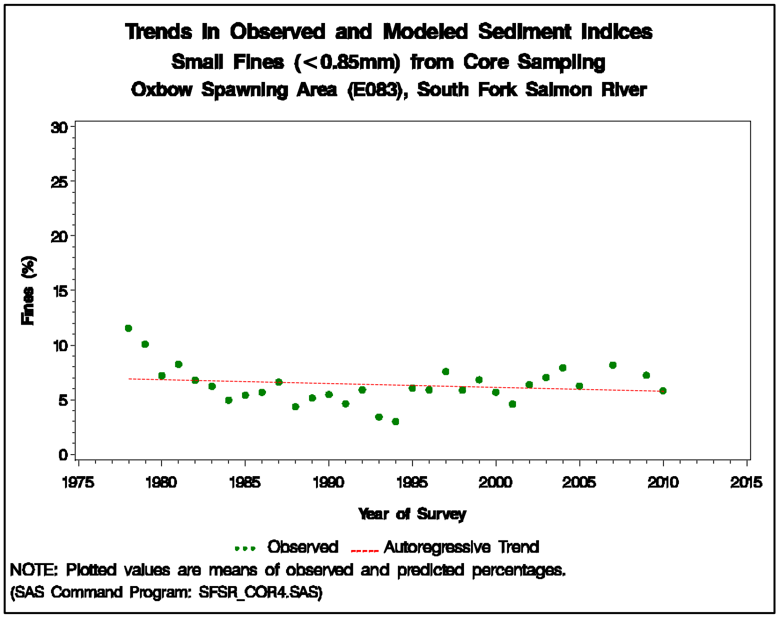

Figure 20—Time trends in small fine sediments in the Oxbow spawning area, upper SFSR, 1977-2010 (NOTE: no data collected here in 2006, 2008, 2009, or 2011).

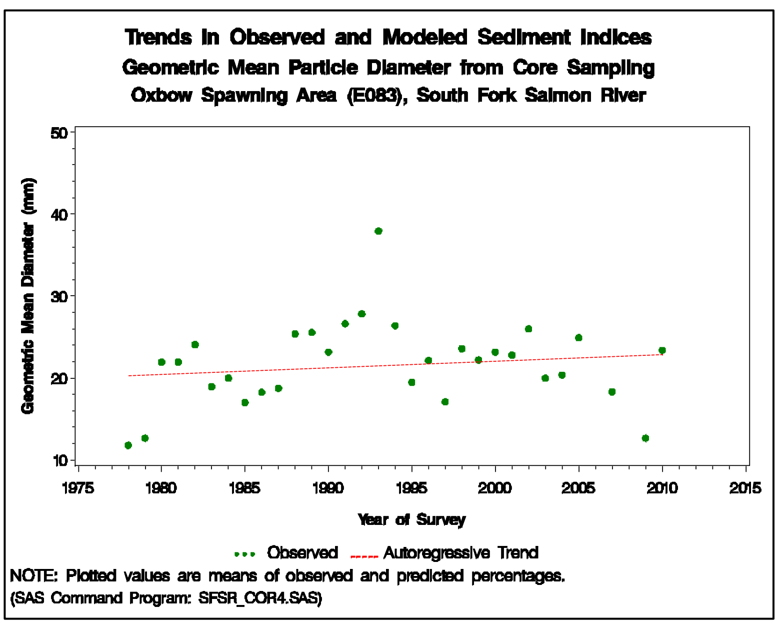

Figure 8.—Time trends in geometric mean particle diameter in the Oxbow spawning area, upper SFSR, 1977-2010 (NOTE: no data collected here in 2006, 2008, 2009, or 2011).

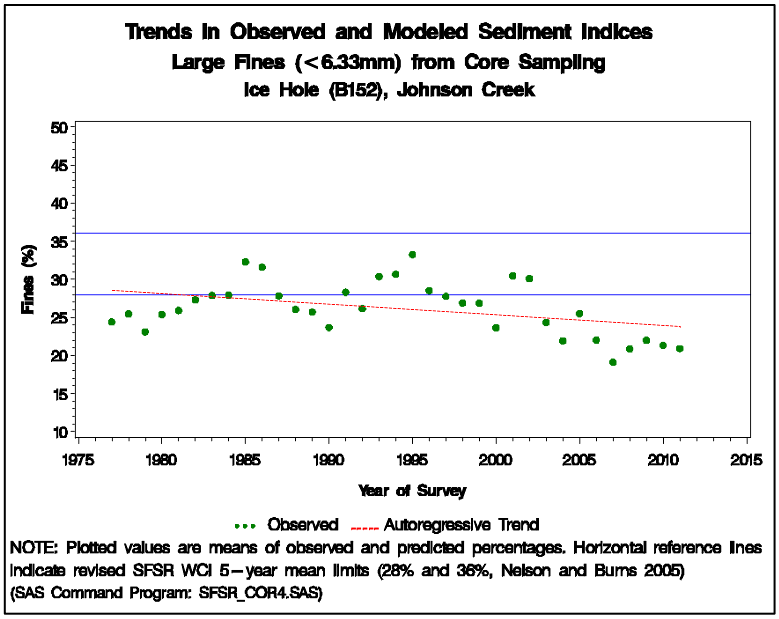

Figure 10.—Time trends in large fine sediments in the Ice Hole spawning area, upper SFSR, 1977-2011.

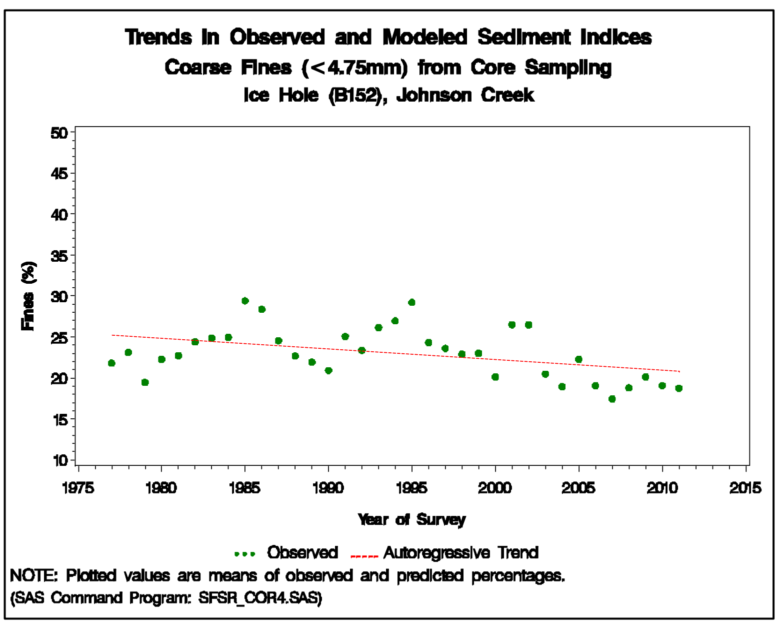

Figure 9.—Time trends in coarse fine sediments in the Ice Hole spawning area, upper SFSR, 1977-2011.

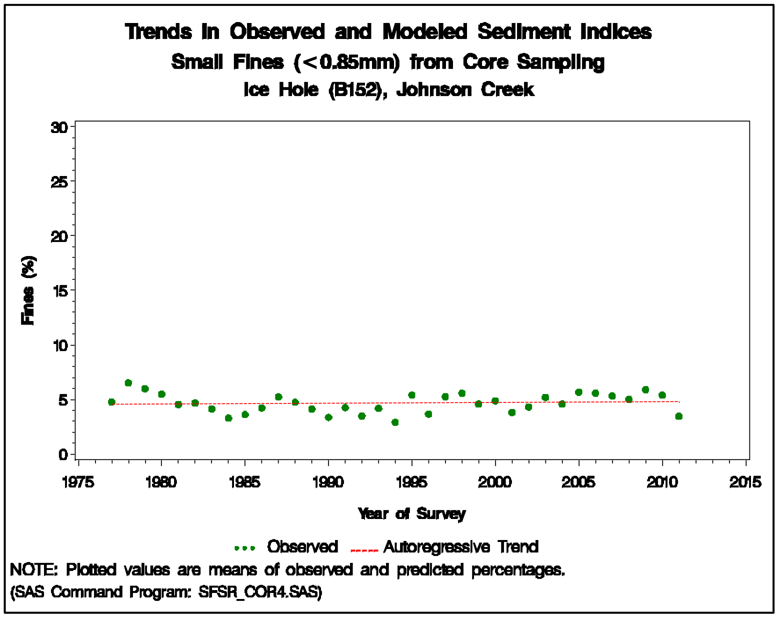

Figure 12.—Time trends in small fine sediments in the Ice Hole spawning area, upper SFSR, 1977-2011.

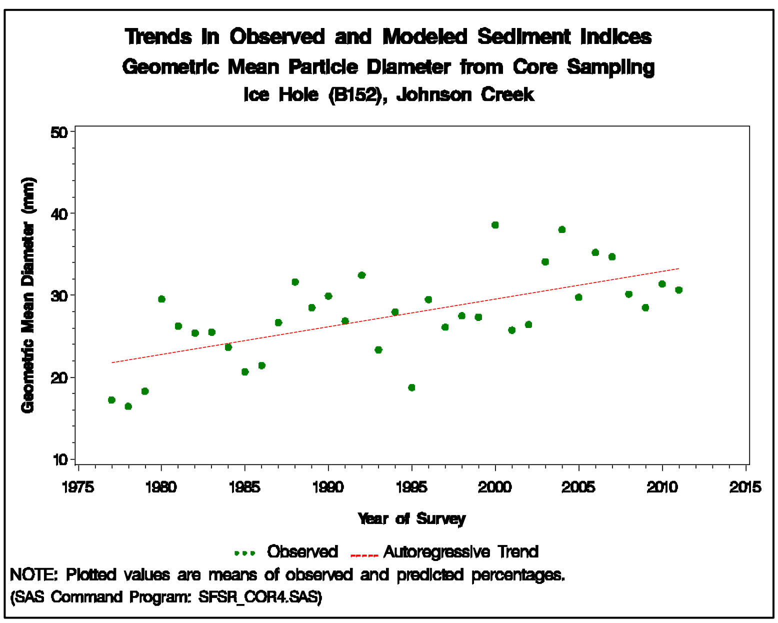

Figure 11.—Time trends in geometric mean particle diameter in the Ice Hole spawning area, upper SFSR, 1977-2011.

Recent Models

Stolle Meadows (B081)

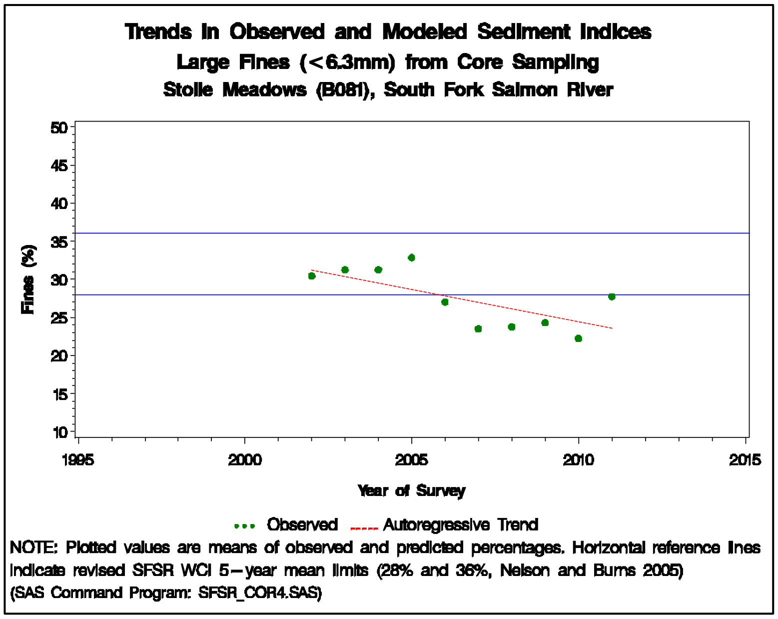

Figure 13.—Time trends in large fine sediments in the Stolle Meadows spawning area, upper SFSR, 2001-2011.

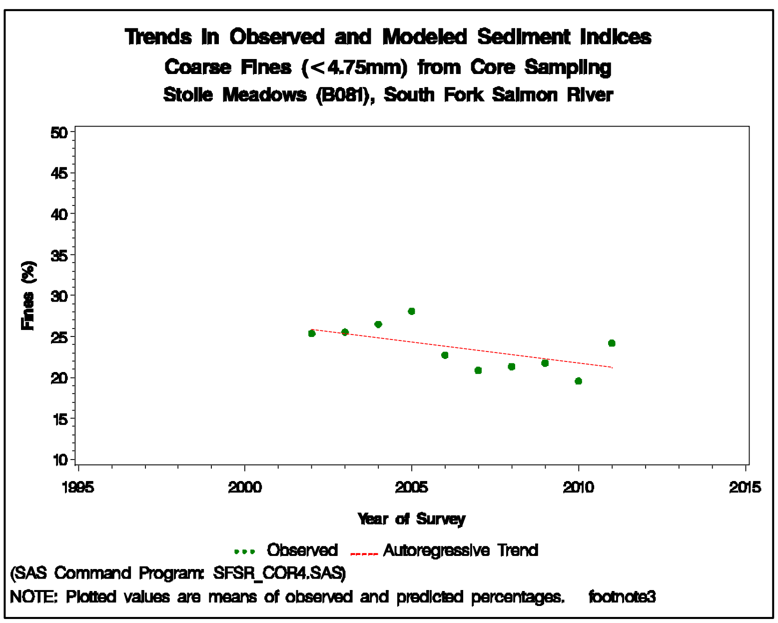

Figure 27.—Time trends in coarse fine sediments in the Stolle Meadows spawning area, upper SFSR, 2000-2011.

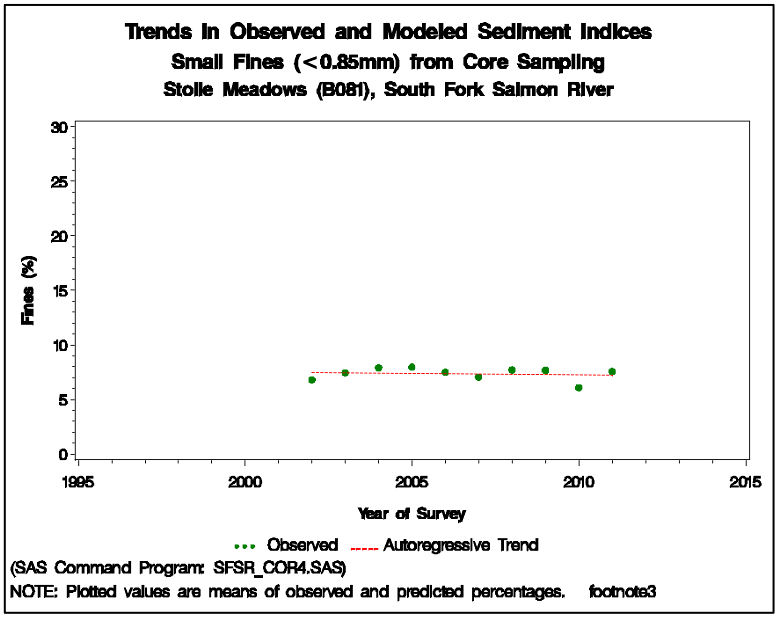

Figure 28.—Time trends in small fine sediments in the Stolle Meadows spawning area, upper SFSR, 2000-2011.

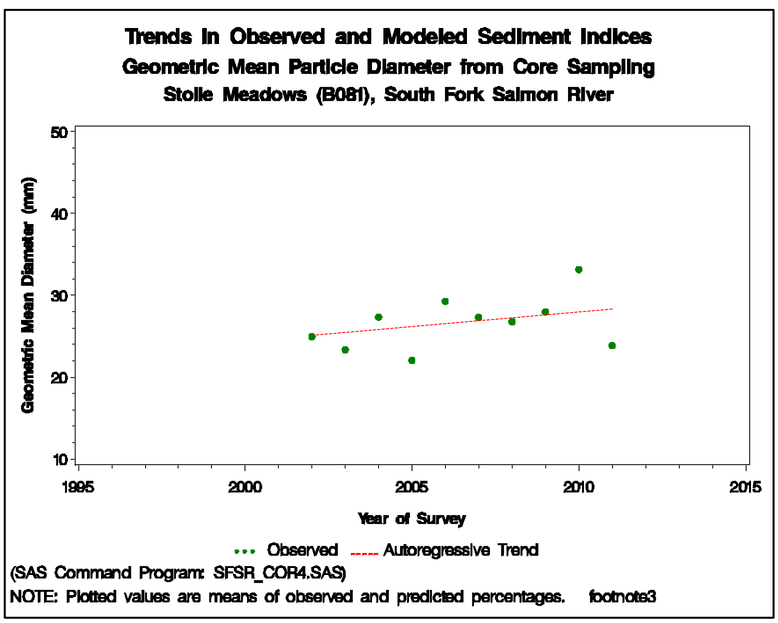

Figure 29.—Time trends in geometric mean particle diameter in the Stolle Meadows spawning area, upper SFSR, 2000-2011.

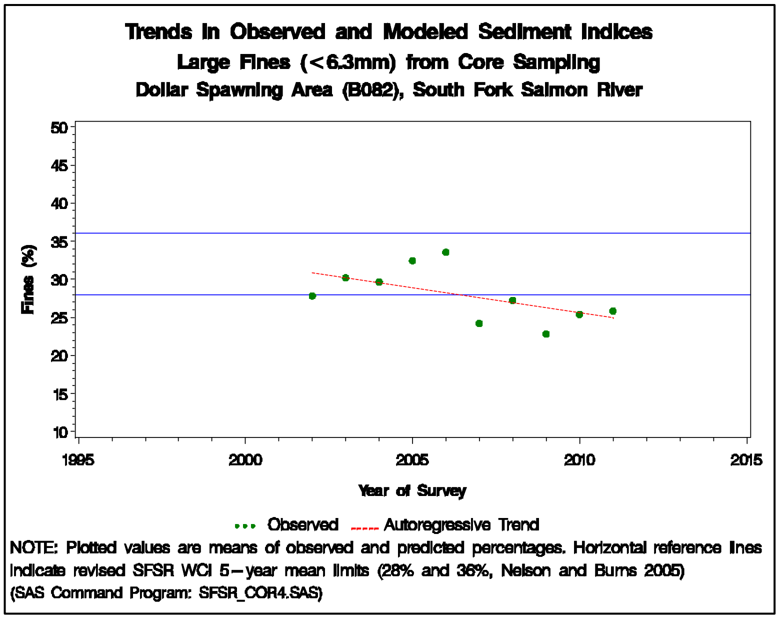

Figure 30.—Time trends in large fine sediments in the Dollar Creek spawning area, upper SFSR, 2000-2011.

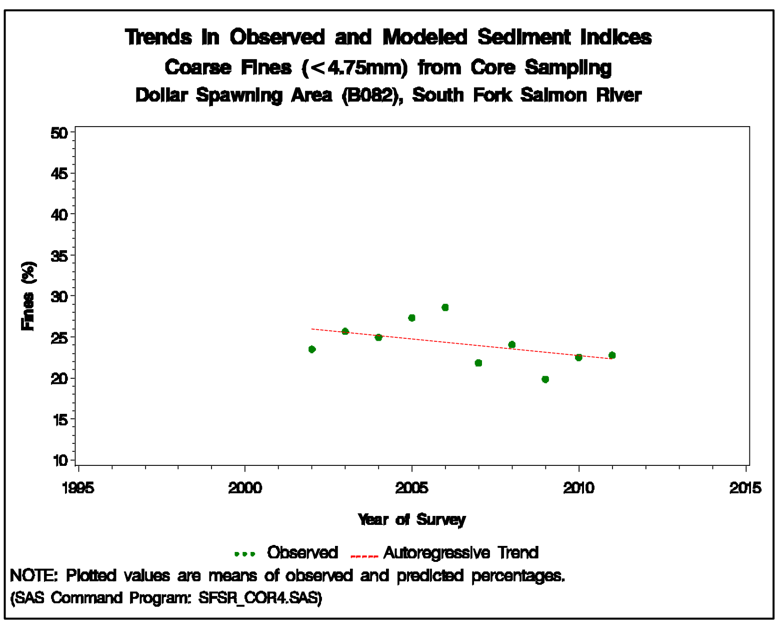

Figure 14.—Time trends in coarse fine sediments in the Dollar Creek spawning area, upper SFSR, 2000-2011.

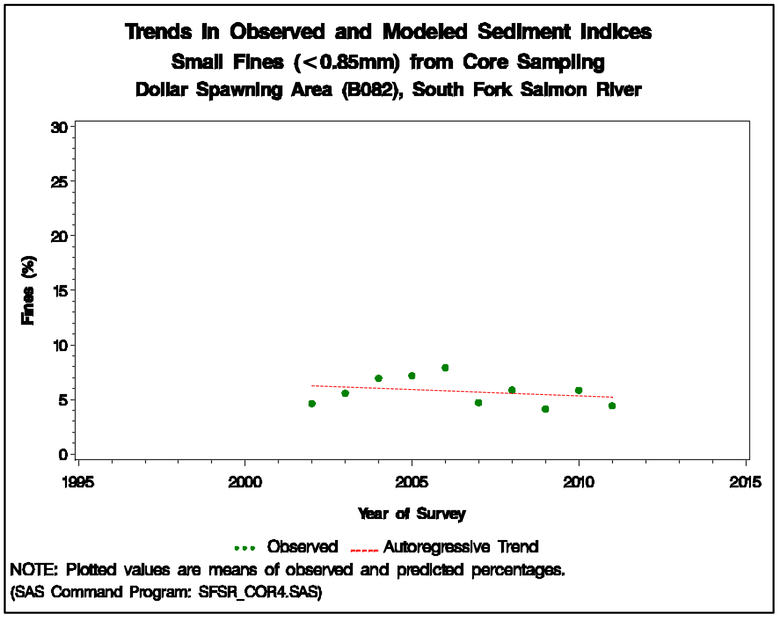

Figure 16.—Time trends in small fine sediments in the Dollar Creek spawning area, upper SFSR, 2000-2011.

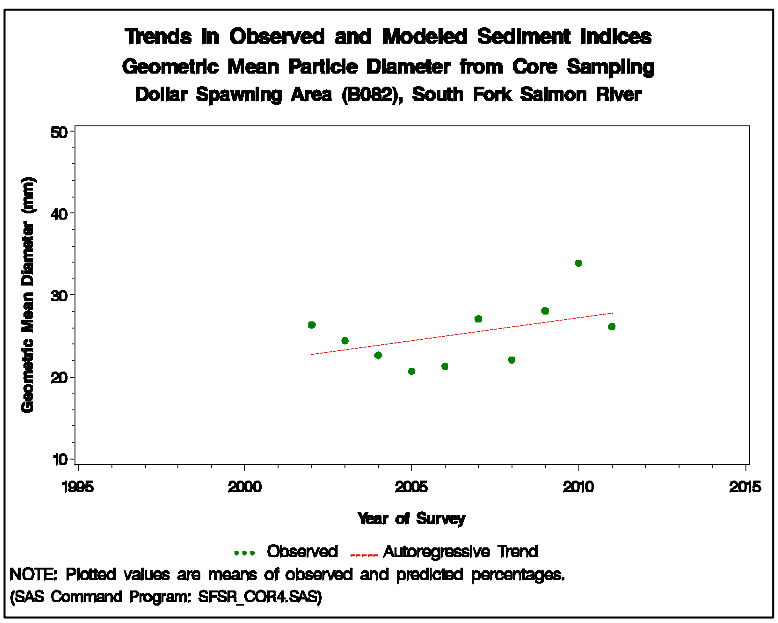

Figure 15.—Time trends in geometric mean particle diameter in the Dollar Creek spawning area, upper SFSR, 2000-2011.

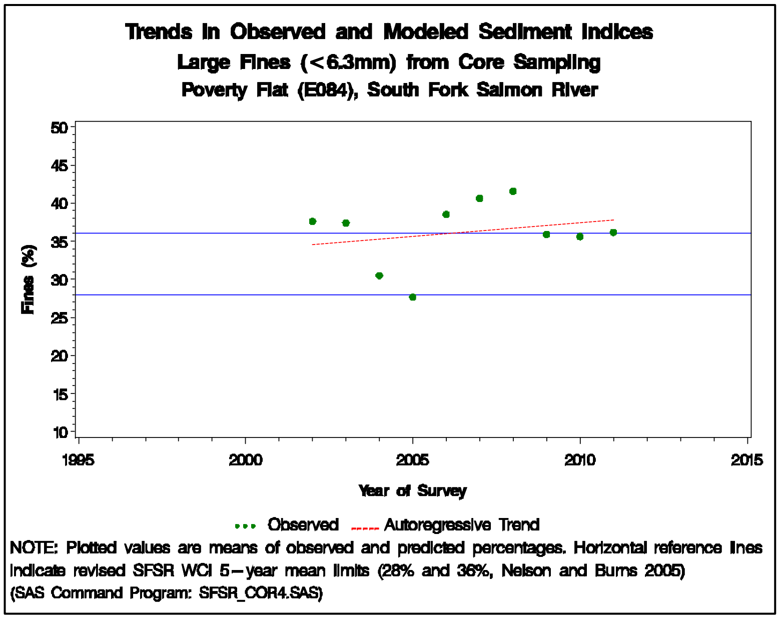

Figure 34.—Time trends in large fine sediments in the Poverty Flat spawning area, upper SFSR, 2000-2011.

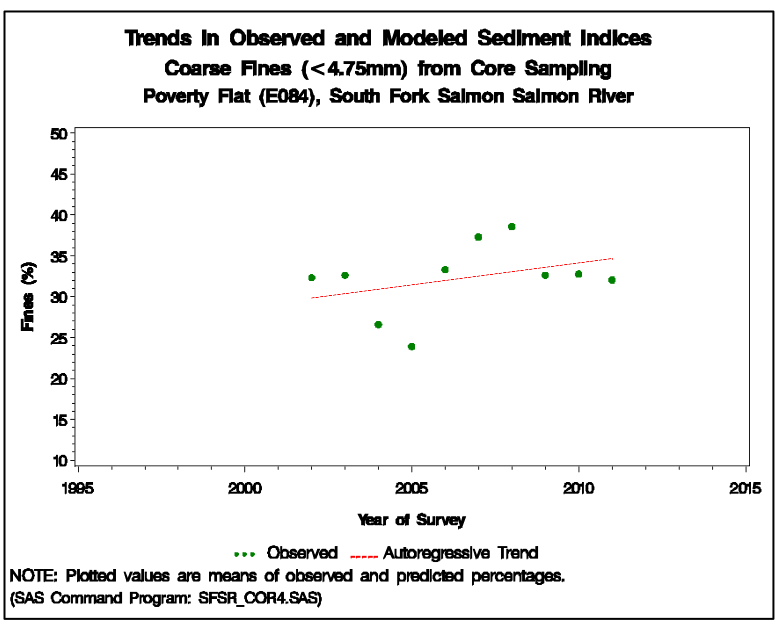

Figure 17.—Time trends in coarse fine sediments in the Poverty Flat spawning area, upper SFSR, 2000-2011.

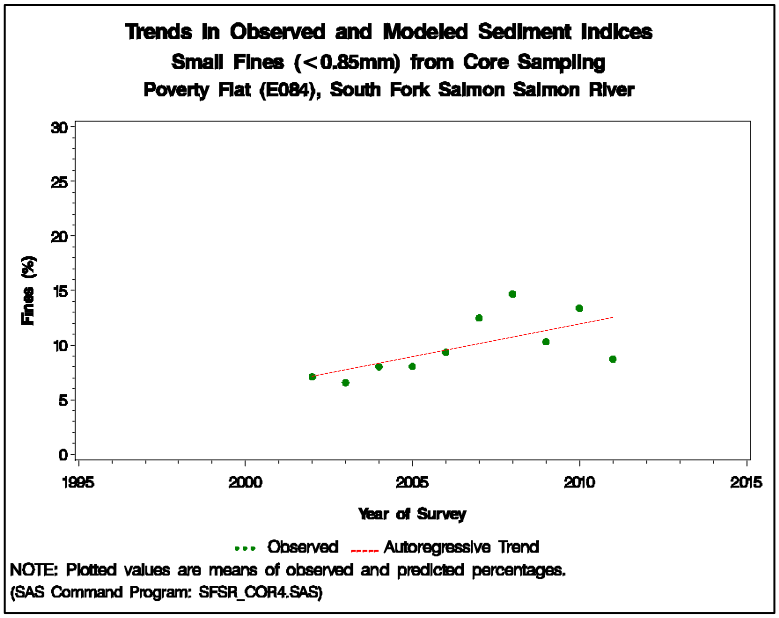

Figure 36.—Time trends in small fine sediments in the Poverty Flat spawning area, upper SFSR, 2000-2011.

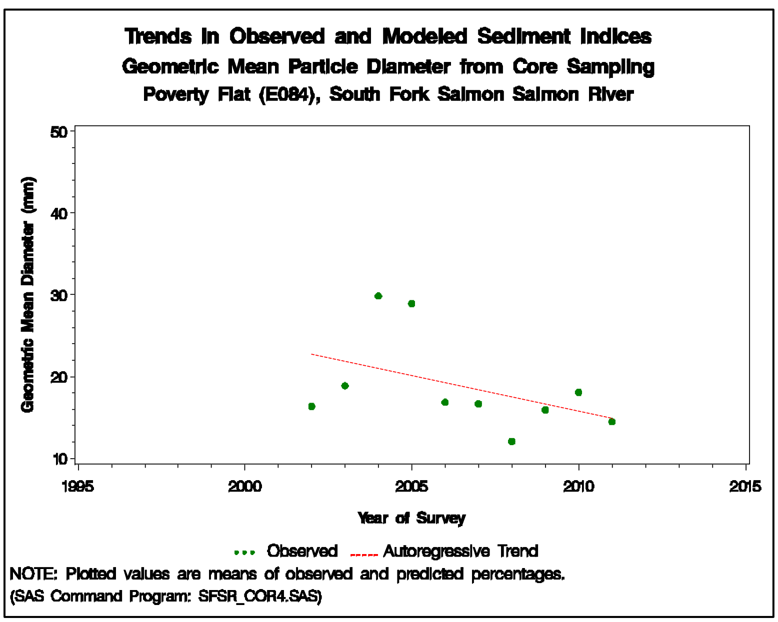

Figure 37.—Time trends in geometric mean particle diameter in the Poverty Flat spawning area, upper SFSR, 2000-2011.

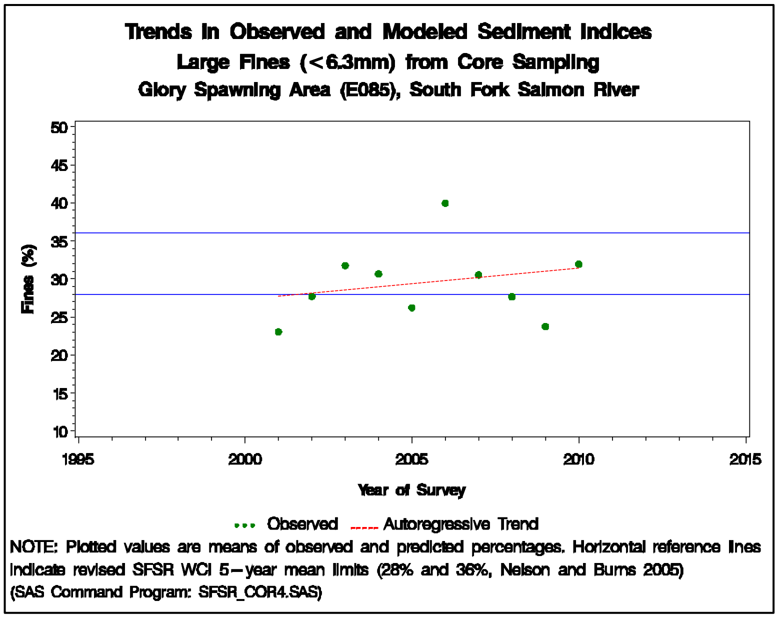

Figure 38.—Time trends in large fine sediments in the Glory Hole spawning area, upper SFSR, 2000-2010(no data collected in 2011).

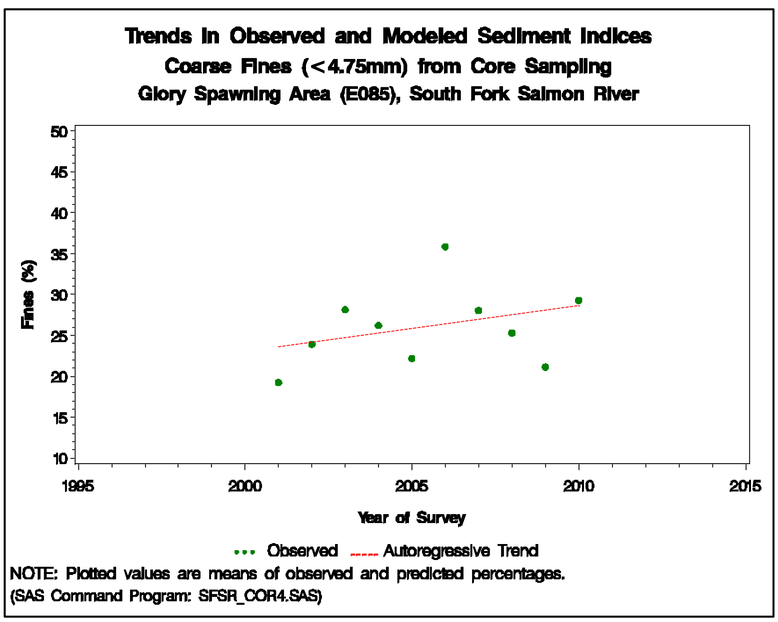

Figure 39.—Time trends in coarse fine sediments in the Glory Hole spawning area, upper SFSR, 2000-2010(no data collected in 2011).

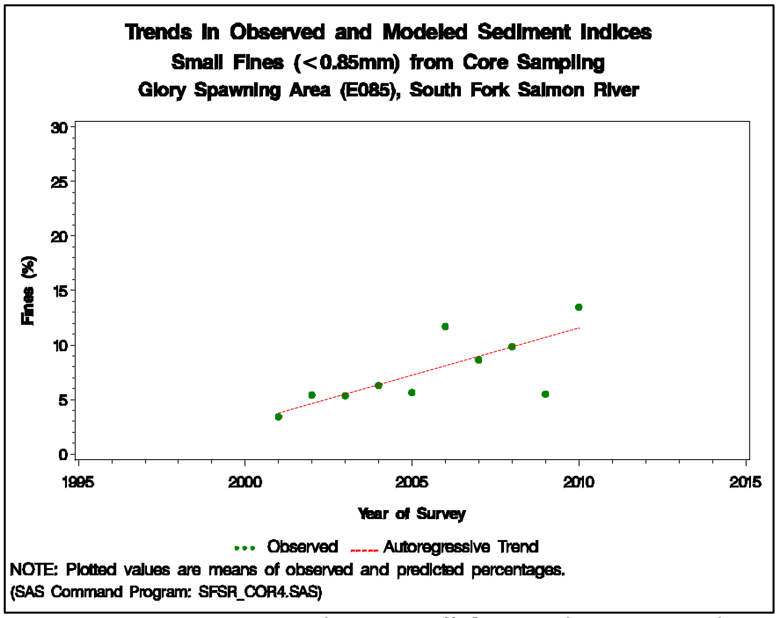

Figure 40.—Time trends in small fine sediments in the Glory Hole spawning area, upper SFSR, 2000-2010(no data collected in 2011).

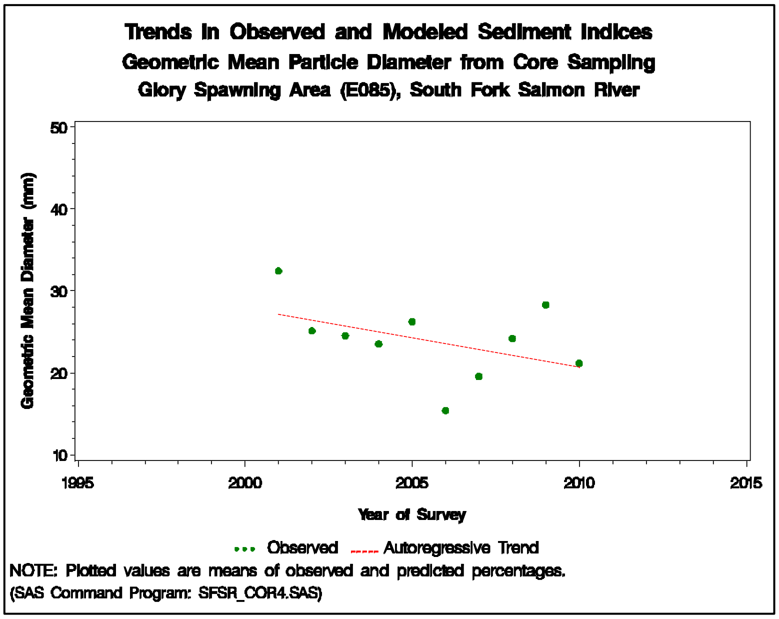

Figure 18.—Time trends in geometric mean particle diameter in the Glory Hole spawning area, upper SFSR, 2000-2010(no data collected in 2011).

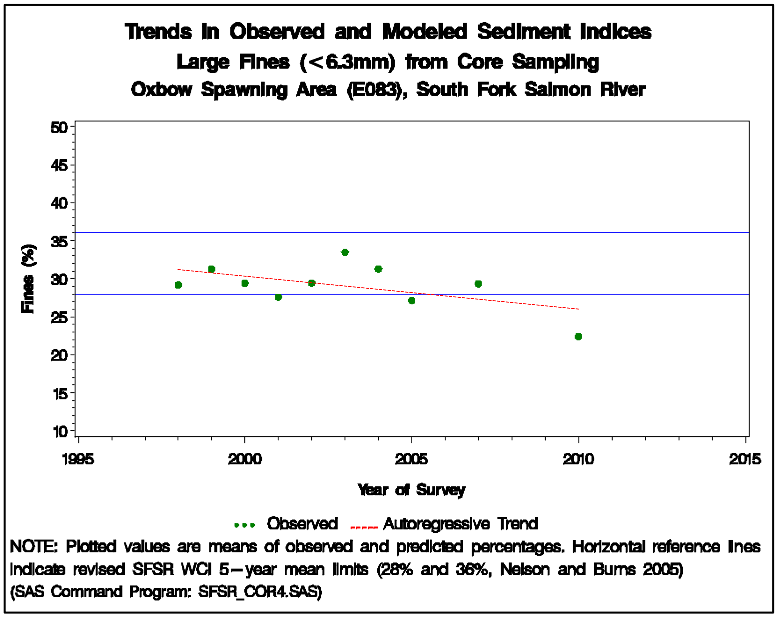

Figure 20.—Time trends in large fine sediments in the Oxbow spawning area, upper SFSR, 1997-2010 (NOTE: no data were collected here in 2006, 2008, 2009, or 2011).

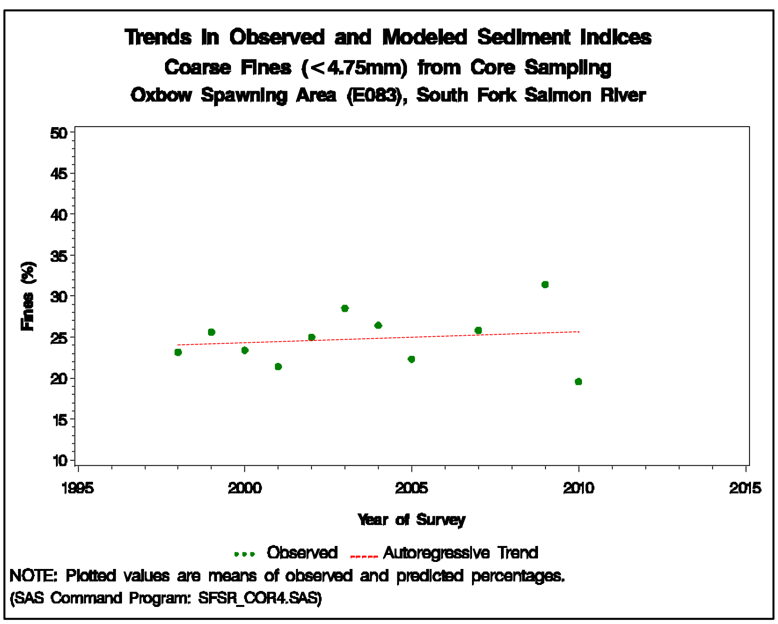

Figure 19.—Time trends in coarse fine sediments in the Oxbow spawning area, upper SFSR, 1997-2010 (NOTE: no data were collected here in 2006, 2008, 2009, or 2011).

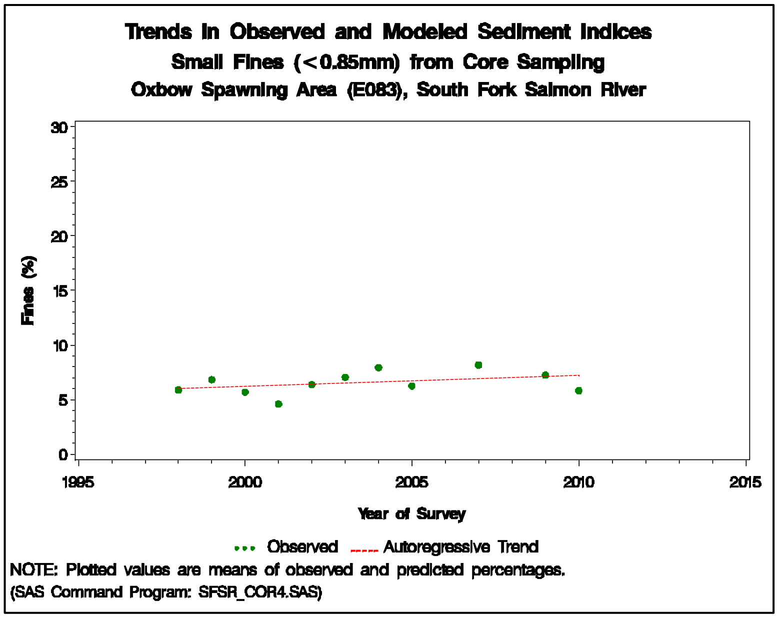

Figure 21.—Time trends in small fine sediments in the Oxbow spawning area, upper SFSR, 1997-2010 (NOTE: no data were collected here in 2006, 2008, 2009, or 2011).

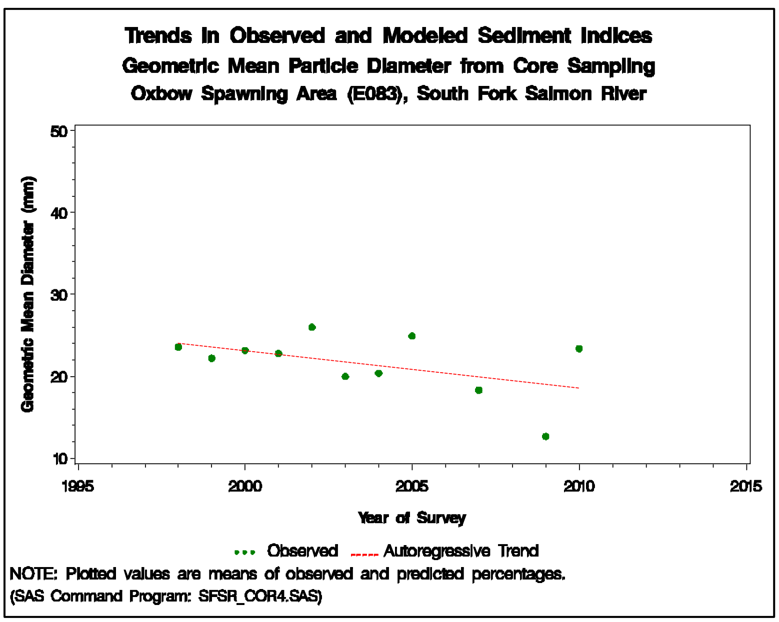

Figure 43.—Time trends in geometric mean particle diameter in the Oxbow spawning area, upper SFSR, 1997-2010 (NOTE: no data were collected here in 2006, 2008, 2009, or 2011).

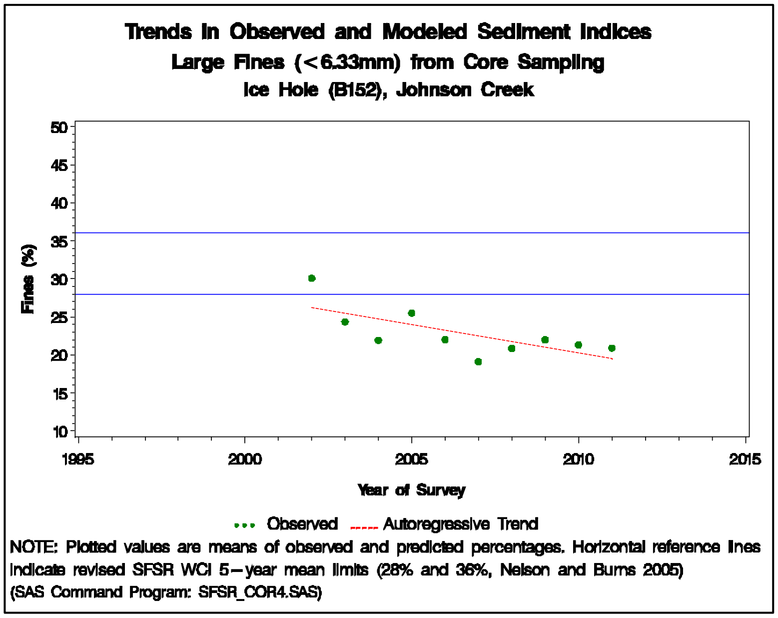

Figure 22.—Time trends in large fine sediments in the Ice Hole spawning area, upper SFSR, 2000-2011.

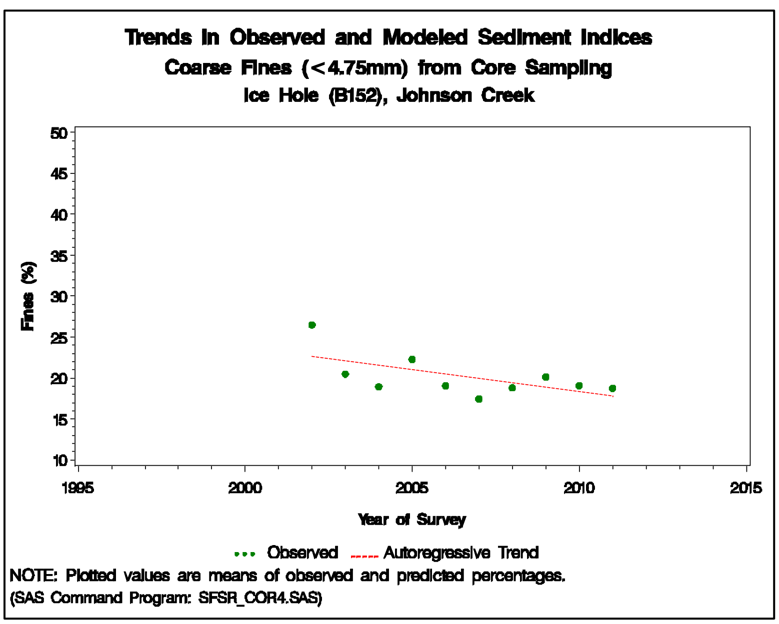

Figure 45.—Time trends in coarse fine sediments in the Ice Hole spawning area, upper SFSR, 2000-2011.

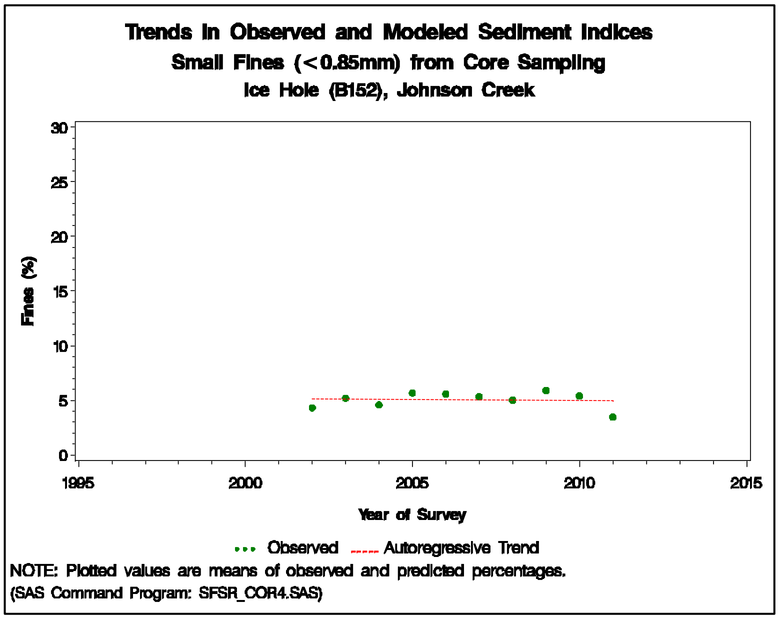

Figure 46.—Time trends in small fine sediments in the Ice Hole spawning area, upper SFSR, 2000-2011.

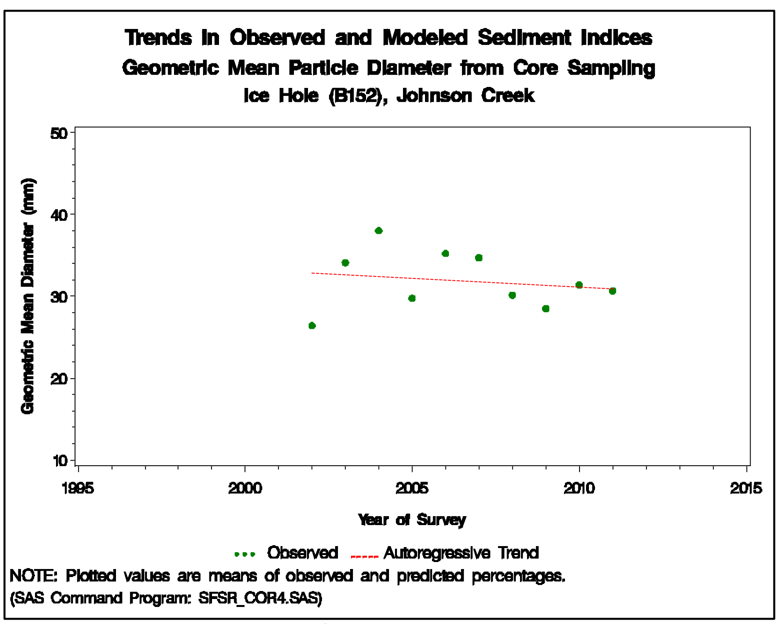

Figure 47.—Time trends in geometric mean particle diameter in the Ice Hole spawning area, upper SFSR, 2000-2011.

Overall Models

Corduroy Junction (E034)

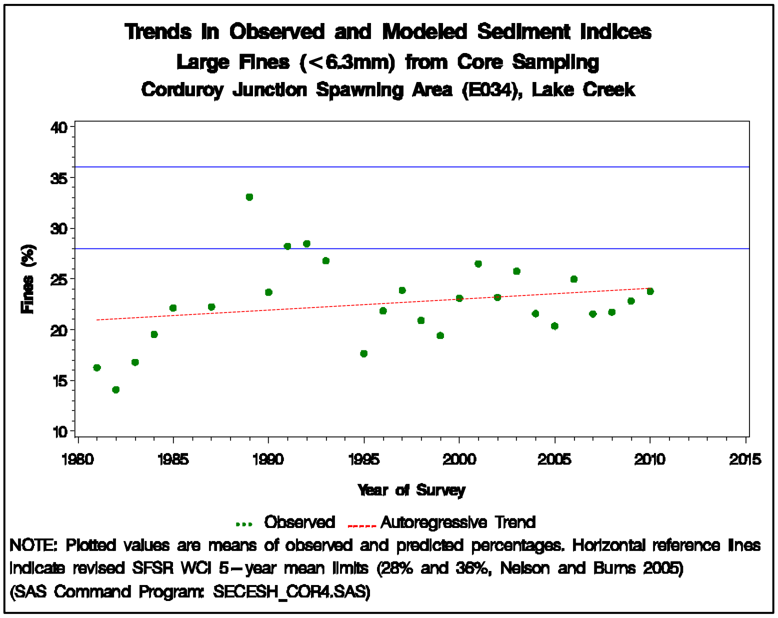

Figure 48.—Time trends in large fine sediments in the Corduroy Junction spawning area, Lake Creek, 1981-2010.

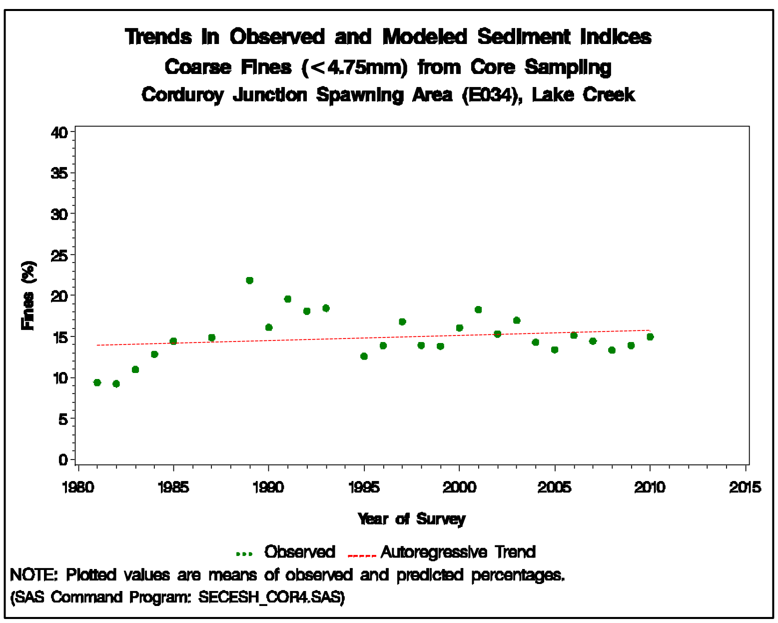

Figure 49.—Time trends in coarse fine sediments in the Corduroy Junction spawning area, Lake Creek, 1981-2010.

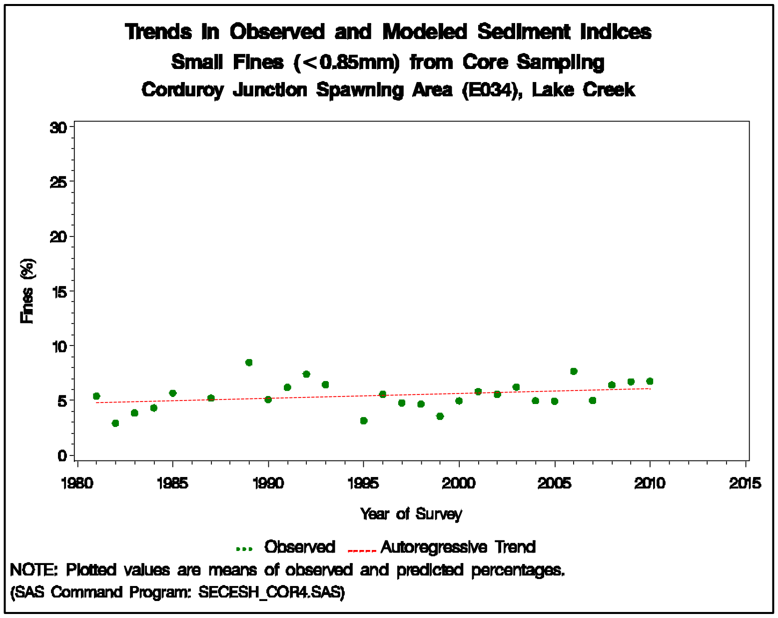

Figure 24.—Time trends in small fine sediments in the Corduroy Junction spawning area, Lake Creek, 1981-2010.

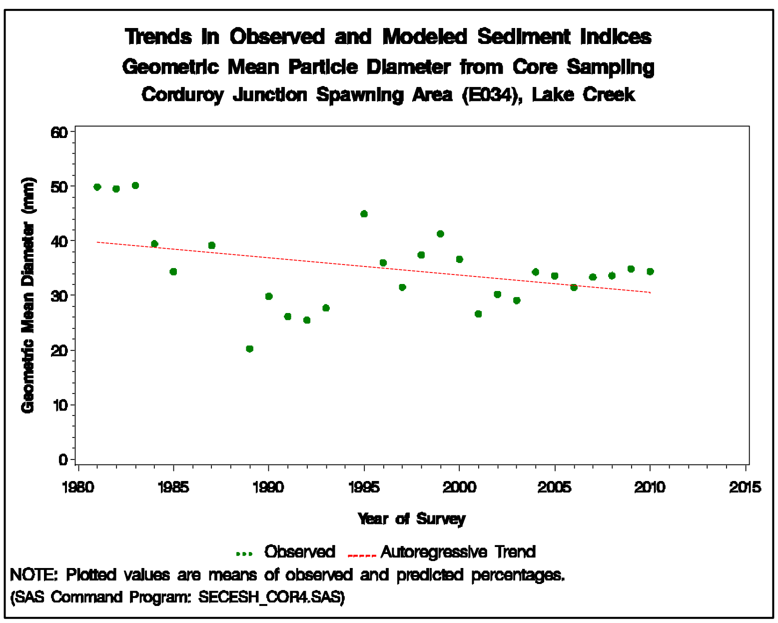

Figure 23.—Time trends in geometric mean particle diameter in the Corduroy Junction spawning area, Lake Creek, 1981-2010.

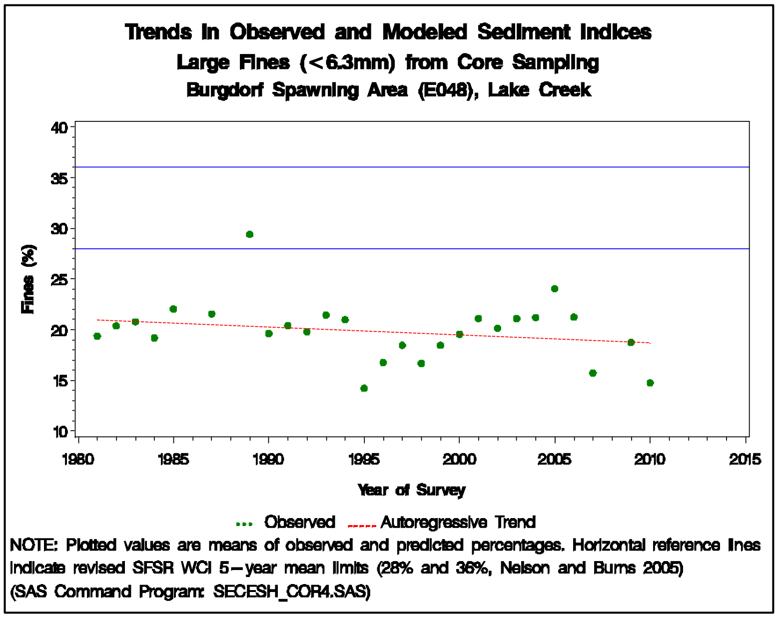

Figure 25.—Time trends in large fine sediments in the Burgdorf spawning area, Lake Creek, 1981-2010.

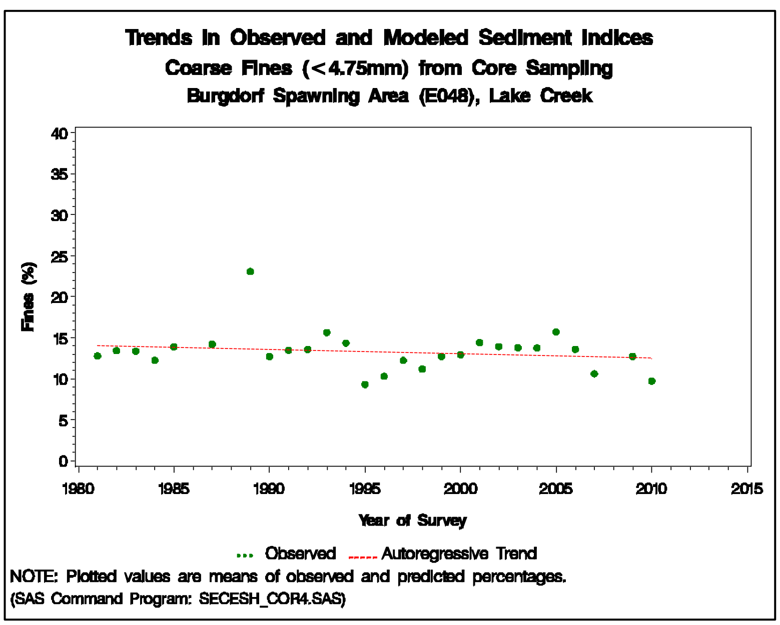

Figure 53.—Time trends in coarse fine sediments in the Burgdorf spawning area, Lake Creek, 1981-2010.

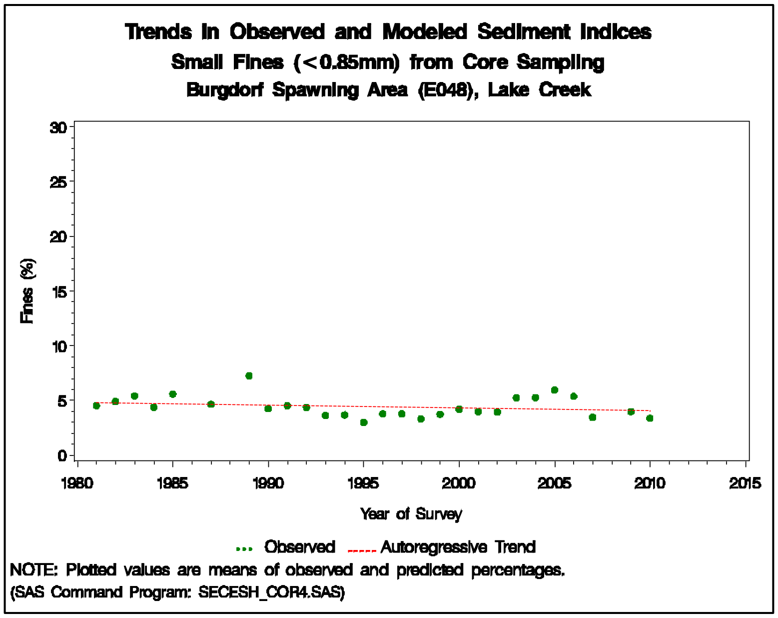

Figure 54.—Time trends in small fine sediments in the Burgdorf spawning area, Lake Creek, 1981-2010.

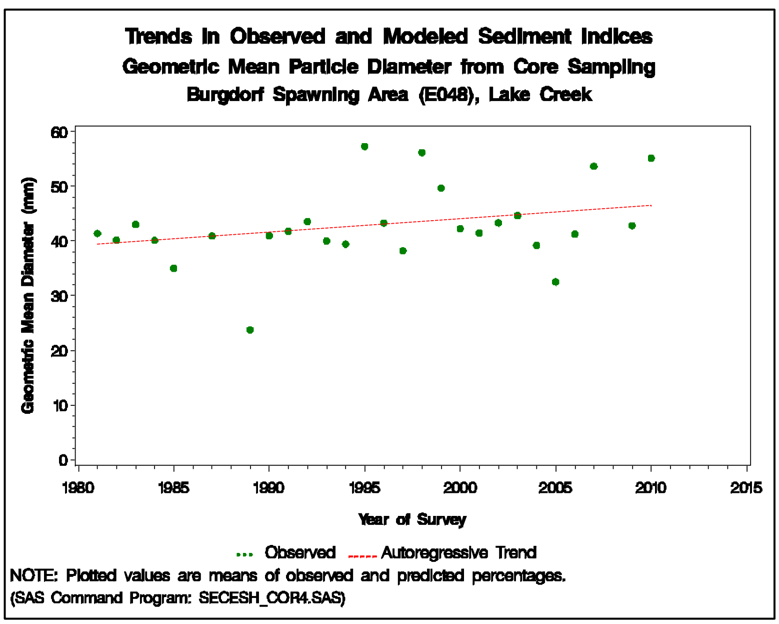

Figure 26.—Time trends in geometric mean particle diameter in the Burgdorf spawning area, Lake Creek, 1981-2010.

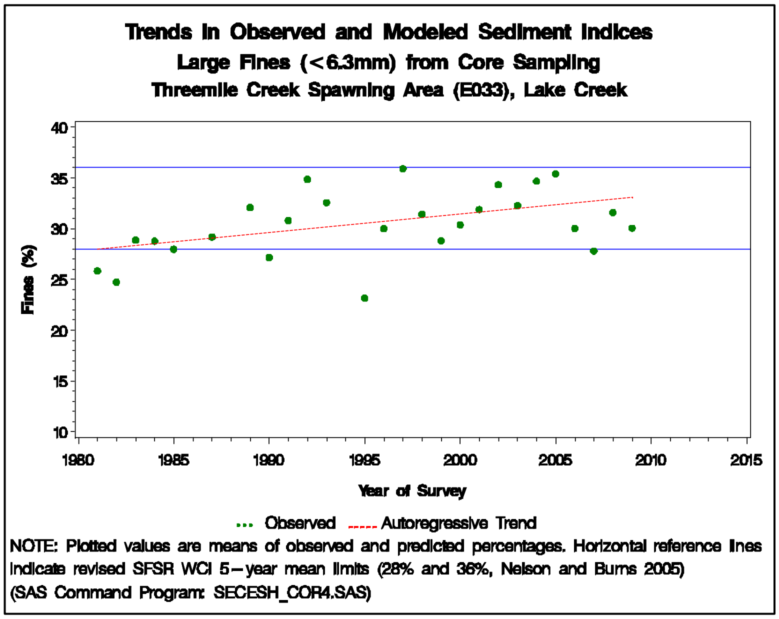

Figure 56.—Time trends in large fine sediments in the Threemile Creek spawning area, Lake Creek, 1981-2010.

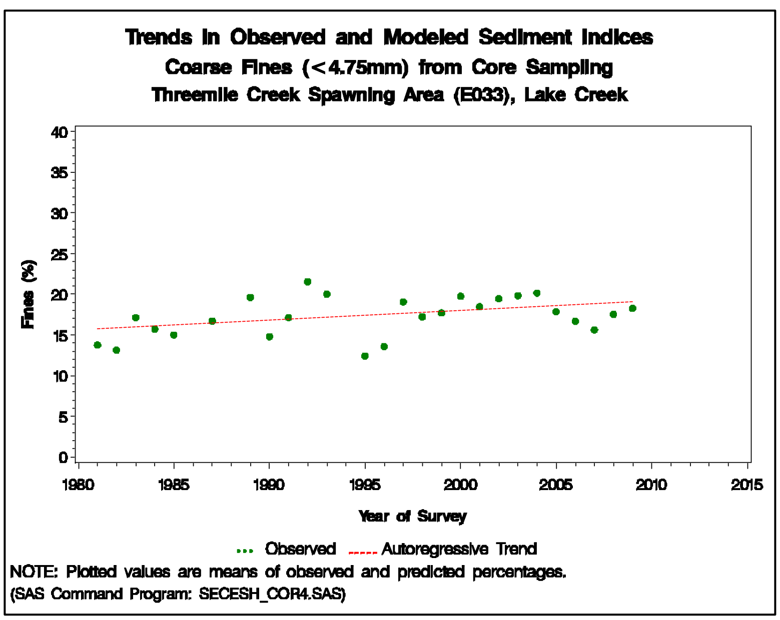

Figure 57.—Time trends in coarse fine sediments in the Threemile Creek spawning area, Lake Creek, 1981-2010.

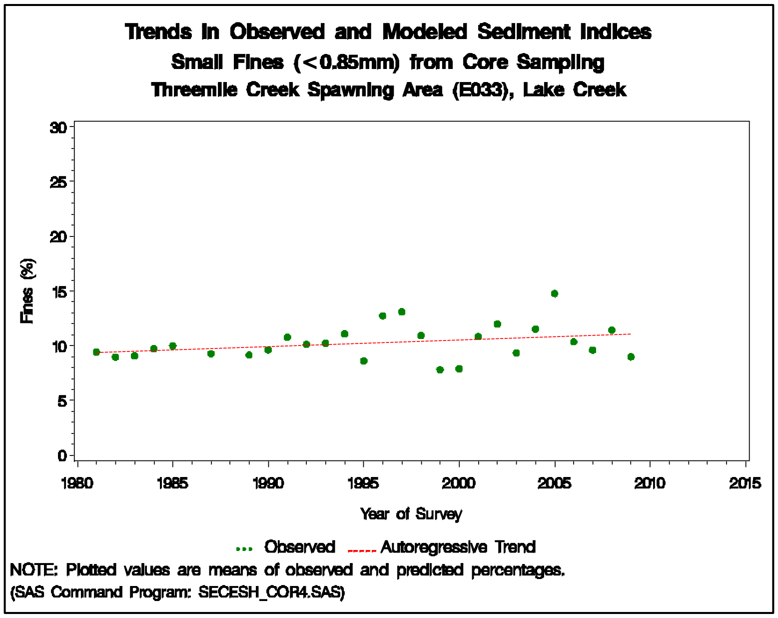

Figure 58.—Time trends in small fine sediments in the Threemile Creek spawning area, Lake Creek, 1981-2010.

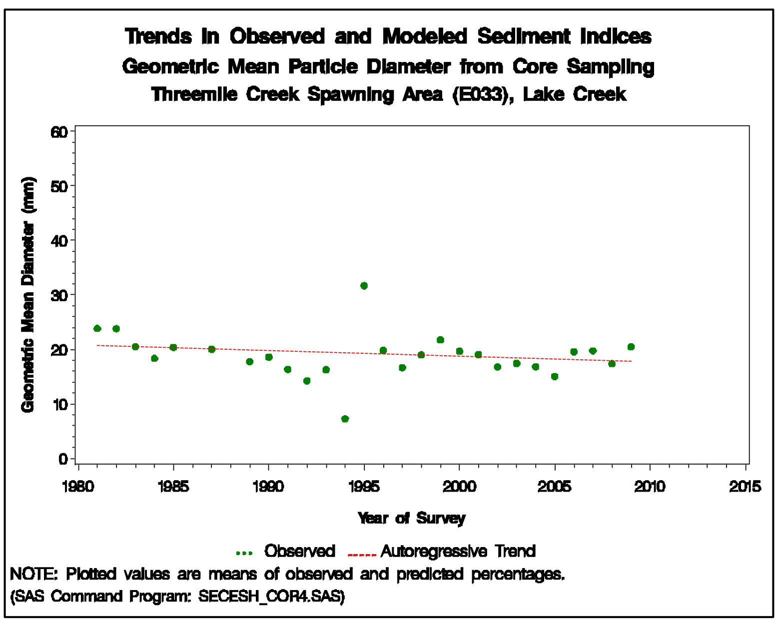

Figure 59.—Time trends in geometric mean particle diameter in the Threemile Creek spawning area, Lake Creek, 1981-2010.

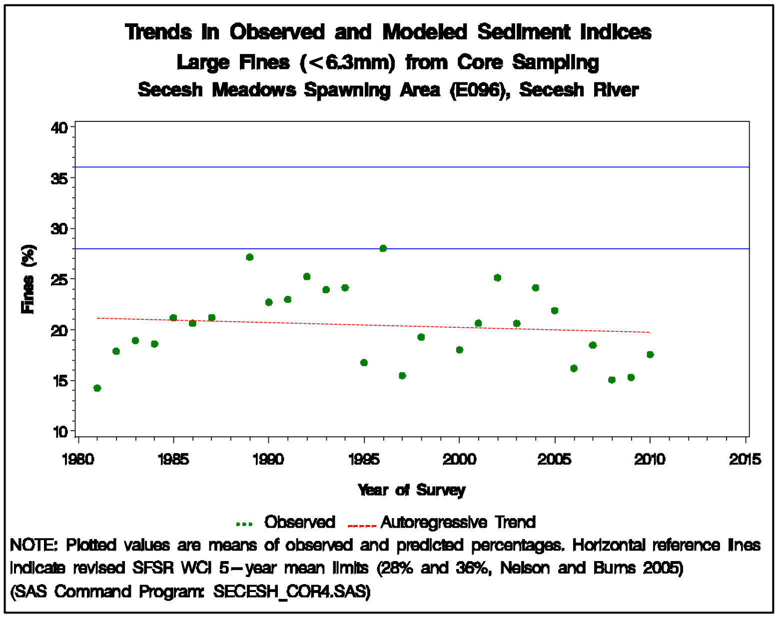

Figure 28.—Time trends in large fine sediments in the Secesh Meadows spawning area, Secesh River, 1981-2010.

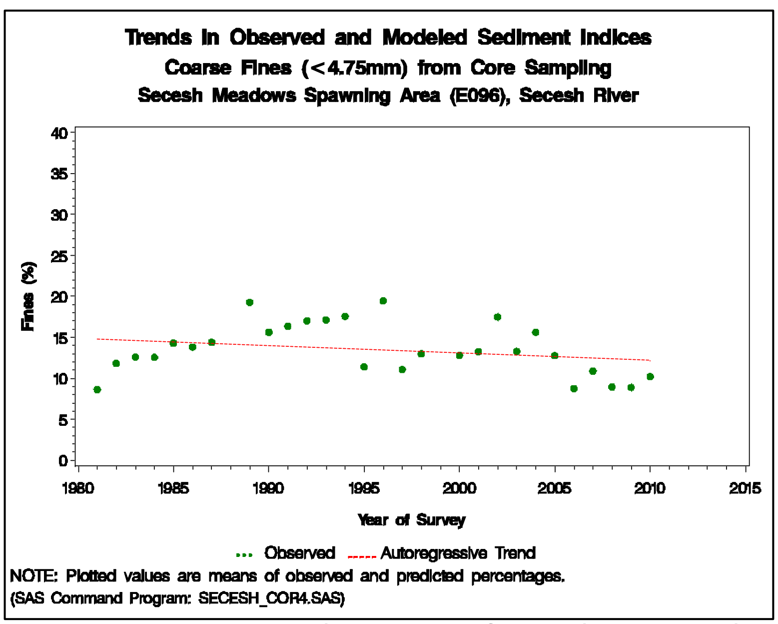

Figure 27.—Time trends in coarse fine sediments in the Secesh Meadows spawning area, Secesh River, 1981-2010.

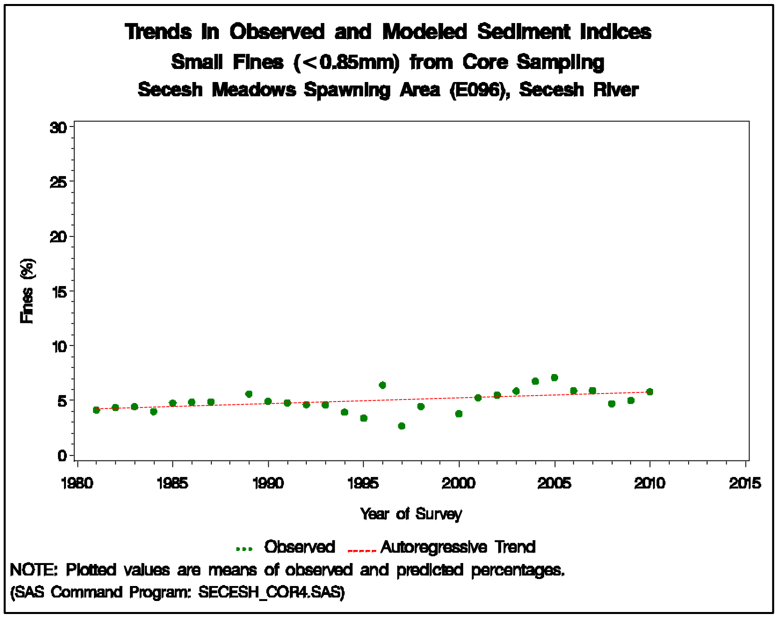

Figure 29.—Time trends in small fine sediments in the Secesh Meadows spawning area, Secesh River, 1981-2010.

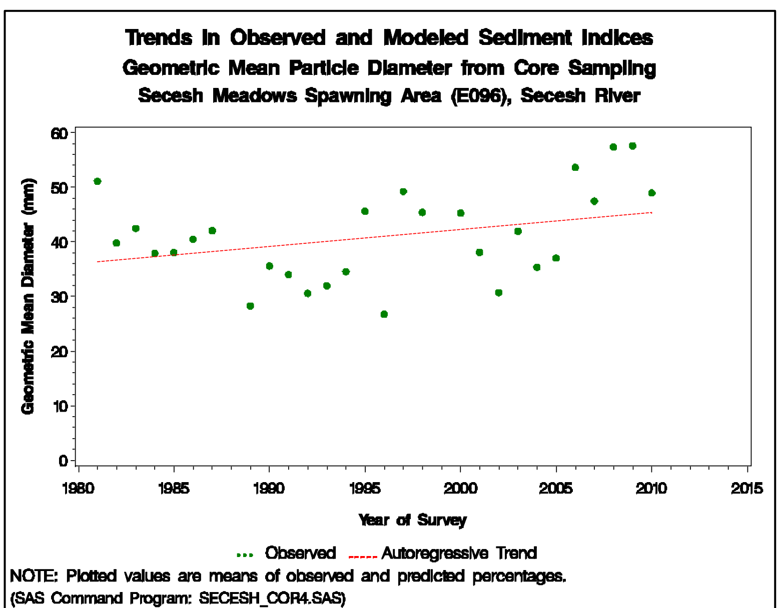

Figure 30.—Time trends in geometric mean particle diameter in the Secesh Meadows spawning area, Secesh River, 1981-2010.

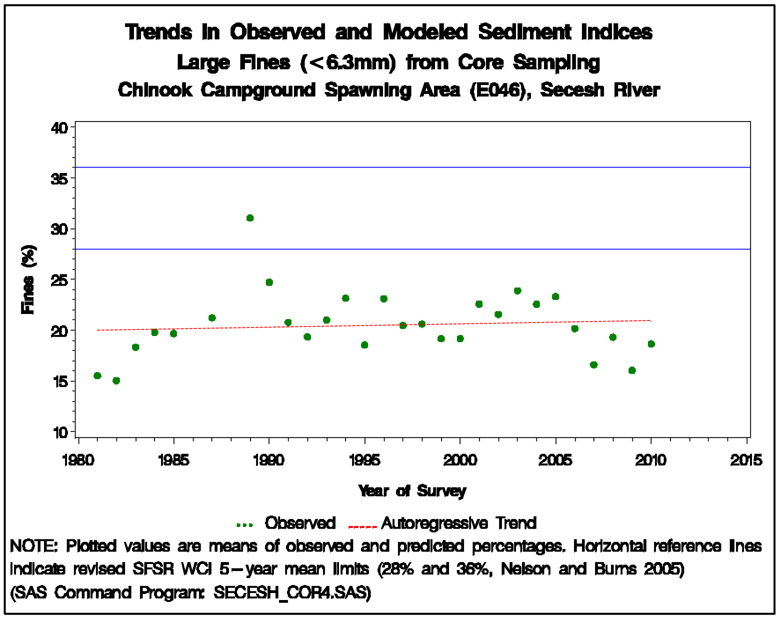

Figure 64.—Time trends in large fine sediments in the Chinook Campground spawning area, Secesh River, 1981-2010.

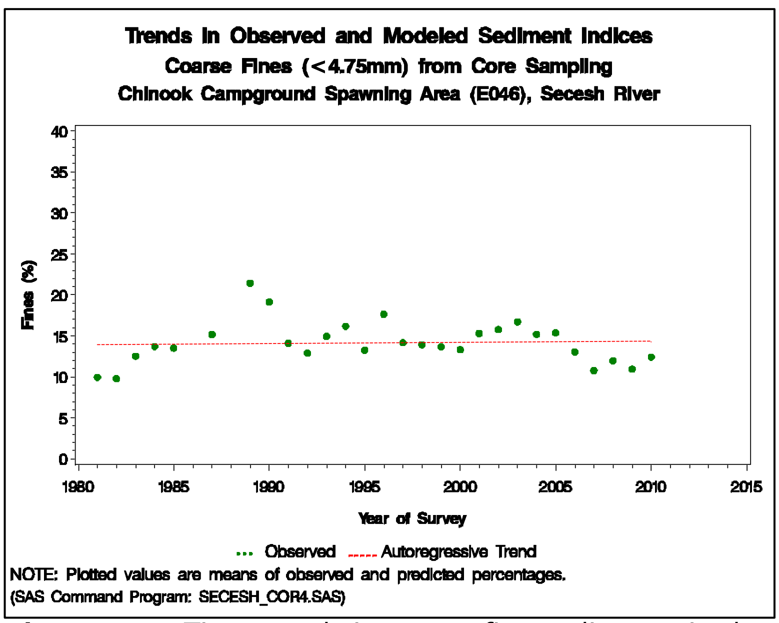

Figure 31.—Time trends in coarse fine sediments in the Chinook Campground spawning area, Secesh River, 1981-2010.

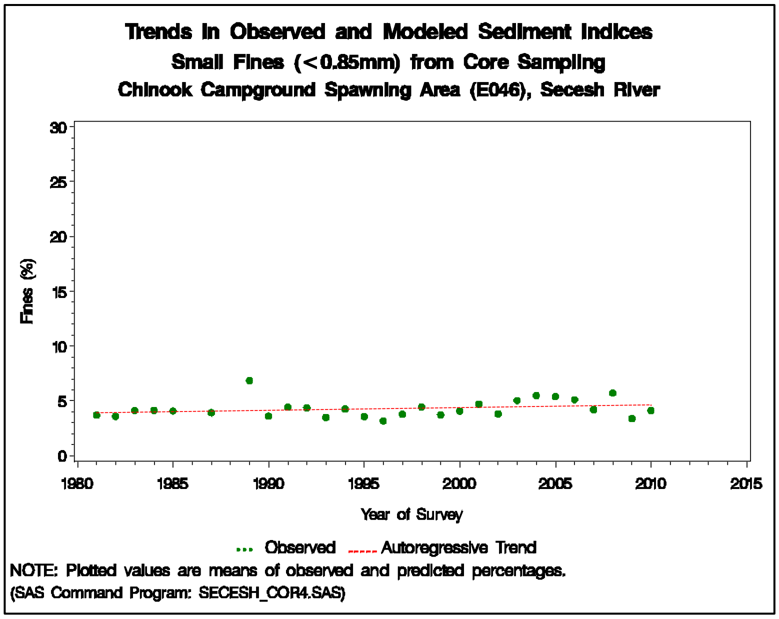

Figure 66.—Time trends in small fine sediments in the Chinook Campground spawning area, Secesh River, 1981-2010.

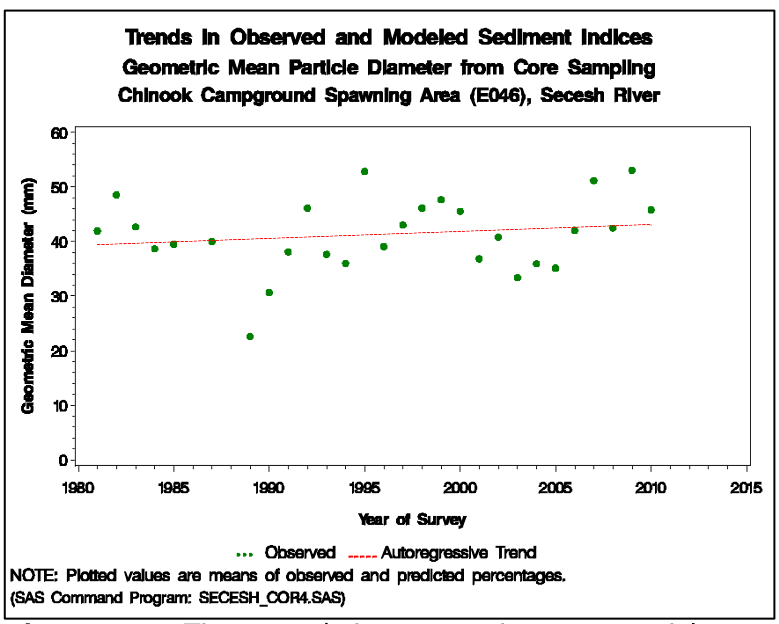

Figure 67.—Time trends in geometric mean particle diameter in the Chinook Campground spawning area, Secesh River, 1981-2010.

Recent Models

Corduroy Junction (E034)

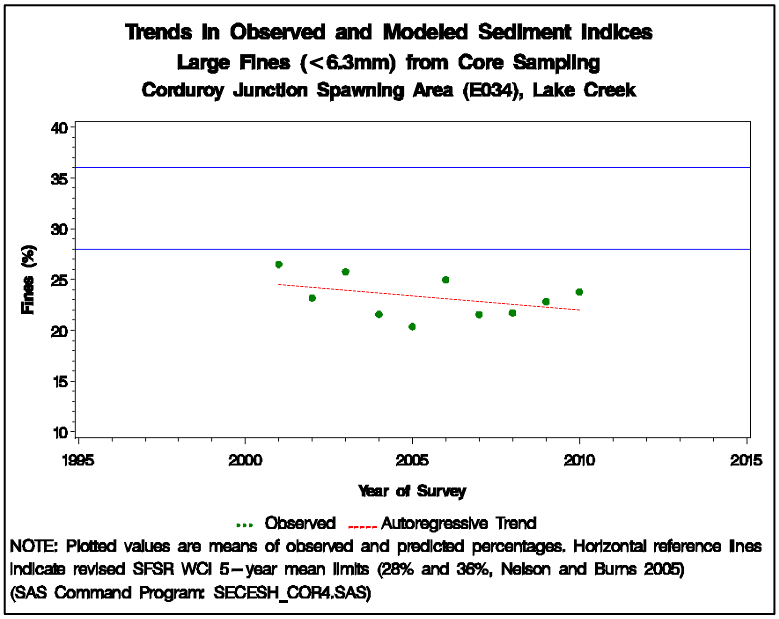

Figure 68.—Time trends in large fine sediments in the Corduroy Junction spawning area, Lake Creek, 2000-2010.

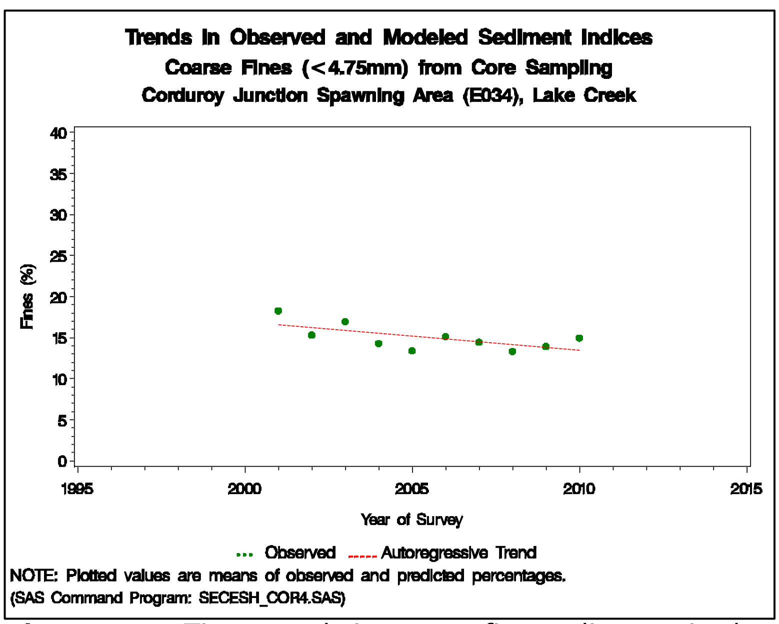

Figure 69.—Time trends in coarse fine sediments in the Corduroy Junction spawning area, Lake Creek, 2000-2010.

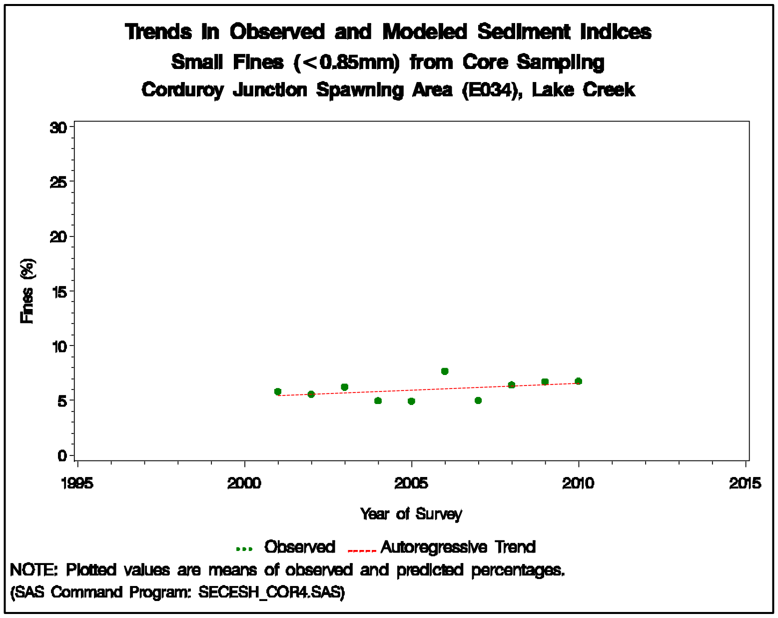

Figure 33.—Time trends in small fine sediments in the Corduroy Junction spawning area, Lake Creek, 2000-2010.

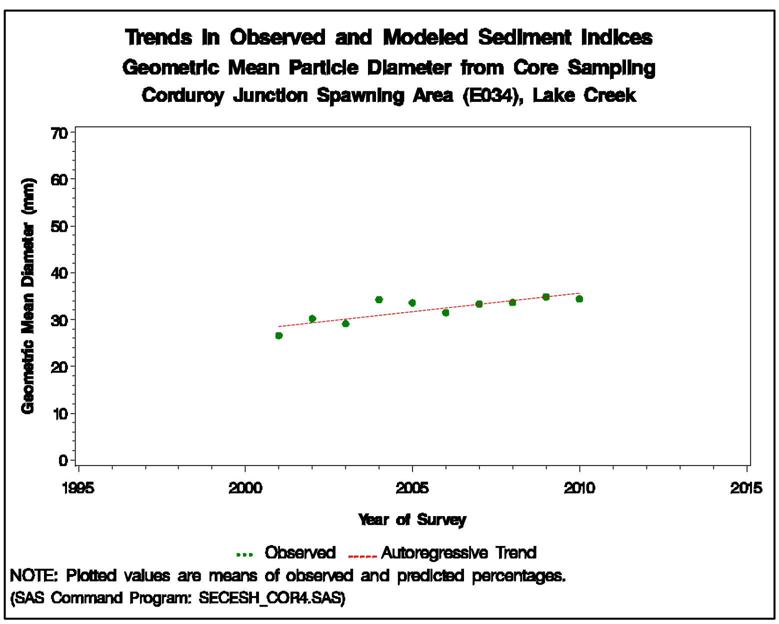

Figure 32.—Time trends in geometric mean particle diameter in the Corduroy Junction spawning area, Lake Creek, 2001-2010.

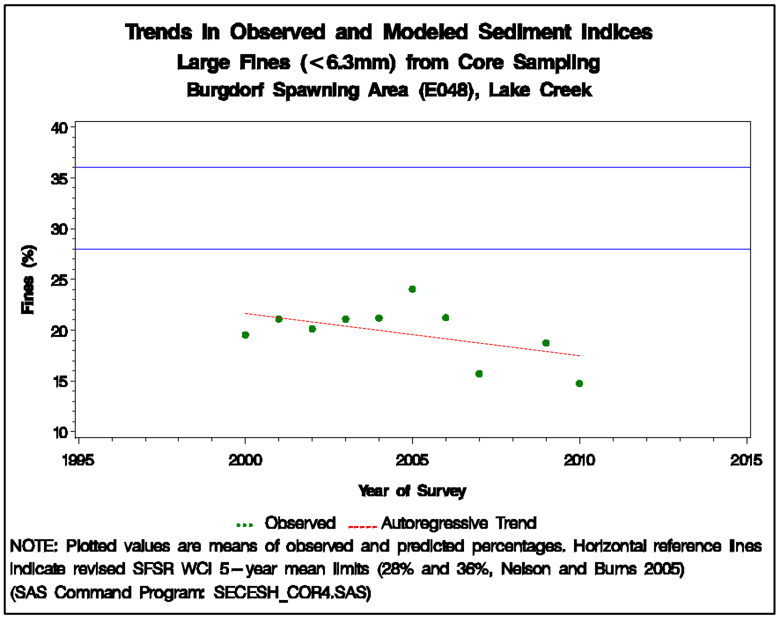

Figure 35.—Time trends in large fine sediments in the Burgdorf spawning area, Lake Creek, 2000-2010.

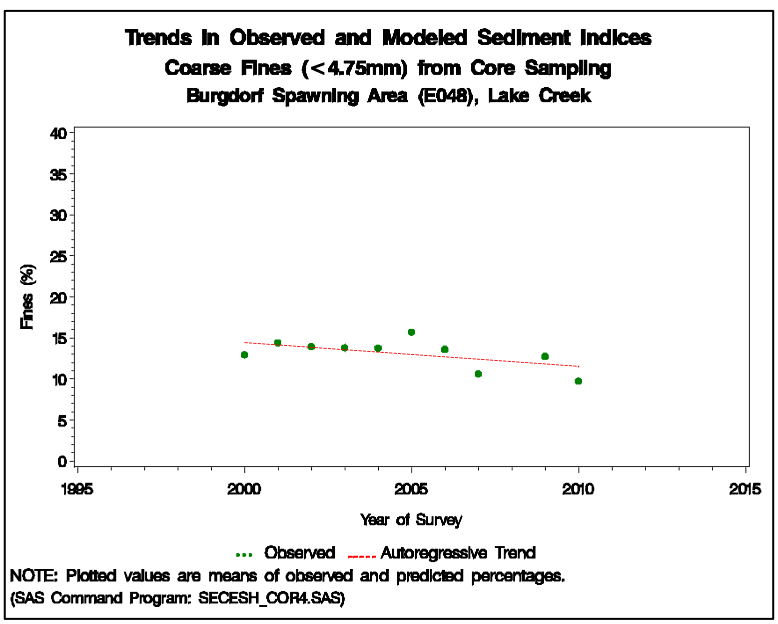

Figure 34.—Time trends in coarse fine sediments in the Burgdorf spawning area, Lake Creek, 2000-2010.

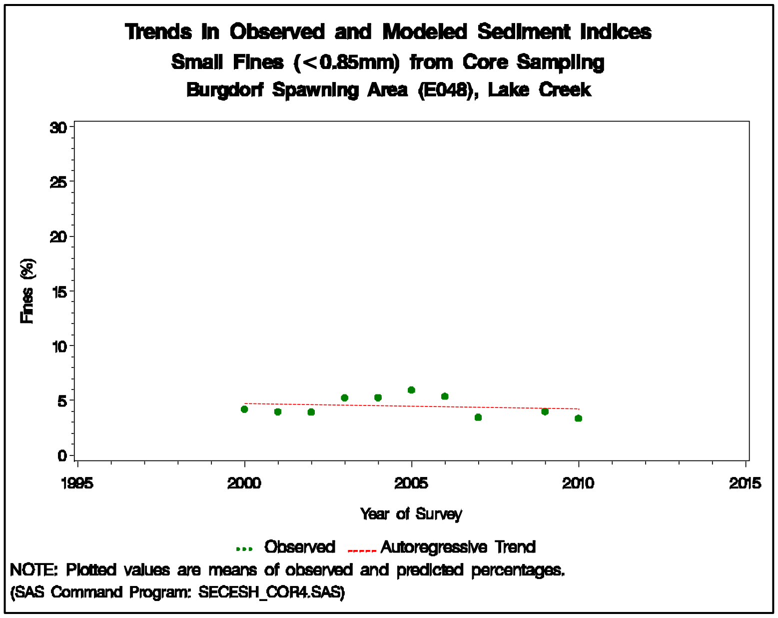

Figure 74.—Time trends in small fine sediments in the Burgdorf spawning area, Lake Creek, 2000-2010.

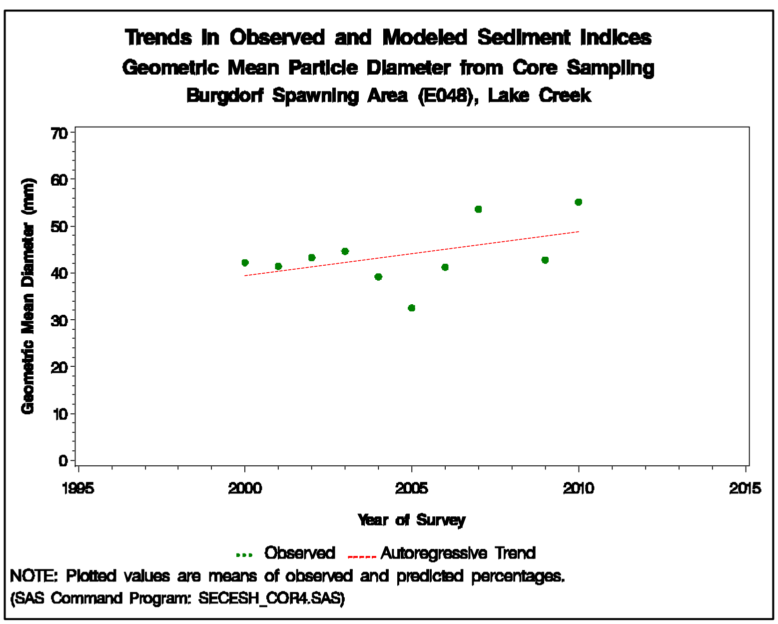

Figure 36.—Time trends in geometric mean particle diameter in the Burgdorf spawning area, Lake Creek, 2000-2010.

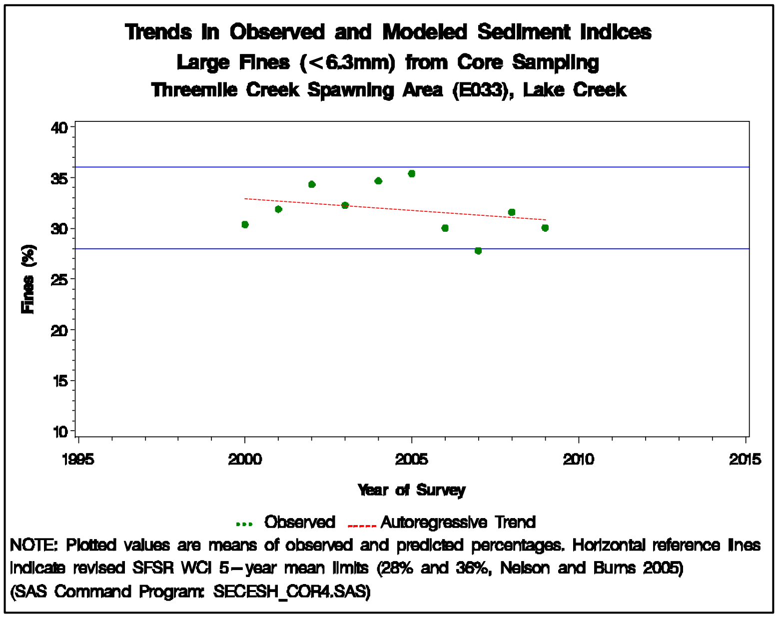

Figure 76.—Time trends in large fine sediments in the Threemile Creek spawning area, Lake Creek, 2000-2010.

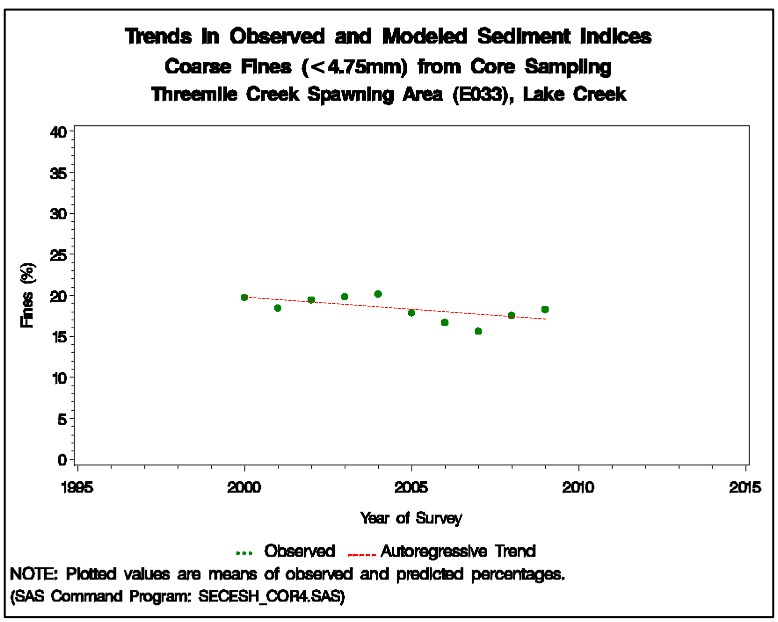

Figure 77.—Time trends in coarse fine sediments in the Threemile Creek spawning area, Lake Creek, 2000-2010.

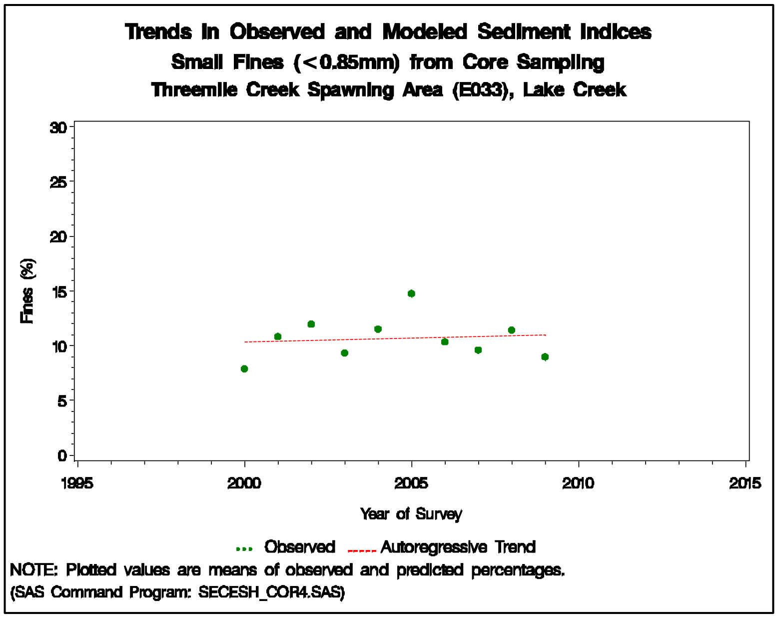

Figure 78.—Time trends in small fine sediments in the Threemile Creek spawning area, Lake Creek, 2000-2010.

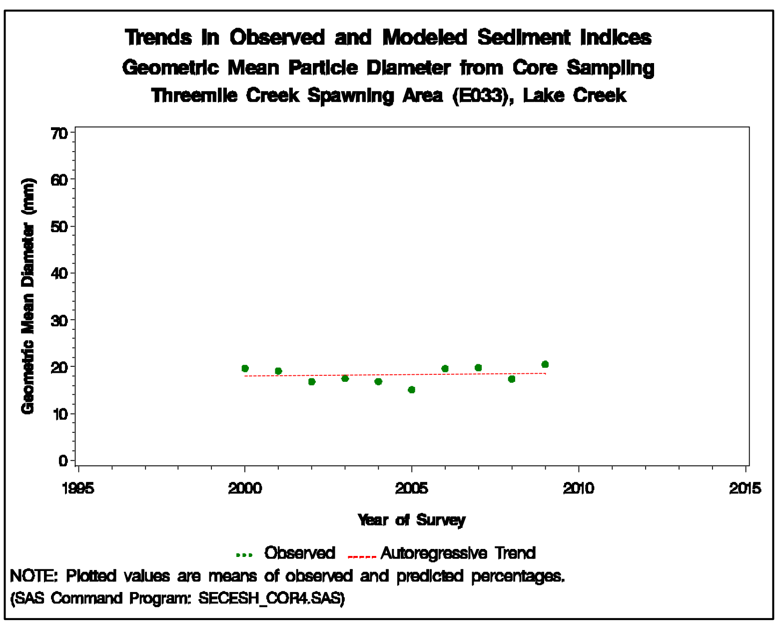

Figure 79.—Time trends in geometric mean particle diameter in the Threemile Creek spawning area, Lake Creek, 2000-2010.

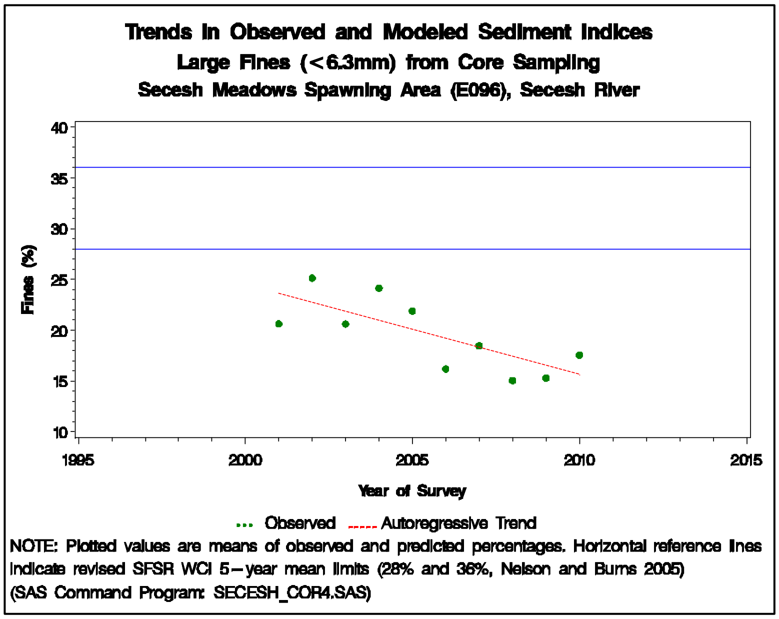

Figure 380.—Time trends in large fine sediments in the Secesh Meadows spawning area, Secesh River, 2001-2010.

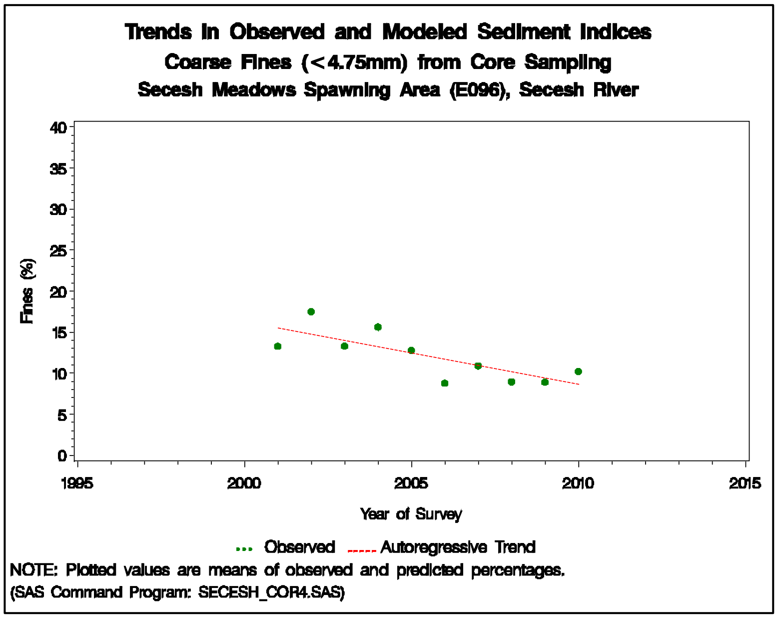

Figure 37.—Time trends in coarse fine sediments in the Secesh Meadows spawning area, Secesh River, 2001-2010.

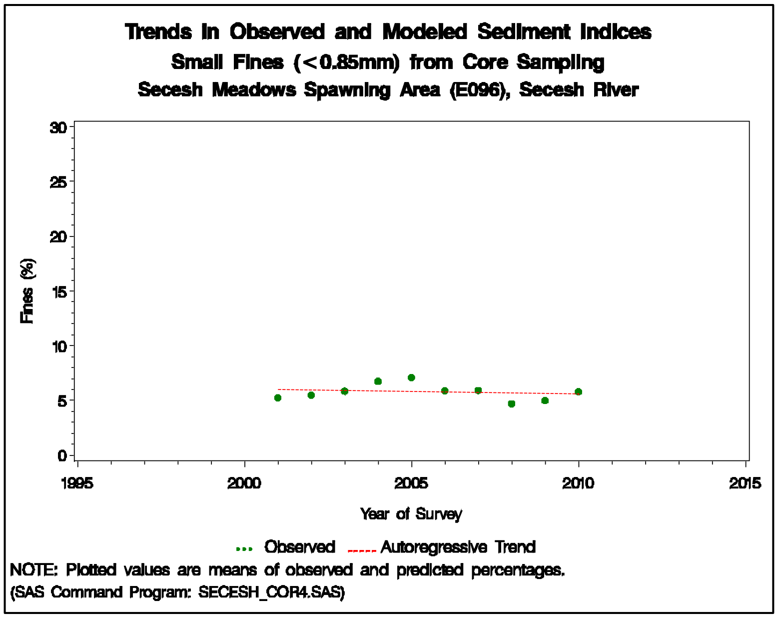

Figure 40.—Time trends in small fine sediments in the Secesh Meadows spawning area, Secesh River, 2001-2010.

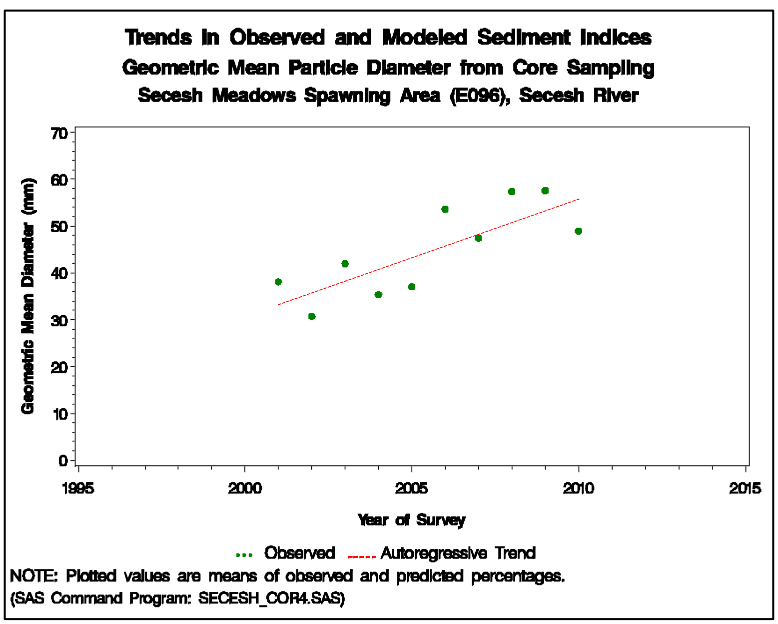

Figure 39.—Time trends in geometric mean particle diameter in the Secesh Meadows spawning area, Secesh River, 2001-2010.

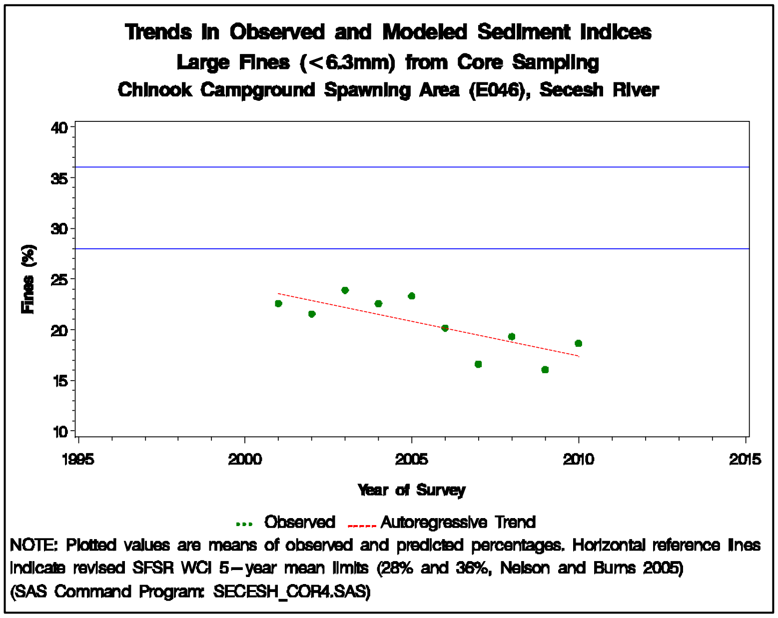

Figure 84.—Time trends in large fine sediments in the Chinook Campground spawning area, Secesh River, 2001-2010.

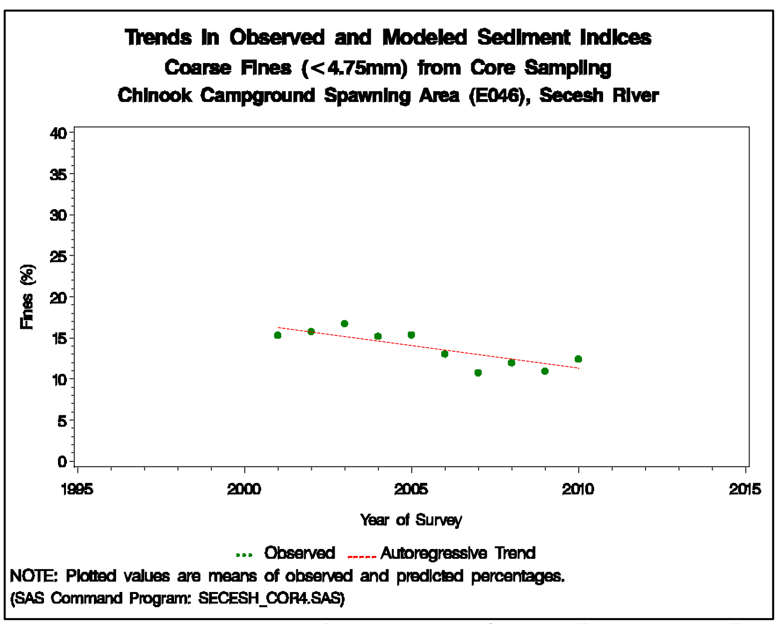

Figure 41.—Time trends in coarse fine sediments in the Chinook Campground spawning area, Secesh River, 2001-2010.

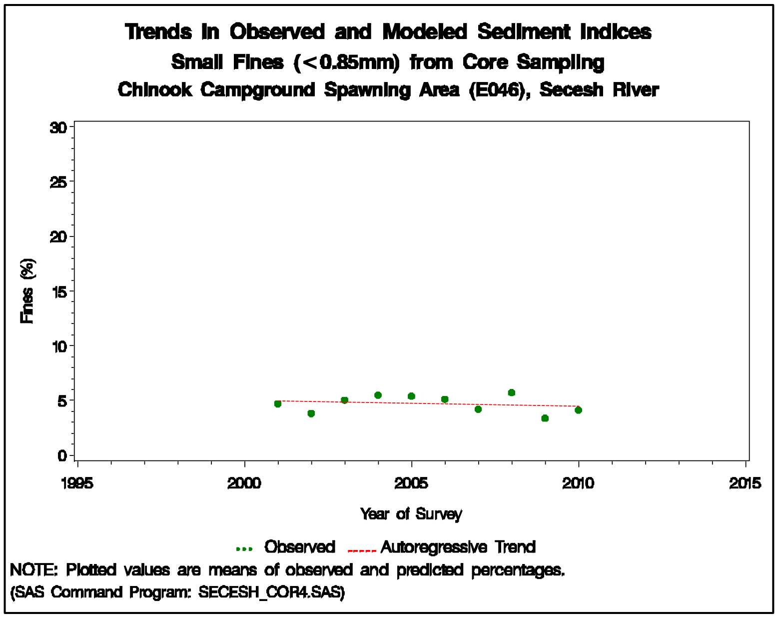

Figure 86.—Time trends in small fine sediments in the Chinook Campground spawning area, Secesh River, 2001-2010.

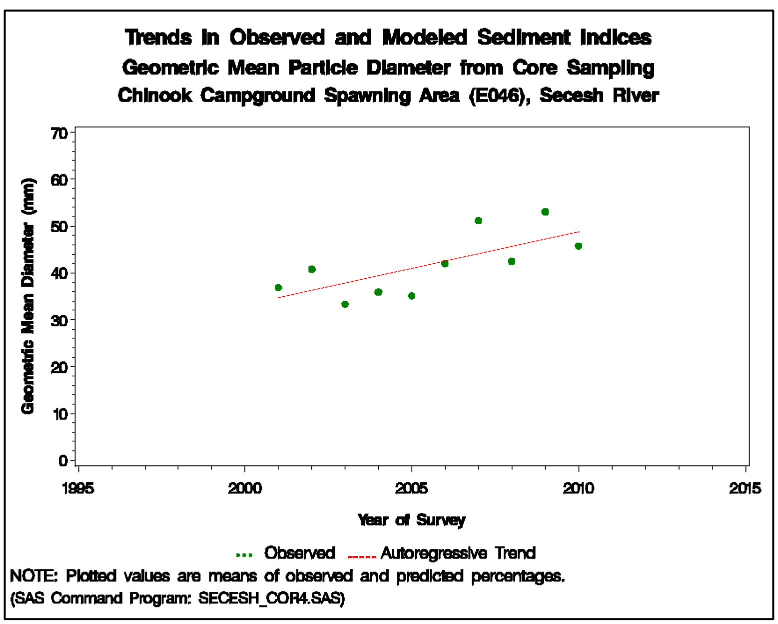

Figure 87.—Time trends in geometric mean particle diameter in the Chinook Campground spawning area, Secesh River, 2001-2010.

Overall Models

Chamberlain Creek (E032)

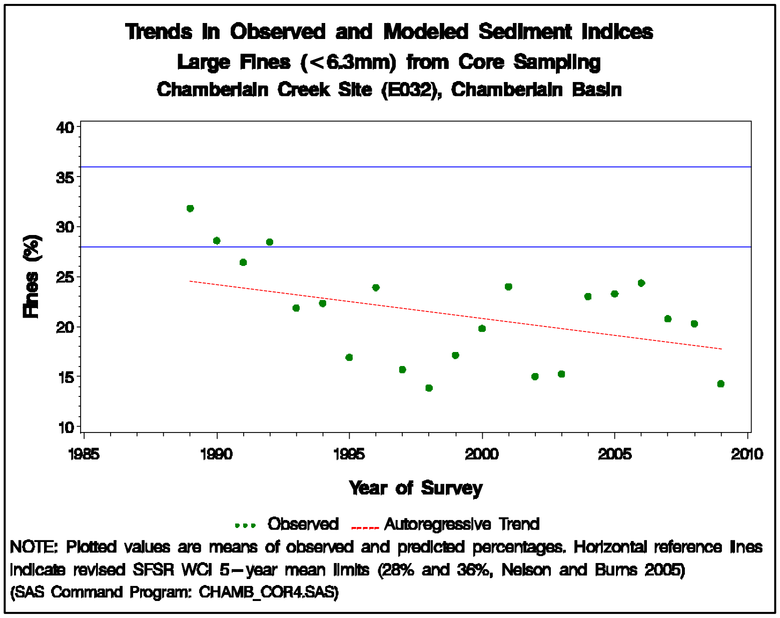

Figure 88.—Time trends in large fine sediments in the Chamberlain Creek spawning area, Chamberlain Basin, 1989-2009.

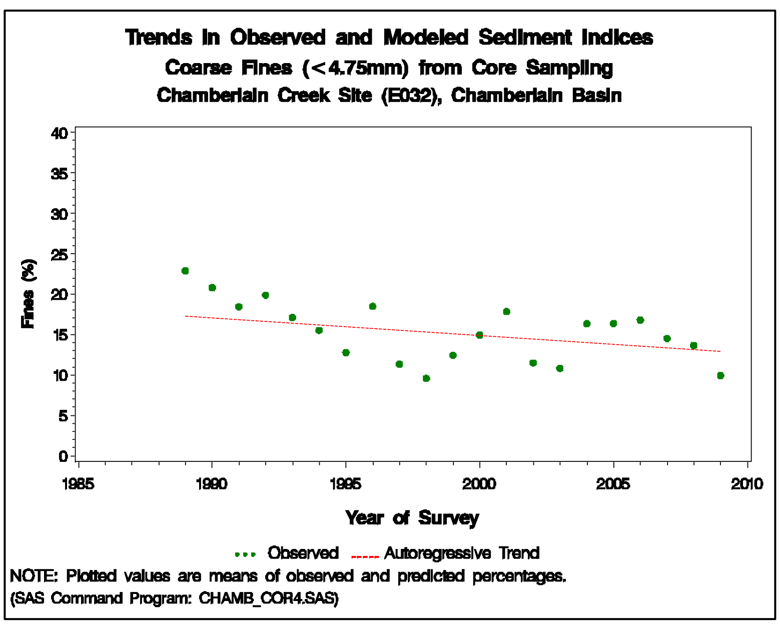

Figure 89.—Time trends in coarse fine sediments in the Chamberlain Creek spawning area, Chamberlain Basin, 1989-2009.

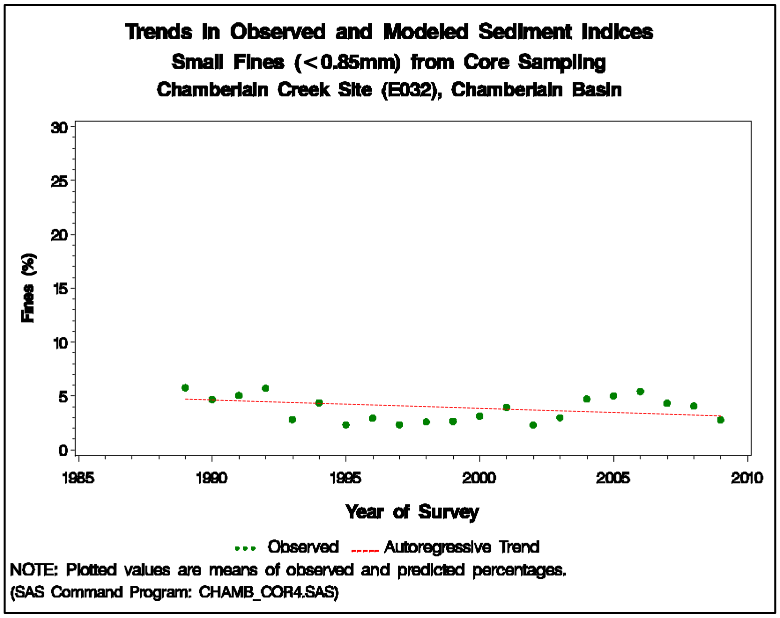

Figure 43.—Time trends in small fine sediments in the Chamberlain Creek spawning area, Chamberlain Basin, 1989-2009.

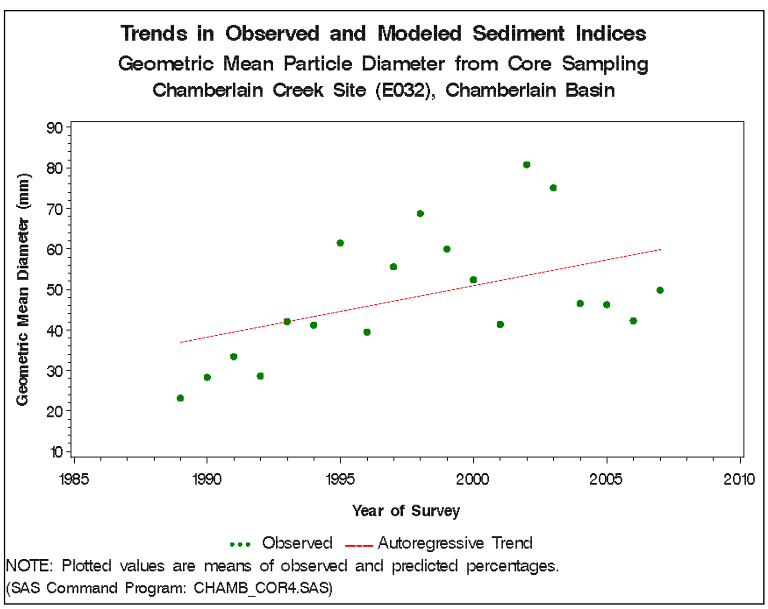

Figure 42.—Time trends in geometric mean particle diameter in the Chamberlain Creek spawning area, Chamberlain Basin, 1989-2009.

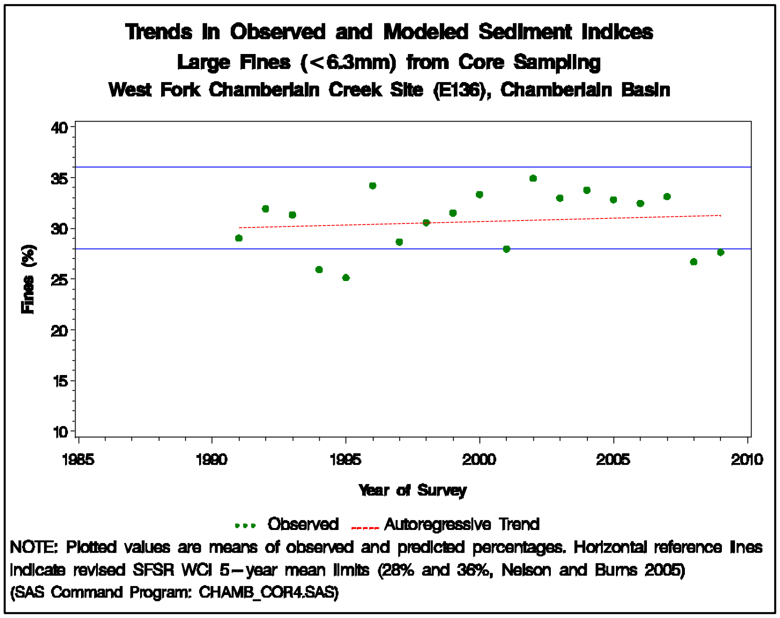

Figure 45.—Time trends in large fine sediments in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 1991-2009.

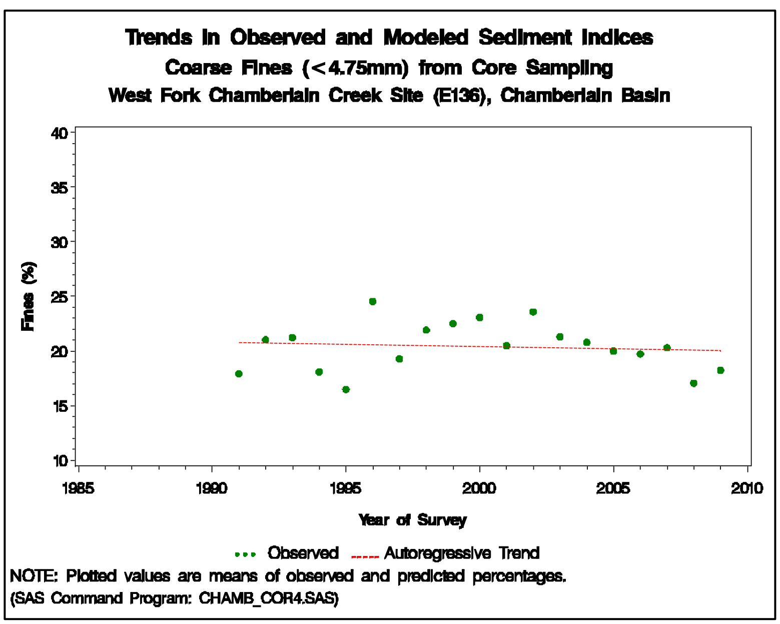

Figure 44.—Time trends in coarse fine sediments in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 1991-2009.

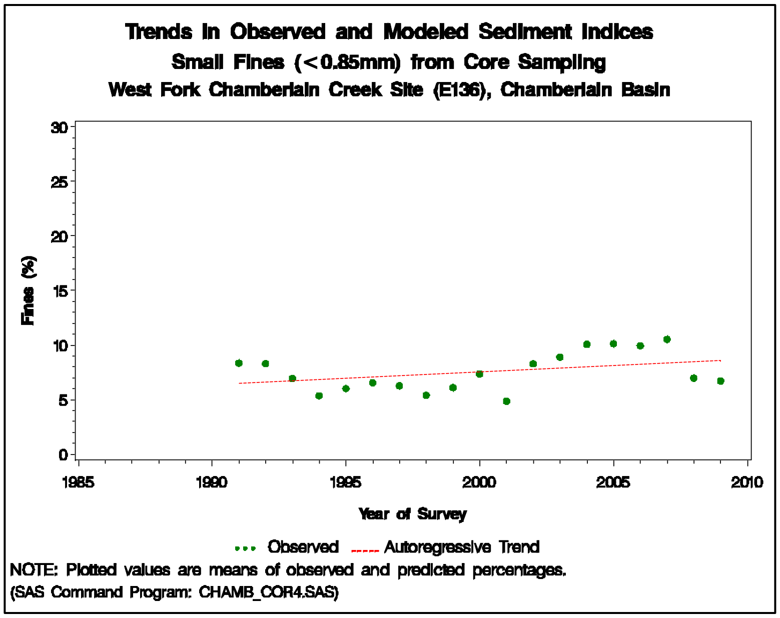

Figure 94.—Time trends in small fine sediments in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 1991-2009.

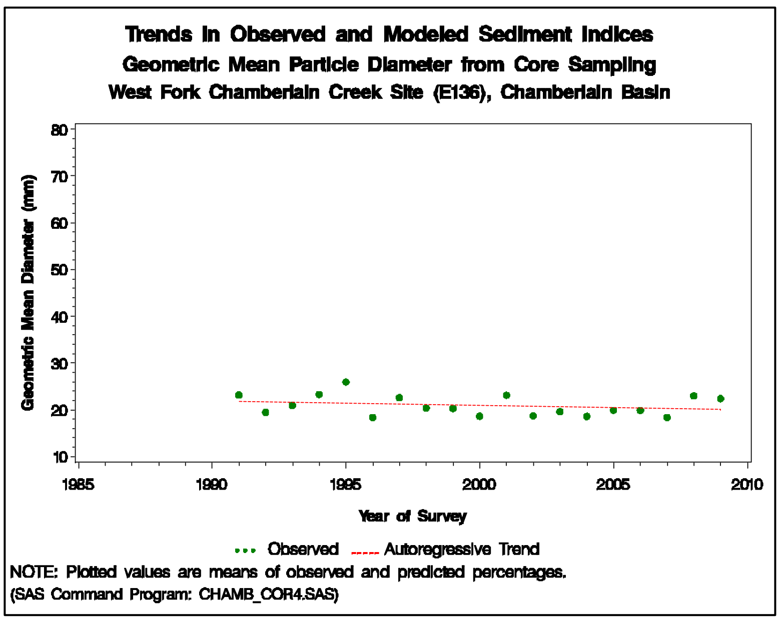

Figure 46.—Time trends in geometric mean particle diameter in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 1991-2009.

Chamberlain Creek (E032)

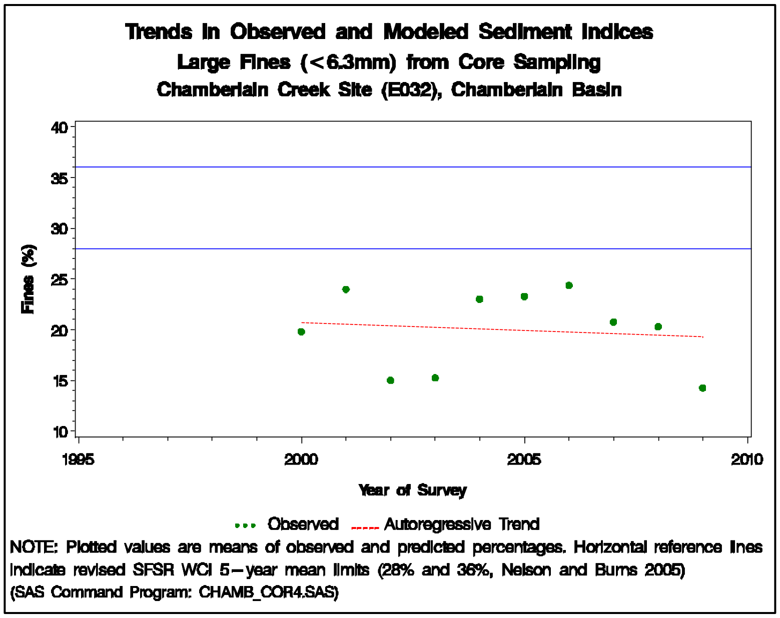

Figure 96.—Time trends in large fine sediments in the Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

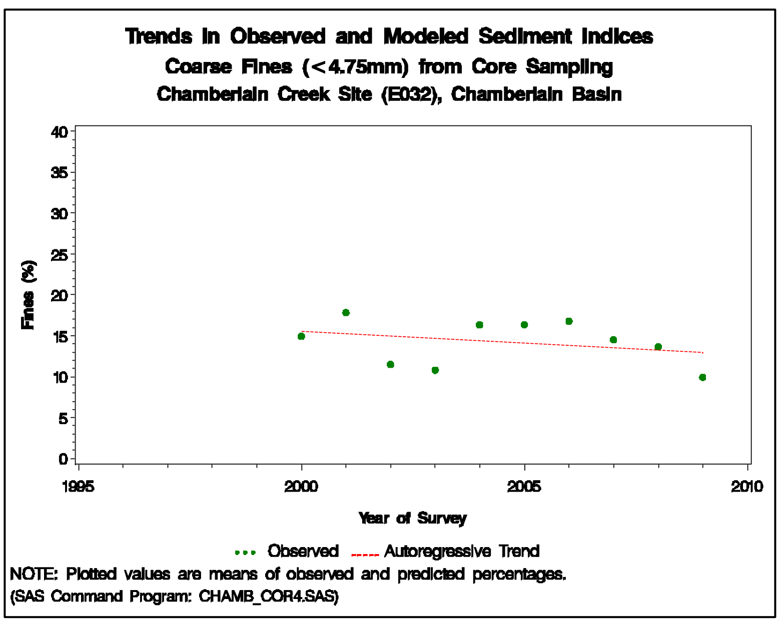

Figure 97.—Time trends in coarse fine sediments in the Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

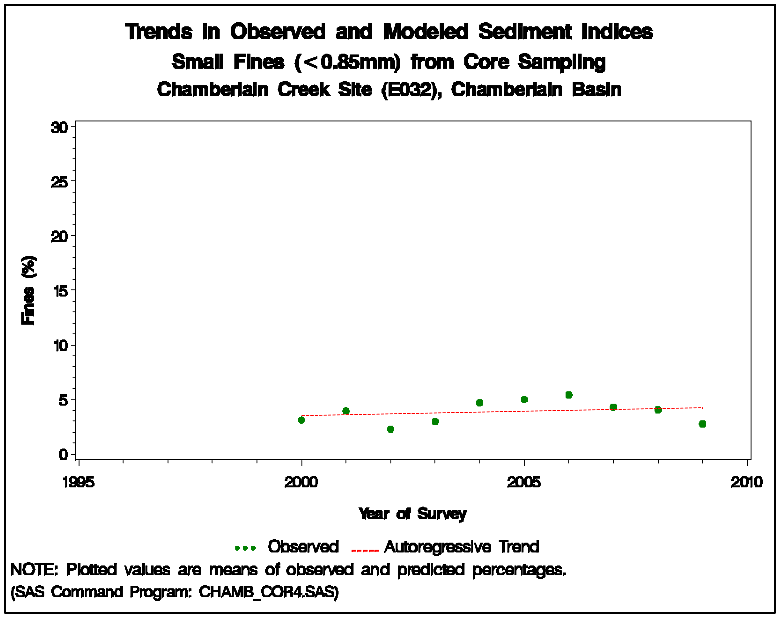

Figure 98.—Time trends in small fine sediments in the Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

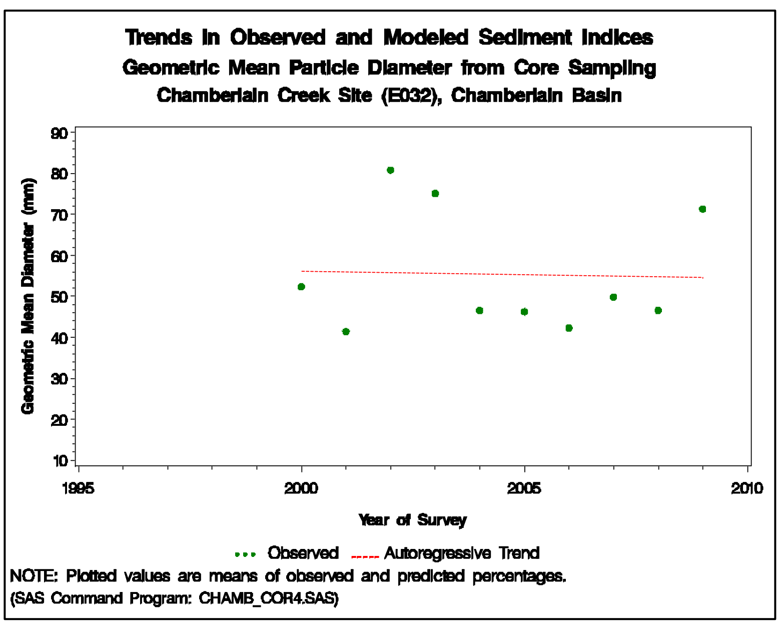

Figure 99.—Time trends in geometric mean particle diameter in the Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

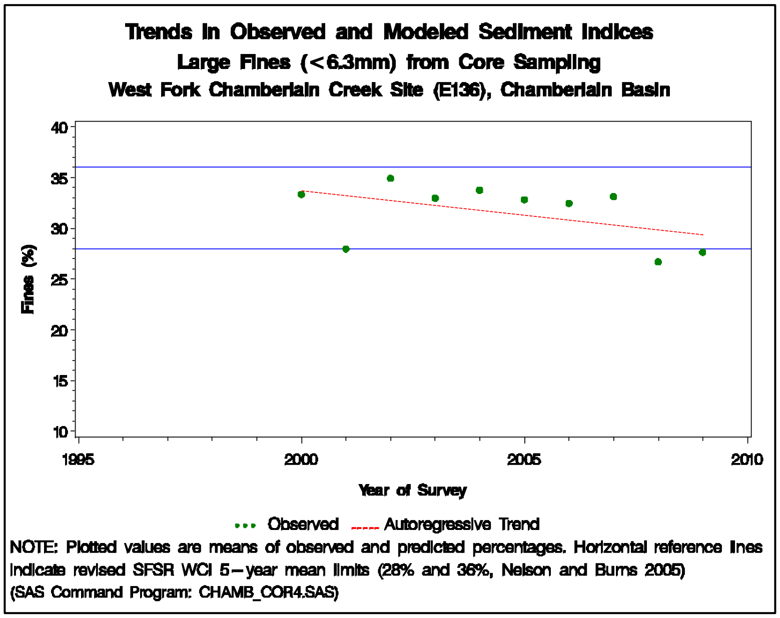

Figure 48.—Time trends in large fine sediments in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

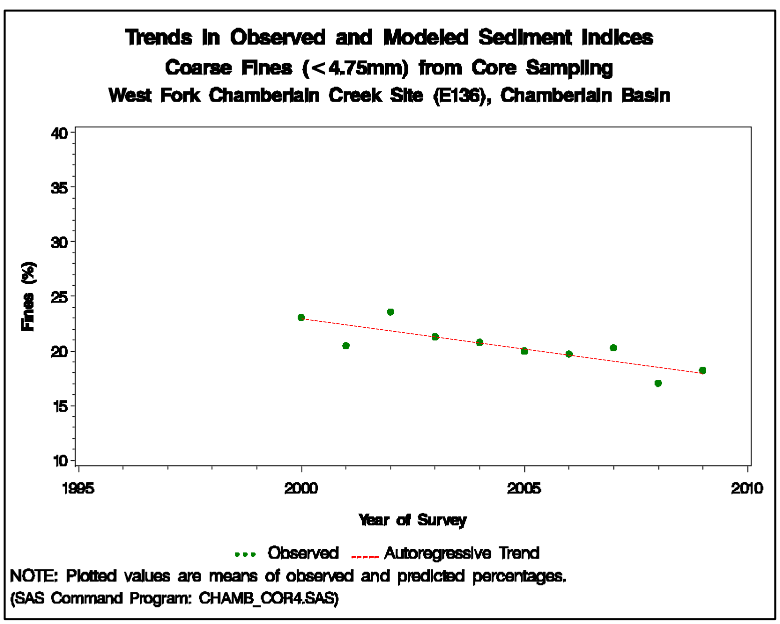

Figure 47.—Time trends in coarse fine sediments in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

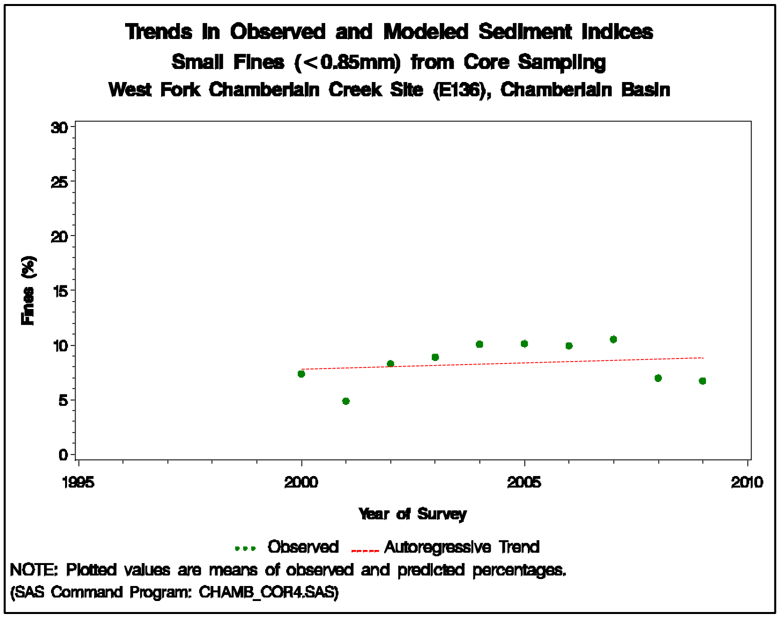

Figure 50.—Time trends in small fine sediments in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

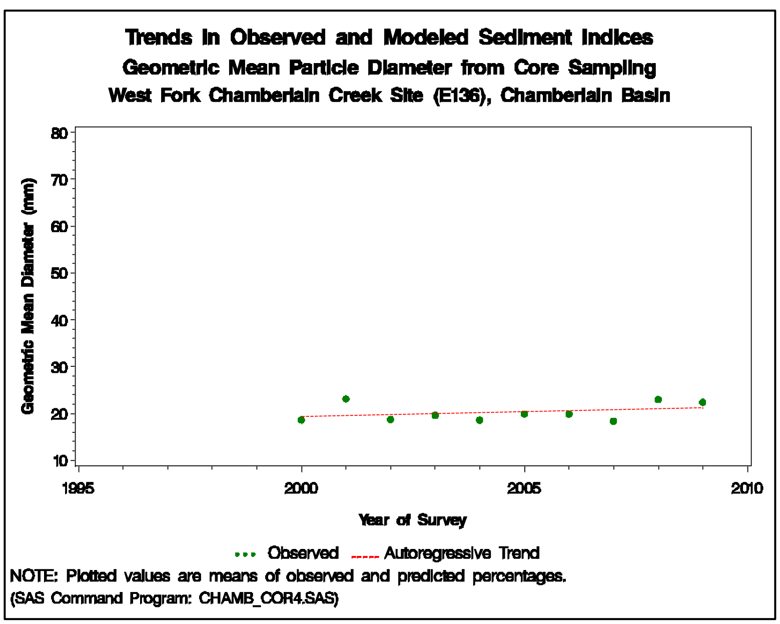

Figure 49.—Time trends in geometric mean particle diameter in the West Fork Chamberlain Creek spawning area, Chamberlain Basin, 2000-2009.

Appendix 4. Acronyms and Abbreviations

11T	UTM Zone 11T.
ANOVA	Analysis Of Varaiance.
BA	Biological Assessment.
BNF	Boise National Forest.
BO	Biological Opinion.
E	Easting.
EFSFSR	East Fork South Fork Salmon River.
ESA	Endangered Species Act of 1973 (PL 93-205, 16 USC 1531 *et seq*.).
FA	Functioning Appropriately.
FCRONRW	Frank Church River Of No Return Wilderness.
FR	Functioning At Risk.
FUR	Functioning At Unacceptable Risk.
HSD	Tukey's "Honestly Significant Difference" Test.
LRMP	Land and Resource Management Plan (also called Forest Plan).
N	Northing.
NMFS	National Marine Fisheries Service (also NOAA Fisheries Service).
NOAA	National Oceanic And Atmospheric Administration.
P	Probability.
PAF	Payette National Forest.
R^2	Coefficient Of Determination.
SFSR	South Fork Salmon River.
USC	United States Code.
USFS	United States Forest Service.
UTM	Universal Transverse Mercator.
WCI	Watershed Condition Indicator.