OREGON DEPARTMENT OF FISH AND WILDLIFE

ROGUE WATERSHED DISTRICT REPORT

TITLE: Upper Rogue Smolt Trapping Project, 2004
Restoration and Enhancement Project # 03-038

STREAM: Bear, Little Butte, Elk, Slate and West Fork Evans Creeks and the Little Applegate River

REPORT DATE: August 2004

AUTHOR: Jerry Vogt, Assistant District Fisheries Biologist

INTRODUCTION

In March 1998, the Rogue District office of the Oregon Department of Fish and Wildlife (ODFW) began a cooperative smolt trapping project with the Butte Falls Resource Area of the Bureau of Land Management (BLM) on three streams in the Rogue River basin. Trapping was expanded to 6 streams in 1999 when the Ashland Ranger District of the Rogue River National Forest (RRNF) became an additional partner in the project. Since 1999, some trap sites have been dropped and others added, and we continue to conduct smolt trapping on six Rogue River basin streams.

This trapping project is part of a statewide effort by ODFW to monitor juvenile salmonid production as outlined in the Oregon Plan for Salmon and Watersheds. The objectives of this project were to 1) obtain an estimate of the production of coho salmon (*Oncorhynchus kisutch*), chinook salmon (*O. tshawytscha*) and steelhead (*O. mykiss*) smolts; 2) determine the timing of outmigration of smolts; and 3) determine the sizes of smolts migrating from each of these stream systems. While mark-recapture estimates were not done for other species or life stages of fish, this project also provided some information on the abundance of pre-smolt steelhead and coho and resident and anadromous cutthroat trout (*O. clarki*).

METHODS

Five-foot rotary screw traps were installed at sites on Bear, Elk, Slate and West Fork Evans Creeks and on the Little Applegate River. Screw traps were positioned in the channel of each stream and anchored in place with cables attached to trees on each bank. Sites selected for these traps were generally characterized as having a steep riffle or constricted channel pouring into a pool that was deep enough to accommodate the five-foot trap. Rotary screw traps captured juvenile fish as they moved downstream and entered the funnel-shaped drum of the trap, which then directed the fish into a livebox.

Trapping on Little Butte Creek was done with the use of an irrigation diversion bypass trap on the Little Butte Creek Mill ditch near Eagle Point, Oregon. Fish entered the ditch at the diversion dam on Little Butte Creek, moved approximately ¼ mile down the ditch to the rotary fish screens, and were returned to Little Butte Creek

via a bypass pipe at the fish screens. Trapping was accomplished by placing a 4'x 4' x 8' box trap at the end of the bypass pipe to intercept fish as they returned to the stream.

The target trapping period for all six sites was March 1 – June 30, and each trap began operating March 1 this year. However, the Slate and West Fork Evans Creek traps were removed during mid May due to low streamflows that prevented the traps from turning. The Elk Creek trap was operated until June 12 when streamflows at that site dropped and the trap stopped turning. Trapping was discontinued at the Bear Creek site in mid June due to the low numbers of smolts being captured at that time and because streamflows were too low to operate the trap. Streamflows and water temperatures remained good in the Little Applegate River and Little Butte Creek and the traps at these sites were operated until June 23. Each trap was operated 7 days per week.

Fish were collected daily from each trap, identified to species and life stage, and enumerated. Fork lengths were measured from a sample of up to 25 fish per week from each species and life stage. With the exception of chinook salmon, a subsample of all salmonids over 60 mm was marked daily with a caudal fin clip. Chinook salmon over 50 mm in length received a caudal fin clip. A minimum of 25 fish of each species and life stage was marked each day unless fewer than 25 were captured. Marked fish were then transported upstream to a release point ranging from 0.2 to 0.5 miles upstream of the trap site and released. Fish that were not marked or that were previously marked and recaptured were released below the trap site. All fish mortalities occurring during handling and release were recorded.

Marked fish recaptured at each trap were enumerated to provide an estimate of trapping efficiency. Weekly and seasonal trapping efficiencies were calculated with the following formula:

$$E = R/M$$

where E = trap efficiency, R = the number of marked fish recaptured, and M = the number of marked fish released. The total number of migrants (N) passing the trap site during a given period of time was estimated with the formula:

$$N=C/E$$

where C = the number of unmarked fish captured. A 95% confidence interval around each estimate was calculated using the formula:

$$95\%\ CI = 1.96\ \sqrt{V}$$

where V = sample variance. A bootstrap program was used to estimate sample variance (Thedinga et al 1994).

TRAP LOCATIONS

Bear Creek

The trap site on Bear Creek was located approximately 0.6 mile upstream from the confluence of Bear Creek and the Rogue River (Figure 1). Bear Creek drains an area of approximately 246,000 acres. Land use within the Bear Creek basin consists of private timber (31%), publicly owned forest (20%), agriculture (39%),

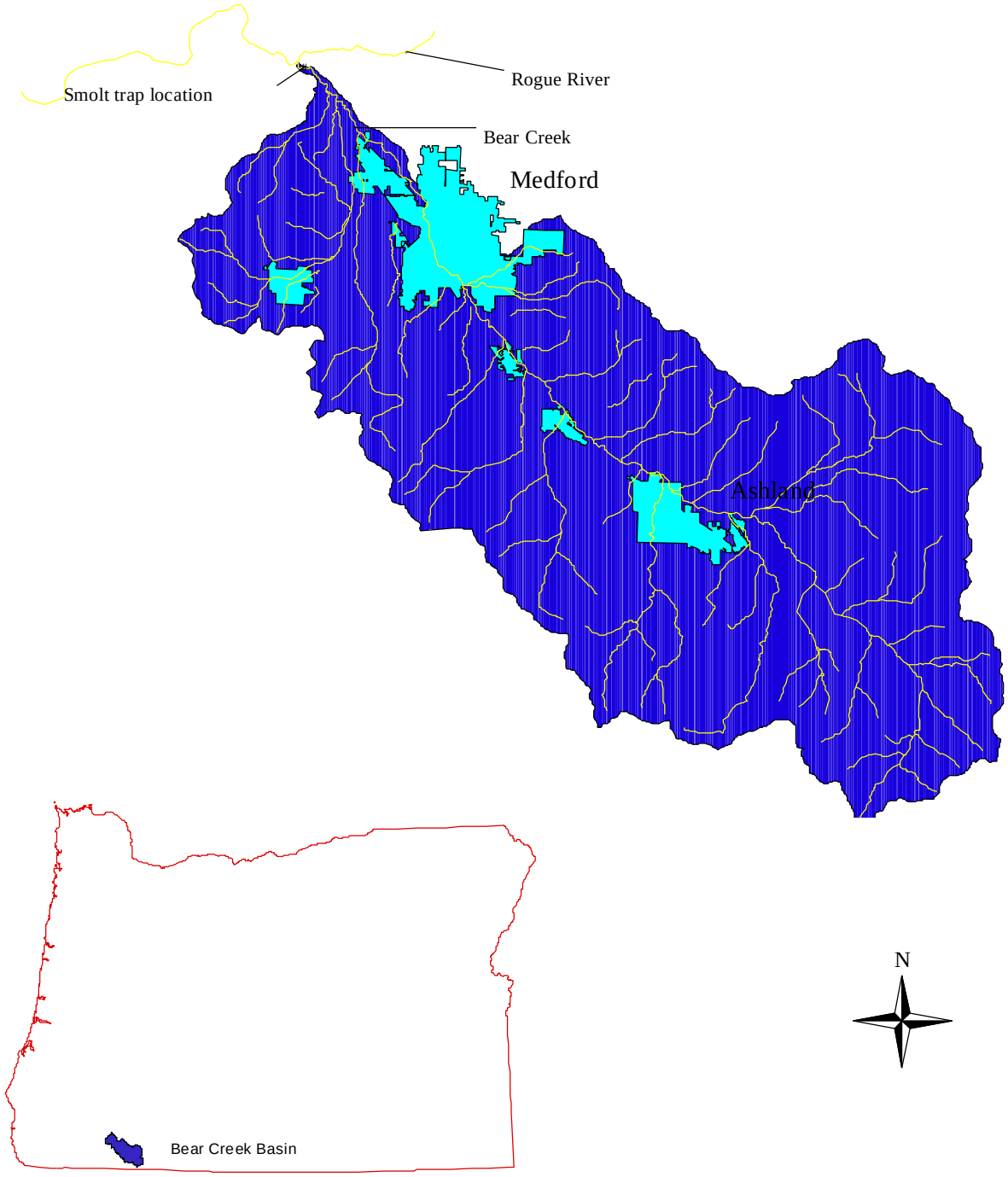

Figure 1. Smolt trap location on Bear Creek.

urban areas (7%) and mining and other uses (2%) (Prevost et al. 1995). The cities of Medford, Ashland, Central Point, Talent, Phoenix and Jacksonville are the major population centers in the Bear Creek basin.

Water quality and instream habitat are highly degraded in Bear Creek and many of its tributaries. Bear Creek has been placed on the Department of Environmental Quality (DEQ) list of water quality limited streams for a number of factors including high fecal coliform concentrations, streamflow modification, habitat modification and high summer water temperatures. The stream has been channelized over much of its length, especially where the stream flows through urban areas. Streamflows in Bear Creek are highly manipulated due to imports of water into the Bear Creek basin from the Klamath and Little Butte Creek basins, a water storage project at Emigrant Lake and the withdrawal of large amounts of water from Bear Creek for agricultural and municipal use.

Despite the poor condition of fish habitat in the Bear Creek basin, Bear Creek and its tributaries support native populations of fall chinook salmon, coho salmon, steelhead (summer and winter runs) and cutthroat trout. There are a total of 25.5 miles of chinook spawning habitat in the mainstem of Bear Creek and in a few of the larger tributaries. Coho spawning and rearing habitat occurs in approximately 30 miles of streams in the basin; steelhead spawn and rear in approximately 98 miles of habitat.

Elk Creek

Elk Creek drains an area of about 17,157 acres, making it the smallest subbasin in this trapping study. The smolt trap on this stream was located 0.3 miles upstream from the confluence of Elk Creek and the West Fork Illinois River (Figure 2). The Elk Creek drainage is bisected by the Oregon-California border, and approximately 60% (18 of 30 square miles) of the drainage lies in California. Land use in the Elk Creek drainage consists primarily of private or federally owned forest land. The largest single landowner is a private timber company that owns approximately 30% of the watershed; the USFS and other private interests own the remaining lands (Bauer and Goforth 1995).

Elk Creek supports populations of fall chinook and coho salmon, winter steelhead and cutthroat trout. Chinook spawning occurs in approximately 7.4 miles of streams in the Elk Creek drainage. Coho and steelhead spawning and rearing occurs in approximately 15 and 18 miles of streams within the basin, respectively.

Little Butte Creek

The Little Butte Creek trap was located at RM 5.5 near Eagle Point, Oregon (Figure 3). The Little Butte Creek watershed is approximately 238,600 acres in size. The federal government (BLM and USFS) owns forty-eight percent of the Little Butte watershed, while 50% of the basin is in private ownership. The remaining two- percent is land within the urban growth boundary of Eagle Point and land owned by the State of Oregon (BLM and USFS 1997). The principal land uses in the Little Butte Creek Basin are forest land (72.2%), range land (19.4%) and irrigated agricultural land (5.0%). Other land uses include non-irrigated agricultural lands and urban areas (Anthony and Grenbemer 1995).

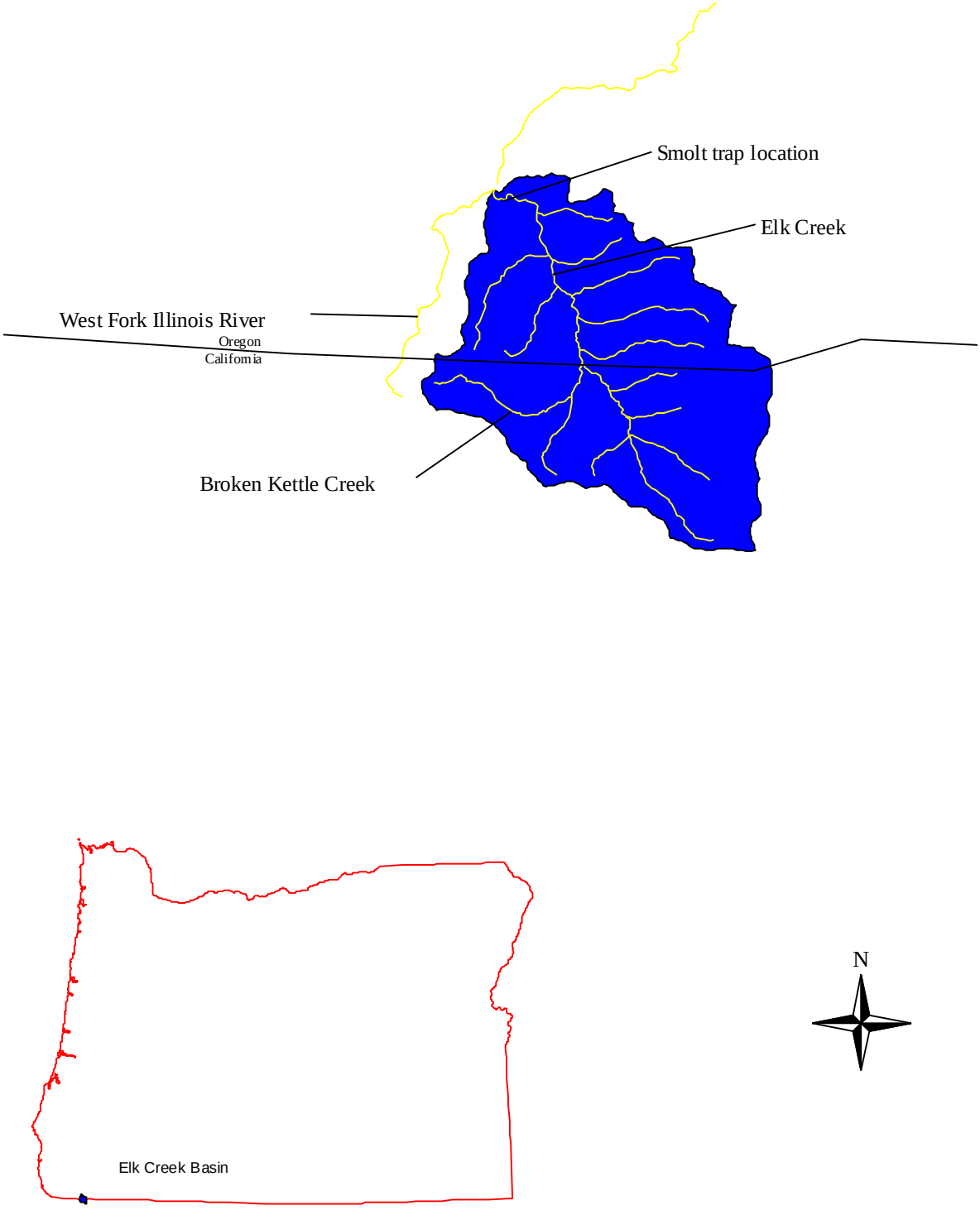

Figure 2. Smolt trap location on Elk Creek.

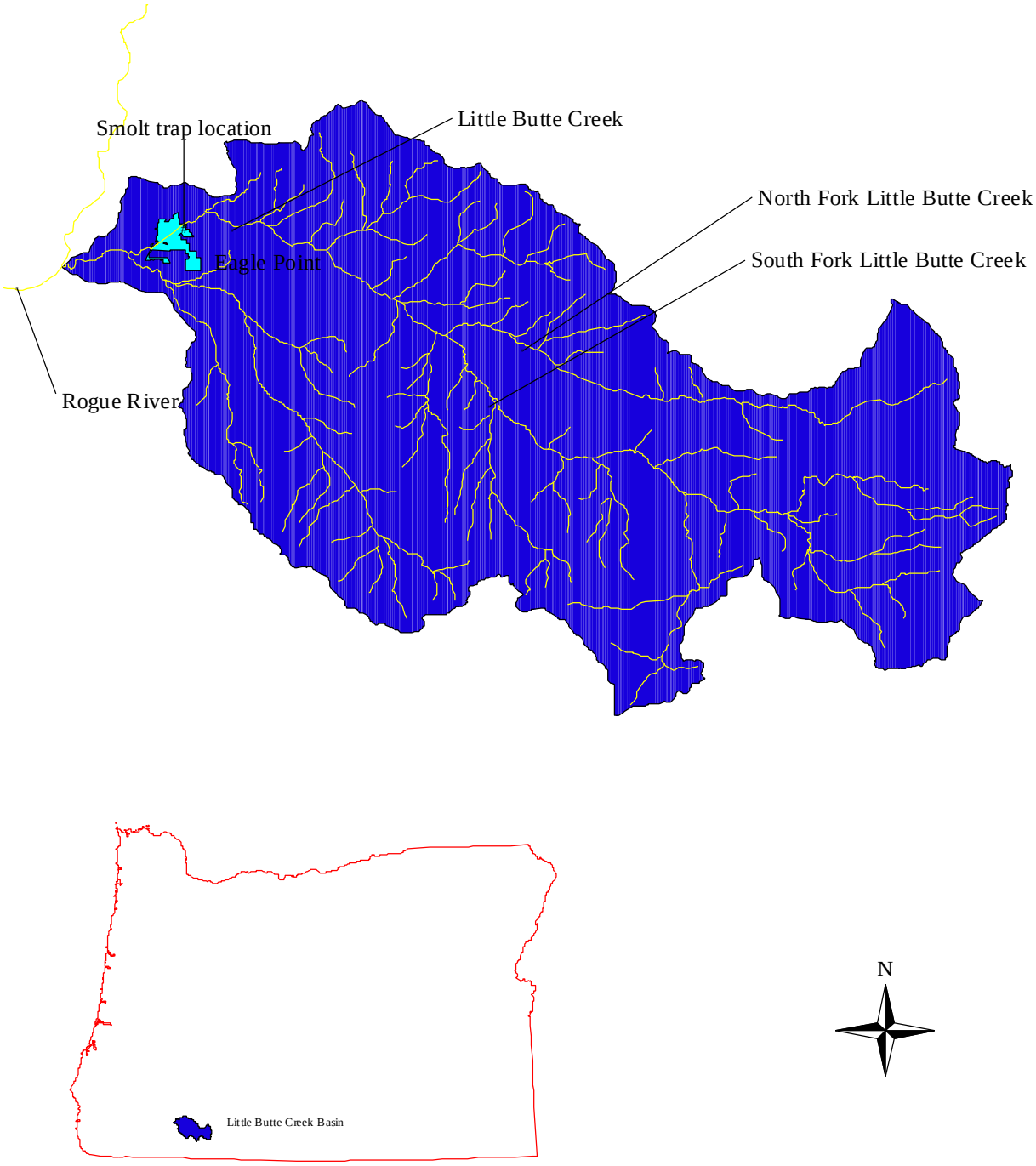

Figure 3. Smolt trap location on Little Butte Creek

Anadromous fish species present in the Little Butte Creek basin include chinook salmon (spring and fall runs), coho salmon and steelhead (summer and winter runs). There are 18 miles of known spawning habitat for chinook salmon in the basin as well as 55 and 96 miles of spawning and rearing habitat for coho salmon and steelhead, respectively. However, because this trap is located 5.5 miles upstream from the mouth of Little Butte Creek, the production of salmonids from lower Little Butte Creek is not estimated. In addition, the trap site is located upstream from the mouth of Antelope Creek, which supports populations of coho salmon and steelhead. There are approximately 6 miles of coho habitat and 19 miles of steelhead habitat in the Antelope Creek subbasin. As a result, the estimates of anadromous salmonid production at the Little Butte Creek trap site are underestimates of the production of the entire Little Butte Creek basin.

West Fork Evans Creek

The size of the West Fork Evans Creek Basin is 39,176 acres, of which 21,310 acres (54%) are in BLM ownership. The remaining non-BLM ownership is composed of agricultural (<0.05%), industrial forest (40%), non-industrial forest (<1%), and other federally-owned timber (4%) lands (BLM 1995). The upper portion of the basin is composed of highly erodible decomposed granitic soils. The high road density in the basin (4.8 miles of road/section) is a major factor in the introduction of decomposed granite sediments into West Fork Evans Creek and its tributaries (BLM 1995).

Coho salmon, steelhead (summer and winter runs) and cutthroat trout are present in the West Fork Evans Creek basin. There are approximately 23 and 26 miles of spawning and rearing habitat for coho and steelhead, respectively, in the basin. Chinook salmon are not present in the West Fork Evans Creek Basin. The trap site on West Fork Evans Creek was located at approximately RM 2.8 (Figure 4).

Slate Creek

Slate Creek supports populations of fall chinook, summer and winter steelhead, coho salmon and cutthroat trout. Fall chinook utilize approximately 14 miles of spawning habitat in Slate Creek and its tributaries. Coho and steelhead are known to utilize approximately 22 and 32 miles of habitat, respectively, in the Slate Creek subbasin. The Slate Creek smolt trap was located at RM 0.3 (Figure 5)

The Slate Creek subbasin is approximately 28,400 acres in size. The primary land uses in the Slate Creek subbasin are agriculture and rural residential at lower elevations and forest land at upper elevations. Forty-two percent of the subbasin is owned by the USFS, 18% is owned by BLM and the remaining 40% is in private ownership (Applegate River Watershed Council 1994).

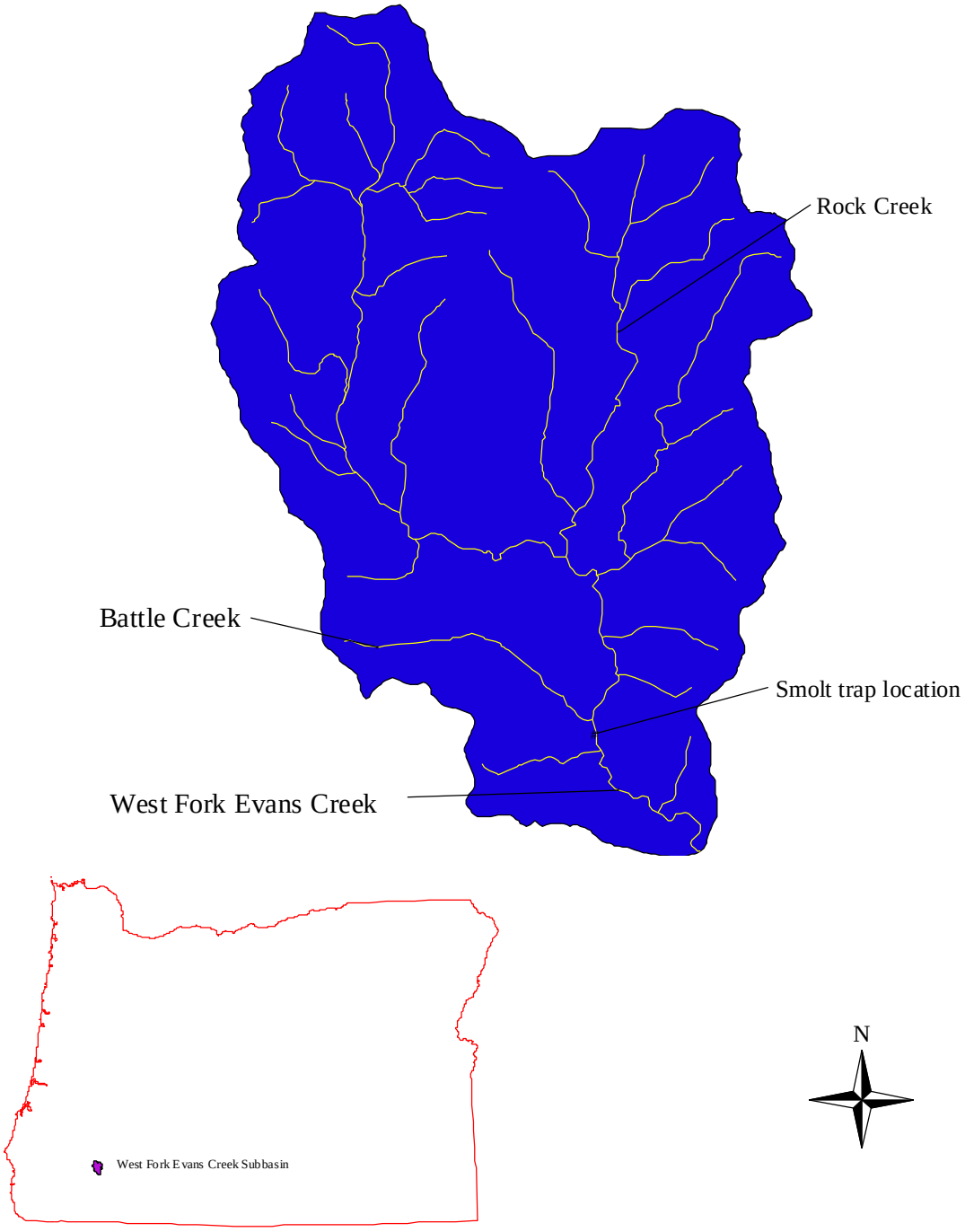

Figure 4. Smolt trap location on West Fork Evans Creek.

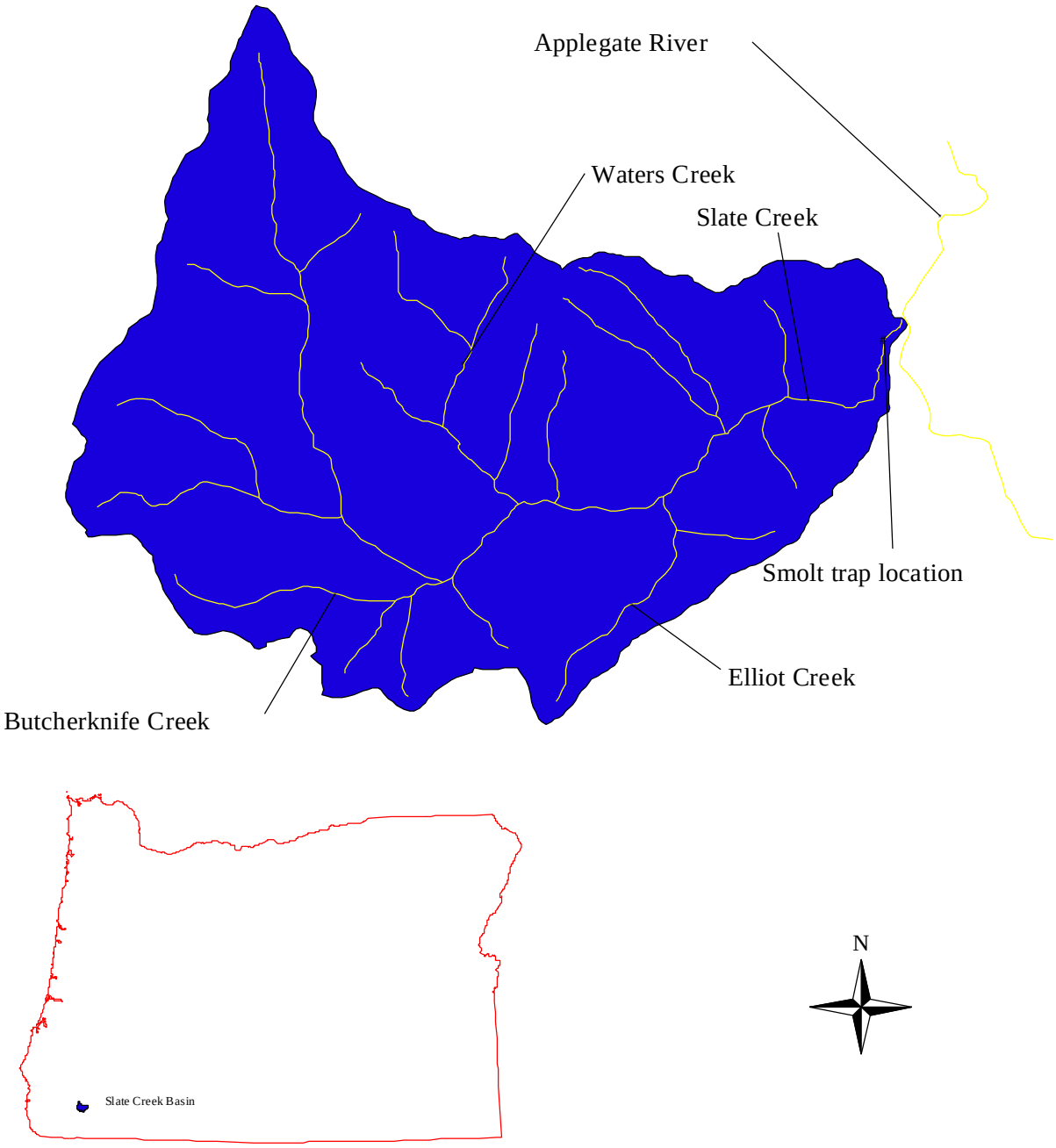

Figure 5. Smolt trap location on Slate Creek.

Little Applegate River

The Little Applegate River drains an area of approximately 72,200 acres and is the last major Applegate River tributary before fish passage is blocked at Applegate Lake. Over 70% of the subbasin is owned by either the U.S. Forest Service (32.2%) or BLM (40%); the remaining lands are owned by individuals or corporations (27.4%) and the State of Oregon (0.4%). Although private ownership of the basin is less than 30% of the area, approximately 60% of the fish habitat in the subbasin is located on private land (BLM and USFS 1995).

The Little Applegate River and its tributaries support populations of fall chinook and coho salmon, summer and winter steelhead and cutthroat trout. Approximately 5 and 6 miles of the Little Applegate River is utilized as spawning and rearing habitat by fall chinook and coho salmon, respectively; however, a natural waterfall located at approximately RM 1.5 may be a barrier to these species under low flow conditions. There are approximately 33 miles of known spawning and rearing habitat for steelhead in the basin. The smolt trap on this stream was located at approximately RM 0.2 (Figure 6).

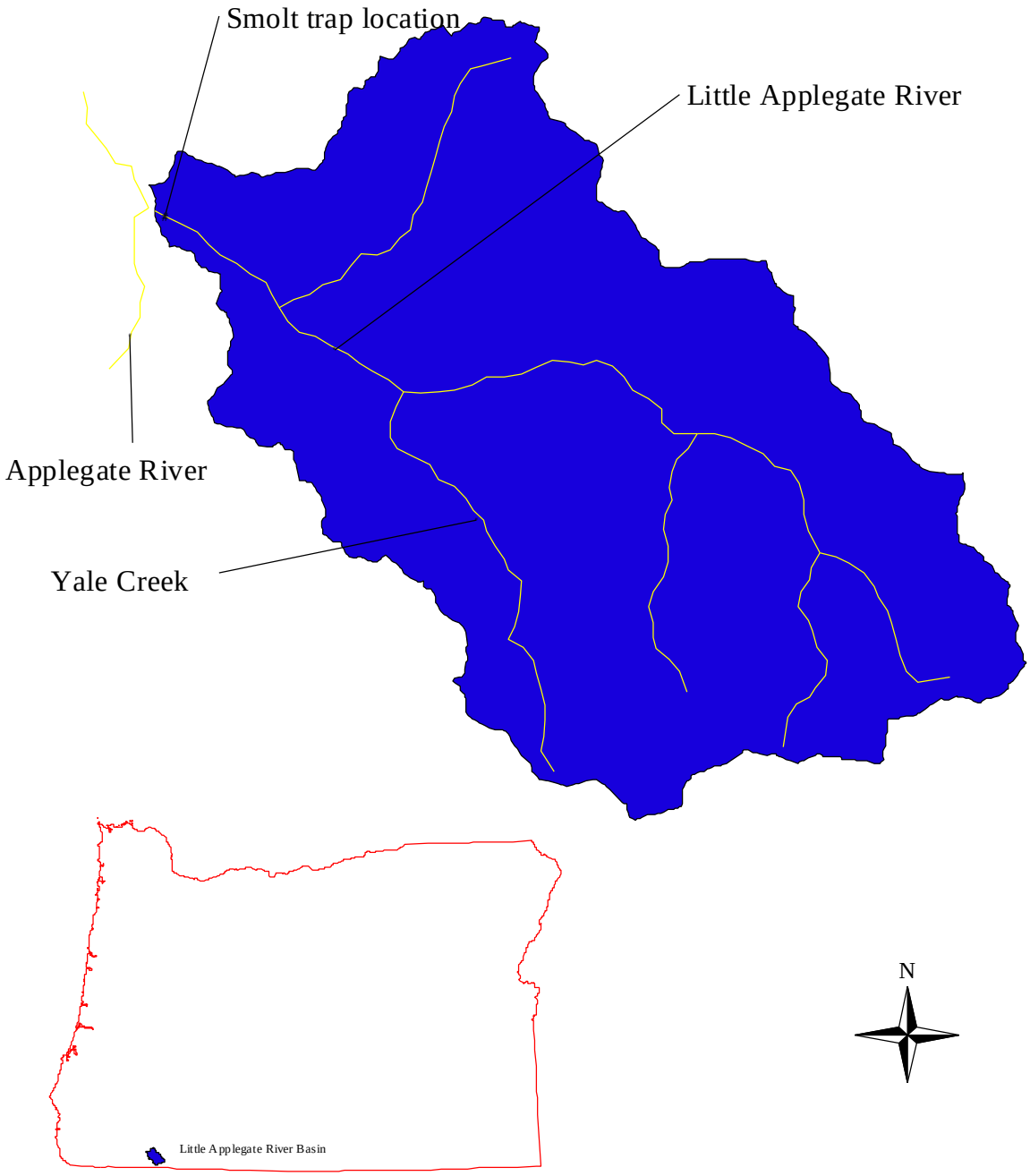

Figure 6. Smolt trap location on the Little Applegate River.

RESULTS AND DISCUSSION

Smolt Production Estimates

Coho smolt production estimates were lower in 2004 than in 2003 at each of the sites where coho were captured (Figure 7). Coho smolt production was especially low compared with last year in Little Butte Creek. Although lower than last year, coho smolt production in West Fork Evans Creek appears to be following an upward trend over the last 5 years. In contrast, coho production at Slate and Elk Creeks appears relatively stable from year to year, with no detectable upward or downward trend. Coho production from Elk Creek has been very consistent for the three years of trapping at that site; the stream has produced between 5,200 and 6,100 coho smolts each year. No coho smolts were captured at either the Bear Creek or Little Applegate River traps.

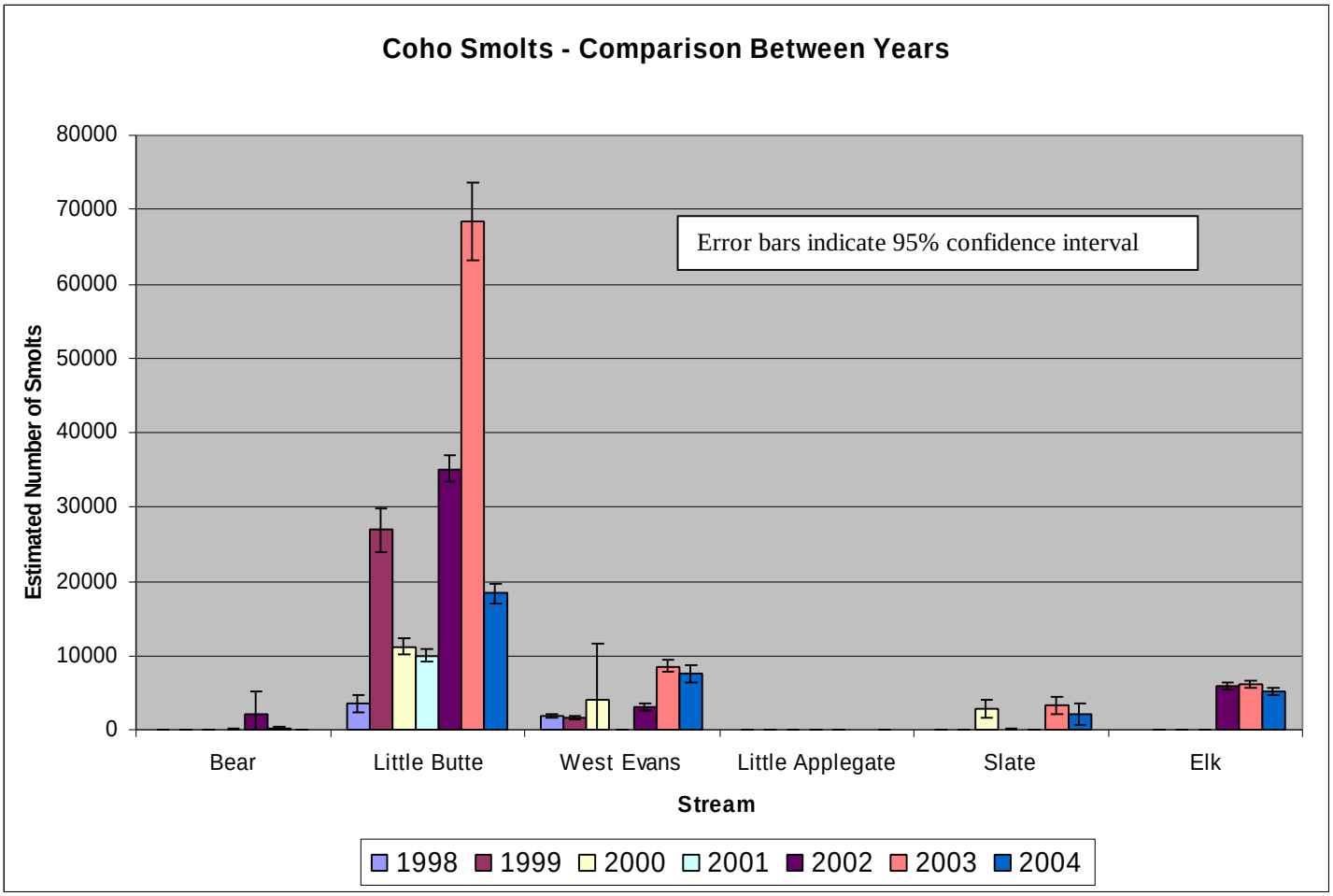

Figure 7. Between-year comparison of coho smolt estimates at each trap site (1998-2004).

Because the amount of habitat for coho differs between stream systems, I compared the production of coho smolts between streams by calculating the estimated number of coho smolts per mile of habitat available. On a fish-per-mile basis, Little Butte Creek produced the highest number of coho smolts in 2004 (over 400 per mile), followed by West Fork Evans and Elk Creeks (Figure 8). The number of coho smolts produced per mile dropped to below 100 at Slate Creek. Aside from the 1998 trapping season, Little Butte Creek has consistently produced the highest number of coho smolts per mile of habitat each year of this study.

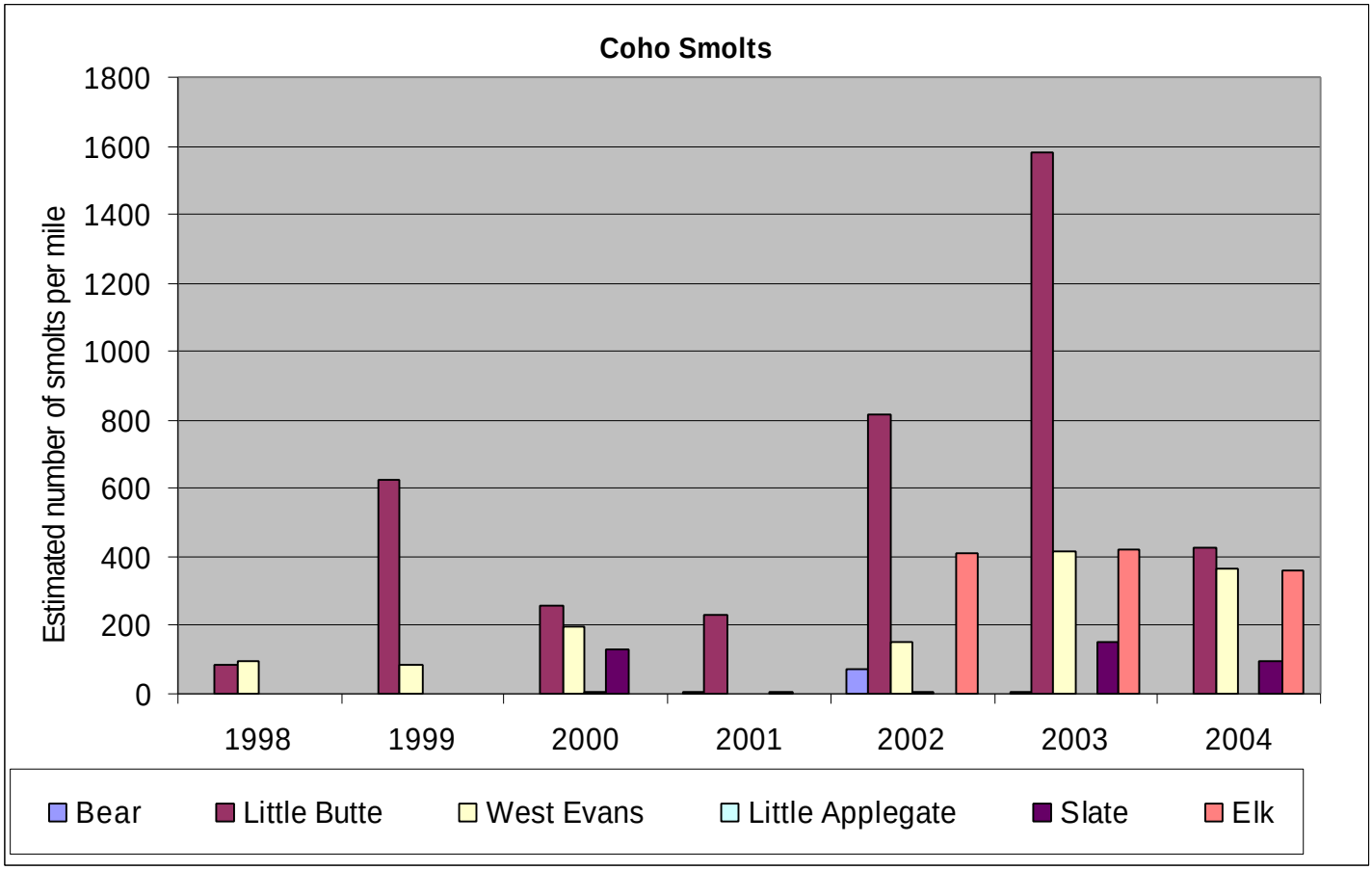

Figure 8. Estimated number of coho smolts produced per mile of habitat (1998-2004).

This year's steelhead smolt estimate for Little Butte Creek was very similar to the 2003 estimate (Figure 9) and it was slightly lower than the average number (approximately 22,000) of steelhead smolts produced over the seven years of trapping at that site. While steelhead production at Little Butte Creek has varied annually since 1998, there is no detectable increasing or decreasing trend in steelhead production. Similarly, there is no trend detectable for steelhead smolt production at either West Fork Evans, Elk or Slate Creeks. Steelhead smolt production from these streams remains relatively low compared to production from Little Butte Creek. The steelhead smolt estimate of approximately 7,400 this year for the Little Applegate River is the highest since trapping began at the site in 1999, and there is a slight upward trend in steelhead production from this site over the last 6 years. No steelhead abundance estimates were made for Bear Creek since only 2 smolts were captured. However, the absence of steelhead smolts at this trap may have been more a function of trap efficiency than the abundance of steelhead smolts (see discussion on trap efficiency).

Of the six streams in this study, Little Butte Creek produced the highest number of steelhead smolts in 2004 (Figure 9). Over the last several years, Little Butte Creek has consistently produced more steelhead smolts than any other stream included in our trapping study; however, the steelhead smolt estimate for Bear Creek was the highest of all trap sites in 2002 (Figure 9). As with coho, these results indicate that the Little Butte Creek watershed is an important steelhead-producing watershed in the Rogue Basin.

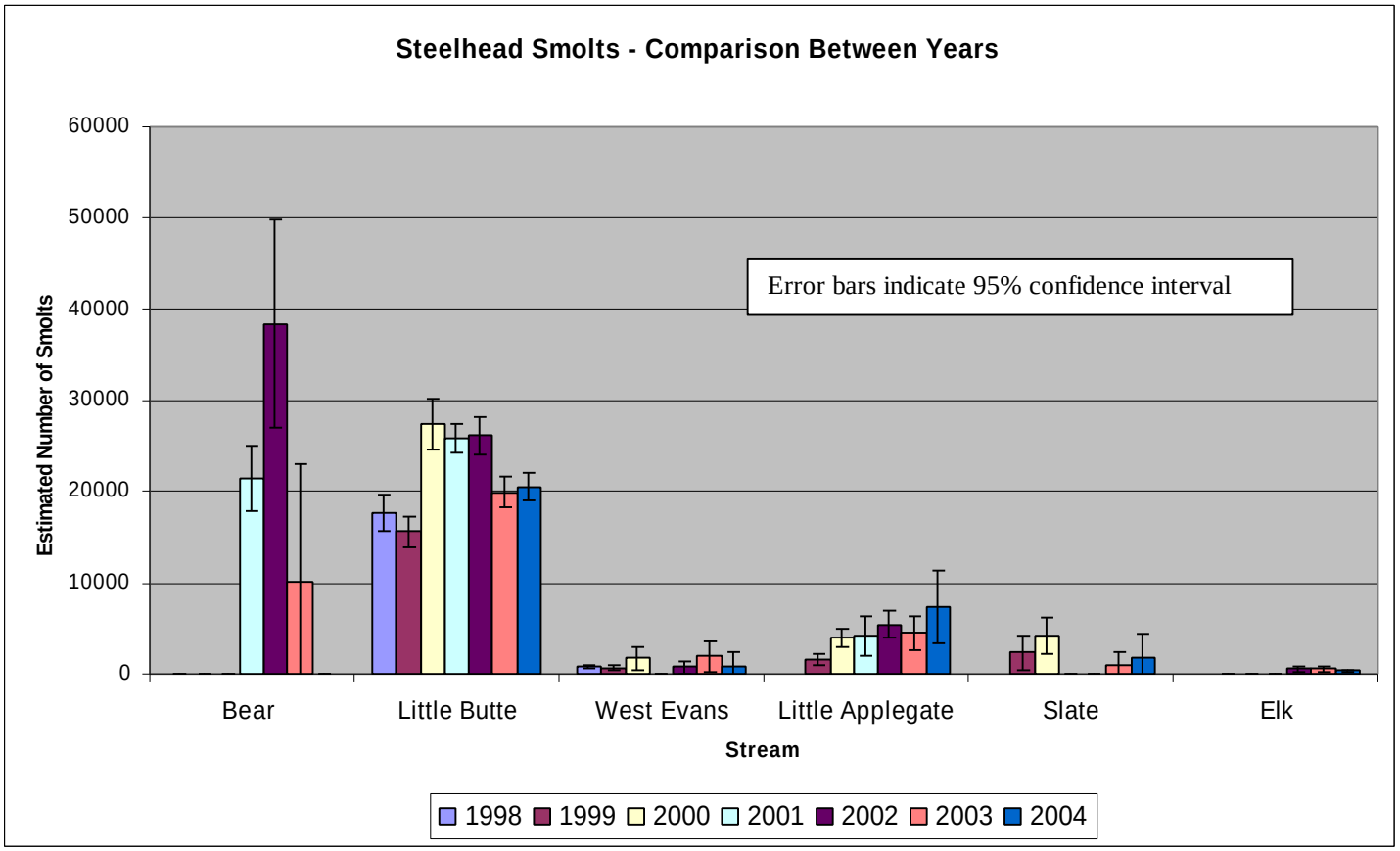

Figure 9. Between-year comparison of steelhead smolt estimates at each trap site (1998-2004).

When comparing steelhead smolt production between sites based on the number of smolts produced per mile of habitat, Little Butte Creek produced the highest steelhead smolt estimates each year with the exception of 2002 (Figure 10). Over the last 7 years, Little Butte Creek steelhead production has averaged over 300 steelhead smolts per mile of habitat. The Little Applegate River produces an average of nearly 140 steelhead smolts per mile, followed by Slate Creek (73/mile), West Fork Evans Creek (48/mile) and Elk Creek (27/mile). The production of steelhead per mile in the Little Applegate was much higher this year than the 6 year average. The estimate of 226 steelhead per mile from the Little Applegate in 2004 approached the production level observed in Little Butte Creek.

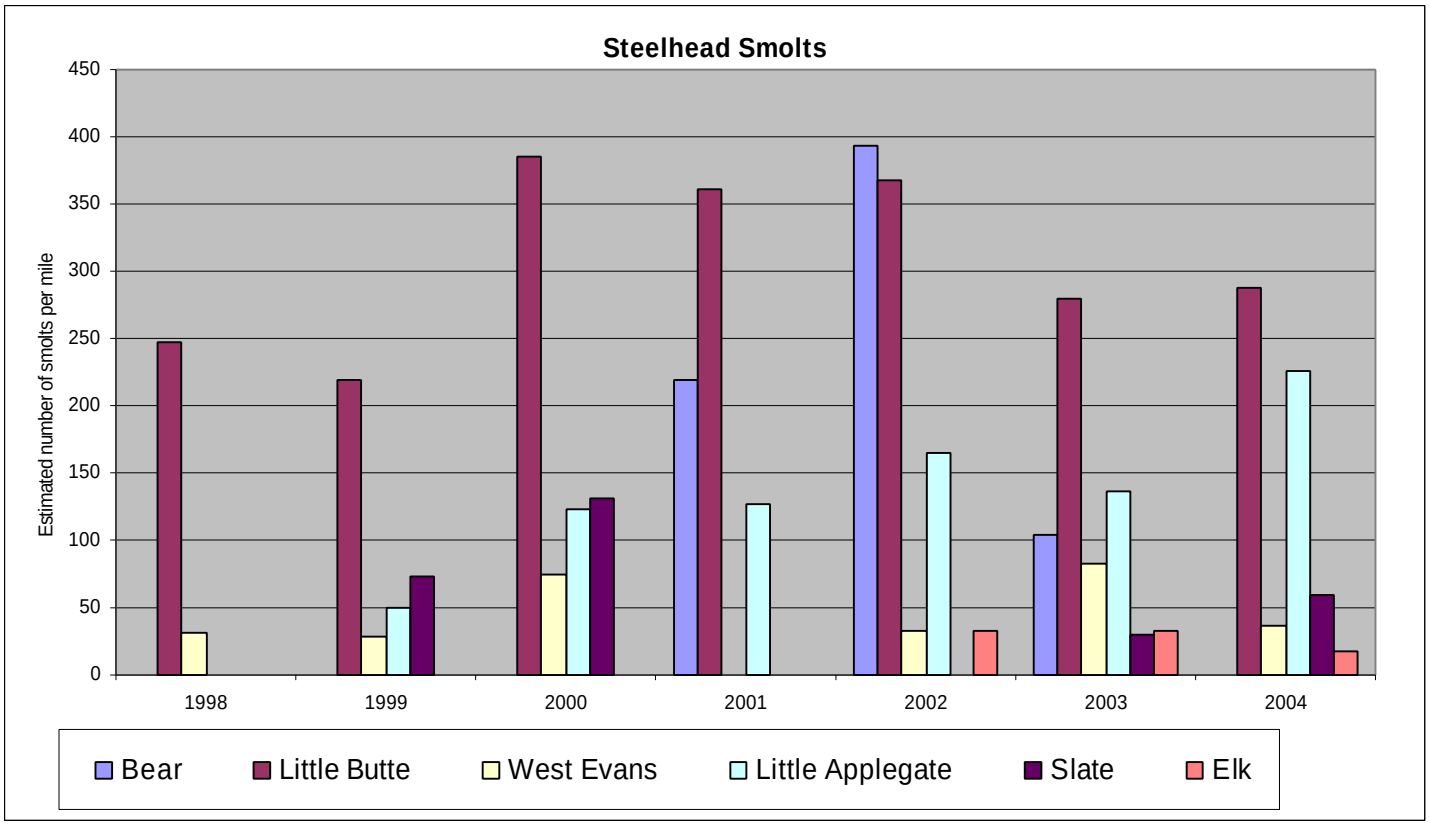

Figure 10. Estimated number of steelhead smolts produced per mile of habitat (1998-2004).

For the third consecutive year we attempted to estimate the number of chinook smolts produced at each of the trap sites and were successful at each site including Little Butte Creek. For the past two years, we were unable to estimate chinook smolt production at Little Butte Creek due to the large number of fish that were captured. The large number of chinook captured during the peak weeks of outmigration made marking fish and looking for marks impractical, especially when we were attempting to work fish up as quickly as possible to minimize stress. This year, fish numbers in the trap were lower and we were able to mark and recapture chinook smolts at the Little Butte Creek trap.

Although we captured a total of 913 chinook from Bear Creek, we were only able to recapture 1 of the 129 fish we marked. As a result, we were unable to produce a reliable estimate of chinook production from Bear Creek. Little Butte Creek produced an estimated 250,000 chinook in 2004 (Figure 11). We captured a total of approximately 48,000 chinook in the trap and recaptured 19% of the 1,622 marked fish. If this efficiency is representative of trap efficiencies for chinook smolts each year at Little Butte Creek, our estimate of chinook smolt production in 2002, when we captured over 130,000 chinook, would have been nearly 689,000 fish.

Chinook smolt production from the Little Applegate River in 2004 was similar to estimates from the two previous years, but was relatively low when compared with other streams. Slate Creek produced over 150,000 chinook smolts this year, compared with only 22,000 last year, although the confidence interval around the 2004 estimate is quite large. This increase in chinook production corresponds with an increase in spawning escapement of chinook into Slate Creek. A total of 66 chinook carcasses were observed in Slate Creek during the fall of 2002; this number increased to 125 carcasses in 2003 (Stewart and Jacobs 2004). Chinook smolt

production was lower in Elk Creek this year than last year. This reduction in chinook smolt production is surprising given that indices of chinook adult abundance (carcass counts and adult returns at Gold Ray Dam) show that the fall chinook run has been steadily increasing over the last several years (Stewart and Jacobs 2004; Unpublished Gold Ray dam counts).

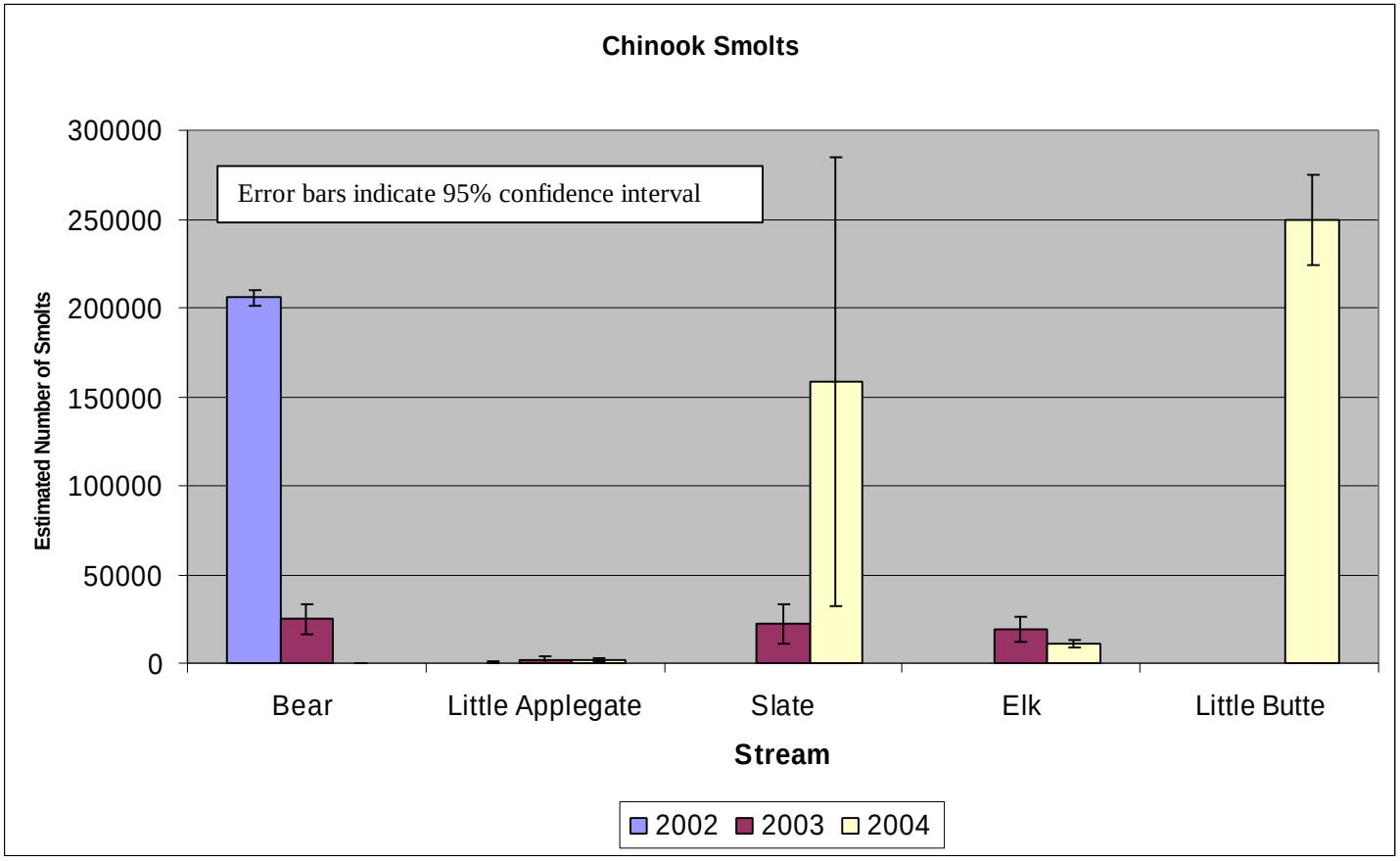

Figure 11. Between-year comparison of chinook smolt estimates at each trap site (2002-2004).

The production of chinook smolts per mile varies widely between years and streams (Figure 12). The highest estimate of chinook per mile during the last three years was 20,000 at Little Butte Creek this year, although it is likely that the 2002 estimate would have been much higher. Slate Creek produced over 10,000 chinook per mile in 2004.

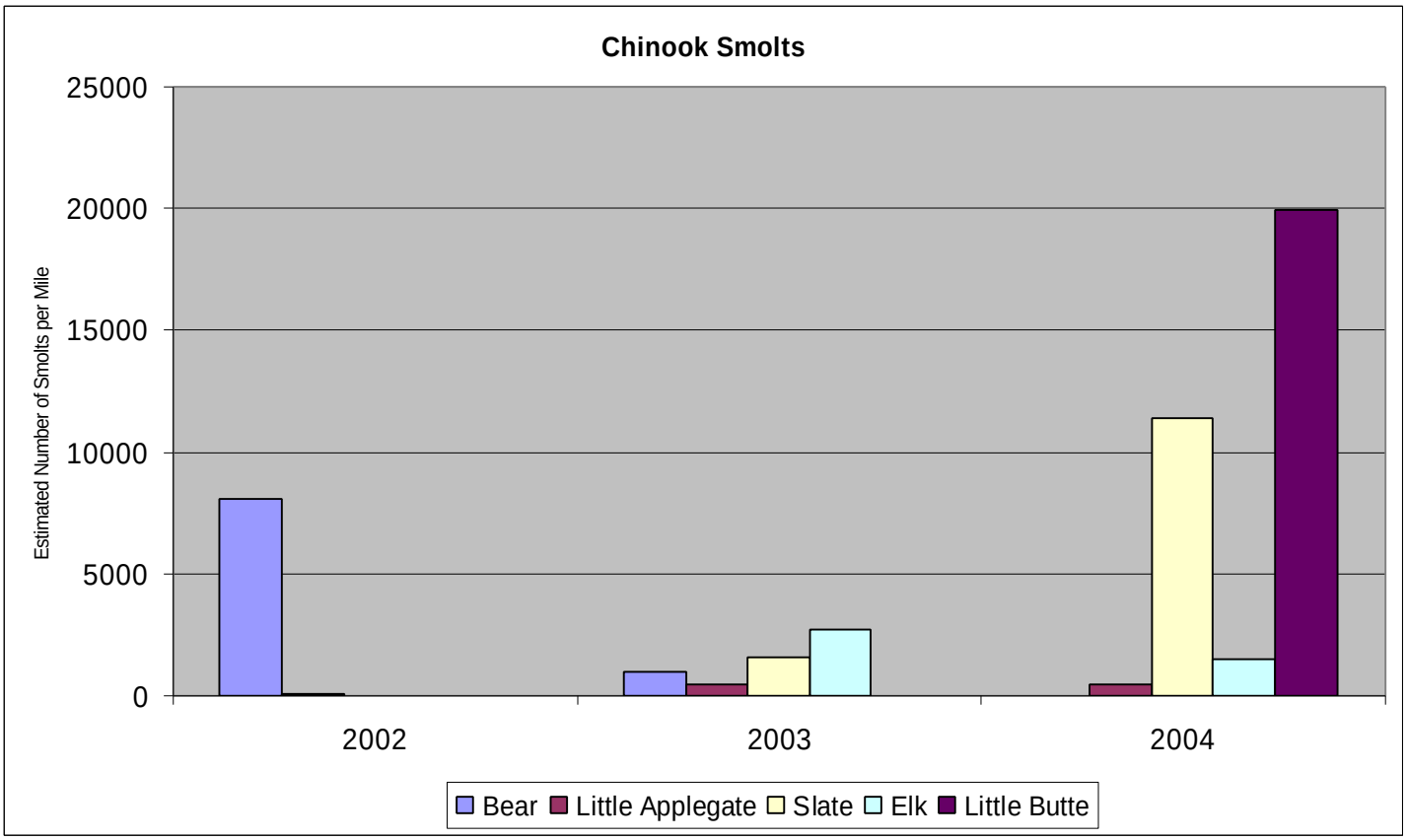

Figure 12. Estimated number of chinook smolts produced per mile of habitat (2002-2004).

Trap Efficiency

Trap efficiencies for coho smolts ranged from 9% at the Slate Creek trap to 36% at the Elk Creek trap (Table 1). Since trapping began at Elk Creek in 2002, trap efficiency for coho smolts has been at least 30% each season. Streamflows dropped quickly during the 2004 trapping season and the trapping periods at the West Fork Evans and Slate Creek traps were 20 days and 12 days shorter (respectively) this year than in 2003. Trapping efficiency for coho smolts was very good at both Little Butte and West Fork Evans Creeks. No coho smolts were captured at the Little Applegate or Bear Creek traps.

Table 1. 2004 coho smolt trap efficiencies and population estimates for each trap site.

Stream	Dates Trapped	# Days Trapped	# Coho Captured	# Coho Marked	# Coho Recaptured	Trapping Efficiency	Population Estimate	95% Confidence Interval
Little Butte	3/1 – 6/23	115	5,423	1,995	589	30 %	18,383	17,045 – 19,721
Bear Creek	3/1 – 6/16	106*	0	0	0	NA	NA	NA
West Evans	3/1 – 5/13	74	1,172	943	147	16 %	7,513	6,293 – 8,733
Elk Creek	3/1 – 6/12	103*	1,862	1,460	524	36 %	5,187	4,784 – 5,590
L Applegate	3/1 – 6/23	113*	0	0	0	NA	NA	NA
Slate	3/1 – 5/13	74	185	183	16	9 %	2,126	794 – 3,458

* Trap disabled one or more days by high flows/debris.

Trap efficiency for steelhead smolts was very good at Little Butte and Elk Creeks but fairly low at each of the other trap sites (Table 2). The low trap efficiency at these three sites resulted in wide confidence intervals around the population estimates. Only two steelhead smolts were captured at Bear Creek; thus no estimates for steelhead production were produced.

Table 2. 2004 steelhead smolt trap efficiencies and population estimates for each trap site.

Stream	Dates Trapped	# Days Trapped	# St Captured	# St Marked	# St Recaptured	Trapping Efficiency	Population Estimate	95% Confidence Interval
Little Butte	3/1 – 6/23	115	5,356	2,358	615	26 %	20,521	18,996 – 22,046
Bear Creek	3/1 – 6/16	106*	2	1	0	0	NA	NA
West Evans	3/1 – 5/13	74	58	58	4	7 %	841	-715 – 2,397
Elk Creek	3/1 – 6/12	103*	86	85	23	27 %	317	186 – 448
L Applegate	3/1 – 6/23	113*	379	371	19	5 %	7,431	3,445 – 11,417
Slate	3/1 – 5/13	74	62	60	2	3 %	1,879	- 530 – 4,288

* Trap disabled one or more days by high flows/debris.

Trapping efficiency for chinook smolts ranged from 0.7-36% at five trap sites (Table 3). Prior to 2004, we only marked chinook over 60 mm in length. This year we marked chinook over 50 mm in length, which enabled us to mark many more fish, especially at Elk Creek, where fish tended to be smaller. The production estimate for Slate Creek had fairly wide confidence intervals due to the relatively low number of fish marked. We were unable to calculate a production estimate for Bear Creek due to the poor recapture rate at that trap.

The Elk Creek, Little Applegate and Bear Creek traps were disabled for at least one day during the trapping season due to high streamflows and debris. The Elk Creek trap was out of operation for only short periods, so the production estimate for these traps was probably not significantly affected by the lost trapping time. The Little Applegate trap was disabled for periods of several days when high streamflows and debris submerged the trap; as a result, we probably underestimated actual production in the Little Applegate by missing both marked and unmarked fish during those extended periods of trap inactivity. Trap efficiency at the Bear Creek trap was also greatly reduced in April and May due to high streamflows. During high flows the thalweg of the stream shifted away from the trap, leaving the trap in a low velocity area that caused the trap to turn very slowly. Even though we adjusted the Bear Creek trap with changing flow conditions and were able to keep the trap turning for most of the season, we were never able to catch significant numbers of fish. As a result, we could not estimate salmonid production from this stream.

Table 3. 2004 chinook smolt trap efficiencies and population estimates for each trap site.

Stream	Dates Trapped	# Days Trapped	# chinook Captured	# chinook Marked	# chinook Recaptured	Trapping Efficiency	Population Estimate	95% Confidence Interval
Little Butte	3/1 – 6/23	115	48,151	1,622	313	19 %	249,487	223,791 – 275,183
Bear Creek	3/1 – 6/16	106*	913	129	1	0.7 %	NA	NA
West Evans	3/1 – 5/13	74	NA**	NA**	NA**	NA**	NA**	NA**
Elk Creek	3/1 – 6/12	103*	3,934	237	86	36 %	10,837	8,875 – 12,799
L Applegate	3/1 – 6/23	113*	248	168	20	12 %	2,084	1,019 – 3,149
Slate	3/1 – 5/13	74	19,220	91	11	12 %	158,843	32,615 – 285,071

* Trap disabled one or more days by high flows/debris. ** Species is not present in this stream

Timing of Downstream Migration

Peak downstream migration of coho smolts from Little Butte, West Fork Evans and Slate Creeks in 2004 was earlier than in previous years (Figure 13). The earlier outmigration of coho this year may have been the result of rapidly decreasing streamflows during the spring; this may be especially true on West Fork Evans and Slate Creeks, which were so low by mid-May that trapping was discontinued. On Elk Creek, coho outmigration peaked in mid March in 2004, which is similar to the median week of peak outmigration since 2002.

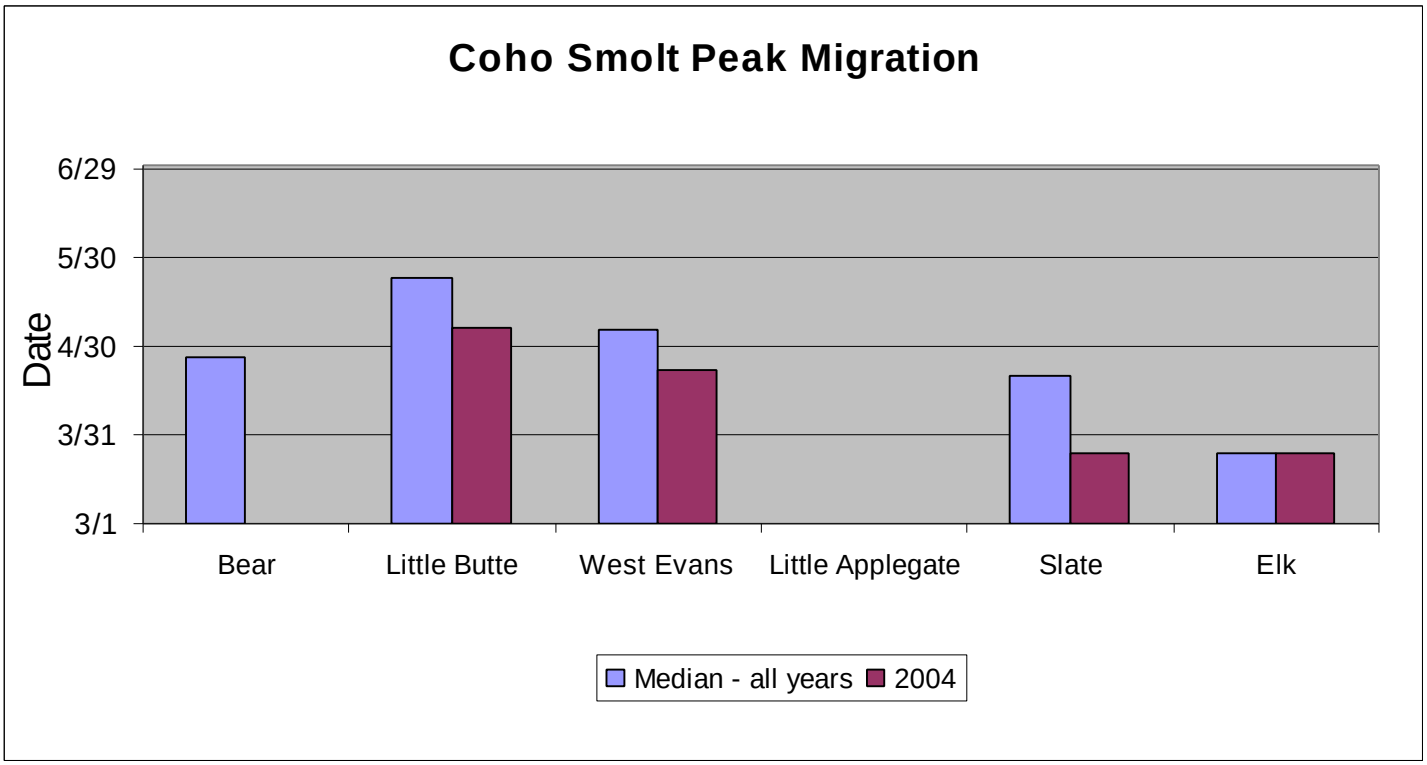

Figure 13. Date of peak week of migration of coho salmon smolts at 6 trap sites.

In 2004, steelhead smolt downstream migration peaks varied between stream basins (Figure 14). In contrast with coho, steelhead migration peaked later than in previous years in West Fork Evans Creek, Little Butte Creek and the Little Applegate River. Steelhead outmigration did peak earlier than in previous years on Slate Creek. In general, peak downstream migration of steelhead occurs by the end of April for most streams, with the exception of Bear and Little Butte Creeks, the two largest drainages, where peak downstream migration occurs in mid May. The timing of peak migration in 2004 was the same as the median peak for all years at Elk Creek. For most trap sites, steelhead downstream migration peaked more than once during the trapping season.

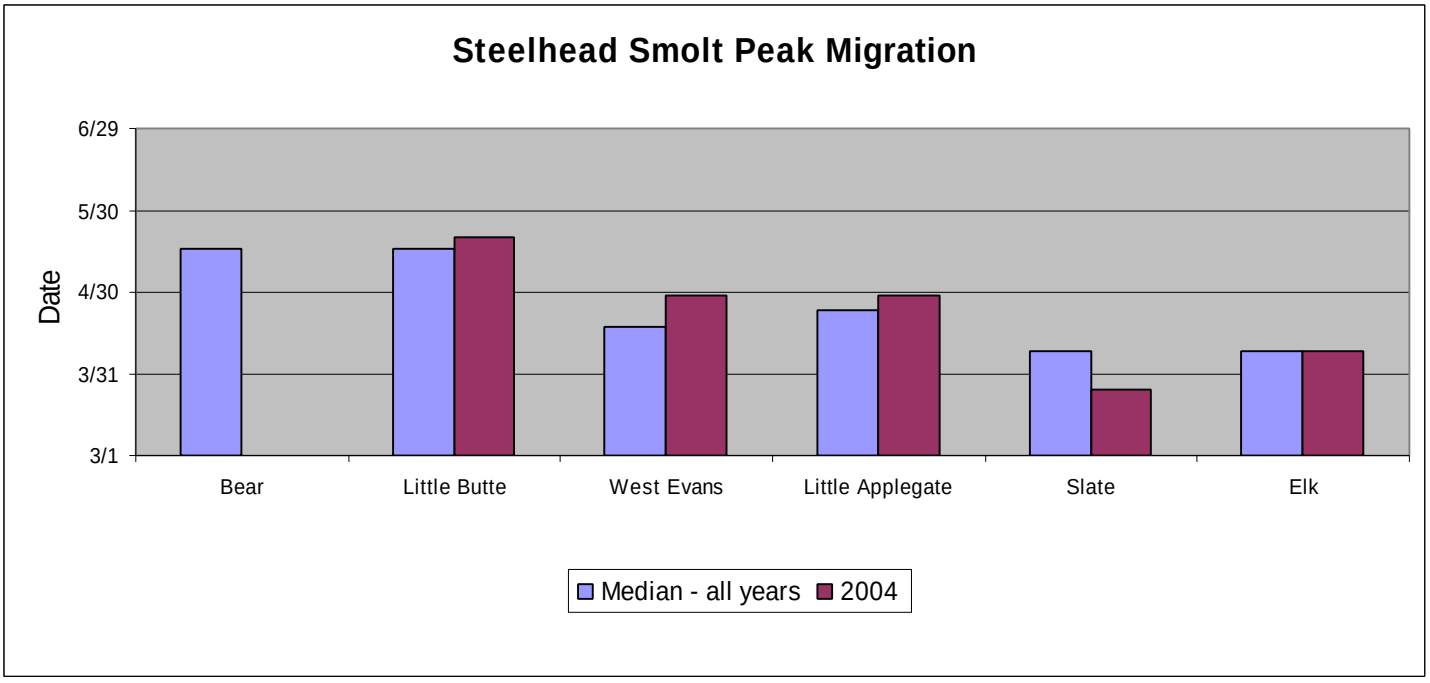

Figure 14. Date of peak week of migration of steelhead smolts at 6 trap sites.

The timing of peak chinook smolt emigration was similar in 2004 to previous years at Elk Creek and the Little Applegate River (Figure 15). Chinook downstream migration peaked peaked earlier this year than in previous years on both Little Butte and Slate Creeks.

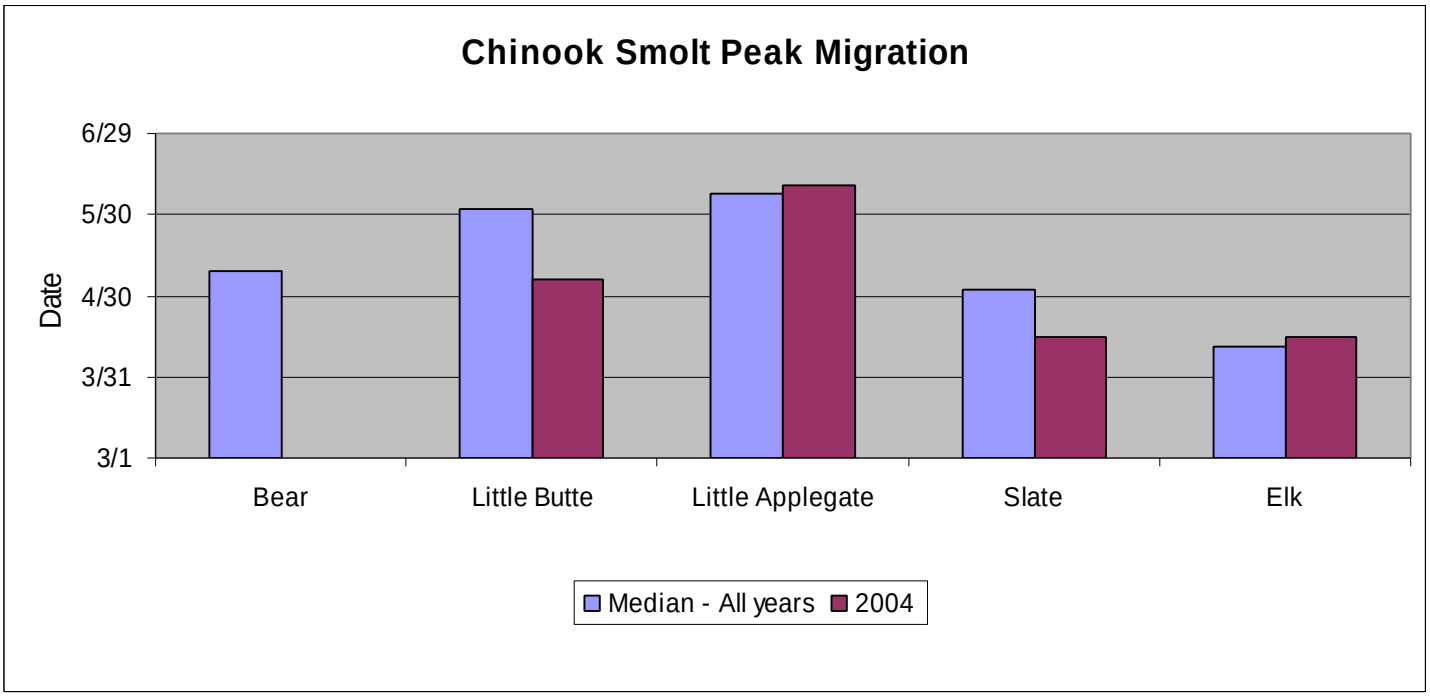

Figure 15. Date of peak week of migration of chinook smolts at 5 trap sites. Chinook are not present in West Fork Evans Creek

Size of Smolts

Mean coho smolt lengths during peak downstream migration were similar this year to previous years (Figure 16). Coho smolt sizes continue to be consistently smaller at West Fork Evans Creek than at other trap sites. In 2004, mean coho smolt lengths were greatest in Little Butte Creek, which is consistent with previous years.

There did not appear to be much variation in the mean length of steelhead smolts between streams in 2004 (Figure 17). Mean steelhead lengths varied from 126 mm at West Fork Evans Creek to 144 mm at Elk Creek. Mean steelhead lengths in 2004 appeared to be smaller in Little Butte and West Fork Evans Creeks than in previous years, while lengths of steelhead in the Little Applegate River and Slate and Elk Creeks in 2004 appeared to be close to the average observed over the last several years; however, no analysis was done to determine if these differences were statistically significant.

In 2003, mean length of chinook smolts during the peak of downstream migration appeared to be related to the timing of peak migration (Vogt 2003). This relationship was also observed in 2004. Chinook from Elk and Slate Creeks were smaller than those from the other streams (Figure 18), and chinook emigration peaked earlier in these streams than in the other streams. Chinook from Little Butte Creek and the Little Applegate River were larger than those from Elk and Slate Creeks, and their downstream migration peaked later in the season. Chinook from Little Butte Creek were, on average, smaller this year than in previous years, and their peak outmigration was earlier this year than in previous years. In general, during years when chinook emigration peaks later in the season, the mean length of chinook smolts is larger.

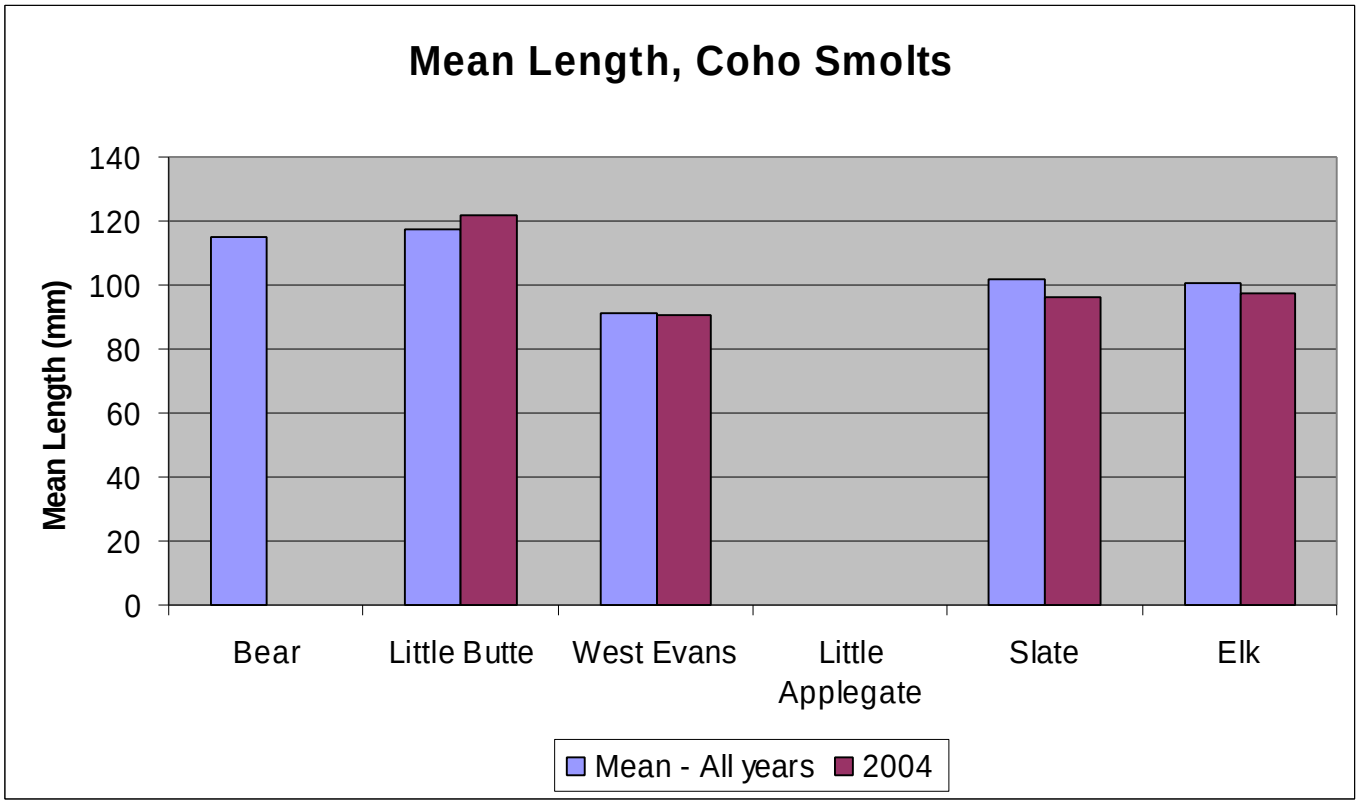

Figure 16. Mean length of coho smolts during the peak week of downstream migration at each trap site.

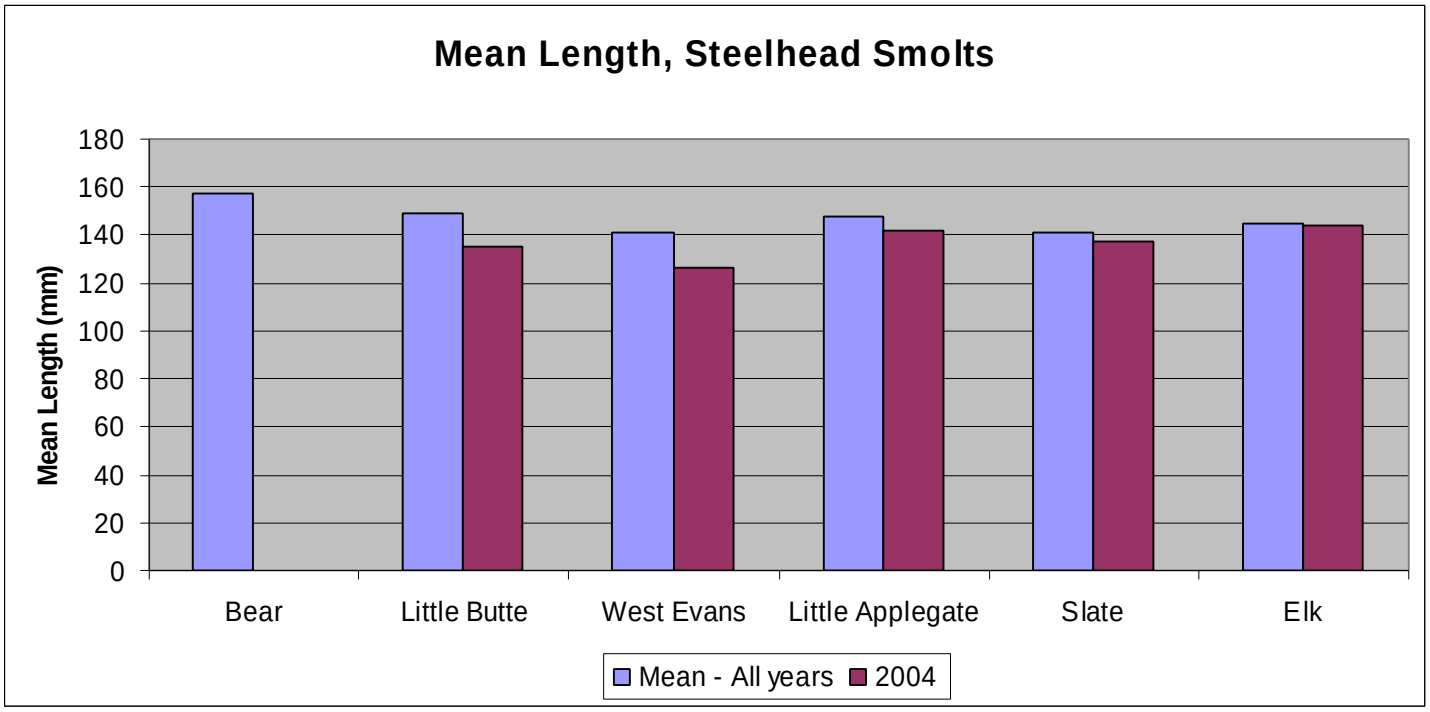

Figure 17. Mean length of steelhead smolts during the peak week of downstream migration at each trap site.

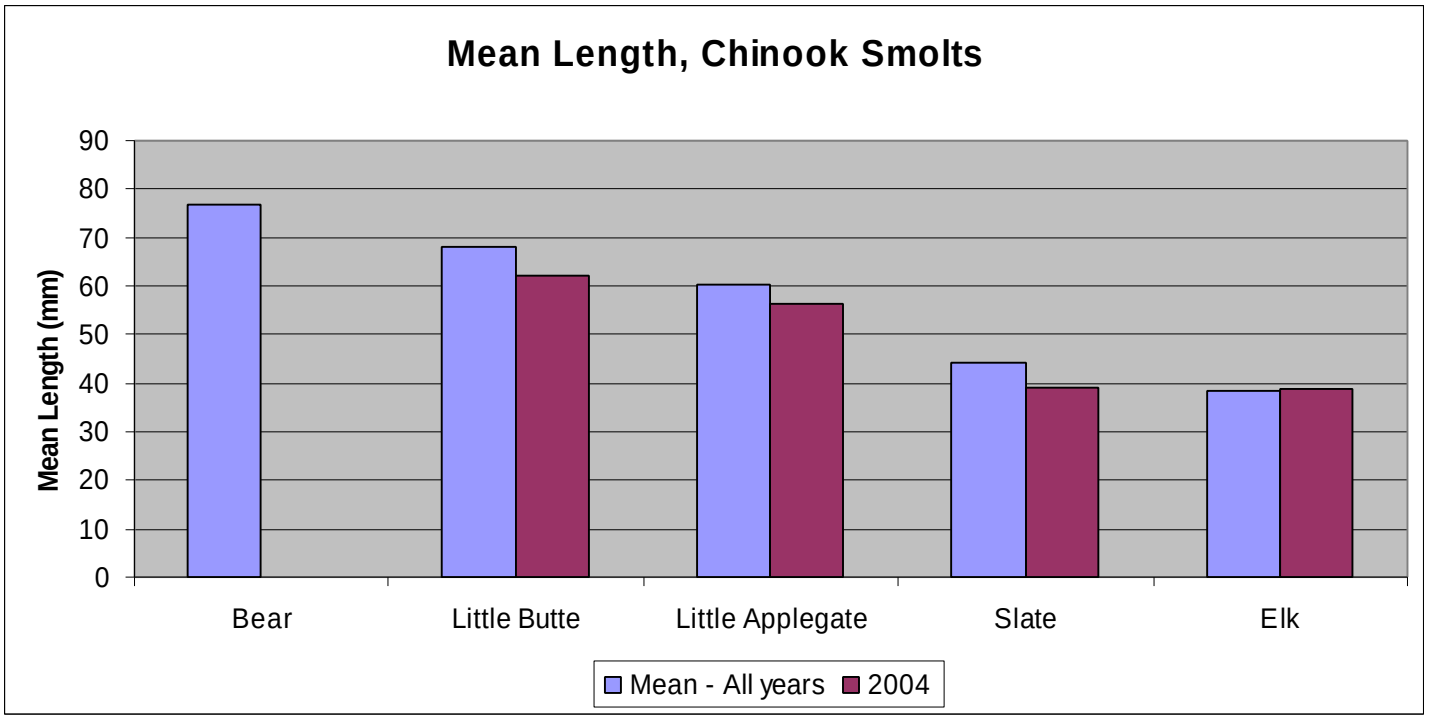

Figure 18. Mean length of chinook smolts during the peak week of downstream migration at each trap site. Chinook are not present in West Fork Evans Creek.

Abundance of Other Species and/or Lifestages

In addition to coho, chinook and steelhead smolts, pre-smolt coho and steelhead, as well as a number of other species, were captured at each trap site. Since coho, steelhead and chinook smolts were assumed to be migrating to the ocean when captured, the mark-recapture technique was used to estimate total smolt production from each stream. However, pre-smolt coho and steelhead captured at each trap may not have been on a sea-ward migration when trapped and were therefore not included in the estimate of smolt production. No production estimates were attempted for cutthroat trout, since the number of cutthroat captured at each trap site was very low, and since it was unknown whether cutthroat captured were resident or migratory fish. In addition, no estimates of lamprey production were attempted. Lamprey ammocetes caught during this study were all assumed to be Pacific lamprey (*Lampetra tridentata*); each of a subsample of lamprey ammocetes taken from several trap sites in 2001 were identified as Pacific lamprey by Dr. Doug Markle of Oregon State University (Jeannine Rossa, BLM, email communication 2001).

Since mark-recapture estimates were not made for pre-smolt coho and steelhead, cutthroat trout and lamprey, the actual number of fish captured at each trap was used as a measure of their abundance in each stream (Table 4).

Table 4. Number of each species/lifestage captured in 2004 for which a mark-recapture estimate was not made.

Species/Lifestage	Little Butte	Bear	West Evans	Little Applegate	Slate	Elk
Coho Fry	2,998	26	219	52	212	363
Trout Fry*	10,141	5	20	308	2	1,105
Steelhead (60-89 mm)	14,245	7	369	304	202	367
Steelhead (90-119 mm)	12,136	0	193	488	187	274
Cutthroat trout (60-89 mm)	1	0	2	1	4	7
Cutthroat trout (90-119 mm)	11	0	19	1	55	18
Cutthroat trout (120-159 mm)	41	0	35	5	119	79
Cutthroat trout ($\geq$ 160 mm)	23	0	4	1	14	29
Pacific Lamprey (Adult)	0	0	0	0	1	2
Lamprey (Ammocetes)	917	2	1	165	42	101

* Steelhead or cutthroat fry under 60 mm were classified as trout fry due to difficulty with identification of species.

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