OREGON DEPARTMENT OF FISH AND WILDLIFE

ROGUE FISH DISTRICT REPORT

TITLE: Upper Rogue Smolt Trapping Project, 2001

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

REPORT DATE: August 2001

AUTHOR: Jerry Vogt

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 Big Butte, Little Butte and West Fork Evans Creeks. In March 1999, the Ashland Ranger District of the U.S. Forest Service became a cooperator in this project, and smolt trap sites in addition to the 1998 sites were selected on Slate Creek, South Fork Big Butte Creek and the Little Applegate River. Trapping at these six sites was continued during the spring of 2000. In 2001, access to the trap site on Big Butte Creek was lost, so a replacement trap site on Bear Creek was selected.

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*) 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. An objective specific to the South Fork Big Butte Creek site was to determine the extent of anadromous fish production above the natural waterfall near the town of Butte Falls. 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, coho and chinook salmon (*O. tshawytscha*).

METHODS

Five-foot rotary screw traps were installed at sites on Bear, South Fork Big Butte, Slate and West Fork Evans Creeks and on the Little Applegate River. These 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. The 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'x4'x8' box trap at the end of the bypass pipe to intercept fish as they returned to the stream.

The trapping period for all six sites was March 1 – June 30. However, the Slate and West Fork Evans Creek traps were removed during the first week of May due to streamflows that were too low to operate the traps. The remaining four traps were removed June 24 due to low streamflows and extremely low catches of steelhead and coho smolts. Each trap was operated 7 days per week.

Fish at each trap site were collected from the trap daily, 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. Each day, a subsample of all fish over 60 mm was marked with a caudal fin clip. A minimum of 25 fish of each species and life stage (fish over 60 mm) 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.

For the subsample of steelhead that were measured, fish over 90 mm in length were given a qualitative designation based on the appearance of characteristics of the smoltification process. Fish that appeared uniformly silvery in color with faded parr marks were classified as "silver"; fish that had partially faded parr marks and had begun to become more silvery in color were classified as "partially silver". Fish that did not show any of these "smolt-like" characteristics were classified as "not silver".

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%), 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 (*O. clarki*). 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 27 miles of streams in the basin; steelhead spawn and rear in approximately 94 miles of habitat.

South Fork Big Butte Creek

The smolt trap site on South Fork Big Butte Creek was located at approximately RM 2.6 near the town of Butte Falls (Figure 2). A natural waterfall at RM 1.6 is an apparent migration barrier for anadromous fish at most streamflows. There are anecdotal data that suggest adult steelhead and coho salmon are able to migrate over the falls at high flows. This trap site was selected to determine the extent of anadromous fish production above these falls. In addition to use by anadromous fish populations, this stream is used by resident cutthroat and rainbow trout. The number of miles of habitat used by coho and steelhead in this stream has not been quantified.

The South Fork Big Butte Creek drains 92,379 acres in the Upper Big Butte Creek basin (USFS 1995, BLM 1995a). Most of this area is in federal ownership (BLM – 8%; USFS – 60%); the remaining lands are owned by timber companies (26%), private landowners (3%) and the Medford Water Commission (3%).

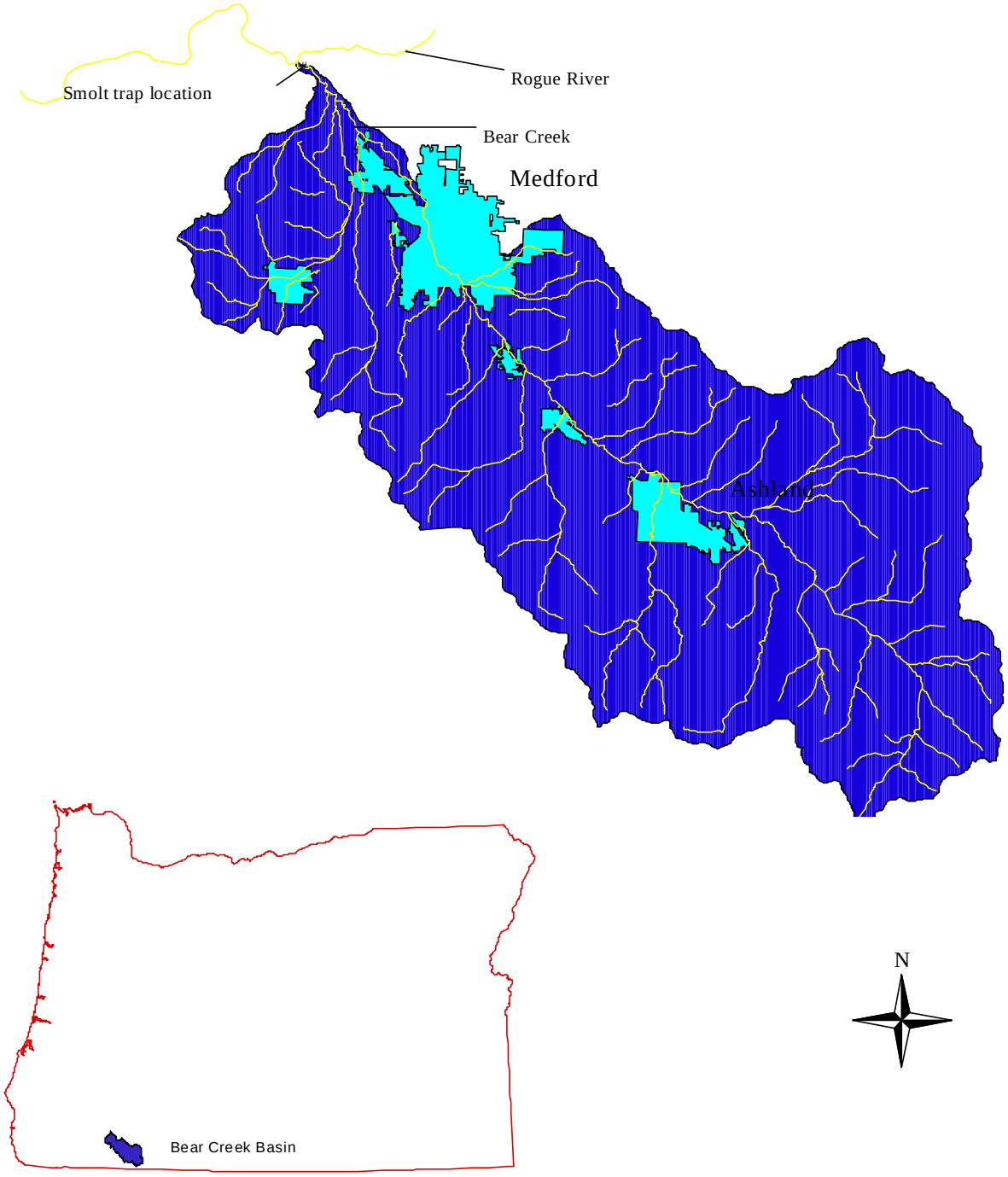

Figure 1. Smolt trap location on Bear Creek.

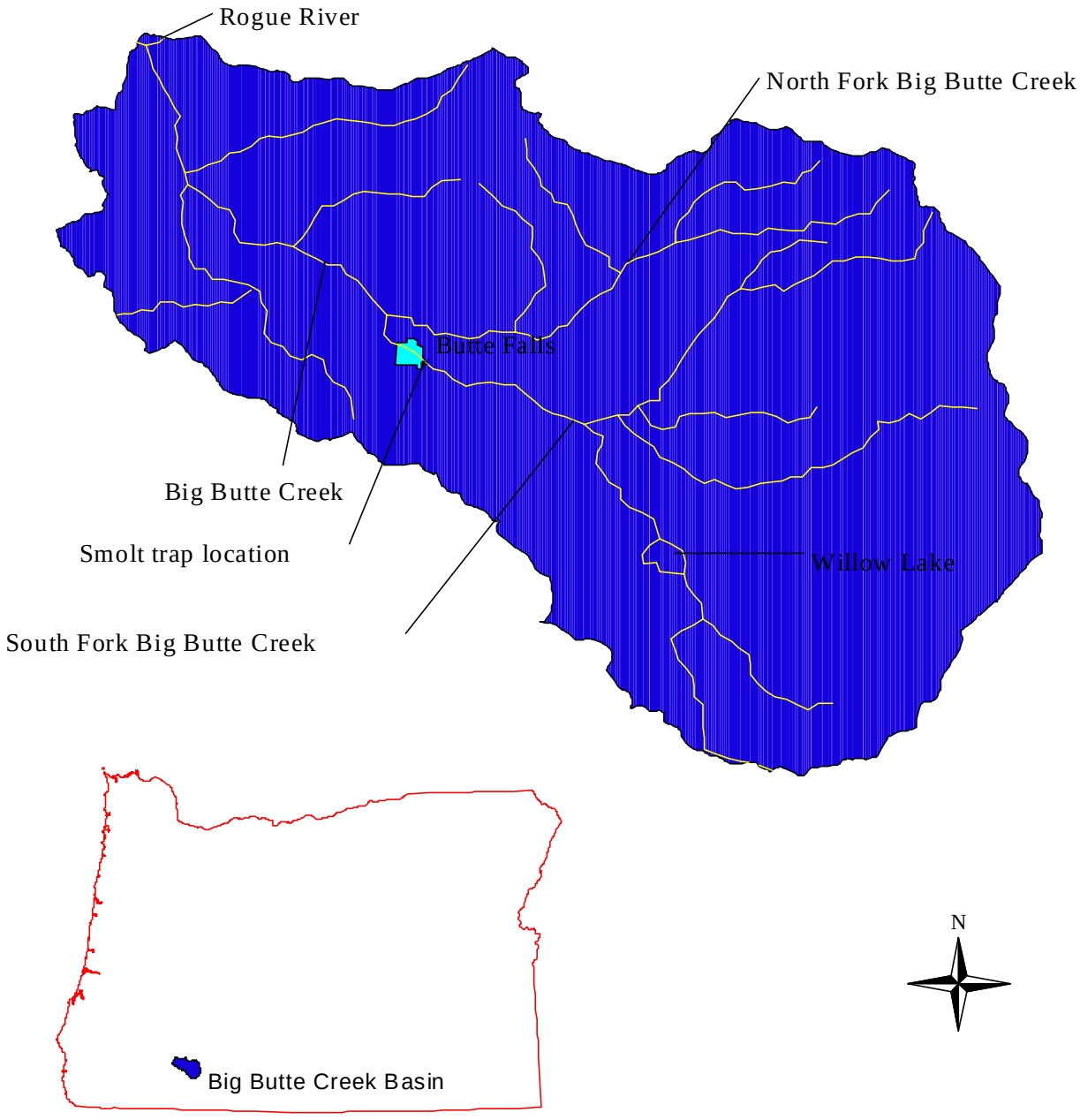

Figure 2. Smolt trap location on South Fork Big Butte Creek.
Little Butte Creek

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).

Anadromous fish species present in the Little Butte Creek basin include chinook salmon, 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 46 and 84.5 miles of spawning and rearing habitat for coho salmon and steelhead, respectively.

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 18.6 and 25.2 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 21 and 26 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 3. Smolt trap location on Little Butte Creek

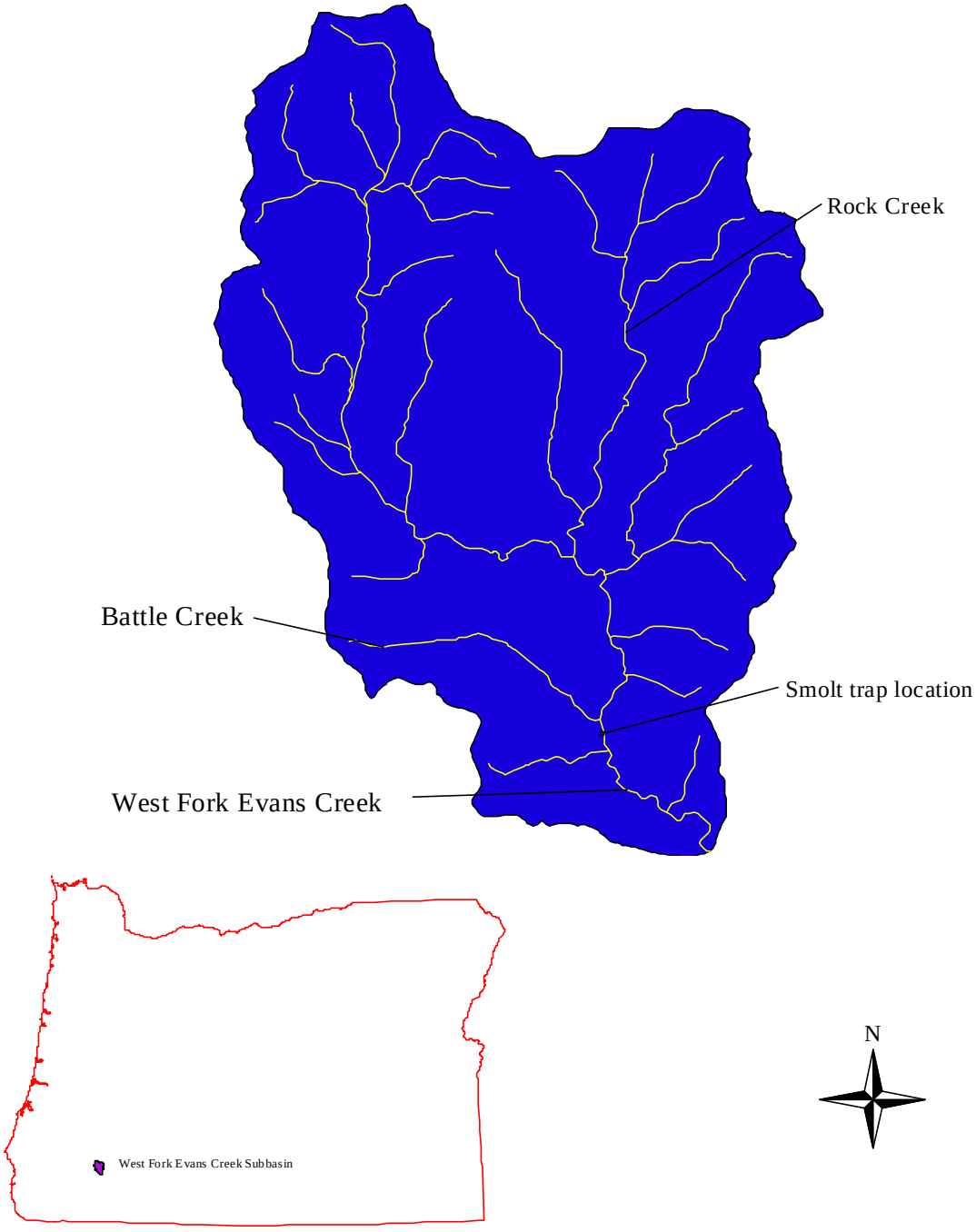

Figure 4. Smolt trap location on West Fork Evans Creek.

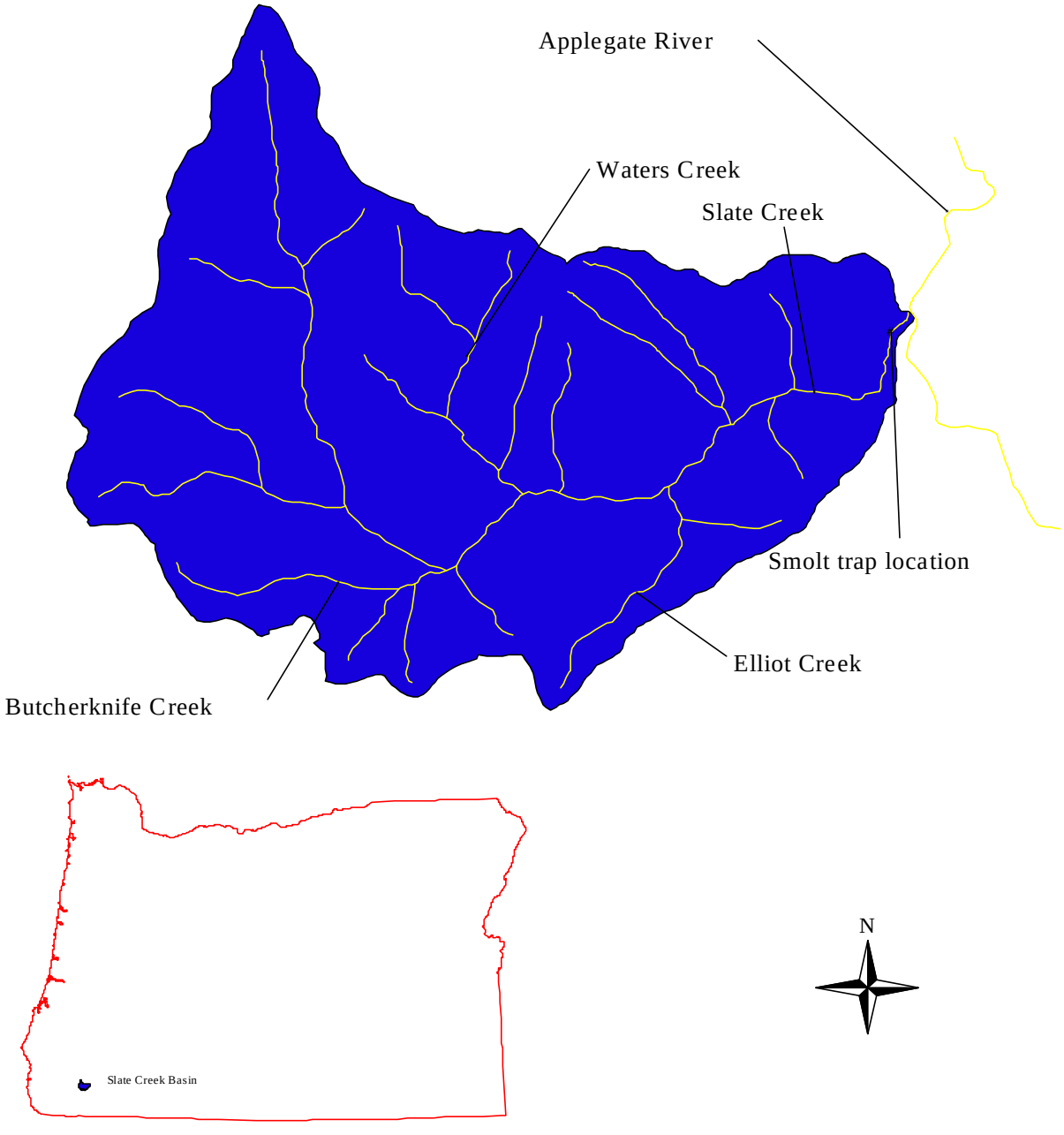

Figure 5. Smolt trap location on Slate Creek.
Little Applegate River

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 36 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).

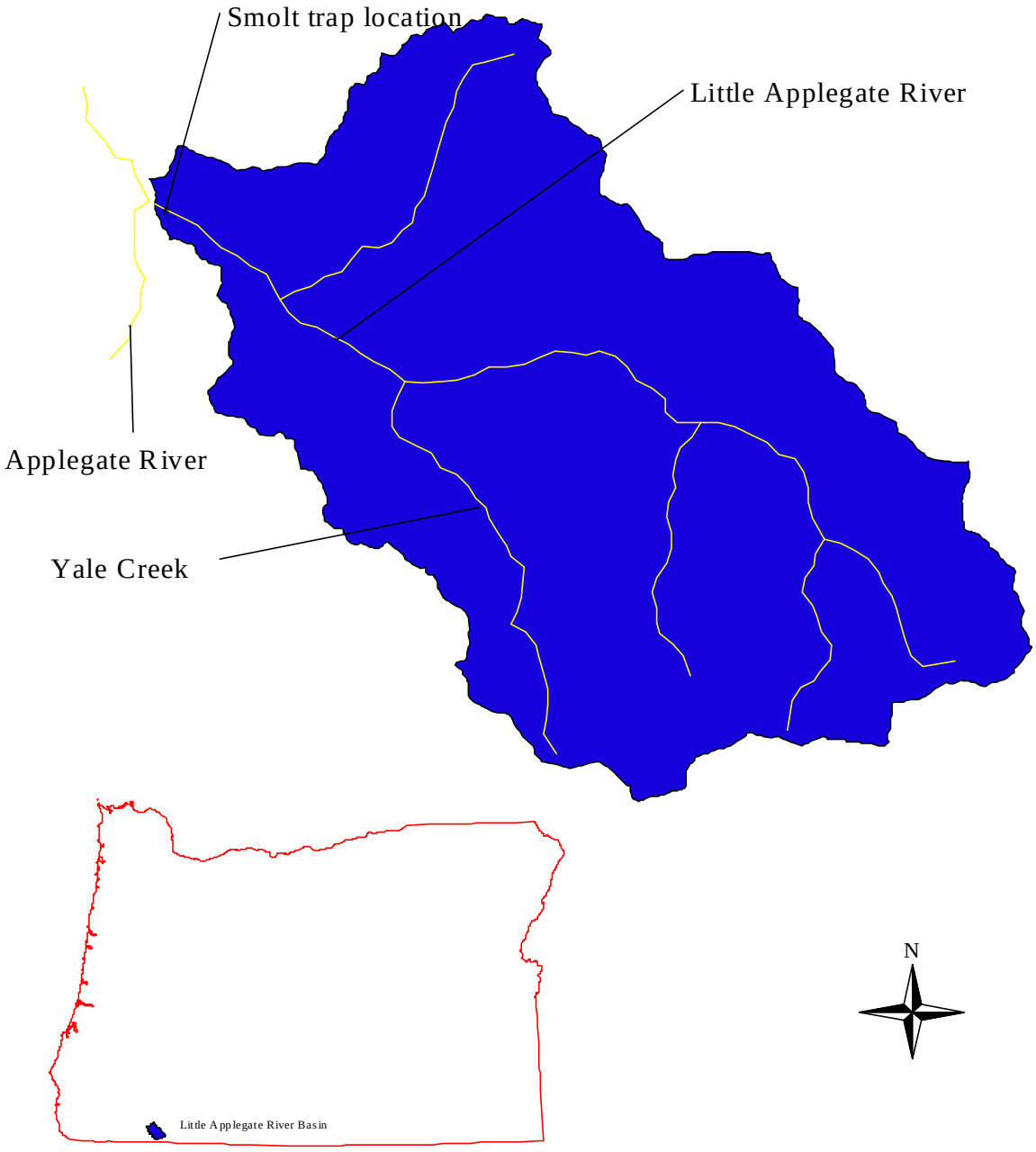

Figure 6. Smolt trap location on the Little Applegate River.

RESULTS AND DISCUSSION

Smolt Production Estimates

Trap efficiencies for coho smolts ranged from 0% at the Little Applegate River trap to 35% at the Little Butte Creek trap (Table 1). Trap efficiency for coho smolts at Slate Creek was 11%; however, only 9 fish were caught and marked and only one marked fish was recaptured. No coho smolts were captured at the South Fork Big Butte or West Fork Evans Creek traps. Little Butte Creek had the highest estimate of coho smolt production of the six streams sampled (Figure 7). The 95% confidence interval about the estimate for the Little Butte Creek trap was narrow (± 7.8%), indicating that this estimate is very good.

Table 1. 2001 coho smolt trap efficiencies for each trap site.

Stream	Dates Trapped	# Days Trapped	# Coho Captured	# Coho Marked	# Coho Recaptured	Trapping Efficiency
Little Butte	3/1 - 6/24	116	3,484	1,409	491	35 %
Bear	3/1– 6/24	116	27	26	7	27 %
West Evans	3/1 – 5/3	64	0	0	0	NA
S.Fork Big Butte	3/1– 6/24	116	0	0	0	NA
Little Applegate	3/1 – 6/24	116	1	1	0	0 %
Slate	3/1 – 5/3	64	9	9	1	11 %

Coho smolt production estimates at Little Butte Creek in 2001 were lower than those for the previous 2 years, although the 2001 estimate did not appear to be significantly lower than the 2000 estimate (Figure 7). Coho smolt estimates for the remaining sites were all lower in 2001 than in previous seasons. This is misleading for the West Fork Evans and Slate Creek traps, however, because low flows that prevented these traps from operating correctly produced estimates that probably do not reflect true population numbers. Juvenile salmonids were observed in both of these streams, but the West Fork Evans Creek trap did not catch a single fish during the entire season, and the Slate Creek trap caught very few fish during the limited time that that trap worked properly. The coho smolt estimate for Bear Creek was low (100 fish), but there were no previous data with which to compare this estimate. No coho fry or smolts were captured at the South Fork Big Butte Creek trap in 2001, indicating that coho adults have not successfully spawned above the falls near Butte Falls for the last two brood years.

Coho smolt estimates were much higher at Little Butte Creek during the past 3 years than they were in 1998 (Figure 7). This is consistent with the three years of trapping results at Big Butte Creek (Vogt 2000). Coho smolts migrating in 1998 were the offspring of the 1996 brood year, which spawned during the fall/winter of 1996. The eggs from these adult fish were incubating when the New Year's Day flood of 1997 occurred in the Rogue Basin. The low number of smolts captured in 1998 may have been the result of poor survival of coho eggs and fry caused by that flood event.

In two of the last four years, the Little Butte Creek trap site has produced the highest estimates of coho smolts. Big Butte Creek is the only stream that has produced a higher coho smolt estimate during that period (Vogt 2000). Smolt production estimates from Little Butte Creek indicate that this stream basin is one of the better coho-producing watersheds in the Rogue Basin. The Little Applegate River and Slate and West Fork Evans Creeks continue to produce much lower numbers of coho smolts than did Little Butte Creek. However, the low

(or non-existent) trap catches at the latter two sites due to extremely low streamflow conditions are not good indicators of the actual number of coho smolts in those streams. In its first year of operation, the Bear Creek trap produced a low estimate of coho smolts when compared with catches from Little Butte Creek.

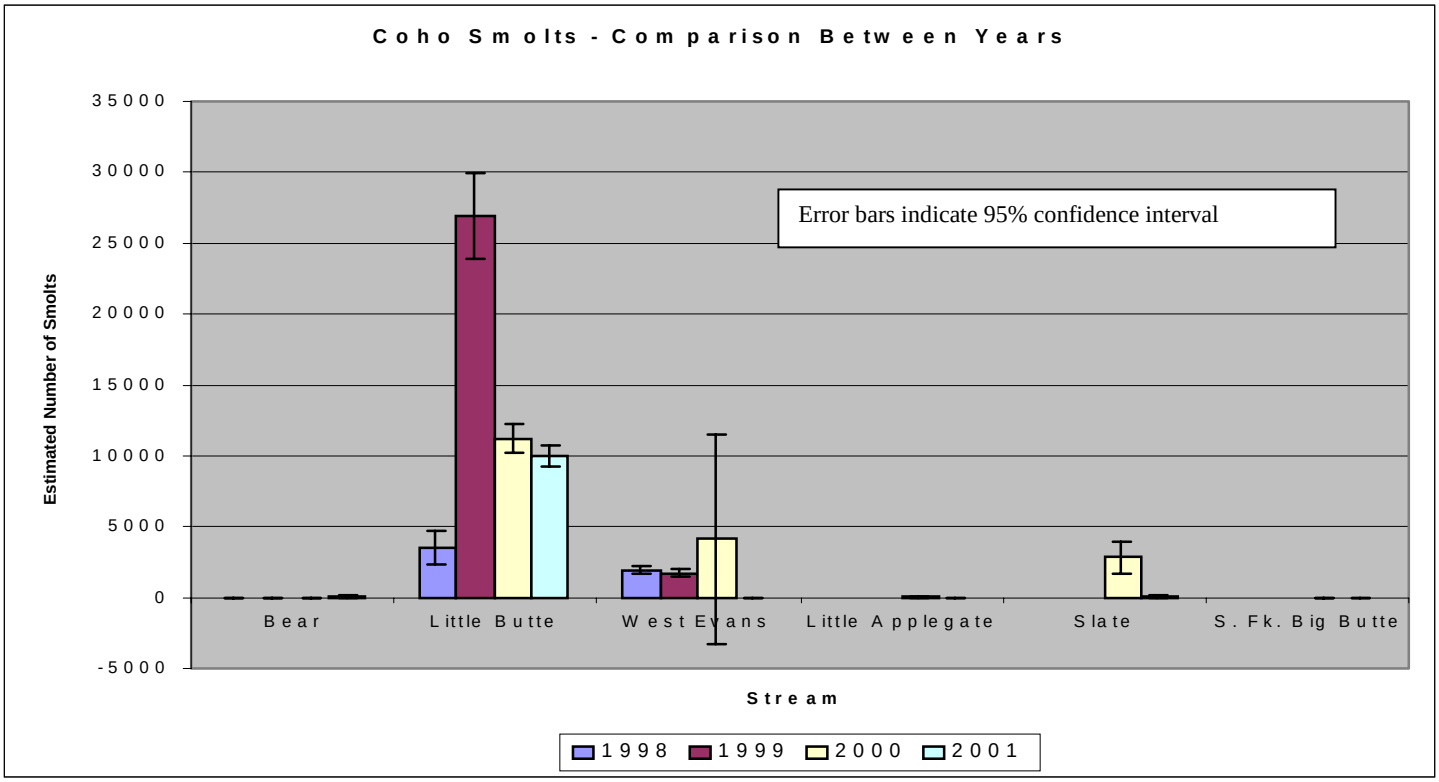

Figure 7. Between-year comparison of coho smolt estimates at each trap site (1998-2001).

Steelhead smolt estimates in 2001 were similar to those in 2000 at the Little Butte Creek and Little Applegate River sites (Figure 8). No steelhead smolt estimates could be made at West Fork Evans Creek or at Slate Creek in 2001. The South Fork Big Butte trap produced a low estimate for the abundance of steelhead smolts this year; this was an increase over past years when no estimate could be made due to the lack of recaptures of marked fish. During its first year of operation, the Bear Creek trap produced a relatively high estimate of steelhead smolts and due to the good capture efficiency of the trap, this estimate had relatively tight confidence intervals (± 16.5%).

Of the six streams in this study, Little Butte and Bear Creeks produced the highest number of steelhead smolts in 2001 (Figure 8). Trap efficiency for steelhead smolts was very good at these two sites (Table 2). Over the last several years, Little Butte Creek has consistently produced more steelhead smolts than any other stream included in our trapping study (Figure 8). The only exception to this was in 1999 when Big Butte Creek produced slightly more steelhead smolts (Vogt 1999). As with coho, these results indicate that the Little Butte Creek watershed is an important steelhead-producing watershed in the Rogue Basin. No steelhead smolts were captured at the West Fork Evans Creek trap, and no marked fish were recaptured at the Slate Creek trap. Trap efficiencies for steelhead smolts at the Little Applegate and South Fork Big Butte Creek sites were low, yielding estimates with relatively wide confidence intervals (± 52% and ± 85%, respectively).

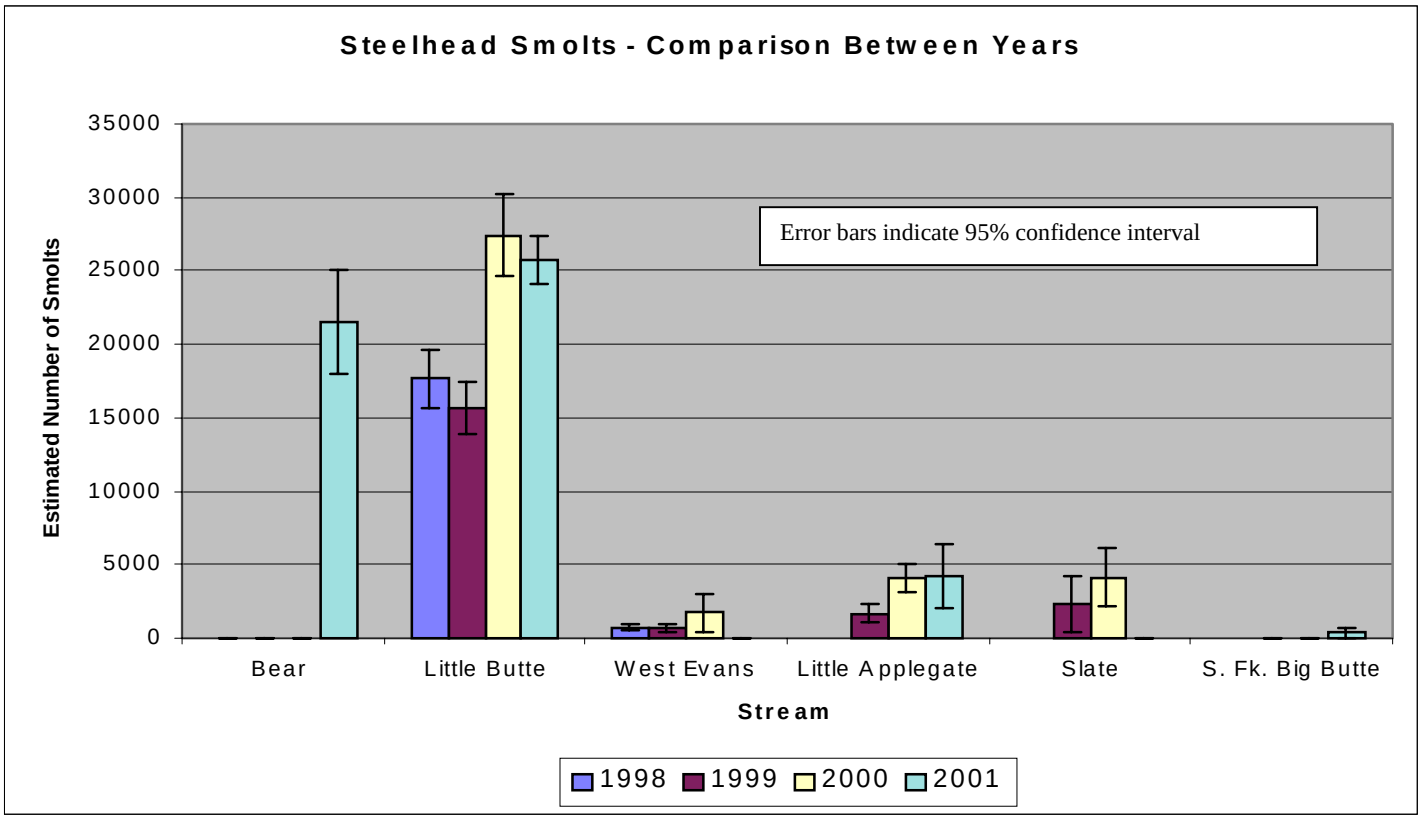

Figure 8. Between-year comparison of steelhead smolt estimates at each trap site (1998-2001).

Table 2. 2001 steelhead smolt trap efficiencies for each trap site.

Stream	Dates Trapped	# Days Trapped	# St Captured	# St Marked	# St Recaptured	Trapping Efficiency
Little Butte	3/1 - 6/24	116	8,166	2,375	752	32 %
Bear	3/1– 6/24	116	2,447	1,270	145	11 %
West Evans	3/1 – 5/3	64	0	0	0	NA
S.Fk Big Butte	3/1– 6/24	116	19	19	1	5 %
Little Applegate	3/1 – 6/24	116	305	303	22	7 %
Slate	3/1 – 5/3	64	6	6	0	0

Because the amount of habitat for coho and steelhead differs between stream systems, I compared the production of each species between streams by calculating the estimated number of coho and steelhead smolts per mile of habitat available. On a fish-per-mile basis, Little Butte Creek produced the highest number of coho smolts (Table 3). For steelhead, Little Butte Creek produced the highest number of smolts per mile, followed by Bear Creek and the Little Applegate River.

Table 3. Comparison of estimated number of coho and steelhead smolts per mile of habitat (2001 season).

Stream	Coho	Steelhead
Little Butte	217.6	304.9
Bear	3.7	229.6
West Evans	NA	NA
Little Applegate	NA	116.1
Slate	3.9	NA
South Fork Big Butte	NA	NA

Timing of Downstream Migration

Downstream migration of coho smolts from Little Butte Creek in 2001 was similar to previous years (Figure 9). Since 1998, coho smolt migration at each trap site has generally peaked between late April and late May. Coho smolt migration on Bear Creek peaked about 4 weeks earlier than Little Butte Creek; however, this is based on a very small number of coho in Bear Creek.

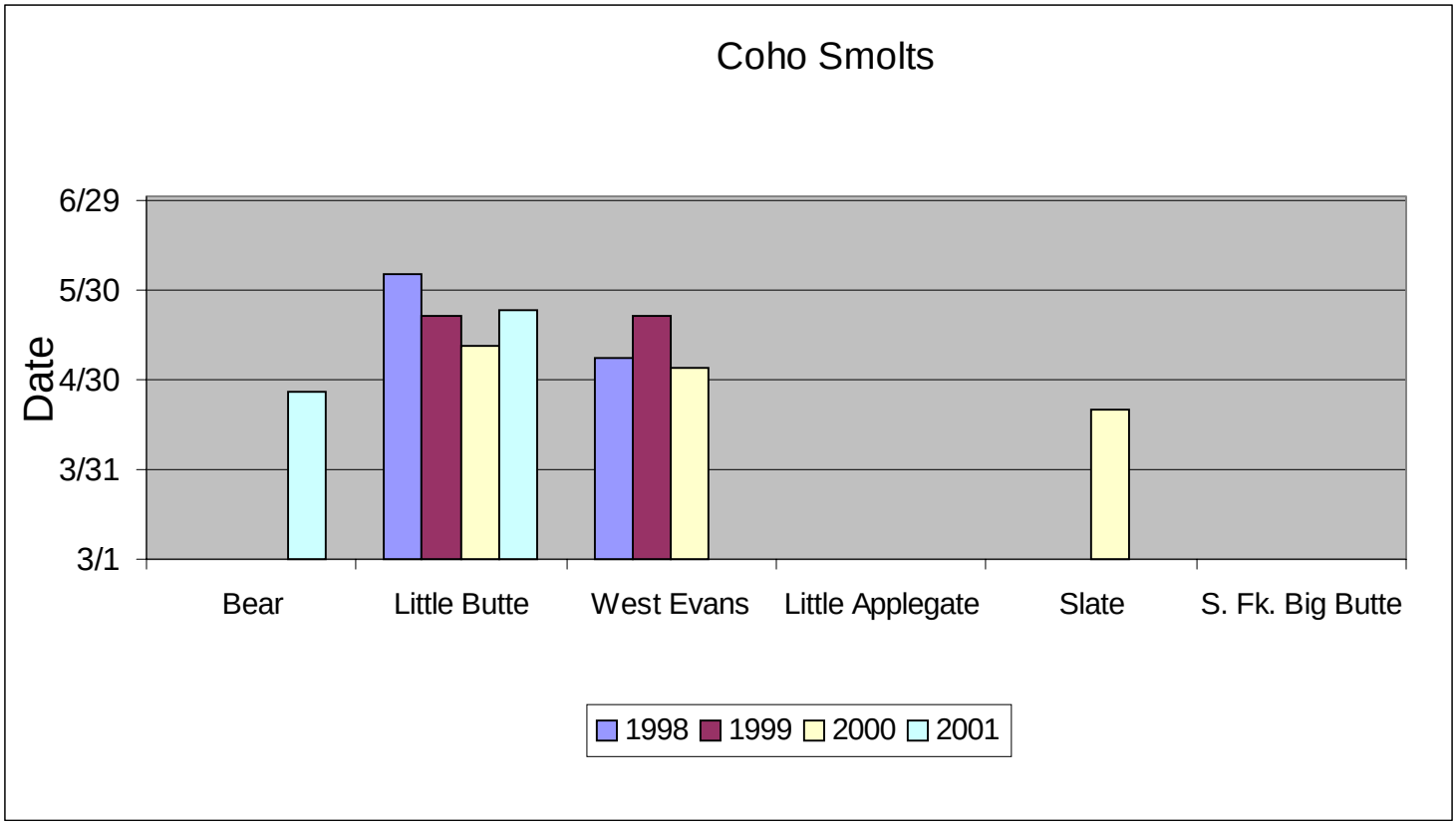

Figure 9. Date of peak week of migration of coho salmon smolts at 6 trap sites 1998-2001.

In 2001, steelhead smolt outmigration peaks were similar on Bear Creek and Little Butte Creek (Figure 10). Steelhead migration peaked earlier on South Fork Big Butte Creek and the Little Applegate River. At Little Butte Creek and the Little Applegate River, steelhead downstream migration peaked earlier in 2001 than in

previous years. With a few exceptions, steelhead downstream migration appears to peak at these sites between mid April and late May.

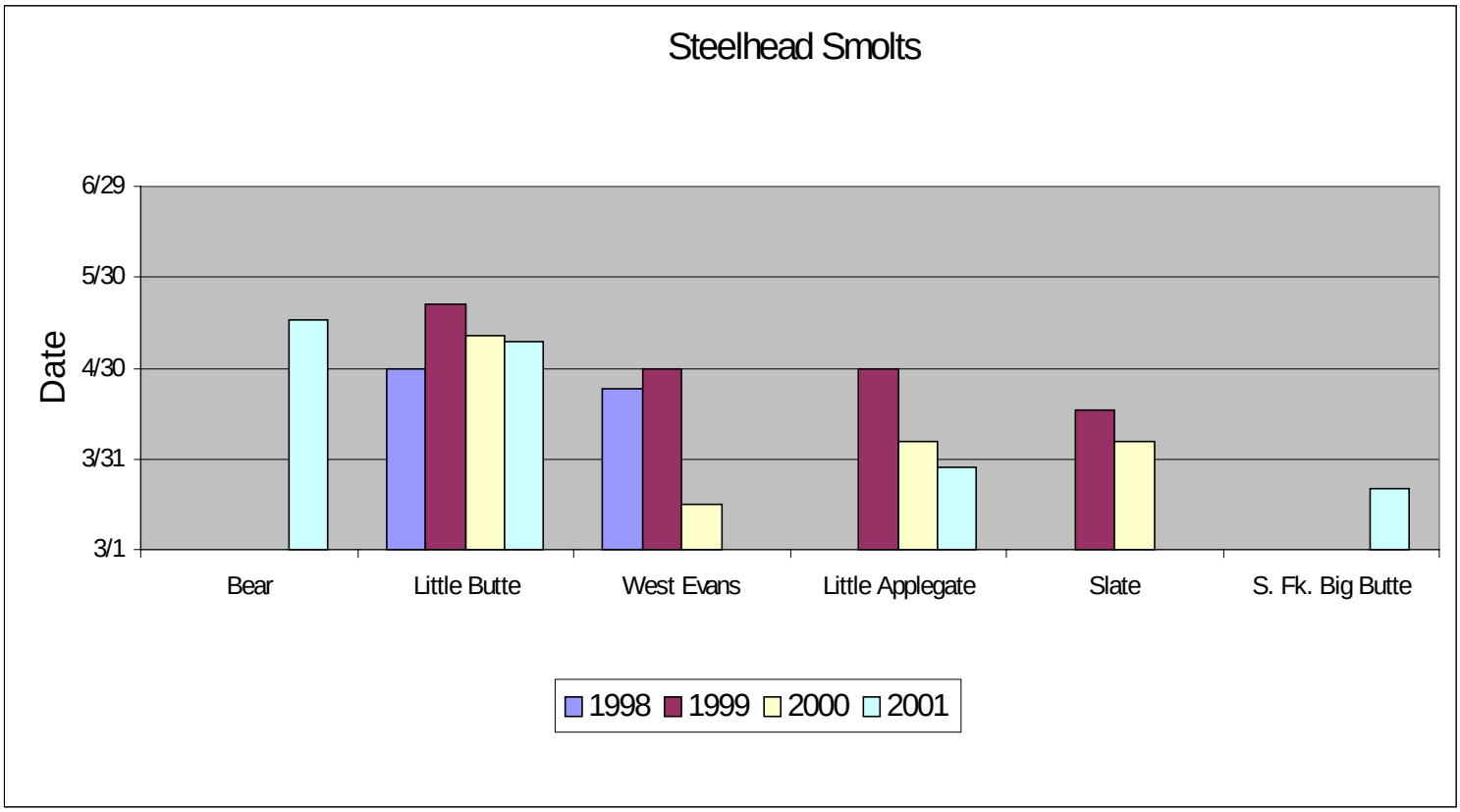

Figure 10. Date of peak week of migration of steelhead smolts at 6 trap sites 1998-2001.

Size of Smolts

Mean coho smolt lengths during peak migration are fairly similar between years at each site (Figure 11). Mean lengths of coho smolts in 2001 were larger for Little Butte Creek and Bear Creek than at the other trap sites. Coho smolt sizes are consistently smaller at West Fork Evans Creek than at other trap sites.

Steelhead smolt lengths were fairly consistent between years at the Little Butte Creek and Little Applegate River sites, although there seemed to be a slight drop in smolt lengths in 2001 when compared with previous years (Figure 12). In 2001, mean lengths of steelhead smolts ranged from 136 mm in South Fork Big Butte Creek to 150 mm in Bear Creek.

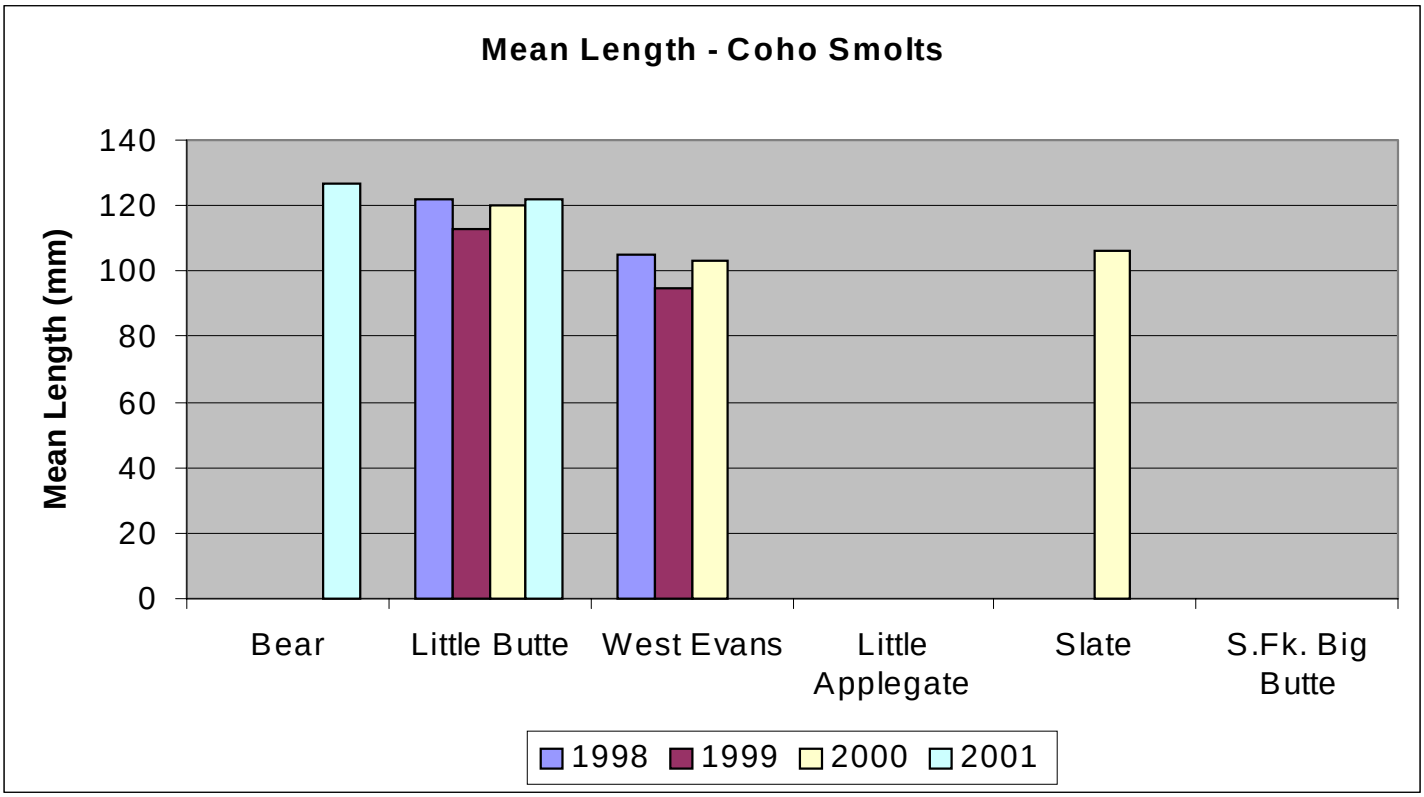

Figure 11. Mean length of coho smolts during the peak week of downstream migration at each trap site (1998-2001).

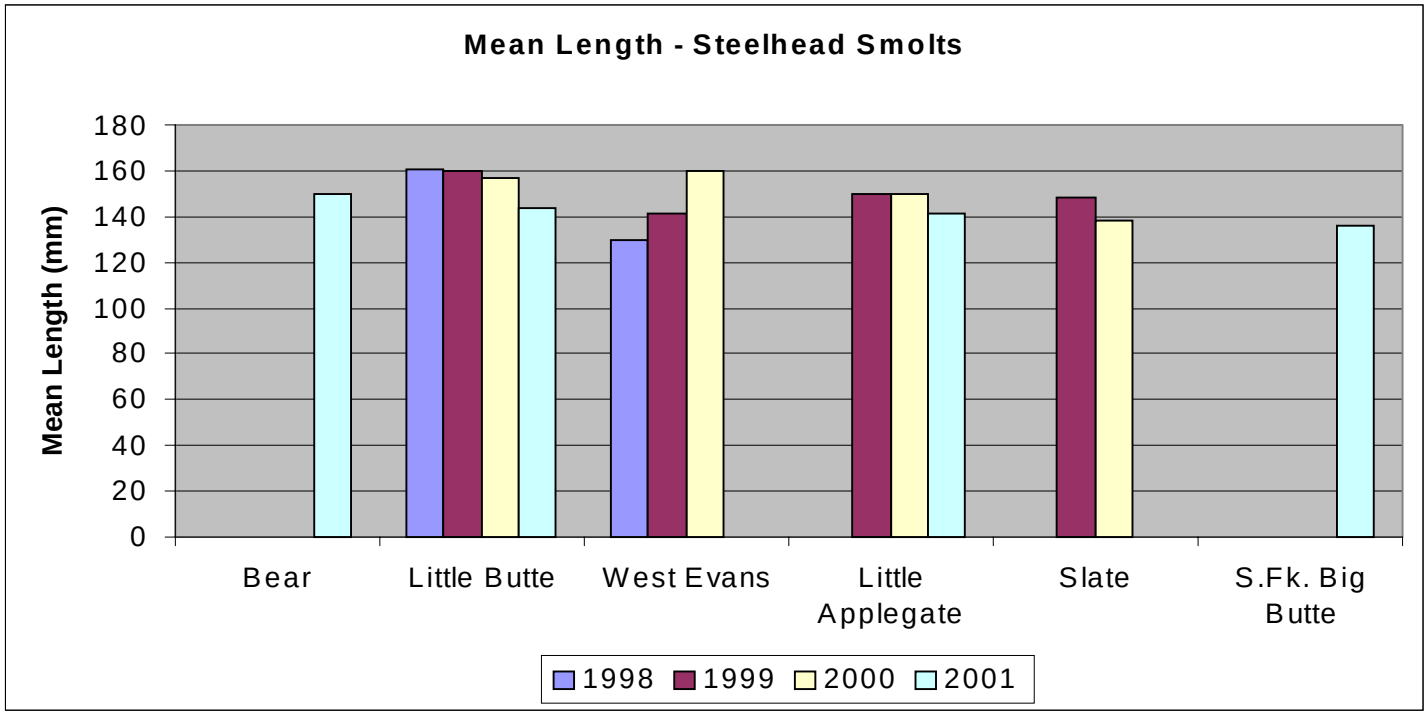

Figure 12. Mean length of steelhead smolts during the peak week of downstream migration at each trap site (1998-2001).

Abundance of Other Species and/or Lifestages

In addition to coho salmon and steelhead smolts, pre-smolt coho and steelhead, as well as a number of other species, were captured at each trap site. Since coho and steelhead 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. Chinook salmon, which begin to smolt and migrate to the ocean as 0+ fish, were captured at four of the trap sites and an estimate of chinook smolt production could have been made with the mark-recapture technique used in this study. However, since chinook fry at the beginning of the season were under 60 mm in length, we did not mark them and therefore could not estimate trapping efficiency for those fish. 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; each of a subsample of lamprey ammocetes taken from several trap sites were identified as Pacific lamprey by Dr. Doug Markle of Oregon State University (Jeannine Rossa, BLM, email communication).

Since mark-recapture estimates were not made for pre-smolt coho and steelhead, chinook salmon, 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). The numbers of chinook captured at the Little Butte and Bear Creek traps were particularly high in 2001. Over 100,000 chinook were caught in the Little Butte Creek trap compared with about 8,700 in 2000 (Vogt 2000), 2,400 in 1999 (Vogt 1999) and 2,700 in 1998 (Vogt 1998). Chinook numbers caught at these two traps far exceed the highest number of chinook caught at any trap in the 3 previous years of this study.

Table 4. Number of each species/lifestage captured in 2001 for which a mark-recapture estimate was not made.

Species/Lifestage	Little Butte	Bear	West Evans	Little Applegate	Slate	South Fk. Big Butte
Coho Fry	23,341	0	0	226	6	0
Trout Fry*	16,992	14	0	238	0	5
Steelhead (60-89 mm)	2,340	72	0	1,063	0	20
Steelhead (90-119 mm)	11,554	518	0	830	0	28
Cutthroat trout (60-89 mm)	1	0	0	0	0	2
Cutthroat trout (90-119 mm)	4	0	0	0	0	12
Cutthroat trout (120-159 mm)	33	0	0	1	1	4
Cutthroat trout (≥ 160 mm)	24	3	0	0	0	7
Chinook	100,350	47,532	0	2,793	1	0
Pacific Lamprey (Adult)	4	10	0	2	1	0
Lamprey (Ammocetes)	4,034	6,710	0	136	34	0

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

ACKNOWLEDGMENTS

I would like to thank the Oregon Watershed Enhancement Board for providing funding for this project. I would also like to thank the Upper Rogue, Applegate and Little Butte Creek Watershed Councils for co-sponsoring this project and Lu Anthony for administering the OWEB grant. The Butte Falls Resource Area of the Bureau of Land Management provided three of the rotary screw traps and labor for trap operation. The Ashland Ranger District of the Rogue River National Forest provided one of the rotary screw traps and assisted with trap operation. The irrigation ditch bypass trap was provided by the ODFW Fish Screening program. Thanks also go to Rogue Aggregates, Inc., Mrs. Gemmrig, The Applegate Tree Farm, Phillip Boersma and Indian Hill LLC for allowing us access to their properties for trapping.

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