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2000 Prairie Creek Downstream Migration Study
HSU Cooperative Fishery Research Unit

Catch effort summary from October 12, 1999 through November 8, 2000.

1999
10-17

CDFG Files-SCP
Draft Data

Species	Upper Prairie Creek Fyke Trap			Middle Creek Fyke Trap			Boyes Creek Fyke Trap		
	catchtotal	mortality	(%)	catchtotal	mortality	(%)	catch total	mortality	(%)
0+ Coho	0	0	0.00	0	0	0.00	0	0	0.00
1+ Coho	276	34	12.32	59	1	1.69	33	4	12.12
1+ Chinook	4	0	0.00	1	0	0.00	0	0	0.00
Cutthroat	17	1	5.88	4	0	0.00	3	0	0.00
Steelhead	0	0	0.00	0	0	0.00	0	0	0.00
1+ Trout	23	1	4.35	4	0	0.00	14	0	0.00
0+ Trout	0	0	0.00	0	0	0.00	0	0	0.00
Ammocetes	5	0	0.00	3	0	0.00	3	0	0.00
B. Lamprey	41	0	0.00	1	0	0.00	0	0	0.00
P. Lamprey	2	0	0.00	0	0	0.00	0	0	0.00

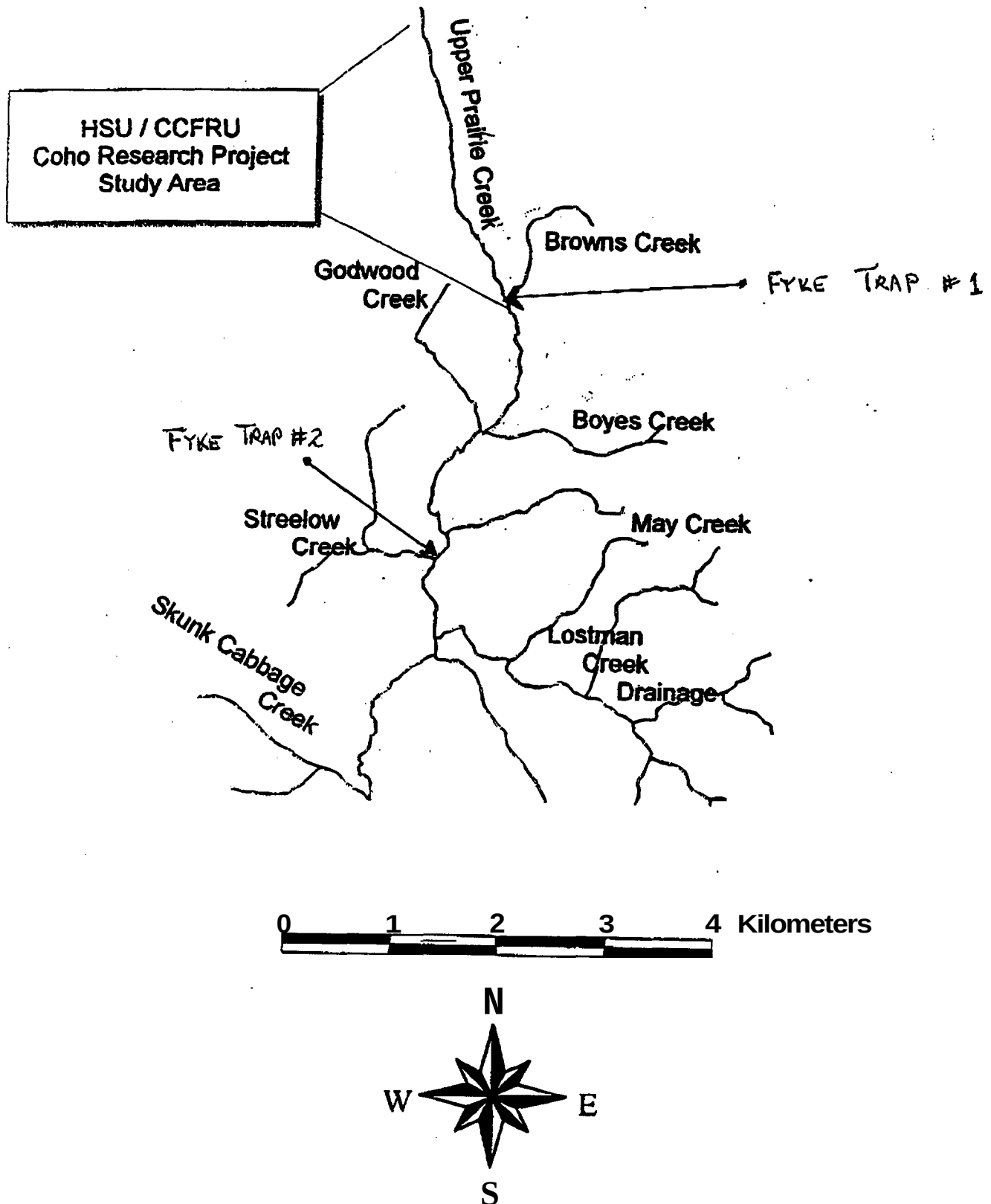
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Figure 1

Site map of upper prairie creek Drainage, Northern California. Taken from the Klamath Basin Bioregional Assessment.

Upper Prairie Creek Drainage



Interim Report, December 1999

Over-summer **and** over-winter survival **of** coho salmon in northern California streams of **varying** habitat quality.

Prepared by: **Kyle Brakensiek**

The **following** is part **of** an interim report **on** research efforts by the California Cooperative Fishery Research Unit at Humboldt State University to **determine** the effects of habitat quality on Coho salmon (*Onchorhynchus kisutch*) survival rates in **northern** California coastal **streams**. Research objectives include abundance, distribution **and** survival estimates of juvenile coho salmon in Prairie, **Streelaw**, and Boyes Creek, all located within Redwood National **and** State Park. **This** report will be presented in **three** parts. **One**, downstream migrant fish trapping **efforts and** results. **Two**, methods and estimates of over-winter survival of coho **salmon** in upper Prairie Creek **for** the 1998-99 season, **and** three, methods **and** estimates of over-summer distribution, density and survival of juvenile coho **salmon** in the **above** mentioned creeks for the summer of 1999. Presented results are insightful but should be considered preliminary.

Over-Winter Downstream Fish Trapping

Downstream migrant **fishtraps** were set **and** operated throughout **the** winter and **summer** months **of 1999** in **Boyes**, Streelaw and **Prairie** Creek. During winter and spring months, traps were operated continuously except during periods of high **flow** **and** **trap** repair. Traps were operated intermittently on **a** weekly basis throughout the summer. Catch totals provide relative measures of movement but do not in themselves indicate **fish** abundance. Catch totals provided in Table 1 are through October 11, **1999**.

Streelaw Creek

A downstream migrant **fyke** trap was placed near the **mouth** of Streelaw **Creek** on March **29, 1999**. The **fyke** trap was operated 136 **fishing** days of a **possible** 233 **days**. Within that time **an** estimated 3,444 age 0+ **coho** were caught. **Only** nineteen age 1+ **coho** were caught. A mark-recapture design to assess trap efficiency was intended but **not** implemented due to the low number of 1+ **coho** captured.

A juvenile coho salmon population survey conducted in Streelaw Creek during October of 1998, estimated 1,408 age 1+ **coho**. Over-winter trap catches, even considering extremely low trap efficiency estimates, do not reflect summer population estimates. The fyke trap will continue to be operated through **the** fall **and** **winter** of 1999-00 to assess the possibility of early out-migrant behavior by juvenile coho in Streelaw Creek.

Boyes Creek

Installed on March 19, 1999 near **the** mouth of **Boyes** Creek, a weir pipe trap was operated 123 **of** a **possible** 201 **days**. A **total** of seventy 0+ and fifty-seven 1+ **coho** salmon were caught within this period. **The** low number of fish caught may indicate trap inefficiency, low **fish** abundance, early outmigrant behavior or coho salmon residency. Increased efforts will be

Figure 1. Weekly catch totals of 1+ coho salmon by trap site, in Prairie Creek, California, between February and July, 1999. Week 1: (February 5 - 11); week 7: (March 19 - 25); week 14: (May 7 - 13); week 21: (June 25 - July 1).

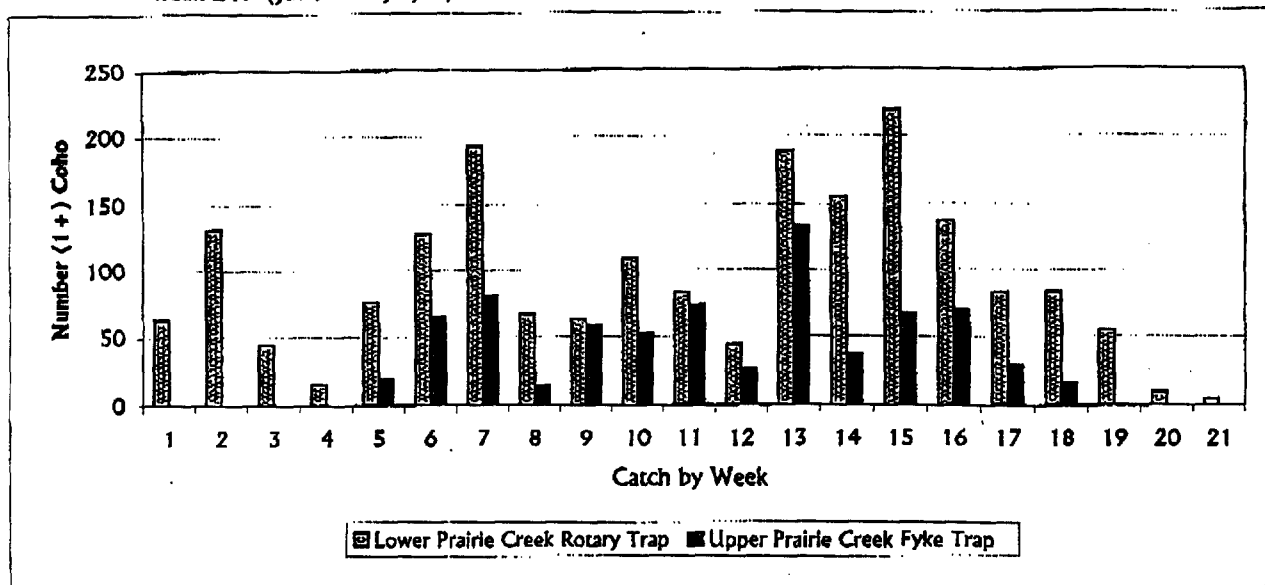
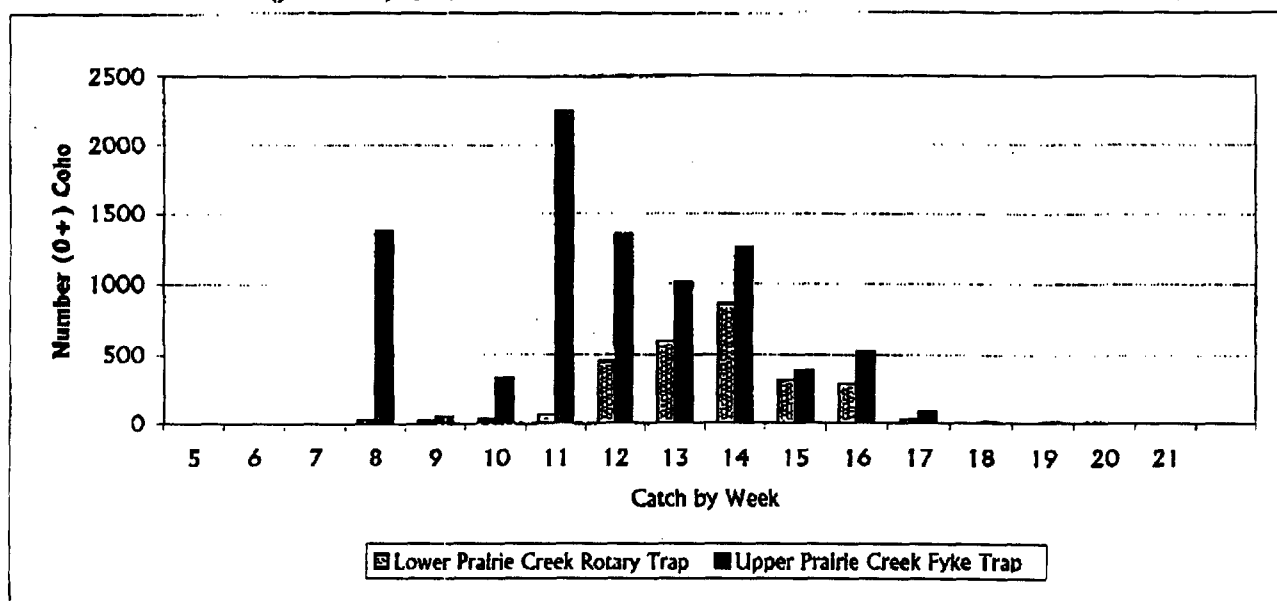


Figure 2. Weekly catch totals of 0+ coho salmon by trap site, in Prairie Creek, California, between February and July, 1999. Week 1: (February 5 - 11); week 7: (March 19 - 25); week 14: (May 7 - 13); week 21: (June 25 - July 1).



made to accurately document the number and timing of coho salmon outmigrating from Boyes Creek during the 1999-00 trapping season.

Prairie Creek

Downstream migrant fish traps were installed and operated at two different trap sites within Prairie Creek throughout the 1999 trapping season. The two trap sites within Prairie Creek were located just upstream of the confluence with Streeflow Creek and Browns Creek. The trap located just above the Browns Creek confluence is approximately 7,500 m upstream of Streeflow Creek.

A floating rotary screw trap with a 5 ft. diameter cone was placed just upstream of the Streeflow Creek confluence on February 5, 1999. Due to inadequate flows, the rotary screw trap was removed on June 8 and replaced the following day with a downstream migrant fyke trap. The fyke trap was removed permanently on July 1, 1999. The lower Prairie Creek trap site was operated 133 of a possible 146 days. Within that time period 1,954 (1+) and 2,702 (0+) coho salmon were captured (Figures 1 and 2). Rotary screw trap catches of outmigrating 1+ coho salmon was highest throughout the month of May.

Located upstream of the rotary screw trap, a fyke trap was placed on February 20, 1999. Immediately upstream of the confluence with Browns Creek, the fyke trap site was at the lower end of the 6.22 km study reach to determine over-summer and over-winter survival of juvenile coho salmon in Prairie Creek. The upper Prairie Creek fyke trap was removed for the month of June, but was otherwise operated throughout the 1999 trapping season. The trap was operated 119 of a possible 207 days since placement. Within this trapping period 792 (1+) coho salmon and 8,862 (0+) coho were caught with a pulse of 0+ coho captured the last week in April, 1999.

In Prairie Creek, attempts were made to implement a mark-recapture design using caudal fin clips on coho salmon to estimate trap efficiencies and coho abundance. The design was ineffective due to delayed outmigration of clipped fish combined with a limited combination of unique fin clips. Instead, a mark-recapture study design using PIT (passive integrated transponder) tags was used in an effort to estimate over-winter survival, trap efficiencies and absolute coho salmon abundance.

Over Winter Survival of Juvenile Coho in Prairie Creek

In conjunction with project research to determine over-winter growth and habitat fidelity of juvenile coho salmon in Prairie Creek, a total of 1,187 coho were implanted with PIT tags to evaluate over-winter survival of coho. The use of PIT tags allows for known individual histories of recaptured fish especially suitable for release-recapture studies. Coho salmon were PIT tagged within three distinct time periods (Table 2). As an initial treatment group, a total of 619 coho salmon were tagged within a 30 day period beginning November 15, 1998. An additional 422 coho salmon were tagged between December 23, 1998 and January 26, 1999. To better evaluate the possibility of detecting over-winter mortality, 146 coho salmon were tagged within a 28 day period beginning February 18, 1999.

Downstream migrant trap recaptures of PIT tagged coho salmon were recorded and evaluated according to tag group and time of recapture (Table 2). A total of 199 or 16.8 % of PIT tagged coho were recaptured at one or both downstream migrant traps located within Prairie

Table 1. Total catch, mortality and percent mortality by species and trap site for the 1999 downstream migrant fish (trapping efforts in Prarie Creek basin, northern California, through October 11, 1999.

Species	Lower Prarie Creek			Upper Prarie Creek			Sagehen Creek			Boys Creek			Upper Prarie Creek		
	catch total	mortality	(%)	catch total	mortality	(%)	catch total	mortality	(%)	catch total	mortality	(%)	catch total	mortality	(%)
0+ Coho	2702	33	1.22							70	1	1.43	0	0	0.00
1+ Coho	1954	8	0.41	792	9	1.14	19	1	5.26	57	0	0.00	1	0	0.00
0+ Chinook	56615	427	0.75	97004	1012	1.04	431	5	1.16	110	0	0.00	0	0	0.00
Cutthroat	462	1	0.22	496	2	0.40	7	1	14.25	17	0	0.00	7	1	14.25
Steelhead	218	0	0.00	23	0	0.00	0	0	0.00	5	0	0.00	0	0	0.00
1+ Trout	828	23	2.78	117	5	4.27	10	0	0.00	31	0	0.00	0	0	0.00
0+ Trout	522	10	1.92	273	2	0.73	64	0	0.00	17	0	0.00	2	0	0.00
Ammocetes	152	2	1.32	87	2	2.30	11	0	0.00	7	0	0.00	1	0	0.00
B. Lamprey	159	0	0.00	126	0	0.00	13	2	15.33	8	0	0.00	2	0	0.00
P. Lamprey	56	0	0.00	14	0	0.00	0	0	0.00	9	0	0.00	0	0	0.00
Trap Info															
Placed	05-Feb-99			20-Feb-99			29-Mar-99			19-Mar-99			02-Aug-99		
Removed	01-Jul-99			11-Oct-99			11-Oct-99			11-Oct-99			11-Oct-99		
Total # Days	146			233			207			201			70		
# Days Fishing	133			136			119			123			31		
# Non-Op Day	13			97			78			83			39		

Creek. Percent recaptures by tag group were 17.1, 15.2 and 19.7 for November, January and March tag groups respectively.

Using methods detailed in Burnham et al. (1987), release recapture arrays were developed and preliminary chi-square tests of independence between groups were conducted. Preliminary tests indicated no treatment effect and no significant difference in survival rates between treatment and control tag groups. Furthermore, equations provided in Burnham et al. (1987, p. 69-72) fail to produce consistent results between calculated survivorship, trap efficiency, and total catch of coho salmon at respective trap sites in Prairie Creek. The relatively small number of fish tagged and recaptured for the March control group limit analyses results and interpretation. Appropriate survival models are currently being explored.

To correct for release recapture design deficiencies from the previous year, a greater number of coho salmon will be tagged with a larger time period allowed between the treatment and control tag groups. In addition, downstream migrant fish traps located in Prairie Creek will continue to be operated to evaluate and correct for early outmigration of PIT tagged fish prior to establishment of the control tag group.

In essence, a Jolly-Seber mark-recapture design will be used to estimate over-winter survival rates of coho salmon in upper Prairie Creek. Working within a ten-day period on two separate efforts, 814 and 674 coho salmon were tagged in early October and the middle of November, 1999. Approximately 400-500 coho salmon will be implanted with PIT tags in March of 2000 to better evaluate and determine over-winter survival rates.

Throughout the October and November 1999 tagging effort, a total of 30 coho salmon tagged from the previous winter were recaptured. The high recapture rate of essentially 2+ coho salmon complicates efforts to determine over-winter survival rates and suggests that a significant proportion of coho may be over-wintering for two years in Prairie Creek. These recent findings are being further explored and incorporated into analyses methods.

Over-Summer Juvenile Coho Salmon Population Surveys

To derive an estimate of over-summer survival, juvenile coho population estimates were conducted once each in the early summer and late fall for Boyes, Streebaw and Prairie Creek. Sequential stratified sampling designs were used to select sample units from an early summer stream habitat inventory. Inventoried habitat units were collapsed into pools, deep pools (>1.1 in), runs, riffles, complex and 'other' habitat types for the purpose of juvenile coho salmon surveys. Habitat units classified as complex or 'other' were considered unsuitable for diver observations or electrofishing and excluded from juvenile surveys. All habitat units selected for population surveys during the summer sampling period were retained and resampled during the fall. Complete retention and exact resampling of units allows for improved detection of change in survival. Population surveys were completed within 10 days for each sampling period within the three study creeks.

Downstream migrant fish traps were installed and intermittently operated over the summer to assess potential outmigration of coho between over-summer population samples. In addition, a pipe trap was placed at the upstream end of the study section in Prairie Creek to estimate potential immigration. Traps were periodically operated on a weekly basis. Over-summer trap catches indicated essentially no emigration and in the case of upper Prairie Creek, immigration of juvenile coho salmon between the two sampling periods.

Streelow Creek

We sampled 2.20 km of Streelow Creek, beginning at the stream's confluence with Prairie Creek. The survey endpoint was determined when electrofishing methods were no longer practical. In early June and late September of 1999, depletion removal electrofishing methods were used in pool, run and riffle habitat units. Using total lengths by habitat stratum, electrofishing was conducted on 19.5% of pool, 13.5% of run and 14.0% of riffle habitats (Table 2). Streelow Creek estimates and standard errors (in parentheses) for summer and fall samples of juvenile coho salmon were 3,266 (481) and 2,340 (313) respectively. Ninety-five percent confidence intervals represented 29.5% and 26.5% of the total population estimate for summer and fall samples respectively. Not included in total population estimates, all deep pool habitats in Streelow Creek were sampled in early summer using multiple-pass diver observation techniques. Observation methods were not used in Streelow Creek during the fall population survey due to increased tannins and reduced underwater visibility. Stratum specific and stream total estimates are presented in Table 2.

Table 2. Habitat composition, habitats surveyed and estimated number of coho salmon with standard errors (in parentheses) in Streelow Creek, California during June and September 1999.
(*) Totals do not include deep pool unit samples and estimates.

Habitat	Units Surveyed	Units Sampled	Estimated number of coho salmon	
			June	September
Pool	66	8	1,539 (385)	1,195 (237)
Run	49	8	1,342 (272)	1,029 (200)
Riffle	25	5	290 (96)	116 (46)
Deep Pool	7	7*	95* (7)	--
Complex	26	--	--	--
Other	3	--	--	--
Total	176	21	3,171 (481)	2,340 (313)

A preliminary indication of over-summer survival of juvenile coho salmon can be calculated by dividing fall stratum specific and stream total estimates by respective summer estimates. Using this calculation, over-summer survival rates of juvenile coho salmon in Streelow Creek for 1999 was 77.6%, 76.7% and 40.0% for pool, run and riffle habitats respectively. Estimated average over-summer survival was 73.8% in Streelow Creek for 1999.

Boyes Creek

A total of 2.17 km of Boyes Creek was sampled beginning at the stream confluence with Prairie Creek. In both fall and summer population surveys, no coho salmon were present past 1.50 km from stream mouth. The first fish migration barrier in Boyes Creek is located at stream km 2.17. The absence of coho salmon in the upstream portion of Boyes Creek coincides with the last known coho redd recorded for the previous winter and suggests lack upstream movement by juvenile coho in Boyes Creek.

Using depletion removal electrofishing methods, we sampled 19.5%, 13.5% and 14.0% of total stratum lengths for pools, runs and riffles respectively (Table 2). Boyes Creek population estimates for summer and fall samples of juvenile coho salmon were both 1,537 with a standard error of 312 for the June sample and 298 for the late September sample. These estimates indicate no significant over-summer mortality. However, population estimates for Boyes Creek may not be suitable for estimation of over-summer survival due to poor electrofishing capture probabilities during the summer sample. Ninety-five percent confidence intervals represented 52, 68 and 102 percent of the stratum-specific June population estimates for pools, riffles and runs respectively.

Table 3. Habitat composition, habitats surveyed and estimated number of coho salmon with standard errors (in parentheses) in Boyes Creek, California during June and September 1999.

Habitat	Units Surveyed	Units Sampled	Estimated Number of coho salmon	
			June	September
Pool	75	11	720 (188)	750 (120)
Run	64	15	716 (243)	741 (228)
Riffle	55	10	102 (52)	45 (28)
Complex	7	--	--	--
Other	3	--	--	--
Total	204	36	1,537 (312)	1,537 (298)

Prairie Creek

A two-phase sequential random sampling design was used in selecting habitats for population surveys in Prairie Creek. Sequential independent sampling of units was used to select habitats for sampling. A probability of 0.5 was selected for phase I sampling, while a phase II sampling probability of 0.25 and 0.33 was selected for pool and run habitats respectively. In Prairie Creek, phase I sampling units consisting of pools and runs were sampled using single-pass diver observation counts. In phase II sampling units, the method of bounded counts, based on four independent diver counts, was used if phase I diver counts were ≤ 30 coho salmon. If diver counts were >30 coho salmon, depletion removal electrofishing was used to estimate true number of coho salmon in conditionally selected units. In addition, all pools >1.1 m deep were sampled using repeated diver observations only and every 12th riffle was sampled using electrofishing methods.

In Prairie Creek, we sampled 6.27 km beginning at the confluence with Browns Creek. Juvenile coho population surveys were conducted within a ten-day period beginning in early July and October. Chosen sampling probabilities were approximately reflected in the number of units selected for phase I and II population samples (Table 4).

Table 4. Percent composition of habitat units and number of Units sampled using diving and electrofishing methods for estimates of juvenile coho salmon abundance at two time periods in Prairie Creek, California 1999.

Habitat	Percent Length of total	Units Surveyed	Units Sampled phase I dives	Units Sampled phase II			
				July Diving	July E-fishing	October Diving	October E-fishing
Pool	35.1	133	66	13	4	13	4
Run	23.3	93	50	11	5	13	3
Riffle	26.7	153	--	--	11	--	12
Deep pool	3.3	10	--	8	--	10	--
Complex	8.6	24	--	--	--	--	--
Other	3.0	16	--	--	--	--	--
Total		430	116	32	20	36	19

Two-stage regression estimation was used to determine the abundance of juvenile coho salmon in upper Prairie Creek. Second phase estimates were used to calibrate observation probability and 'true' abundance of phase I single-pass dive estimates. The total number of estimated juvenile coho in upper Prairie Creek for early June and October of 1999 was 6,798 (564) and 4,886 (478) respectively (Table 5). Ninety-five percent confidence intervals represented 17 and 20 percent of total abundance estimates for July and October respectively.

Table 5. Stratum-specific and total population estimates with associated errors of estimation and 95% confidence intervals for upper Prairie Creek California in June and October, 1999.

Habitat	June			October		
	Estimated Number coho salmon	Standard Error	95% CI	Estimated Number coho salmon	Standard Error	95% CI
Pool	4,069	439	± 878	2,710	276	± 552
Run	1,760	353	± 706	1,463	386	± 772
Riffle	771	552	± 1,104	243	190	± 380
Deep Pool	196	20	± 40	469	62	± 62
Total	6,798	564	± 1,128	4,886	478	± 956

A preliminary indication of over-summer survival of juvenile coho salmon can be calculated by dividing fall stratum specific and stream total estimates by respective summer estimates. Using this calculation, over-summer survival rates of juvenile coho salmon in Prairie Creek for 1999 was 66.6%, 83.1% and 31.5% for pool, run and riffle habitats respectively. Estimated average over-summer survival was 71.9% in Prairie Creek for 1999. More rigorous statistical analysis of juvenile coho salmon survival are in progress.