STUDY 10.

JUVENILE SALMONID ABUNDANCE AND HABITAT AT BASELINE SITES

Rationale

Flooding could drastically alter juvenile salmonid populations and habitat in the Situk and Lost Rivers. Determining juvenile abundance and habitat at specific sites will enable changes to be evaluated after flooding.

Objectives

The objective of this study was to establish base lines for juvenile salmonid abundance and habitat at sites inside and outside the flood zone of the Situk and Lost Rivers so that changes after flooding can be evaluated.

Summary of Results

Juvenile salmonid density was estimated and habitat was measured at two sites outside and three sites inside the flood zone. Sites were sampled once in summer and fall from 1987 through 1990. Coho were captured at all sites and were the most abundant salmonid, whereas sockeye were least abundant and were captured at only two sites. Densities were generally lower in fall than in summer; however, sockeye and Dolly Varden densities were greater in fall at one site and steelhead density was greater at one site in fall. Density varied annually in both summer and fall.

METHODS

Populations of juvenile salmonids were estimated and habitat was characterized at five sites on the Situk and Lost Rivers from 1987 to 1990. Two sites were outside the flood zone (Wad Hole on the main-stem Situk River and Day Glo Creek, a tributary of the Situk River) and three sites were inside the flood zone (Situk Meander, a tributary of Old Situk River; Cable Hole on the main-stem Situk River; and Airport Creek, a tributary of the Lost River) (Fig. 10.1). The sites were the same used in Study 2, and were selected because they had representative fish populations and habitat characteristics, and were reasonably accessible. All sites were sampled in summer and four sites were sampled in fall. Site locations were permanently marked with a global positioning system (Table 10.1). Fish populations were estimated and habitat was measured the same as described in Study 2. Fish densities at the two main-stem Situk River sites were estimated by the removal method and at the other sites by the mark-recapture method. Relative percent difference in density was calculated by the equation:

$$D_i = 100 \frac{\sum_{i=1}^{n-1} (x_i - x_n)}{\sum_{i=1}^{n-1} (x_i + x_n)}, \quad (1)$$

where (D_i) is the relative percent difference in density in site i, x_i is the density in year 1 and x_n is the density in year n. Water temperature was measured with a thermograph at all sites except Cable Hole.

RESULTS

The physical characteristics of the sites differed (Table 10.2, Fig. H.6). Airport Creek was the widest (9.8 m) and the pool habitat at Cable Hole was the deepest (121 cm). The percentage of pool habitat varied from 100% in the pool habitats at Cable Hole and Wad Hole to 37% at Airport Creek. The substrate in Day Glo and Airport Creeks was similar (mean, 44% sand/silt), whereas Situk Meander had nearly twice as much (80% sand/silt). Water velocity and discharge were greatest at Wad Hole and least at Situk Meander. Mean number of LWD pieces varied 14-fold and was greatest in the pools of Wad and Cable Holes, and was absent in willow edges and in Situk Meander. Annual water temperature varied less at Situk Meander than at the other sites because of the influence of ground water at Situk Meander (Fig. H.6).

Not all salmonid species were captured at each site. Coho salmon were at all sites in summer and fall (Table 10.3, Fig. 10.2), but sockeye were captured at only two sites in summer and fall and chinook were found only in summer at the two main-stem sites and in Situk Meander one summer. Steelhead were captured at all sites except Situk Meander in summer and found at all sites in fall. Dolly Varden were captured at all sites in summer and two of four sites in fall.

Seasonal changes in density varied among species and sites (Table 10.3, Fig. 10.2). Coho density decreased at all sites an average of 66% from summer to fall. Sockeye density increased about 1000% in Situk Meander in fall and decreased 95% in Airport Creek in fall. Steelhead density increased over 500% in Day Glo Creek in fall and decreased about 100% in Airport Creek in fall. Dolly Varden density decreased 66% in Day Glo Creek in fall and increased 421% in Situk Meander in fall. In summer and fall, mean annual coho density was highest in 1989 at all sites, but was variable for other species between years (Fig 10.3).

Within each year, density in summer and fall differed among species (Table 10.3). In summer, mean variation among sites was greatest (188%) for chinook and least (95%) for coho (Fig. 10.3). In fall, variation was greatest for steelhead (169%) and least for coho and Dolly Varden (35%). Variation was greater in summer than fall for coho and Dolly Varden, less in summer than fall for sockeye, and similar for steelhead.

Annual variation of fish density differed among sites. For coho in summer, variation of fish density was lowest (8%) at Airport Creek and highest at Cable Hole (pool and willow edge habitats, 151%), whereas in fall, variation ranged from 24% to 53%. For sockeye, annual variation between Airport Creek and Situk Meander was similar in summer (128% and 114%) but different in fall (200% and 115%). Variation of chinook density was similar at the main-stem sites (173%, 190%). Steelhead density variation ranged from 133% to 200% in summer and from 106% to 200% in fall. Variation of Dolly Varden density ranged from 92% to 200% in summer and from 36% to 71% in fall.

DISCUSSION

All study areas are suitable for baseline sites with the possible exception of Day Glo Creek, which is in an area disturbed by logging. Much of Day Glo Creek in the vicinity of and including the baseline site has a buffer zone (about 10-100 m wide) on one or both sides. Logging may affect fish populations and habitat (Murphy et al. 1986; Thedinga et al. 1989) and obscure the potential effects of flooding. All sites had adequate coho populations but the other species were captured only at certain sites. The main-stem sites had all species except sockeye, and the tributary sites each had three or four species depending on season.

Some sites were probably wintering areas for juveniles. Juvenile densities of all species increased from summer to fall in Situk Meander. This site is probably used by juveniles in winter because water temperature is relatively warm due to ground water. The fall increase in steelhead density in Day Glo Creek indicates that some steelhead winter there.

Juvenile densities in fall are less variable than in summer. Density of all species varied considerably between years, seasons, and sites; but based on the annual difference in density, the least variation in density usually occurred in fall. Also, sockeye and steelhead densities were higher in fall than summer in the tributaries. There are disadvantages to sampling in fall however: frequency of freshets increases and most chinook have migrated from the river. Although it would be easier to detect differences in fish abundance in fall, the best time to sample baseline sites is probably late summer before chinook migrate from the river and after fry populations have stabilized. Several more years of data would be useful in determining annual variation in fish abundance.

Table 10.1—Location of benchmark sites and other reference points in the Situk and Lost River watersheds.

Site	Longitude	Latitude
Airport Creek[a]	139°36.45'W	59°28.82'N
Situk boat landing[b]	139°34.36'W	59°26.94'N
Cable Hole[c]	139°34.27'W	59°27.52'N
Wad Hole[c]	139°29.87'W	59°35.23'N
Situk Meander[d]	139°27.59'W	59°34.63'N
Day Glo Creek[c]	139°33.63'W	59°34.68'N
Old Situk River at FH-10[e]	139°26.27'W	59°34.24'N
Nursling Hole[c]	139°33.36'W	59°28.43'N
Mouth of Old Situk River	139°30.43'W	59°33.88'N
Bean Belly Creek at FH-10	139°28.07'W	59°34.83'N
Milk Creek at FH-10	139°35.59'W	59°34.20'N
Situk River at FH-10	139°29.71'W	59°35.17'N

[a]20 m downstream of lower boundary of baseline site.

[b]adjacent to end of road at edge of Situk River.

[c]middle of baseline site.

[d]20 m upstream of lower boundary of baseline site.

[e]Forest Highway 10.

Table 10.2—Physical characteristics of baseline sites on the Situk River and Lost River. Each site was sampled from one to five times. Ranges are in parentheses. A dash indicates characteristic not measured.

Site	Width (m)	Water depth (cm)		Habitat type (%)			Substrate composition (%)			Water velocity cm/s	LWD* No./Site	Discharge (m^3/s)
		Mean	Maximum	Pool	Riffle	Glide	Sand/silt	Gravel	Cobble			
Day Glo Creek	2.7 (2.3-2.9)	20 (9-30)	64 (39-110)	49.4 (32.8-63.2)	14.1 (9.8-21.2)	31.6 (15.6-42.6)	43.6 (28.9-58.3)	55.8 (40.4-71.1)	0.6 (0-1.3)	13.8 (4.3-24.9)	11 (4-17)	0.02 (0.01-0.04)
Lost River	9.8 (8.1-11.4)	50 (36-69)	85 (69-110)	37.1 (26.2-46.2)	0	62.9 (53.8-73.8)	45.6	54.4	0	18.7 (10.3-40.2)	2	0.19 (0.03-0.55)
Situk Meander	8.2 (7.7-8.7)	25 (16-29)	48 (42-57)	97.0 (95.8-98.2)	2.0 (1.8-2.1)	1.0 (0-2.1)	80.0	20.0	0	6.8 (2.3-11.2)	0	0.003 (0.002-0.004)
Wad Hole:												
Debris pool	5.1	77	250	100.0	0	0	—	—	—	23.0	14	0.13
Willow edge	4.2	62	90	0	0	100	—	—	—	29.1	0	0.29
Cable Hole:												
Debris pool	7.5	121	260	100.0	0	0	—	—	—	4.4	8	0.14
Willow edge	3.8	75	110	0	0	100	—	—	—	12.5	0	0.07

*Large Woody Debris >1 m long and 10 cm diameter.

Table 10.3—Densities (no./100 m²) of juvenile salmonids in summer and fall at baseline sites on the Situk and Lost Rivers, 1987-90.

Site	Date	Coho	Sockeye	Chinook	Steelhead	Dolly Varden
			Summer			
Cable Hole:						
Debris pool	7/26/89	116.7	0	66.3	55.0	67.0
	7/26/90	15.0	0	1.3	7.7	0
Willow edge	7/26/89	179.2	0	166.7	33.8	28.2
	7/26/90	26.3	0	5.0	1.3	0
Day Glo Creek	7/21/87	305.0	0	0	0	1.4
	7/10/89	565.8	0	0	0	6.5
	7/16/90	229.0	0	0	1.7	3.0
Airport Creek	6/15/88	103.0	1.3	0	0.4	0.1
	7/12/89	116.8	0	0	0.8	0
	7/18/90	108.7	2.3	0	0	0.1
Situk Meander	7/28/87	25.3	0	0	0	41.8
	7/11/89	169.2	4.0	0	0	15.4
	7/20/90	62.3	3.0	0.2	0	77.4
Wad Hole:						
Debris pool	7/24/89	2227.0	0	166.5	224.0	10.0
	7/19/90	530.3	0	16.6	34.9	1.3
Willow edge	7/24/89	2334.5	0	196.2	217.7	6.8
	7/19/90	255.1	0	9.1	18.1	1.1
			Fall			
Day Glo Creek	9/19/88	133.6	0	0	16.9	4.6
	9/12/89	169.5	0	0	5.2	2.2
Airport Creek	9/22/88	13.7	0	0	0.1	0
	9/14/89	18.2	0.1	0	0	0
Situk Meander	9/23/88	77.2	38.2	0	0	53.1
	9/13/89	133.2	10.3	0	0.7	76.0
Wad Hole:						
Debris pool	9/21/88	18.2	0	0.2	7.0	0

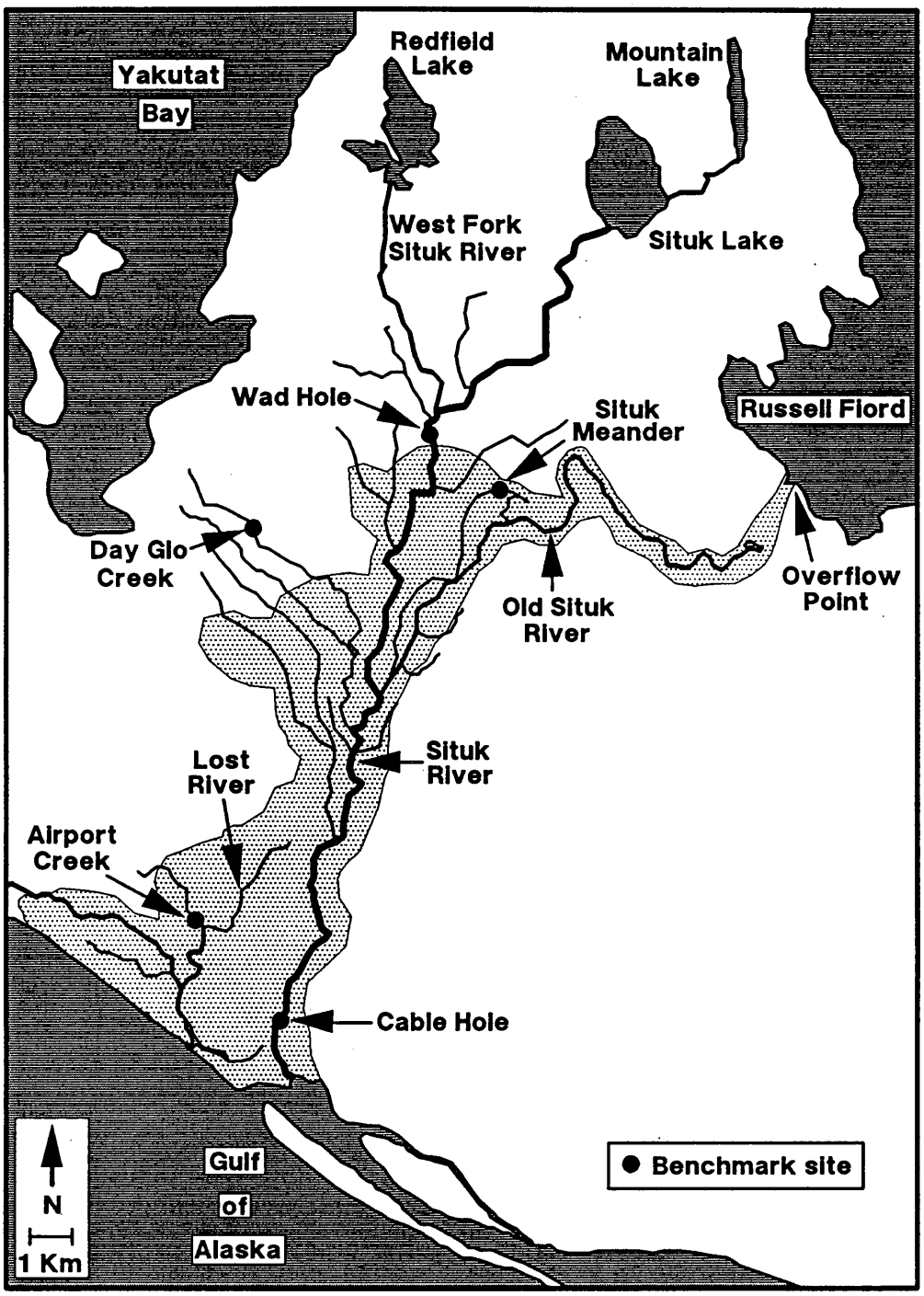

Figure 10.1—Baseline study sites on the Situk River and Lost River, 1987-90.

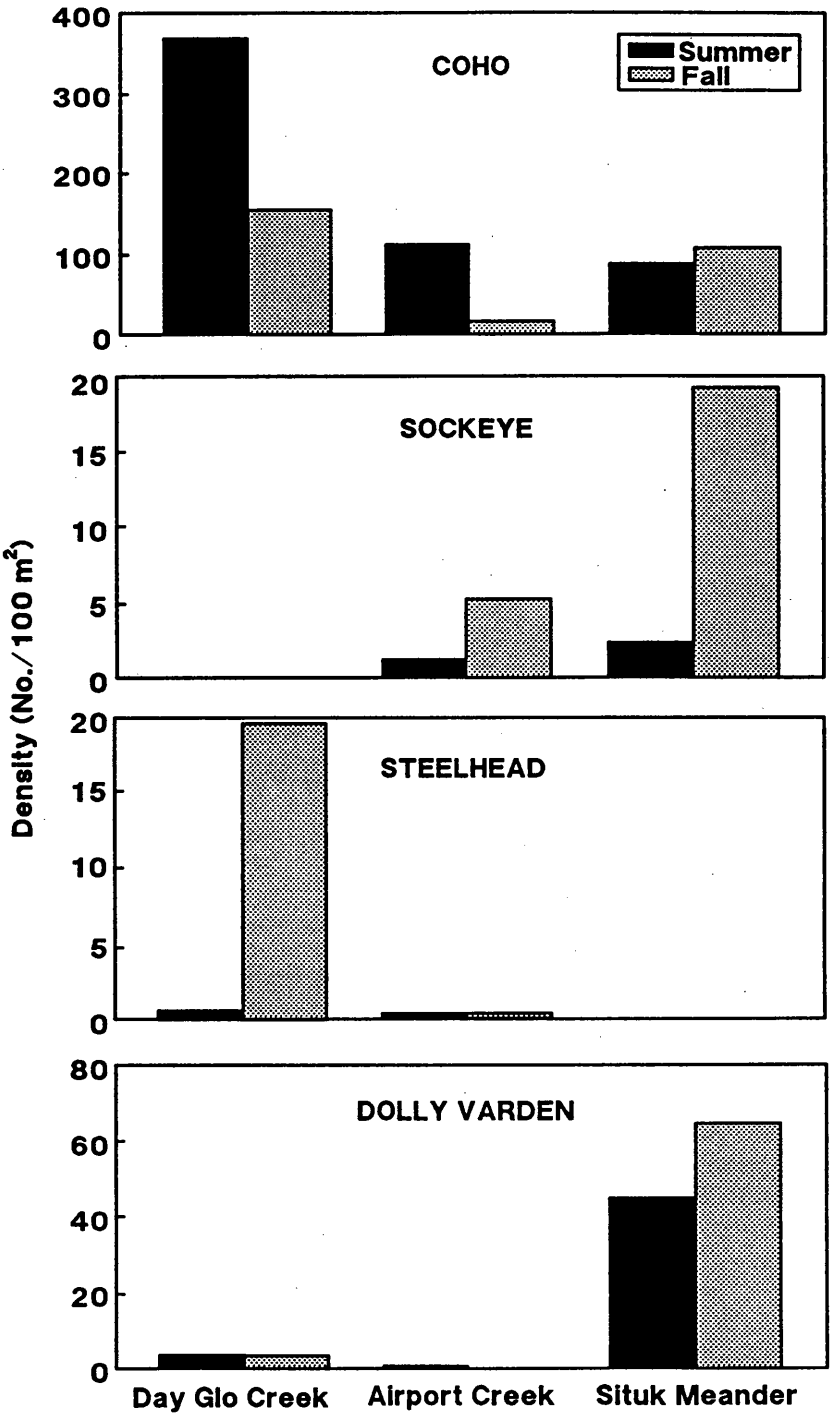

Figure 10.2—Mean seasonal density of juvenile salmonids from baseline sites, Situk River and Lost River, 1987-90. Data are from years and sites when fish density was estimated in both summer and fall.

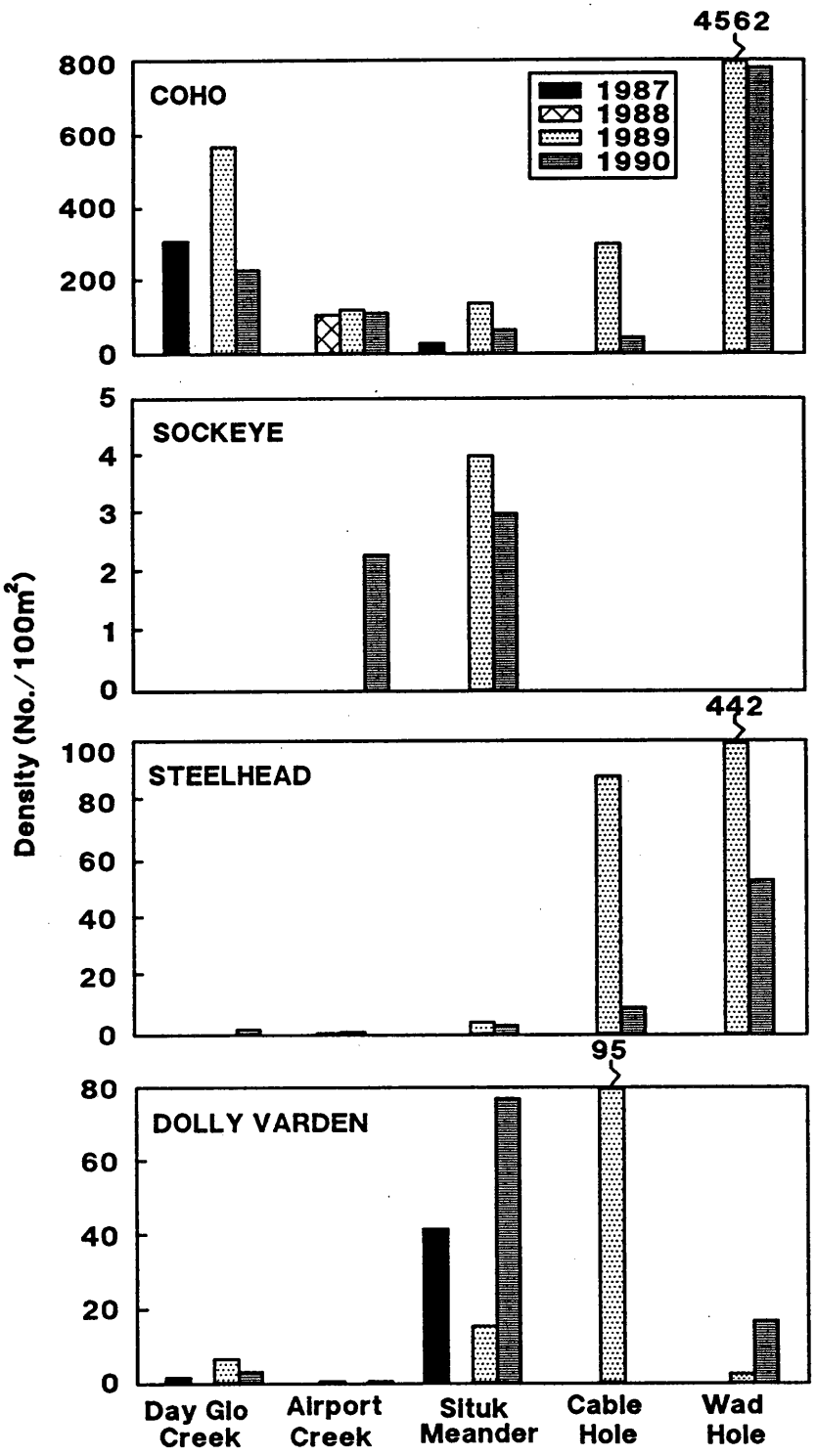

Figure 10.3—Mean annual density of juvenile salmonids from baseline sites in summer, Situk River and Lost River, 1987-90.