STUDY 8.

FISH UTILIZATION OF THE SITUK ESTUARY

Rationale

After Hubbard Glacier dams Russell Fiord, overflow from "Russell Lake" could change the Situk estuary. Information on habitat use by fish in the Situk estuary will help to estimate effects of flooding and to determine appropriate restoration strategies.

Objectives

The objectives of this study were to determine the summer abundance and distribution of fish in the Situk estuary.

Summary of Results

Fish were captured in three habitat types in the Situk estuary during spring and summer of 1987 and 1988. The estuary serves as a productive spring and summer rearing area for salmon fry, particularly ocean-type sockeye. The estuary provides habitat for at least 11 species of marine fish and numerous invertebrates, including Dungeness crab. The estuary also is a migration corridor for anadromous fish entering or leaving fresh water.

METHODS

Three habitat types were sampled: 1) "river channels" in the active river channel near the river mouth, 2) "tidal sloughs" in the intertidal *Carex* marshes, and 3) "beaches" in the estuary basin. One to three sites (Fig. 8.1) of each habitat type were sampled each month from April (May in tidal sloughs) to August in 1987 and from March to July (August in tidal sloughs) in 1988. Temperature and salinity were measured periodically in each tidal slough and beach site. Sampling methods differed among habitat types. At each river channel and beach site, fish abundance was indexed by catch per unit effort. Three separate areas, 20-50 m apart, were sampled with a beach seine that was 28 m long and 3 m deep, with wings of 13-mm mesh and a central bag of 6-mm mesh (Fig. 8.2). The seine was set with a skiff parallel to and 40 m from shore and pulled to shore with ropes. In tidal sloughs, fish density was estimated by the removal method (Zippin 1958). A 30-m section of slough was enclosed with 6-mm-mesh nets and repeatedly seined (≥3 times) with a pole seine (Study 2). Width of the slough section was measured at 3-m intervals, and fish density was calculated by dividing the population estimate by the section area.

Captured salmonids were tranquilized with dilute MS-222, identified, and measured for FL. Scale samples were taken from a representative size range (except Dolly Varden) to determine age. Non-salmonids were identified, counted, and released.

RESULTS

Results presented here from 1987 pertaining to habitat characteristics and sockeye have been published elsewhere (Heifetz et al. 1989), and some 1988 results pertaining to sockeye are also summarized in Study 5.

Fish catches in the river channel usually were dominated by sockeye salmon, staghorn sculpins, and starry flounders (Tables 8.1, 8.2). Other salmonids except pink salmon in May 1987 and adult Dolly Varden (about 200 mm FL) in June 1987 were uncommon. Other nonsalmonids (sticklebacks, eulachon, and Pacific sand lance) were captured only in May 1987 and were uncommon.

In tidal sloughs, fish assemblages were dominated by sockeye fry, coho fry, staghorn sculpins, and sticklebacks (Tables 8.3, 8.4). Chinook, pink, and chum fry were less abundant than coho and sockeye fry and were primarily captured in March and April. Age-1 coho presmolts were present in May and June and were most abundant in early June.

In beach habitat, catches were dominated by Pacific sand lance, starry flounders, and sockeye salmon fry, but several other species also were caught (Tables 8.5, 8.6). Pink fry were common in May, chum fry were common in April, and coho and chinook fry were uncommon. Salmonid smolt catches were generally low (mean, 1-3 smolts per seine haul) and adult Dolly Varden were common in May. For nonsalmonids, larval eulachon were abundant in March and juvenile Dungeness crab were present from May to August.

Salmonid fry were abundant in the estuary, particularly in tidal sloughs. Sockeye fry were the most abundant salmonid; their density in tidal sloughs averaged over 1,200 per 100 m^2 in April 1988 (Table 8.4; Fig. 8.3). Sockeye present in March and April were newly emerged fry, averaging 32 mm FL (Figs. 8.4, 8.5). Mean FL of sockeye fry in tidal sloughs increased to nearly 50 mm in June. Although mean FL increased rapidly, small (<40 mm) sockeye were always present. In July 1987, for example, size ranged from less than 40 mm to over 90 mm FL. Density in tidal sloughs declined sharply in May and remained low the rest of the summer. After density declined in tidal sloughs, numbers temporarily increased in beach and river channel habitats in June and declined sharply thereafter. Ocean-type sockeye are covered in further detail in Study 5.

Coho fry were present in the estuary from March to August, primarily in tidal sloughs (Fig. 8.6). Density in all three habitat types peaked in June and declined sharply in July. Coho in May were primarily newly emerged fry with a mean FL of 39 mm (Fig. 8.7). Mean FL increased during the summer, but newly emerged fry were always present. Mean FL increased to about 50 mm (range, 39-72 mm) in June and 55 mm in July (range, 33-70 mm).

In 1988, chinook fry were present in the estuary from March to mid-July. Abundance in tidal sloughs followed a different pattern from that in the river channel or beaches (Fig. 8.8). In tidal sloughs, density peaked in April; in river channels and beaches, catches peaked twice, in May and again in July. In March and April, captured chinook were primarily newly emerged fry, ranging from 38 to 44 mm FL (Fig. 8.9). In late May, chinook FL increased to a range of 44-57 mm FL. Ocean-type chinook are covered further in Study 4.

Salmonid smolts (age ≥1) were present in the estuary for a shorter time than salmonid fry. Smolts were in the estuary in May, June, and July. Peak abundance was in May and numbers declined sharply during June (Fig. 8.10). Peak density in tidal sloughs was in June, about 1 month later than in other habitats, because coho pre-smolts immigrated into the sloughs in June.

Adult Dolly Varden were numerous along estuary beaches and in the river channel for short periods, but were absent from tidal sloughs (Tables 8.1, 8.6; Fig. 8.11). Adult Dolly Varden were caught in estuary beaches in May, in the river channel in June, and then probably moved upstream into the main-stem river in July, as only one adult Dolly Varden was caught in the estuary after June.

Juvenile Dungeness crab also were caught in estuary beaches, primarily low-gradient sandy beaches off Blacksand Spit (Fig. 8.1). Peak catch of crab (5 crab per seine haul) was in May in 1987 (Table 8.5) and in June in 1988 (Table 8.6). In June 1988, crab carapace length averaged 58 mm, and ranged from 25 to 100 mm.

Water temperature in tidal sloughs increased from about 2-4°C in March and April to 22°C in July (Table 8.7). Water temperature in estuary beaches was lower in June than in the tidal sloughs. Salinity was generally low in tidal sloughs, ranging from 0 to 15‰, and moderate in estuary beaches, ranging from 18 to 26‰ (Table 8.7).

DISCUSSION

The Situk estuary contains productive habitat for juvenile salmonids and other fishes and invertebrates. The tidal sloughs along the estuary margins are particularly important for salmonid fry in spring. Tidal sloughs form essential habitat for the uncommon ocean-type sockeye which migrates to the estuary in March as newly emerged fry and uses tidal sloughs to grow large enough to survive in seawater (Study 5). The southwest aspect of the tidal marshes allows early warming in spring, when many salmon fry emerge and colonize habitats. For example, water temperature in the tidal sloughs in mid-May was about 10°C, compared to about 3-8°C in the main-stem Situk River (see Study Area, Fig. H.6). Relatively high water temperature and low salinity (0-15‰) make tidal sloughs suitable for salmon fry and allow rapid growth and gradual adaptation to seawater.

The estuary serves as a migration corridor for salmonid adults and smolts, as well as eulachon adults and larvae. None of these life stages, however, apparently spends much time in the estuary. Salmon smolts migrated quickly through the estuary. Although several million smolts were estimated to migrate through the estuary (Study 7), few smolts were caught there. Smolts did not use tidal sloughs, even though coho pre-smolts and large numbers of salmonid fry used them. Most smolts probably distributed pelagically, away from the beaches, as they migrated through the estuary.

The Situk estuary provides habitat for a number of stocks from adjoining streams and rivers. Several other salmon-producing streams, including Kunayosh Creek, Seal Creek, and the glacial Ahrnklin River (Fig. 8.1), also flow into the estuary. Thus, some fish residing in the estuary may have originated from streams other than the Situk River.

Table 8.1—Mean catch of all species per seine haul in the river channel, Situk estuary, April to August 1987. Zero values are omitted. Number of sites sampled is in parentheses.

Species	Stage	21 Apr (1)	20 May (2)	17 Jun (2)	26 Jul (2)	8 Aug (1)
Sockeye	fry	4.1	10.8	12.7		
	smolt		14.2	3.3		
Coho	fry			1.7		
	smolt			1.0		
Chinook	fry			0.7	1.7	
Pink	fry	1.7	9.9			
Chum	fry		1.0			
Steelhead	smolt			0.3		
Dolly Varden	adult			16.3		
Staghorn sculpin	all stages		11.0		12.8	10.0
Stickleback	all stages		1.0			
Starry flounder	all stages		22.0	10.8	67.8	10.0
Sand lance	adult		5.8			
Eulachon	adult		1.0			

Table 8.2—Mean catch of all species per seine haul in the river channel of Situk estuary, March to July 1988. One site was sampled each month. Zero values are omitted.

Species	Stage	15 Mar	12 Apr	31 May	23 Jun	13 Jul
Sockeye	fry	10.3	6.3		0.7	1.0
	smolt			1.0	1.7	
Coho	fry		0.3			
	smolt			0.3	4.3	
Chinook	fry	1.0	0.3			1.0
	smolt			0.3		
Pink	fry	0.7	0.3			
Dolly Varden	adult				1.7	
Starry flounder	all stages			1.0		

Table 8.3—Mean density (no./100 m^2) of all fishes from tidal sloughs in the Situk estuary, May to August 1987. Zero values are omitted. Number of sites sampled is in parentheses.

Species	Stage	20 May (1)	17 Jun (3)	26 Jul (3)	8 Aug (2)
Sockeye	fry	12.8	0.4	0.1	0.1
Coho	fry	35.2	69.1	21.0	9.8
	smolt*	4.4	9.8	1.1	
Chum	fry	2.2			
Sculpin	adult	42.9	49.4	47.7	
Stickleback	all stages	56.1	212.3		
Starry flounder	all stages	2.2	1.3	4.6	

*Most age-≥1 coho from tidal sloughs were "pre-smolts," with faint parr marks and silvery sheen to scales.

Table 8.4—Mean density (no./100 m^2) of all fishes in tidal sloughs in the Situk River estuary, March to July 1988. Two sites were sampled each month, except 13 May, 29 July, and 31 August, when one site was sampled. No fish were caught in August. Zero values are omitted.

Species	Stage	14 Mar	11 Apr	13 May	1 Jun	20 Jun	13 Jul	29 Jul
Sockeye	fry	737.5	1226.8	84.2	71.8	14.7	3.2	1.2
	smolt	0.6						
Coho	fry	4.2	7.8	10.8	66.7	73.4	39.8	48.1
	smolt*			3.6	17.3	2.9		
Chinook	fry	3.6	19.3		5.8			
Pink	fry		8.4					
Chum	fry	9.6	7.2					
Sculpin	all stages		110.6	39.7	19.9	20.0	40.0	
Stickle-back	all stages		40.0	49.0	24.7	27.9	50.0	

*Most age-≥1 coho from tidal sloughs were "pre-smolts," with faint parr marks and silvery sheen to scales.

Table 8.5—Mean catch of all species per seine haul from beaches in Situk estuary, April to August 1987. Seven sites were sampled each month. Zero values are omitted.

Species	Stage	21 Apr	20 May	17 Jun	26 Jul	8 Aug
Sockeye	fry	11.2	0.3	23.5	0.4	
	smolt		0.7	0.3	1.3	
Coho	fry	0.7		2.0		
	smolt		3.4	1.7	0.7	
Chinook	fry		0.7	0.3	1.0	
Pink	fry	9.4	23.0			
Chum	fry	14.7	0.7	0.3		
Dolly Varden	adult		22.5			0.3
Sculpin	all stages		1.5	2.0	7.3	3.7
Stickleback	all stages		2.0			
Starry flounder	all stages		23.7	15.2	63.1	47.7
Eulachon	adult	0.7	83.1	4.0	0.3	
Pacific sand lance	adult			112.2	1000.0	50.0
Prickle-back	adult			1.0	3.4	
Sand sole	adult			0.8	1.3	1.2
Herring	juv.				1.0	2.0
Greenling	adult				2.0	0.3
Dungeness crab	juv.		4.8	0.5	1.9	1.3

Table 8.6—Mean catch of all species per seine haul from beaches in the Situk estuary, March to July 1988. Two sites were sampled each month except May and June. Zero values are omitted. No salmonids were caught in July.

Species	Stage	15 Mar	12 Apr	31 May	23 Jun
Sockeye	fry	3.0	3.5		0.7
	smolt			0.3	
Coho	smolt			0.7	
Chinook	fry		0.2		
Pink	fry	1.0			
Dolly Varden	adult			1.0	
Sculpin	all stages		1.2	2.3	1.7
Starry flounder	all stages	4.3	6.2	2.7	4.0
Arrowtooth flounder	juv.				3.7
Pacific sand lance	adult	51.7			82.0
Eulachon	larvae	135.0			
	adult		0.2	2.0	
Smelt	adult			2.3	0.7
Dungeness crab	juv.				5.0

Table 8.7—Mean water temperature (°C) and salinity (‰) in tidal sloughs and estuary beaches in the Situk estuary, March to July 1988. A dash indicates no data.

	Tidal slough		Estuary beach	
Date	Temp.	Salinity	Temp.	Salinity
14 March	4.4	5.0	—	26.0
11 April	2.5	0.0	4.3	17.5
13 May	10.5	0.4	—	—
1 June	16.8	13.0	10.8	26.0
20 June	19.8	—	—	—
11 July	22.5	15.0	—	—

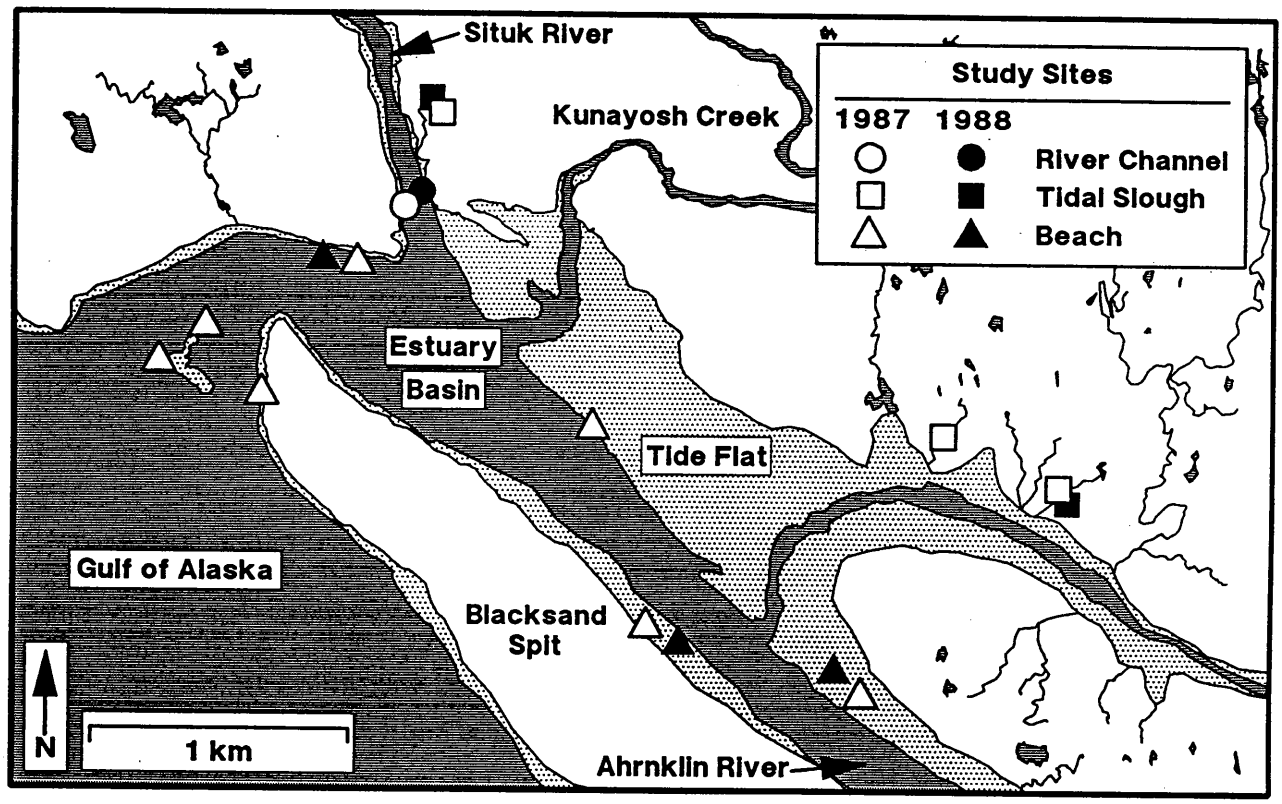

Figure 8.1—Map of Situk estuary, showing location of sampling sites.

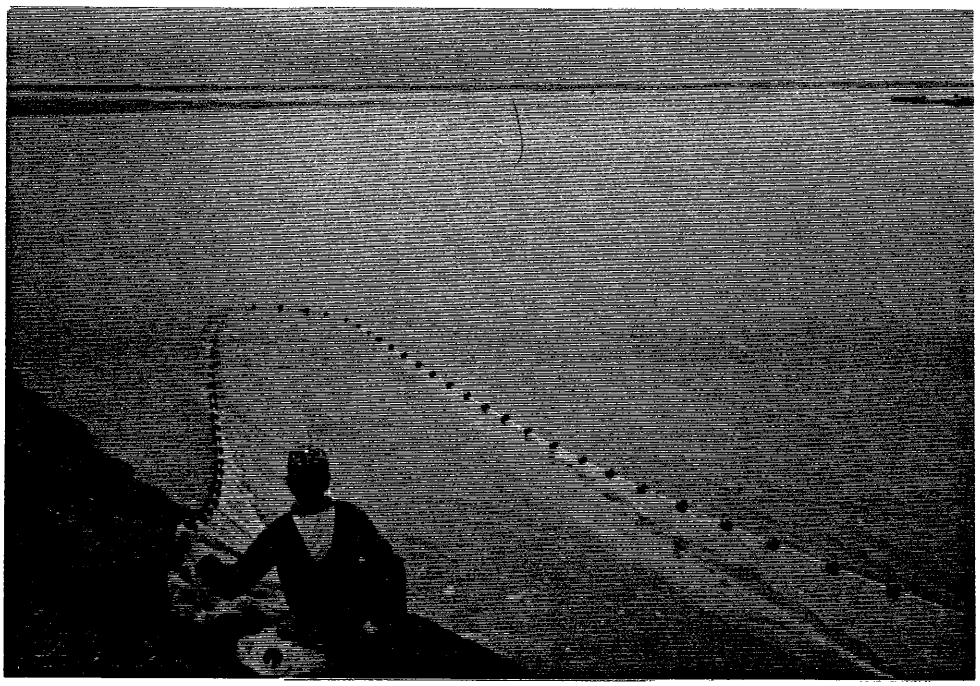

Figure 8.2—Seining in the Situk estuary basin, July 1988.

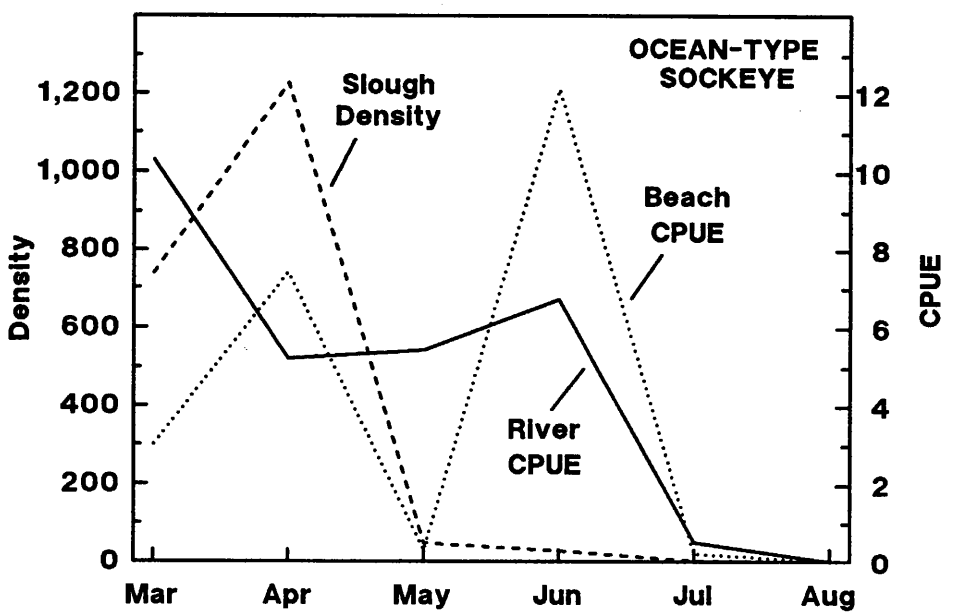

Figure 8.3—Mean density (no./100 m^2) or catch per unit effort (CPUE, no. per seine haul) of ocean-type sockeye from three habitat types in the Situk estuary, March to August 1987 and 1988. Data points are the means of the average density in the two years.

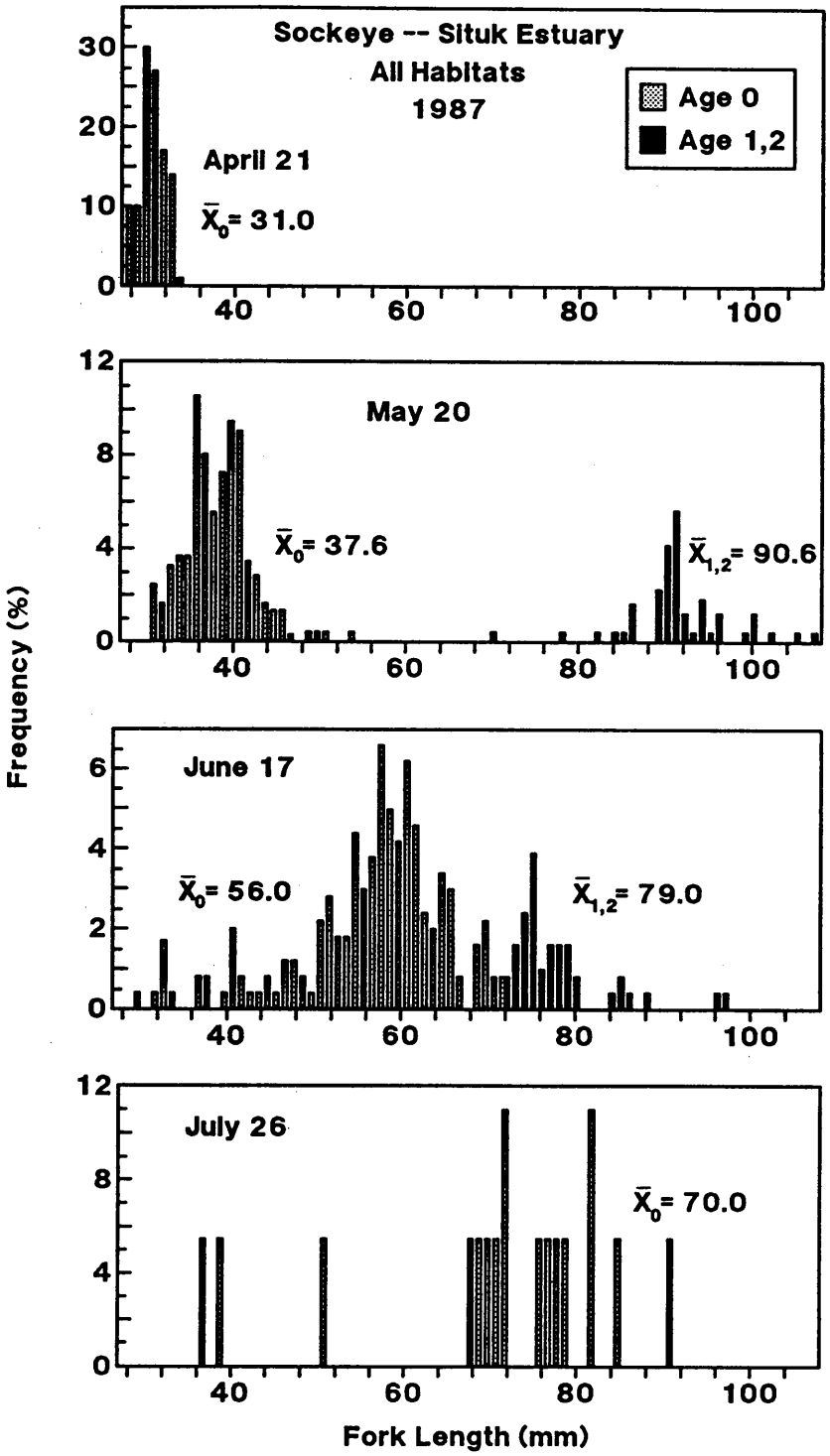

Figure 8.4—Length frequencies of sockeye from the Situk River estuary April to July 1987. Mean FL ($\bar{x}$) is shown for each sampling date and age class (designated by subscript).

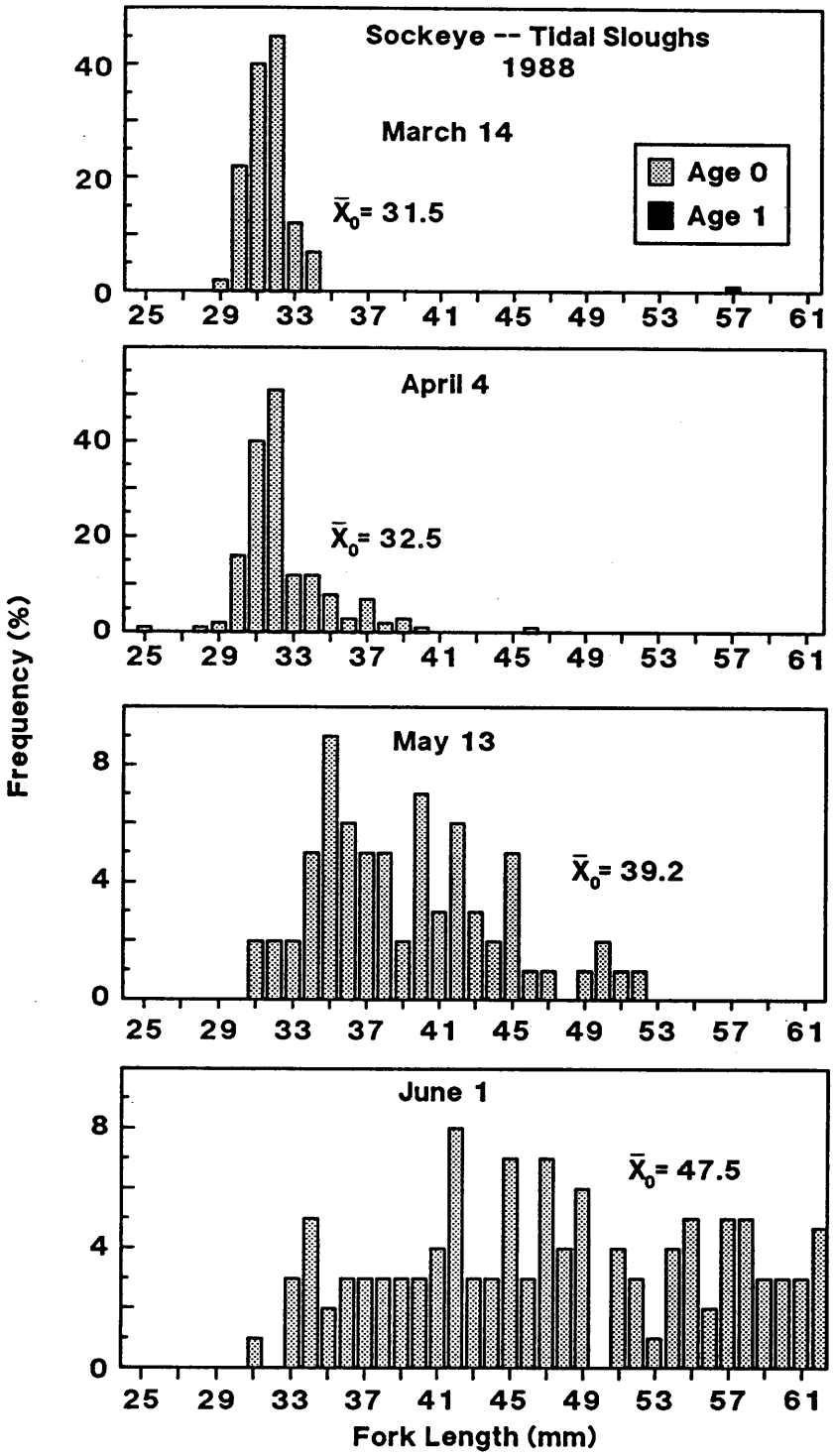

Figure 8.5—Length frequencies of sockeye from tidal sloughs in the Situk estuary March to June 1988. Mean FL ($\bar{x}$) of ocean-type sockeye is shown for each sampling date.

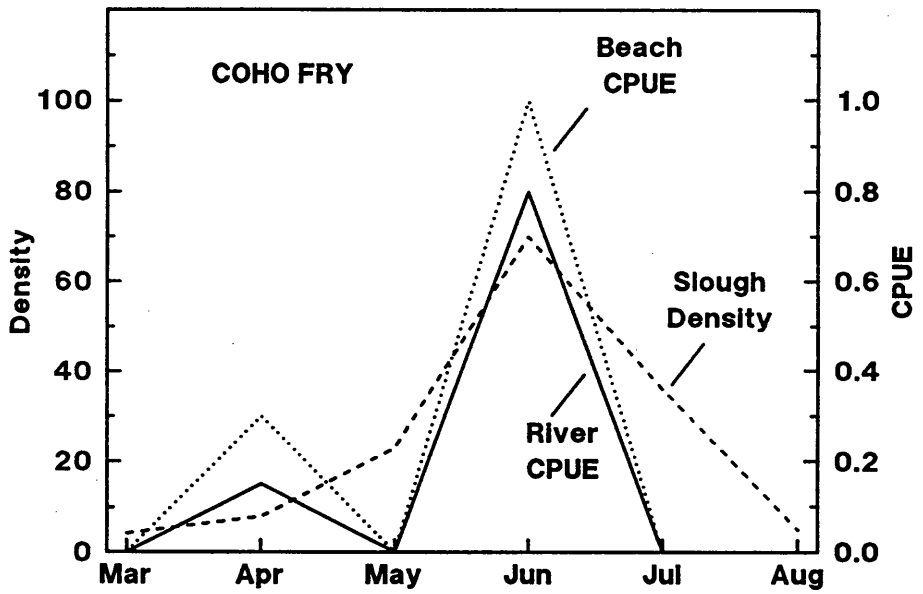

Figure 8.6—Mean density (no./100 m^2) or catch per unit effort (CPUE, no. per seine haul) of coho fry from three habitat types in the Situk estuary March to August 1987 and 1988. Data points are the means of the average density in the two years.

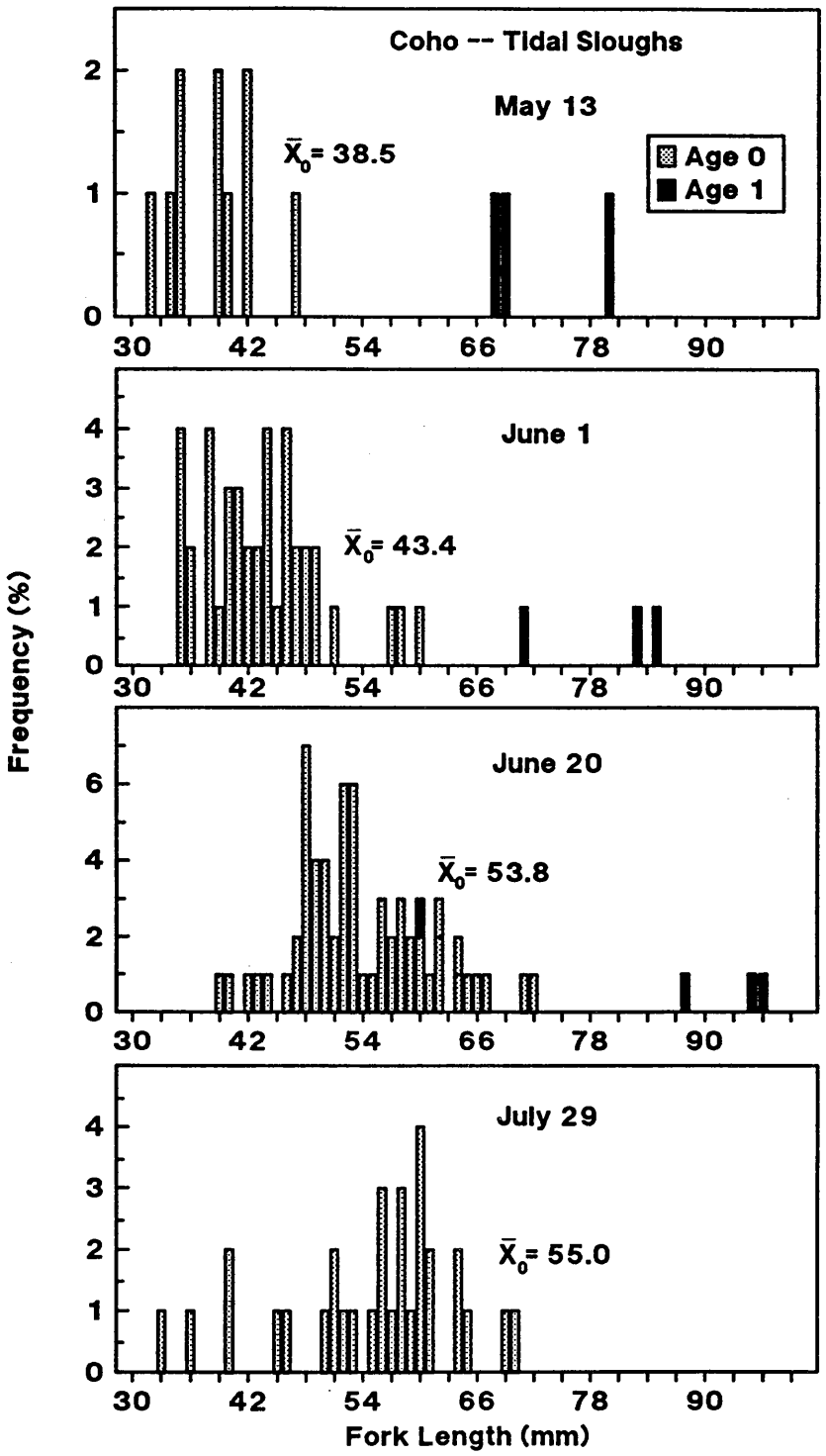

Figure 8.7—Length frequencies of coho from tidal sloughs of the Situk estuary May to July 1988. Mean FL ($\bar{x}$) of coho fry is shown for each sampling date.

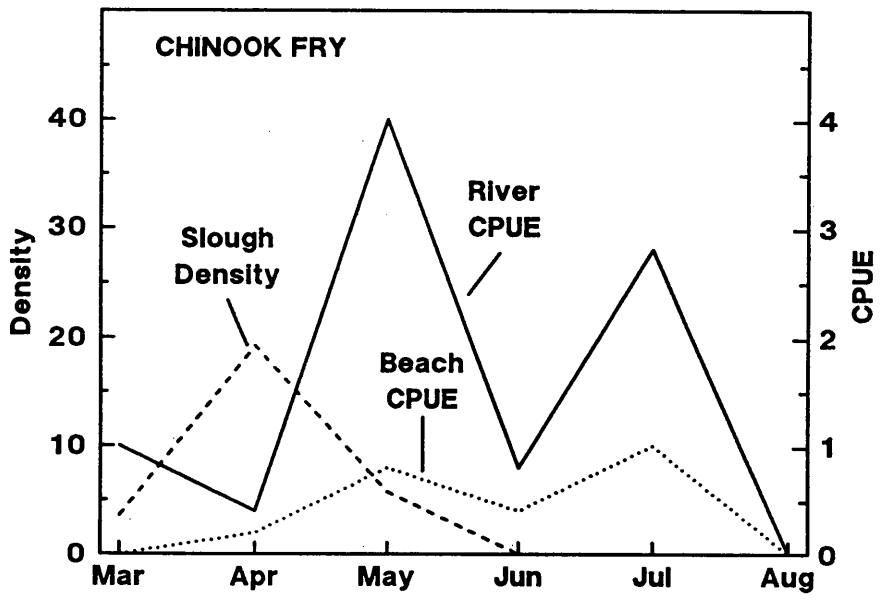

Figure 8.8—Mean density (no./100 m^2) or catch per unit effort (CPUE, no. per seine haul) of chinook fry from three habitat types in the Situk estuary March to August 1988.

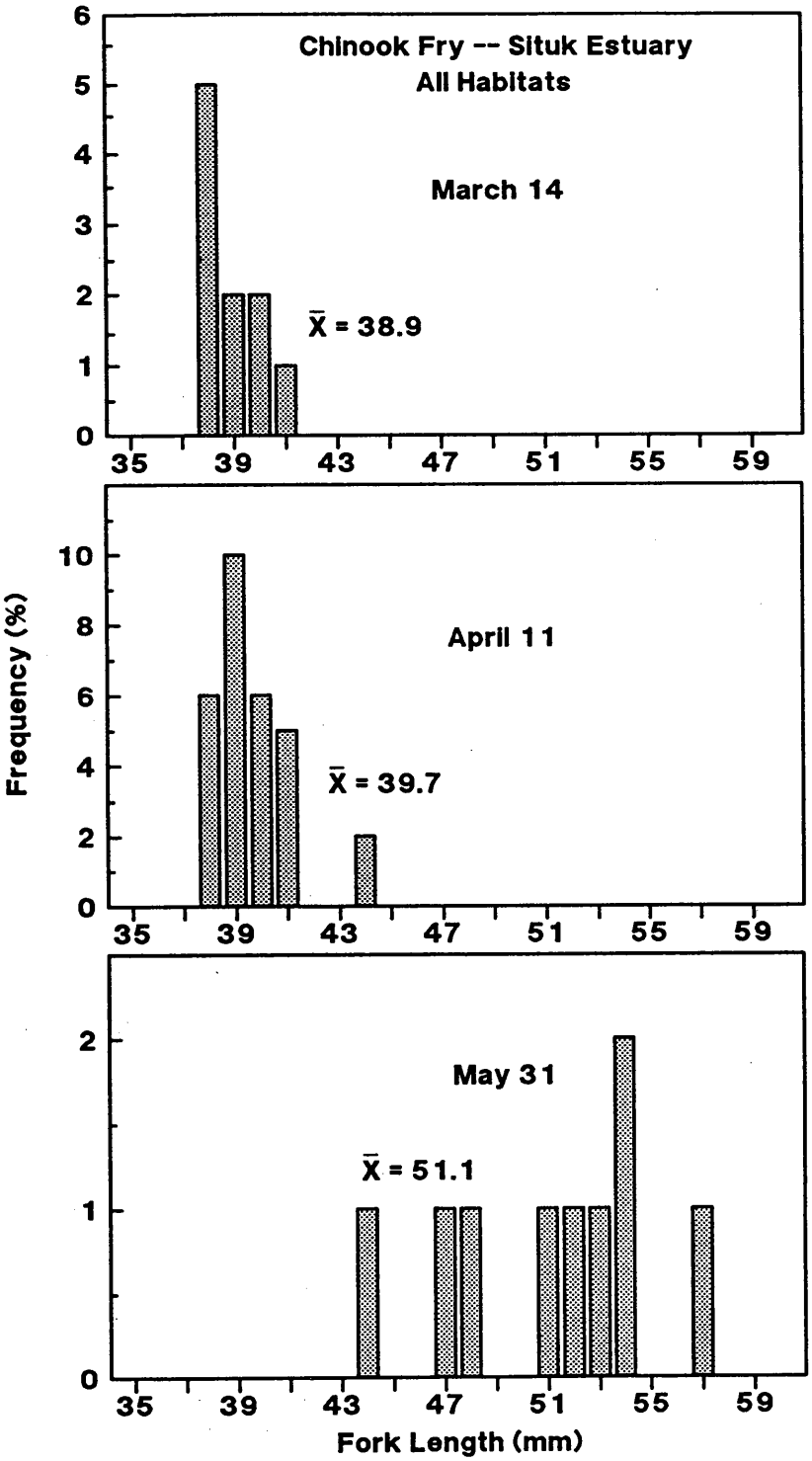

Figure 8.9—Length frequencies of chinook fry from the Situk estuary March to May 1988. Mean FL ($\bar{x}$) is shown for each sampling date.

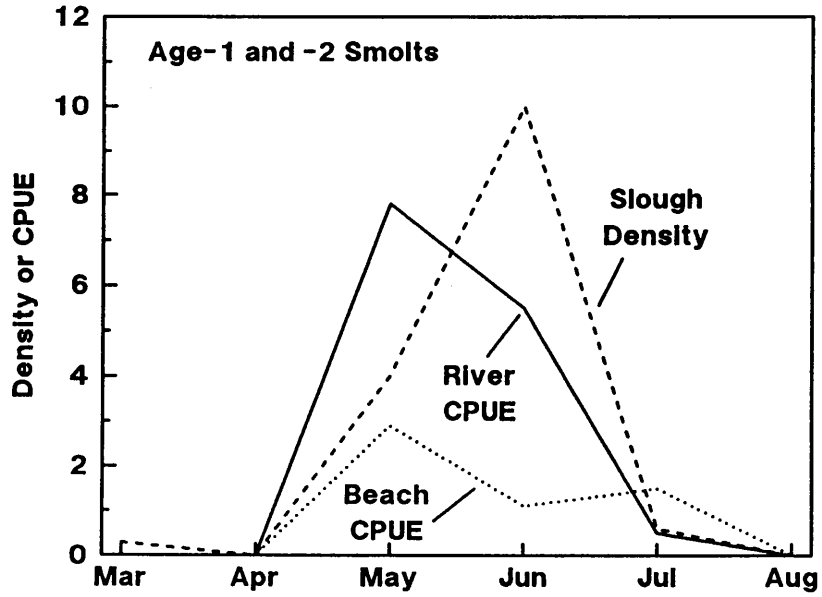

Figure 8.10—Mean density (no./100 m^2) or catch per unit effort (CPUE, no. per seine haul) of age-≥1 salmon smolts from three habitats in the Situk estuary March to August 1987 and 1988. Data are the means of the average density in the two years.

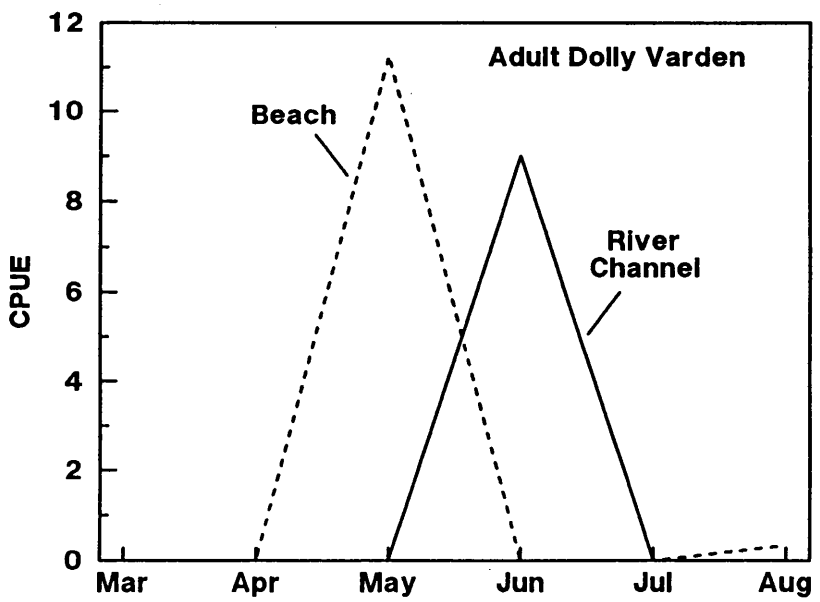

Figure 8.11—Catch per unit effort (CPUE, no. per seine haul) of adult Dolly Varden from river channel and beach habitats in the Situk estuary March to August 1987 and 1988. Data points are the means of the average density in the two years.