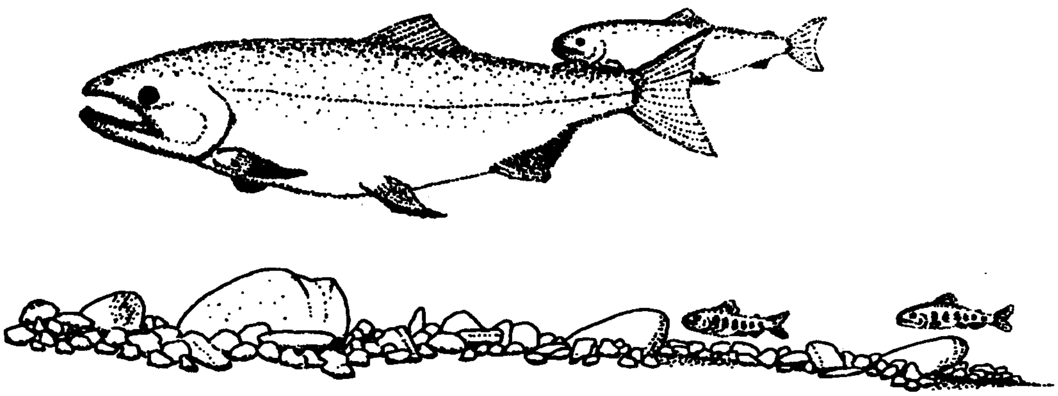
U.S. FISH AND WILDLIFE SERVICE

ELWHA RIVER SPRING CHINOOK

STOCK STATUS EVALUATION



WESTERN WASHINGTON FISHERY RESOURCE OFFICE

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ELWHA RIVER SPRING CHINOOK STOCK STATUS EVALUATION

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ABSTRACT

The U.S. Fish and Wildlife Service, under contract with the Lower Elwha S'Klallam Tribe, conducted a live-capture gillnet fishery in the lower Elwha River during spring of 1992. Study objectives were to 1) determine whether a remnant spring chinook run still exits, and 2) evaluate feasibility of brood collection for enhancement purposes. Incidental catch of steelhead was also recorded to improve the data base on Elwha steelhead. We gillnetted two 24-hour periods per week from late April until mid June at river km 2.1, exercising extreme care to minimize fish injury from capture and handling. We captured a total of five chinook salmon, sixty-one steelhead, and one Atlantic salmon. All chinook were captured during June, and were released in apparent good condition. Based on effort expansions, an estimated total of 24 chinook may have passed the net site during the study period. These fish may have entered the river by early May, which is well within the spring chinook management period, suggesting that a spring chinook run may still exist. Incidental catch of steelhead peaked around mid May, when summer-runs first appeared. Steelhead were mostly of wild origin (85%), and were older than hatchery steelhead which dominate the Tribe's commercial fishery in mid winter. Most steelhead appeared in good condition at release. Live-capture gillnetting should be continued in 1993, but with a possible change in netting site to improve effectiveness. Study results suggested that live-capture gillnetting may be effective for brood collection.

INTRODUCTION

The U.S. Fish and Wildlife Service, under contract with the Lower Elwha S'Klallam Tribe (LET), conducted a live-capture research fishery in the lower Elwha River during spring of 1992 to evaluate the presence of spring chinook salmon. Available information indicates the Elwha River supported a spring chinook run during its pre-dam era prior to 1912. If progeny from the original run still survive, their protection and enhancement are imperative for full restoration of the Elwha River fishery resources.

For this evaluation, Elwha spring chinook were defined as those chinook entering the Elwha River during the 1992 spring chinook management period from April 15 to July 18 (Washington Department of Fisheries (WDF) et al. 1992). It is recognized, however, that this management period is under technical review, and that additional information on status and timing are essential to characterize potential overlap with the adjacent Elwha summer/fall chinook management period (WDF et al. 1990).

This study was the first year of a multi-year evaluation intended to determine 1) whether a remnant segment of the original Elwha spring chinook run still exists, and 2) the feasibility of Elwha spring chinook brood collection for enhancement purposes.

Incidental capture of late winter and early summer steelhead was also expected. We recorded catch information on these fish to improve the data base on Elwha steelhead stocks.

METHODS

We gillnetted in the lower river from April 27 to June 19, 1992. This timing was believed to cover the major entry period of spring chinook based on observations of spring chinook entry in other coastal rivers, and it also closely followed management recommendations for a spring chinook research/test fishery in the Elwha River in 1992 (WDF et al. 1992). During this period, fishing occurred for two 24-hour periods every week beginning on Monday and Thursday (except for the week of April 27th, when high flow prevented most fishing, and the week of May 25th, when fishing started on Tuesday due to Memorial Day). This fishing schedule was expected to evenly space sampling effort, maximize sample coverage, and reduce the chance of recapture.

A fishing site in the center of a broad glide at river km 2.1 (Elwha Tribal Hatchery infiltration site, Figure 1) was selected because it was believed to be far enough upstream to avoid capture of fish milling near the estuary, yet close enough to the river mouth to ensure that most of the population would pass the fishing site. It was also a passage area which would minimize recaptures of previously sampled fish, and it was easily accessible.

The pre-season plan called for fishing two gill nets perpendicularly from opposite shores with each covering no more than one-half of the river's width. However, river conditions prevented effective netting along the left (west) bank of the river most of the season. As a result, one gillnet (net 1) was set perpendicular to shore from the shallow side of the river and extended approximately 40% to 70% of the river's width, depending on river flow and ability to keep the lead line on the bottom (Figure 2). The float line of the net was attached to a cross-line anchored at each shore, with the balance of the net trailing downstream. Typically, this net was fished from a depth of 0.1 m at shoreline to approximately 4 m at mid-river (Figure 2). A second gillnet (net 2) was fished in the same manner from the opposite shore on two occasions in late May to improve capture efficiency, but brush, flow, and depth limited this net's effectiveness. Each gillnet was 38 m (25 fathoms) long, 4.9 m (27 meshes) deep, and composed of 16.5-cm (6.5-in) stretch-measure monofilament mesh.

Once set, the net was constantly monitored throughout the 24-hr fishing period by a two-person crew consisting of an experienced biological technician from the Service and an Elwha Tribal fisheries technician. When a fish became entangled in the net, the crew immediately hand-lined out to the fish in a small skiff and placed the fish, still entangled in the net, on a 5-cm thick foam pad in the skiff to prevent injury. The net's webbing was then cut from the fish, and the fish was placed in a covered, water-filled, foam-padded live box and brought to shore. When a fish was captured at night, a 12-volt floodlight was used to illuminate the fishing site during retrieval of the fish.

At shore, the crew opened the live box and, with the fish still immersed, measured forklength, took four scales from each side of the fish, noted sex and physical condition, and punched a 0.6-cm hole in the outer edge of the operculum (unless it was a recapture) to identify it in any subsequent sampling. The fish was then transferred to a holding pen (Figure 2). The total time between removal of a fish from the net and transfer into the holding pen was 3 to 5 minutes.

All captures were held in the holding pen until the 24-hr sampling period was completed. The holding pen was positioned in the river channel so that adequate flow and cover for the captured fish were continuously available. The holding pen had a zippered lid and was constructed of 0.6-cm knotless mesh hung on a floating frame 1.8 m long, 0.9 m wide, and 0.9 m deep. When fishing was completed, fish were released at the holding pen site and their physical condition was noted.

The following data were collected for each fish:

- Species
- Date of catch
- Time of catch
- Total fishing time during sample period
- Width of river and water conditions
- Capture crew
- Length of net deployed
- Number of nets deployed
- Sex of fish
- Side of net where fish was captured (upstream or downstream)
- Forklength (nearest half cm)

- Presence of adipose fin
- Presence of opercular punch
- Scale sample (except recaptures)
- Apparent physical condition of fish at capture and at release (including visual assessment of whether a steelhead was winter- or summer-run based on brightness and spawning condition)

Catch per unit effort was estimated for each sampling period from total species catch and net-hours. One net-hour was defined as netting 100% of the river's width for one hour. The calculation was:

$$CPUE = C/(T*P)$$

where:

CPUE = catch per unit effort in net-hours
C = total catch by species during sample period (excluding recaptures)
T = total hours fished during sample period (one or both nets)
P = total proportion of the river's width fished (one or both nets)

Total seasonal passage of chinook at the net site was estimated by dividing the total chinook catch by the proportion of total effort exerted during the chinook capture period. The calculation was:

$$TC= (C/E)(\Sigma E)$$

where:

TC = total estimated chinook passage
C = total chinook catch
E = net-hours exerted during the chinook capture period (June 1 through June 18, as discussed below)
ΣE = sum of all net-hours possible during the chinook capture period

The assumptions involved in the above estimate of total chinook passage are 1) chinook were evenly distributed across the river during their capture period, 2) the capture rate was an accurate index of the migration rate, and 3) all chinook which encountered the net were captured.

RESULTS AND DISCUSSION

A total of 5 chinook salmon, 61 steelhead, and 1 Atlantic salmon were captured during the research fishery. Fishing was limited on April 27 and totally curtailed on April 30 due to high water. Otherwise, netting occurred twice weekly throughout the season, as planned. Table 1 shows catch and effort data for chinook and steelhead over the season.

Chinook Salmon

All chinook were captured during June in ocean-bright condition, in the late-evening hours, on the downstream side of the net (Table 2). None of the chinook were captured more than once, and none appeared to be harmed at release after being held from 7 to 11 hours (average holding time of 9 hours). No chinook had adipose fin clips.

All chinook were four-year-old females, averaging 85-cm forklength (Table 2). Although only five chinook were captured, lack of males was unexpected given that recent Tribal test fisheries for summer/fall chinook (described in more detail below) have shown no differences in abundance or timing of males and females (Pat Crain, LET, personal communication).

All chinook were classified as subyearling emigrants, based on scale analysis. There are no Elwha spring chinook reference scales available, so distinguishing time of emigration or hatchery versus wild rearing from the scales is not possible (John Sneva, WDF, personal communication).

Employing the methods and assumptions described above, an estimated 24 chinook (5/91)(432) passed our net site from June 1 through June 18, the chinook capture period (Table 1). This estimate and its assumptions are not verifiable, but the estimate is consistent with the 1992 forecast for "very low" spring chinook abundance in the Elwha River (WDF et al. 1992).

The very low number of chinook observed in this study is probably due to one or more of these reasons:

- Very few early returning chinook are still present in the Elwha River. With construction of Elwha Dam, spring chinook numbers were undoubtedly reduced due to loss of access to upriver habitat and degradation of remaining lower river habitat.

- Gillnet capture at river km 2.1 was probably not as effective as intended. Inability to net 100% of the river width from opposing shores, as originally planned, probably reduced capture efficiency. Brush and depth of water along the left bank (Figure 2) also hindered effective netting from that shore.

- This was a year of generally low chinook abundance in the region. The 1992 pre-season escapement estimate for Elwha summer/fall chinook was approximately 5,000 to 6,000, but actual escapement (prior to Dermocystidium-related mortalities) was much lower (final 1992 chinook escapement estimates for the Elwha River are still under review at this date). There also appeared to be generally low chinook returns to Puget Sound this year, possibly related to poor marine survival (Carol Smith, WDF, personal communication).

We do not know when the captured chinook first entered the river. The Elwha Tribe has conducted gillnet test fishing in four previous years for summer/fall chinook during late summer at two lower river sites: the river mouth (river km 0.0) and the bluffs (river km 0.8). Results indicated a two-week travel time between these sites (Pat Crain, LET, personal communication). Given that our site was 1.3 river km further upstream than the uppermost Tribal site, travel time to our site from the river mouth may have been at least two weeks.

However, in considering travel time to our fishing site, it is recognized that chinook may initially delay for osmo-regulation at a river mouth (such as within the Tribe's fishing sites), and then move rapidly upriver. As well, streamflow was substantially greater during our spring fishery than during the Tribe's late-summer fisheries, so chinook movement rate may have been faster during our study.

Whether the chinook observed in this study were spring chinook and racially distinct from the summer/fall chinook run is not certain. Chinook run timing is very broad in most rivers (Healey 1991). However, it is clear that these chinook entered the system within the 1992 spring chinook management period (provisionally April 15 to July 18). It is further possible that some early returning Elwha chinook have remained reproductively isolated from summer/fall chinook due to differences in spawn timing. While spawn timing for Elwha spring chinook is unknown, neighboring spring chinook stocks in the Dungeness and Soleduck spawn roughly 25-30 days earlier than Elwha summer/fall chinook (Chuck Johnson, WDF, personal communication).

Steelhead

Of the 61 steelhead captured, 39 were male and 22 were female. Eight of the steelhead taken were recaptures, for a total of 53 individual steelhead sampled, of which 31 were judged winter run and 22 summer run based on visual appearance (Table 3). All recaptures were considered winter steelhead. Mean forklength of steelhead males was 73 cm, while mean forklength of steelhead females was 77 cm. Three steelhead (6% of all steelhead sampled) had adipose fin clips.

Steelhead dominated virtually all gillnet catches. Peak capture rate of both winter- and summer-run fish occurred around mid-May (Figure 3), when summer-run fish first appeared. After mid-May, the catch of winter-runs gradually declined, while summer-runs continued to be caught in relatively high numbers (Figure 3). Steelhead catch rate was unrelated to streamflow (Figure 3).

In early May, most steelhead were captured during daylight (dawn to dusk), but thereafter most captures occurred during night (Figure 4). Greater night capture later in the season may have been due to net avoidance associated with lower streamflow and greater water clarity during this period.

Most steelhead were captured on the downstream side of the net. Sixty-two percent of all captures, and seventy-one percent of recaptures, occurred on the net's downstream side.

Scale data revealed a much greater proportion of older steelhead than those taken in the Tribe's early winter-run, hatchery-based fishery which occurs from December to March. Most steelhead were age four (45%), followed by ages five (31%), six (12%), three (10%), and seven (2%) (Table 3). This contrasts with the Tribe's fishery which is dominated by fish of age three (70%) and age four (26%) (Pat Crain, LET, personal communication).

Scale data also showed that a much greater proportion of the steelhead were of wild origin than those taken in the Tribal fishery. The dominant freshwater age was two (71% of readable samples), followed by ages one and three (14% each) (Table 3), indicating that 85% of fish captured were of wild origin (freshwater age greater than one). This contrasts with the Tribal fishery where only 9% of all fish are of wild origin (Pat Crain, LET, personal communication).

Injuries caused by the gillnets did not appear to be significant. One mortality of a recaptured steelhead occurred during the fishery; this fish was already spawned-out, heavily infected with fungus, and generally in poor shape at recapture. Seven additional steelhead showed varying degrees of bleeding from the gills (Table 3), although these fish were released alive and in apparent good condition after being held from 5 to 21 hr (average holding time of 13 hr). All other steelhead appeared in good condition at release after being held from 1 to 23 hr (average holding time of 10 hr).

Atlantic Salmon

The Atlantic salmon was an unripe, 73-cm forklength male. It was not released back to the river.

CONCLUSIONS AND RECOMMENDATIONS

We conclude that there may still be a remnant run of spring chinook in the Elwha River, and live-capture gillnetting may offer a means to collect spring chinook brood for restoration purposes.

We recommend continuing with live-capture gillnetting in the lower river in spring of 1993 to 1) assess run strength when chinook may be more abundant than in 1992, and 2) further evaluate capture techniques and related injury and mortality. The fish recovery and handling techniques used in this year's work should be continued because minimal mortality and injury were apparent. However, an alternative gillnet site in this reach should be considered to more effectively capture chinook. A site near the top (river km 2.3) or bottom (river km 1.9) of the reach may be more amenable to gillnetting, yet still meet the criteria of accessibility, active fish passage, and distance from the river mouth.

ACKNOWLEDGEMENTS

This investigation was funded by the Lower Elwha S'Kallam Tribe. Pat Crain of the Tribe developed the study proposal, reviewed several initial report drafts, and provided valuable technical input to the study.

Chinook scales were read by John Sneva of Washington Department of Fisheries, and steelhead scales were read by Bob Leland of Washington Department of Wildlife.

Netting was conducted by Biological Technicians Stephen Hager and Roger Wiswell of the U.S. Fish and Wildlife Service, and Fisheries Technicians Verna Sampson, Ron Bolstrom, Dennis Charles, Karen Johnson, and Russ Hepfer of the Lower Elwha S'Klallam Tribe.

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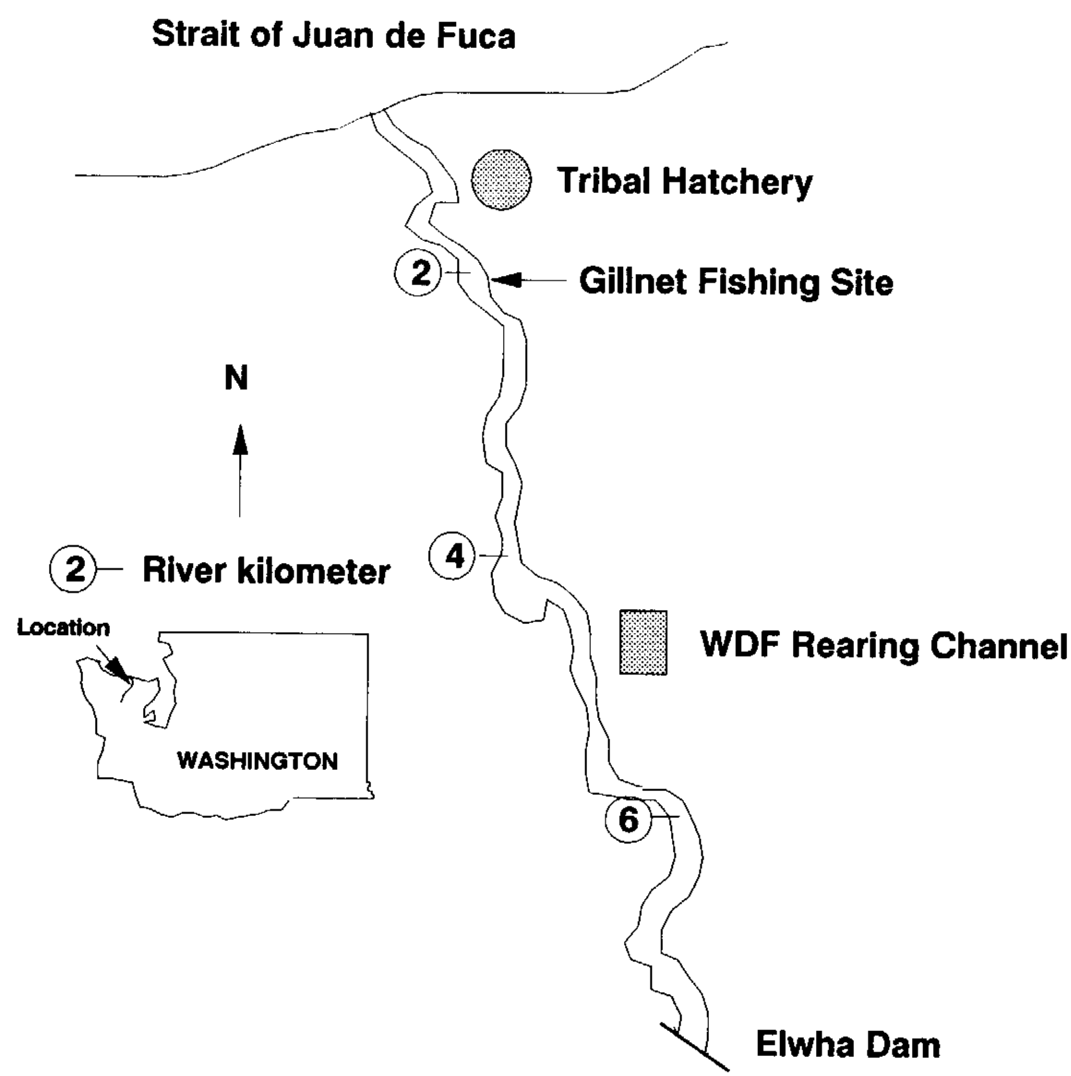

Figure 1. Lower Elwha River and live-capture gillnet fishing site (scale approximate).

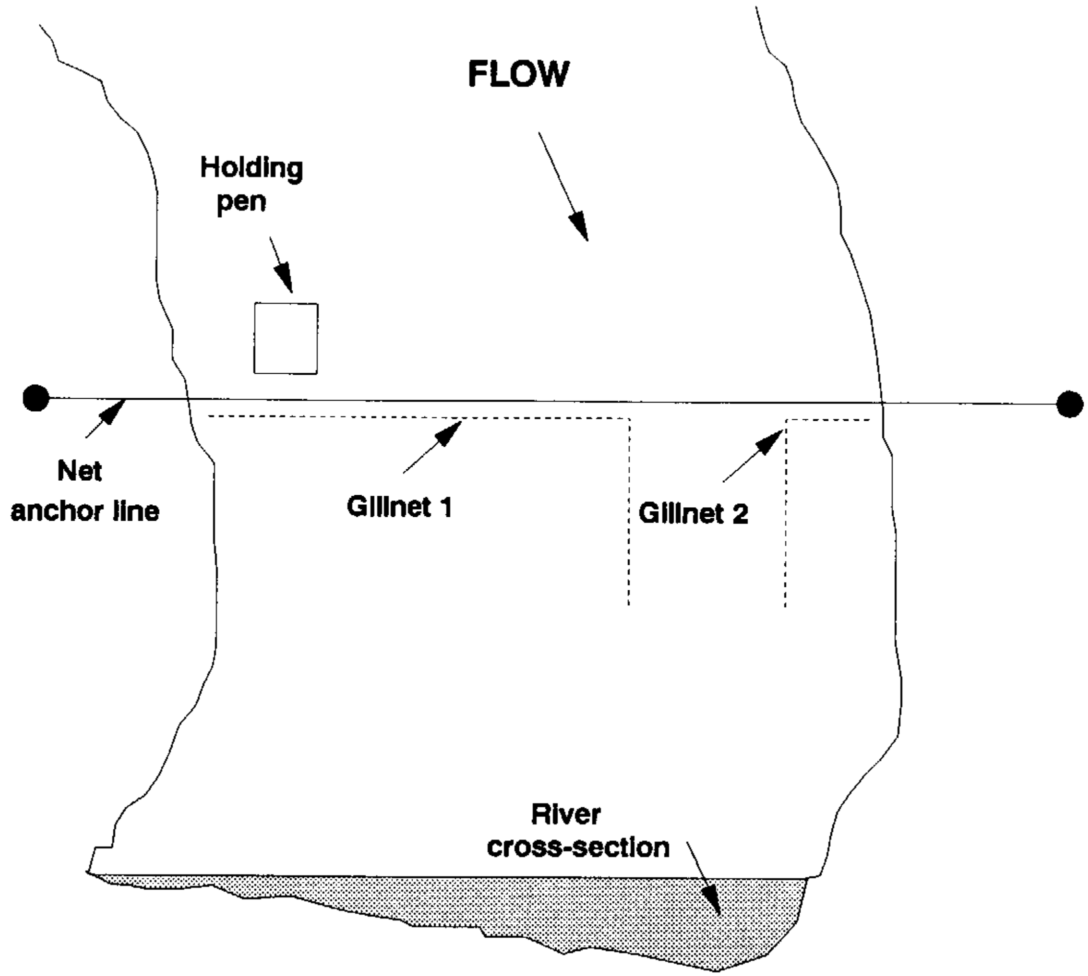

Figure 2. Schematic of typical gillnet installation at river kilometer 2.1 (no scale).

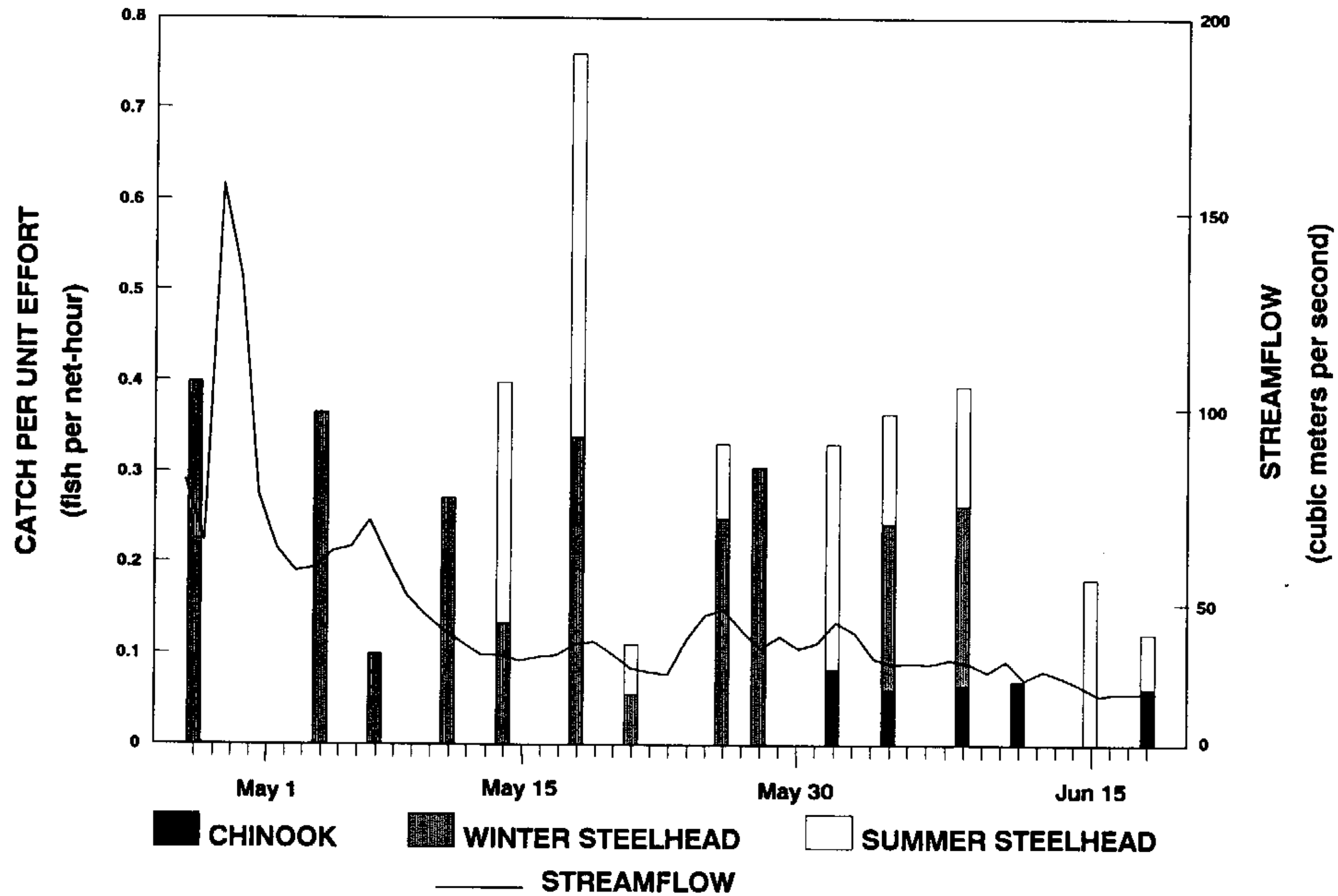

Figure 3. Catch per unit effort and daily streamflow over the study period.

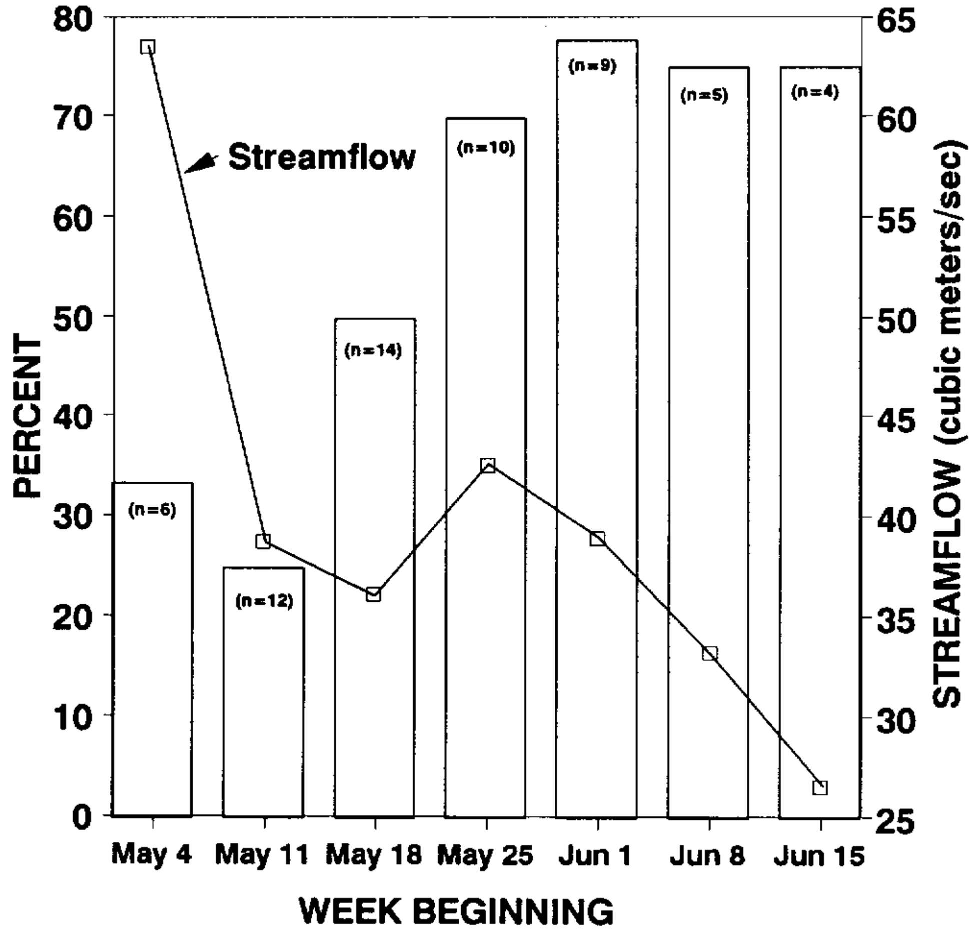

Figure 4. Percent of weekly steelhead catch during night hours. Weekly mean streamflow is also indicated.

Table 1. Catch-per-unit-effort summary for Elwha River live-capture gillnet fishery. One Atlantic salmon was also captured on June 11th.

Date[A]	Hours fished	Nets fished	Percent of river fished		Effort (net-hours)	Catch		Catch per unit effort (fish per net-hour)[B]	
			net 1	net 2		chinook	steelhead	chinook	steelhead
Apr 27	5.00	1	50	0	2.50	0	1	0.00	0.40
Apr 30	0.00	0	0	0	0.00	0	0	-	-
May 4	22.75	1	48	0	10.92	0	4	0.00	0.37
May 7	23.50	1	43	0	10.10	0	2[C]	0.00	0.10
May 11	23.00	1	64	0	14.72	0	4	0.00	0.27
May 14	23.50	1	64	0	15.04	0	8[D]	0.00	0.40
May 18	23.66	2	43	7	11.83	0	10[C]	0.00	0.76
May 21	23.66	2	64	13	18.22	0	4[D]	0.00	0.11
May 26	23.58	1	51	0	12.03	0	5[C]	0.00	0.33
May 28	23.75	1	69	0	16.39	0	5	0.00	0.31
Jun 1	23.75	1	51	0	12.11	1	4[C]	0.08	0.25
Jun 4	23.83	1	69	0	16.44	1	5	0.06	0.30
Jun 8	23.75	1	64	0	15.20	1	5	0.07	0.33
Jun 11	23.75	1	60	0	14.25	1	0	0.07	0.00
Jun 15	23.92	1	69	0	16.51	0	3	0.00	0.18
Jun 18	23.75	1	69	0	16.39	1	1	0.06	0.06
					Total:	5	61		
					Males:	0	39		
					Females:	5	22		

[A] Starting date of planned 24-hr fishing period.
[B] Recaptures are excluded from the calculation.
[C] Includes one recapture.
[D] Includes two recaptures.

Table 2. Chinook captured during 1992 gillnetting in the lower Elwha River.

Date	Time	Forklength (cm)
Jun 1	2144	87.5
Jun 4	2315	86.5
Jun 8	2400	95.5
Jun 12	0150	77.5
Jun 18	2350	77.5

Table 3. Steelhead captured during 1992 gillnetting in the lower Elwha River.

Date	Time	Sex	Net side (up/down)	Fork-length (cm)	Recapture	Age[A]	Comments
Apr 27	1430	M	Down	68.5		1.1+	
May 4	1515	M	Down	93.5		2.2+	
May 4	1715	M	Up	78.5		2.2+	
May 4	1945	M	Up	73.5		R.2+	
May 5	0335	M	Up	67.5		R.1+	
May 7	1205	M	Down	78.0		R.1+S+	Gill bleeding
May 7	2212	M	Down	68.5	Yes		
May 11	1230	M	Down	73.0		2.1+	
May 11	1415	M	Down	76.0		3.1+	
May 11	1450	M	Down	65.0		2.1+	
May 12	0622	M	Down	61.5		R.1+	
May 14	1445	M	Down	70.0		2.2+	
May 14	1830	M	Up	75.0		2.2+	Gill bleeding
May 14	1910	M		77.0	Yes		
May 14	2100	F	Up	78.0		2.3	Bright
May 14	2255	F	Up	88.0		R.2+	Bright
May 14	2256	F	Up	72.5		R.1+	Bright, possible 2.1+
May 15	0807	M	Up	85.0		R.2+	Bright
May 15	0830	M	Down		Yes		
May 18	0938	M	Down	69.5		2.1+	
May 18	1140	M	Up	71.5		R.2+	
May 18	1430	M	Down	74.5		3.2+	Bright
May 18	1900	M	Up	75.5		R.2+	Bright
May 18	2005	M	Down	66.0		2.1+	
May 18	2038	F	Down	70.5	Yes		
May 18	2330	F	Down	76.5		1.3	Bright
May 19	0426	M	Up	70.0		2.2	Bright
May 19	0440	F	Down	72.0		1.2	Bright, ad-clipped
May 19	0551	M	Up	66.5		2.1+	Gill bleeding
May 21	1545	M	Down	74.5	Yes		
May 21	2230	F	Down	79.0		1.3	Bright
May 22	0118	M	Up		Yes		
May 22	0213	F	Down	74.5		2.3	Gill bleeding
May 26	1510	M	Up	70.5		2.1+	
May 26	1535	M	Down	71.0		2.2	Bright
May 26	2150	F	Up	83.0		2.2+S+S+	
May 27	0145	M	Up	70.0	Yes		
May 27	0230	F	Up	83.0		2.2+	
May 28	1155	M	Down	71.5		2.1+	
May 28	2205	M	Up	71.5		2.1+	
May 28	2238	F	Down	83.0		2.3	

Table 3. Continued.

Date	Time	Sex	Net side (up/down)	Fork-length (cm)	Recap-ture	Age[A]	Comments
May 28	2335	F	Down	81.0		R.1+ S+S+S+	Gill bleeding
May 29	0342	F	Down	70.5		2.2	
Jun 1	2000	M	Down	74.0	Yes		Mortality
Jun 1	2248	F	Up	72.0		2.2	Bright
Jun 2	0330	M	Down	74.5		2.2	Bright
Jun 2	0352	F	Down	81.5		R.3	Bright, gill bleeding
Jun 4	1920	M	Down	72.5		2.2	
Jun 4	2205	F	Down	77.0		3.2+	Bright
Jun 5	0140	F	Down	70.0		1.2	Bright, ad-clipped
Jun 5	0315	M	Up	67.5		2.1+	
Jun 5	0450	M	Down	71.5		2.1+	
Jun 8	2230	F	Down	83.5		2.3	Bright, gill bleeding
Jun 8	2235	M	Up	68.0		2.1+S+	
Jun 8	2250	F	Down	74.0		2.3	Bright
Jun 9	0045	M	Up	68.0		2.1+	
Jun 9	0310	F	Down	65.0		2.2+	
Jun 15	2255	M	Down	89.5		3.3	Bright
Jun 15	2325	F	Down	74.5		3.3	Bright
Jun 16	0750	F	Up	78.0		3.3	Bright
Jun 19	0100	M	Down	67.0		1.2	Bright, ad-clipped

[A] Freshwater age . saltwater age; R = regenerated juvenile age; +S = one spawning and return to sea; + = one more spring, summer, and fall at sea with no winter annulus formed at time of capture.