

Fishery Data Series No. 91-42

**Harvest Estimates for Selected Sport Fisheries in
Yakutat, Alaska in 1990**

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Robert E. Johnson

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September 1991

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ABSTRACT

Angler effort for and catch and harvest of steelhead *Oncorhynchus mykiss* and chinook salmon *Oncorhynchus tshawytscha* in recreational fisheries on the Situk River near Yakutat, Alaska were estimated using creel surveys.

An estimated 18,921 (SE = 1,753) angler hours of fishing occurred between March 29 and July 22, 1990. Steelhead anglers who fished the Situk River between April 16 and May 20, 1990 accounted for over 75% of this effort. The total catch of steelhead on the Situk River during the spring of 1990 is estimated at 1,460 (SE = 180), and total harvest is estimated at 321 (SE = 49). The 1990 spring fishery for steelhead on the Situk River was weak, in part because heavy snows delayed the fishery, and later because low water levels precluded optimal fishing conditions. The ratio of the number of steelhead released to the number kept was the lowest (3.5:1) since surveys began in 1985.

The recreational fishery for chinook salmon on the Situk River was restricted to catch-and-release fishing on June 11 in response to provisions in the Situk River Management Plan for a low projected escapement. An estimated 24 (SE = 9) chinook salmon ≥ 16 inches were caught and released during the sport fishery.

KEY WORDS: Creel survey, Situk River, chinook salmon *Oncorhynchus tshawytscha*, steelhead *Oncorhynchus mykiss*, angler effort, harvest, catch, catch-and-release, Yakutat, Alaska.

INTRODUCTION

The Situk River flows across the Yakutat Foreland approximately 8 miles east of Yakutat, Alaska, a community of about 650 people located on the Gulf of Alaska between Juneau and Cordova (Figure 1). The Situk River is the main producer of trout, char, and salmon near Yakutat. The sport fishery for steelhead *Oncorhynchus mykiss* on the Situk River was pioneered in the late 1940's, remained small for about three decades following World War II, and developed rapidly during the 1980's to acquire a world-class reputation. The sport fishery for steelhead is currently being monitored by the Alaska Department of Fish and Game (ADFG) to document angler effort, catch, and harvest.

Since 1985, ADFG has also monitored sport harvests of wild chinook salmon *O. tshawytscha* on the Situk River and has taken in-season management action to curtail sport and commercial harvests in 1986, 1988, 1989, and 1990. In March 1989, the Situk River Sport Fishing Management Plan was adopted by the Alaska Board of Fisheries. This plan sets daily and seasonal bag limits, establishes catch-and-release only sport fishing periods, or closes the fishery, depending on a projection of chinook salmon escapement into the river.

Chinook salmon stocks that are targeted by sport fisheries in Yakutat have historically supported important local subsistence and commercial fisheries. Information from the surveys is used as a basis for in-season management actions, such as closing the fisheries to ensure adequate escapements, and to help formulate new regulations.

The objectives for the 1990 harvest surveys were to estimate:

- 1) total angler effort and harvest of steelhead in the Situk River from March 29 to May 27, 1990; and
- 2) total angler effort and harvest of chinook salmon in the Situk River from June 11 to July 22, 1990.

METHODS

Creel surveys are used to monitor angler effort, catch, and harvests on the Situk River. Access to the river is provided at "Nine Mile Bridge" on Forest Highway 10 and at "Lower Landing" near the river mouth (Figure 1). We assume other access to the river is insignificant. Most anglers fishing for steelhead on the Situk River float from Nine Mile Bridge to the Lower Landing and return to town on the Lost River Road, although some anglers fish and exit at Nine Mile Bridge. After July 1, anglers cannot legally harvest chinook salmon on the Situk River above the U.S. Forest Service (USFS) Middle Cabin, located about 3 miles below the Nine Mile Bridge.

Several data collections were used to estimate catch, effort, and harvests in 1990. All anglers floating the river between March 29 and April 15 were interviewed as they passed our weir, located about 1 mile above the Lower Landing (Figure 1). Between April 16 and April 22, a simple random sampling design (Johnson and Marshall 1990) was used to estimate parameters, whereby all anglers exiting the river at the Lower Landing during selected (280-minute) periods were interviewed. Between April 23 and May 27, stratified two-stage "direct expansion" type surveys were used (independently) to estimate parameters for the

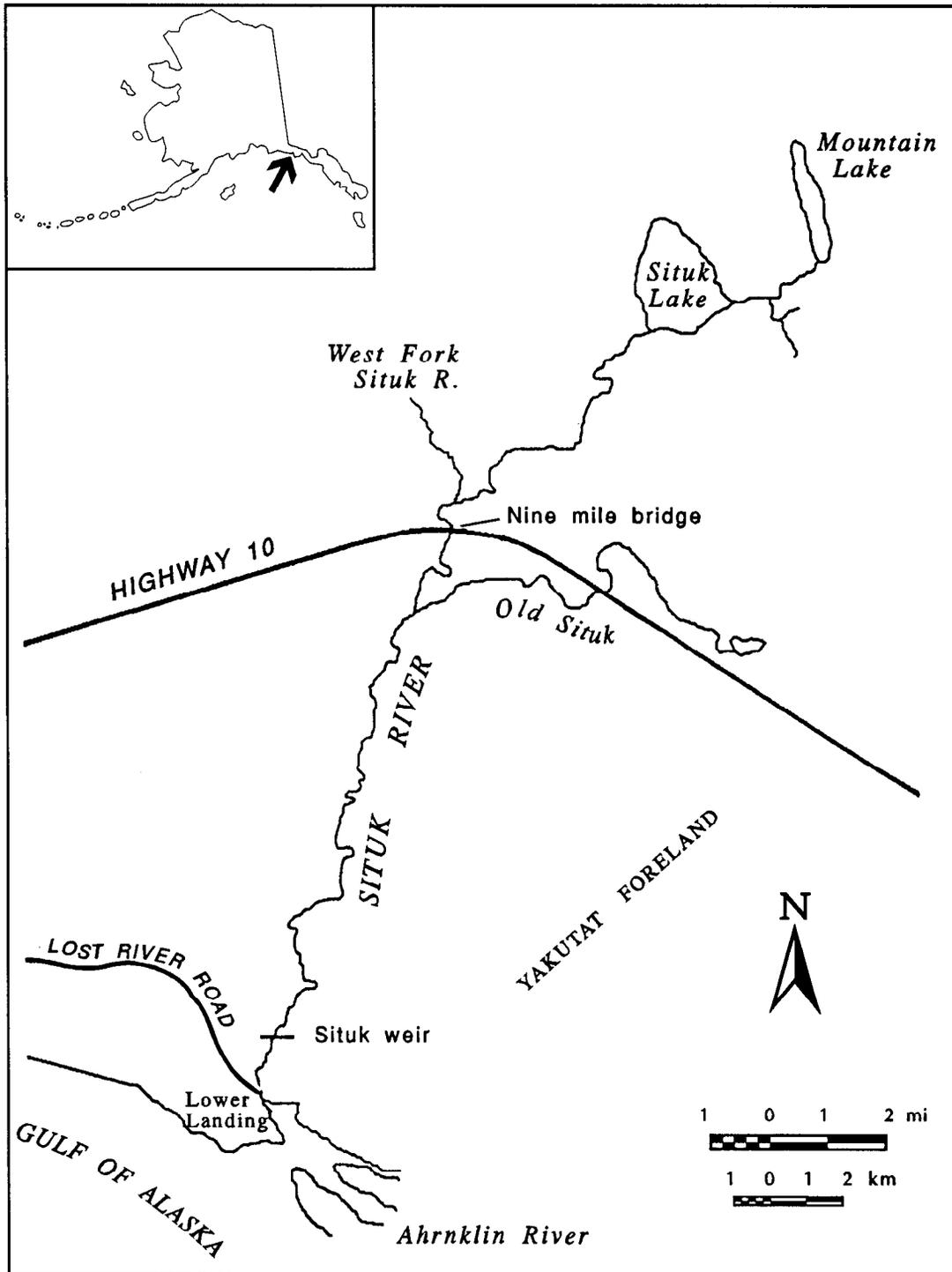


Figure 1. The Yakutat road system and sport fishing areas.

steelhead fisheries at the Lower Landing and Nine Mile Bridge. The multistage design was also used to estimate parameters for the chinook salmon fishery at the Lower Landing between June 11 and July 22, 1990.

The two-stage sampling design had days as primary sampling units and periods within days as secondary sampling units. During each day selected for sampling steelhead anglers, 2 of 5 possible periods were randomly selected for sampling. These sampling periods were equal in length and fixed at between 169 and 193 minutes, depending on the strata. During each day selected for sampling chinook salmon anglers, 2 of 4 possible periods were randomly selected for sampling. These sampling periods were equal in length and fixed at between 209 and 229 minutes, depending on the strata. The available periods in a day together equaled the length of time from 0800 hours to civil twilight on the average day in the biweekly season. All anglers exiting the river during the sample periods were interviewed. Temporal stratification was based on biweekly (14-day) seasonal time periods.

Sampling density for each survey was limited by available technician time. Thus, 7 days in each biweekly period were randomly selected for sampling steelhead anglers exiting at the Lower Landing, and 3 of the 7 remaining days in each biweek were randomly selected for sampling anglers at Nine Mile Bridge. Because complete randomness was not used in selection of days to sample at Nine Mile Bridge, some bias may be present in these estimates. However, estimates for the whole river will be nearly unbiased if totals for Nine Mile Bridge are relatively small. Finally, 9 days in each biweekly period were randomly selected for sampling chinook salmon anglers exiting at the Lower Landing.

Angler catch, C , in each stratum of a multistage survey was estimated:

$$\hat{C}_h = D_h \bar{C}_h \quad (1)$$

$$\bar{C}_h = \frac{\sum_{i=1}^{d_h} \hat{C}_{hi}}{d_h} \quad (2)$$

$$\hat{C}_{hi} = P_h \bar{C}_{hi} \quad (3)$$

$$\bar{C}_{hi} = \frac{\sum_{j=1}^{P_h} C_{hij}}{P_h} \quad (4)$$

where C_{hij} is the catch in period j day i stratum h , p_h is the number of secondary units actually sampled in any day in stratum h , P_h is the number of secondary units (periods) within days in stratum h , d_h is the number of primary units actually sampled in stratum h , and D_h is the number of primary units (days) in stratum h .

The variance of the catch in each stratum is estimated:

$$V[\hat{C}_h] = (1 - f_{1h}) D_h^2 \frac{\sum_{i=1}^{d_h} (\hat{C}_{hi} - \bar{C}_h)^2}{d_h (d_h - 1)} + (1 - f_{2h}) D_h \sum_{i=1}^{d_h} P_h^2 \frac{\sum_{j=1}^{p_{hi}} (C_{hij} - \bar{C}_{hi})^2}{d_h P_h (p_h - 1)} \quad (5)$$

where f_{1h} = the sampling fraction for days (d_h/D_h), and f_{2h} = sampling fraction for periods (p_h/P_h). Equations 1-5 were also used to estimate angler effort and harvest with C now representing effort or harvest.

Total catch, effort, or harvest for the season (and their variances) are the sum of the estimates for each strata.

Standard errors for catch, effort, and harvest estimates were

$$SE = (\text{Variance})^{\frac{1}{2}} \quad (6)$$

Relative precision (95% confidence interval) for catch, effort, and harvest estimates were

$$\text{Relative Precision} = \frac{2 SE}{\text{Estimate}} \quad (7)$$

Overall catch rates were obtained by dividing the total estimated catch by the total estimated effort:

$$CPUE = \frac{\sum \hat{C}}{\sum \hat{E}} \quad (8)$$

While this estimate of CPUE is not success of the average angler, it serves to provide a measure of the overall catch rate.

RESULTS

Situk River Steelhead Fishery

Anglers were first interviewed at the Situk River weir on March 29. Between this date and April 16, when random sampling of anglers started, deep snow limited access to the Situk River, and we believe nearly all steelhead anglers were interviewed. Sampling at the Lower Landing continued through May 27, when steelhead fishing effectively ended and surveys were discontinued. A total of 601 interviews was conducted in the lower Situk River (Table 1); 84 interviews were conducted at Nine Mile Bridge between April 23 (when snow was plowed from Forest Highway 10) and May 27.

Angler effort for and harvest of steelhead on the Situk River peaked between April 23 and May 6 when an estimated 6,474 angler-hours were expended by fisherman exiting at Lower Landing and 1,143 angler-hours were expended by fisherman at Nine Mile Bridge (Table 2). An estimated 41% of 321 total steelhead harvested on the Situk River in 1990 occurred during this period (Table 3). Estimated variances for effort, catch, and harvest of steelhead by stratum and sampling stage, which may be useful for designing future surveys, are presented in Appendix A1.

Table 1. Observed angler effort (hours), number of interviews, number of periods sampled, number of possible sampling periods, and observed harvest and catch by species, site, and sampling strata, for the Situk River creel survey, March 29 through July 22, 1990.

| Sampling strata | Angler effort | Anglers interviewed ^a | Periods sampled | Samples possible | Steelhead | | Chinook salmon >16" | | Chinook salmon <16" | |
|-------------------------|---------------|----------------------------------|-----------------|------------------|-----------|---------|---------------------|---------|---------------------|---------|
| | | | | | Catch | Harvest | Catch | Harvest | Catch | Harvest |
| <u>Lower Landing</u> | | | | | | | | | | |
| 3/29-4/15 ^b | 1045 | 212 | | | 84 | 23 | | | | |
| 4/16-4/22 | 746 | 111 | 6 | 21 | 77 | 25 | | | | |
| 4/23-5/06 | 1295 | 203 | 14 | 70 | 122 | 22 | | | | |
| 5/07-5/20 | 464 | 71 | 14 | 70 | 34 | 13 | | | | |
| 5/21-5/27 | 5 | 4 | 7 | 35 | 0 | 0 | | | | |
| Subtotal | 3,555 | 601 | 41 | 196 | 317 | 83 | | | | |
| 6/11-6/24 | 207 | 39 | 18 | 36 | | | 3 | 0 | 0 | 0 |
| 6/25-7/08 | 578 | 135 | 18 | 36 | | | 2 | 0 | 0 | 0 |
| 7/09-7/22 | 264 | 79 | 18 | 36 | | | 3 | 0 | 0 | 0 |
| Subtotal | 1,049 | 253 | 54 | 108 | | | 8 | 0 | 0 | 0 |
| <u>Nine Mile Bridge</u> | | | | | | | | | | |
| 4/23-5/06 | 98 | 32 | 6 | 70 | 17 | 2 | | | | |
| 5/07-5/20 | 146.1 | 32 | 6 | 70 | 11 | 1 | | | | |
| 5/21-5/27 | 38.2 | 20 | 4 | 35 | 0 | 0 | | | | |
| Subtotal | 282.3 | 84 | 16 | 175 | 28 | 3 | | | | |

^a Number of interviews = number of possible interviews.

^b Weir above Lower Landing manned during daylight hours; all anglers floating the river were interviewed.

Table 2. Estimated total effort (angler hours), harvest, and catch of steelhead and chinook salmon in the Situk River, March 29 through July 22, 1990.

| Sampling strata | Effort | | Harvest | | Catch | |
|--------------------------------|----------|-----------|----------|----------|----------|----------|
| | Estimate | Variance | Estimate | Variance | Estimate | Variance |
| Steelhead-Lower Landing | | | | | | |
| 3/29-4/15 | 1,045 | 0 | 23 | 0 | 84 | 0 |
| 4/16-4/22 | 2,609 | 158,254 | 88 | 198 | 270 | 2,319 |
| 4/23-5/06 | 6,474 | 739,724 | 110 | 957 | 610 | 11,427 |
| 5/07-5/20 | 2,322 | 564,438 | 65 | 651 | 170 | 5,527 |
| 5/21-5/27 | 29 | 705 | 0 | 0 | 0 | 0 |
| Subtotal | 12,479 | 1,463,121 | 286 | 1,806 | 1,134 | 19,273 |
| Steelhead-Nine Mile Bridge | | | | | | |
| 4/23-5/06 | 1,143 | 69,629 | 23 | 498 | 198 | 3,309 |
| 5/07-5/20 | 1,705 | 1,370,222 | 12 | 124 | 128 | 9,819 |
| 5/21-5/27 | 334 | 7,365 | 0 | 0 | 0 | 0 |
| Subtotal | 3,182 | 1,447,216 | 35 | 622 | 326 | 13,128 |
| King salmon >16"-Lower Landing | | | | | | |
| 6/11-6/24 | 642 | 59,224 | 0 | 0 | 9 | 17 |
| 6/25-7/08 | 1,797 | 61,019 | 0 | 0 | 6 | 12 |
| 7/09-7/22 | 821 | 42,652 | 0 | 0 | 9 | 59 |
| Subtotal | 3,260 | 162,895 | 0 | 0 | 24 | 88 |

Table 3. Estimated total effort, harvest, and catch of steelhead and chinook salmon on the Situk River by sampling period, March 29 through July 22, 1990.

| | 29 Mar 15 Apr | 16 Apr 22 Apr | 23 Apr 06 May | 07 May 20 May | 21 May 27 May | 11 Jun 24 Jun | 25 Jun 08 Jul | 09 Jul 22 Jul | Total |
|---------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|
| <u>Angler hours</u> | | | | | | | | | |
| Estimate | 1,045 | 2,609 | 7,617 | 4,027 | 363 | 642 | 1,797 | 821 | 18,921 |
| Variance | 0 | 158,254 | 809,352 | 1,934,660 | 8,070 | 59,224 | 61,019 | 42,652 | 3,073,231 |
| SE | 0 | 398 | 900 | 1,391 | 90 | 243 | 247 | 207 | 1,753 |
| Relative precision | | 0.30 | 0.24 | 0.69 | 0.49 | 0.76 | 0.27 | 0.50 | 0.19 |
| <u>Steelhead harvest</u> | | | | | | | | | |
| Estimate | 23 | 88 | 133 | 77 | 0 | | | | 321 |
| Variance | 0 | 198 | 1,454 | 775 | 0 | | | | 2,427 |
| SE | 0 | 14 | 38 | 28 | 0 | | | | 49 |
| Relative precision | 0 | 0.32 | 0.57 | 0.72 | | | | | 0.31 |
| <u>Steelhead catch</u> | | | | | | | | | |
| Estimate | 84 | 270 | 808 | 298 | 0 | | | | 1,460 |
| Variance | 0 | 2,319 | 14,736 | 15,346 | 0 | | | | 32,401 |
| SE | 0 | 48 | 121 | 124 | 0 | | | | 180 |
| Relative precision | 0 | 0.36 | 0.30 | 0.83 | | | | | 0.25 |
| <u>Chinook salmon >16" harvest</u> | | | | | | | | | |
| Estimate | | | | | | 0 | 0 | 0 | 0 |
| Variance | | | | | | 0 | 0 | 0 | 0 |
| SE | | | | | | 0 | 0 | 0 | 0 |
| Relative precision | | | | | | | | | |
| <u>Chinook salmon >16" catch</u> | | | | | | | | | |
| Estimate | | | | | | 9 | 6 | 9 | 24 |
| Variance | | | | | | 17 | 12 | 59 | 88 |
| SE | | | | | | 4 | 3 | 8 | 9 |
| Relative precision | | | | | | 0.92 | 1.15 | 1.71 | 0.78 |

^a SE = Standard error.

^b Relative precision = 1.96 SE/estimate.

An estimated 15,661 (SE = 1,706) fishing hours were spent on the Situk River by steelhead anglers in 1990, with approximately 3,182 (SE = 1,203) of these hours (20.3%) occurring at Nine Mile Bridge. In contrast, only 35 (SE = 25) of 321 (SE = 49) total steelhead harvested were taken at Nine Mile Bridge.

Anglers caught an estimated 1,460 steelhead during the 1990 spring fishery in the Situk River (SE = 180), of which an estimated 1,139 (78%) were released (Table 4). About 94% of the steelhead catch occurred between April 16 and May 20, 1990.

Situk River Chinook Salmon Fishery

The sport fishery was closed to harvesting chinook salmon ≥ 16 inches in length by emergency order on June 11, under provisions of the Situk River King Salmon Sport Fishing Management Plan (5 AAC 49.025), since spawning escapement of chinook salmon was projected to be below 1,000 fish. Escapement was monitored at the weir, then being operated by the ADFG Division of Commercial Fisheries. Despite the emergency closure, the creel survey was used to monitor chinook salmon catches between June 11 through July 22 (Table 1). An estimated 3,260 (SE = 404) angler-hours of effort were expended to catch 24 (SE = 9) chinook salmon (and other species) during the survey period; no harvest of chinook salmon was documented (Tables 2 and 3). There was no harvest of jack (<16 inches in length) chinook salmon observed during the survey.

DISCUSSION

Situk River Steelhead Fishery

The 1990 sport fishery for steelhead in the Situk River was the poorest in recent years. Overall catch rates were at a six-year low (0.09 steelhead per angler-hour), and, perhaps as a result, anglers continued to keep more of their catch (Table 4). During 1990, about 3.5 steelhead were released for every steelhead harvested. This was the lowest release ratio since the survey began in 1985. More conservative management, such as mandatory catch-and-release fishing, may be necessary if declining trends in abundance and increasing harvest rates develop.

The expanding popularity of the steelhead fishery at Nine Mile Bridge is demonstrated by the relatively high angler effort (3,182 hours) expended there in 1990. This estimate is over twice the estimate (1,376 hours) for the same area during a similar period in 1988 (Suchanek and Bingham 1989).

Situk River Chinook Salmon Fishery

The small (less than 1,000 fish) projected escapement of chinook salmon triggered emergency order catch-and-release fishing and the poorest angling for chinook salmon in the Situk River in recent years (Table 5).

ACKNOWLEDGMENTS

Gordon Woods, Tim Gordy, and Charles Nelson conducted the angler interviews during this study. Their dedication and concern for the resource is appreciated.

Table 4. Summary of estimated sport-fishing catch and catch rates for steelhead in the Situk River, 1985-1990.

| Year | Survey dates | Effort (hours) | Harvest | Release | Catch | Catch per hour | Release to harvest ratio |
|-------------------|------------------------|---------------------|------------------|--------------------|--------------------|-------------------|--------------------------|
| 1985 ^a | 4/29-7/07 ^b | 10,434 ^b | 362 ^b | 2,695 ^b | 3,057 ^b | 0.29 ^b | 7.4 ^b |
| 1986 ^c | 4/14-7/06 | 12,283 | 287 | 2,094 | 2,381 | 0.19 | 7.3 |
| 1987 ^d | 4/06-6/28 ^e | 10,542 | 391 | 3,797 | 4,182 | 0.40 | 9.7 |
| 1988 ^f | 3/28-7/03 | 16,379 | 423 | 4,991 | 5,414 | 0.33 | 11.8 |
| 1989 ^g | 4/04-7/02 | 12,953 ^h | 361 | 2,055 | 2,416 | 0.19 ^h | 5.6 |
| 1990 | 4/23-5/27 | 15,661 | 321 | 1,139 | 1,460 | 0.09 | 3.5 |
| Mean | 1985-1989 | 12,518 | 365 | 3,126 | 3,490 | 0.28 | 8.4 |

^a Mecum and Suchanek (1986).

^b Different data than reported in Johnson and Marshall (1990). Informal surveys indicated that at least 2,230 hours of effort were expended to harvest 66 steelhead and release another 1,889 steelhead between 4/15 and 4/29 (Robert Johnson, Alaska Department of Fish and Game, Yakutat, personal communication).

^c Mecum and Suchanek (1987).

^d Bingham et al. (1988).

^e No survey between 5/26 and 6/14/87.

^f Suchanek and Bingham (1989).

^g Johnson and Marshall (1990).

^h Correction to data in Johnson and Marshall (1990).

Table 5. Summary of estimated sport-fishing harvest, release, and catch of chinook salmon in the Situk River, 1985-1990.

| Year | Survey dates | Effort (hrs) | Harvest | | | Release | | | Catch | | |
|-------------------|--------------|--------------|---------|------|-------|---------|------|-------|-------|------|-------|
| | | | >16" | <16" | Total | >16" | <16" | Total | >16" | <16" | Total |
| 1985 ^a | 6/10-7/21 | 4,958 | 294 | 217 | 511 | 123 | 210 | 333 | 417 | 427 | 844 |
| 1986 ^b | 6/09-7/13 | 3,568 | 0 | 37 | 37 | 704 | 0 | 704 | 704 | 37 | 741 |
| 1987 ^c | 6/15-8/09 | 3,852 | 75 | 319 | 319 | 270 | 90 | 360 | 345 | 409 | 754 |
| 1988 ^d | 6/06-8/14 | 6,715 | 185 | 3 | 188 | 124 | 31 | 155 | 309 | 34 | 343 |
| 1989 ^e | 6/05-7/30 | 5,568 | 0 | 0 | 0 | 62 | 36 | 98 | 62 | 36 | 98 |
| 1990 | 6/11-7/22 | 3,260 | 0 | 0 | 0 | 24 | 0 | 0 | 24 | 0 | 24 |
| Mean | 1985-1989 | 4,932 | 111 | 115 | 211 | 256 | 73 | 330 | 367 | 189 | 556 |

- ^a Mecum and Suchanek (1986).
- ^b Mecum and Suchanek (1987).
- ^c Bingham et al. (1988).
- ^d Suchanek and Bingham (1989).
- ^e Johnson and Marshall (1990).

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APPENDIX A

Appendix A1. Estimated variances for effort, catch, and harvest of steelhead and chinook salmon >16" on the Situk River, by stratum, sampling stage, and site, 1990.^a

| Sampling stratum | Effort | | Harvest | | Catch | |
|---|-----------|---------|---------|---------|---------|---------|
| | Stage 1 | Stage 2 | Stage 1 | Stage 2 | Stage 1 | Stage 2 |
| Steelhead-Lower Landing | | | | | | |
| 4/23-5/06 | 526,223 | 213,501 | 567 | 390 | 8,367 | 3,060 |
| 5/07-5/20 | 407,917 | 156,521 | 508 | 143 | 4,417 | 1,110 |
| 5/21-5/27 | 486 | 219 | 0 | 0 | 0 | 0 |
| Steelhead-Nine Mile Bridge | | | | | | |
| 4/23-5/06 | 58,739 | 10,889 | 428 | 70 | 2,032 | 1,278 |
| 5/07-5/20 | 1,360,901 | 9,321 | 107 | 17.5 | 9,732 | 87.5 |
| 5/21-5/27 | 1,260 | 6,105 | 0 | 0 | 0 | 0 |
| Chinook salmon >16"-Lower Landing | | | | | | |
| 6/11-6/24 | 25775 | 33450 | 0 | 0 | 7.8 | 9.3 |
| 6/25-7/08 | 29136 | 31883 | 0 | 0 | 6.0 | 6.2 |
| 7/09-7/22 | 21054 | 21597 | 0 | 0 | 31 | 28 |

^a Stages: 1) days within 14-day seasons; 2) sample periods within days.

